CHUJIA0-6 AIRPLANE

TECHNICAL SPECIFICATION

FOR

SERVICE AND MAINTENANCE

REPRODUCED IN THIS FORM
BY

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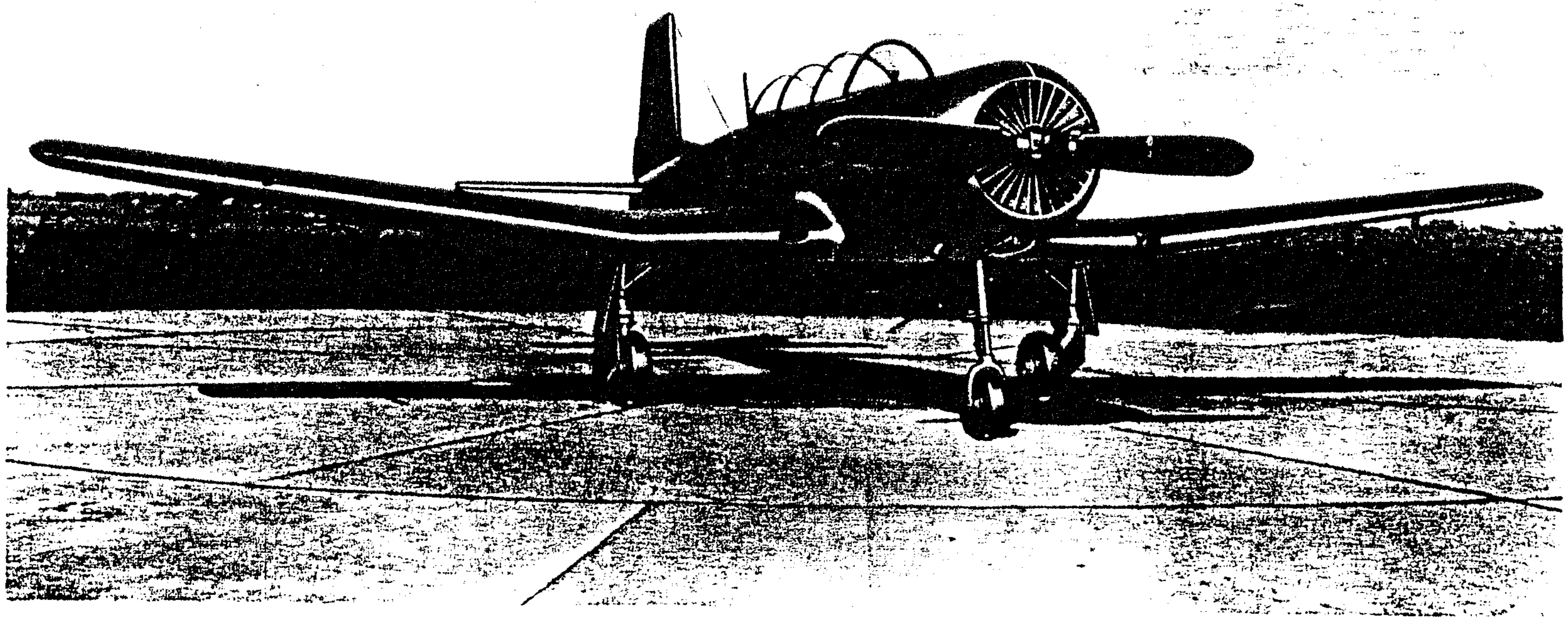

初教6型飞机¾前侧视图

Three quarter front view of the airplane type CHUJIAO-6

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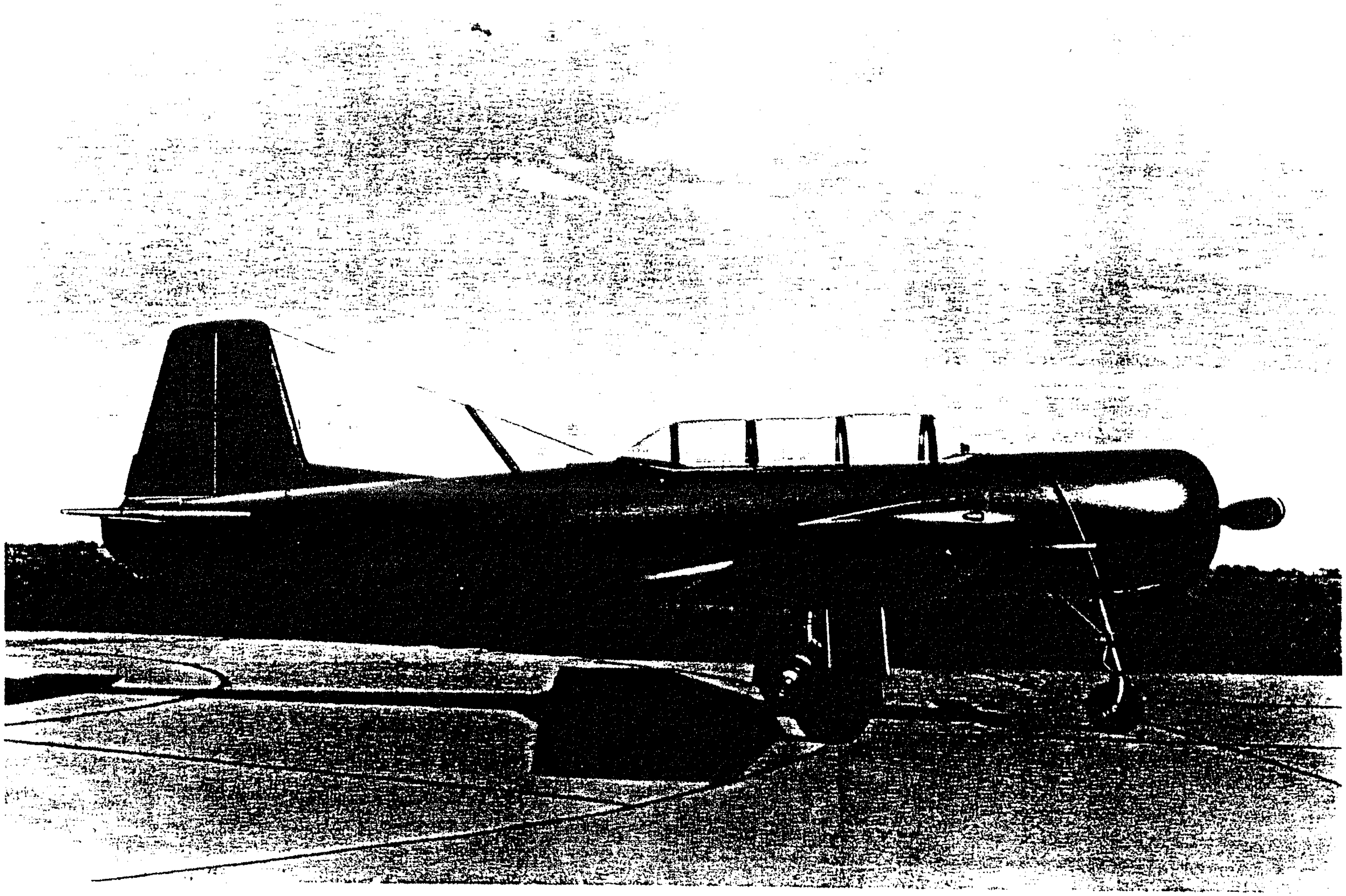

初教6型飞机侧视图

Side view of the airplane type CHUJIAO-6

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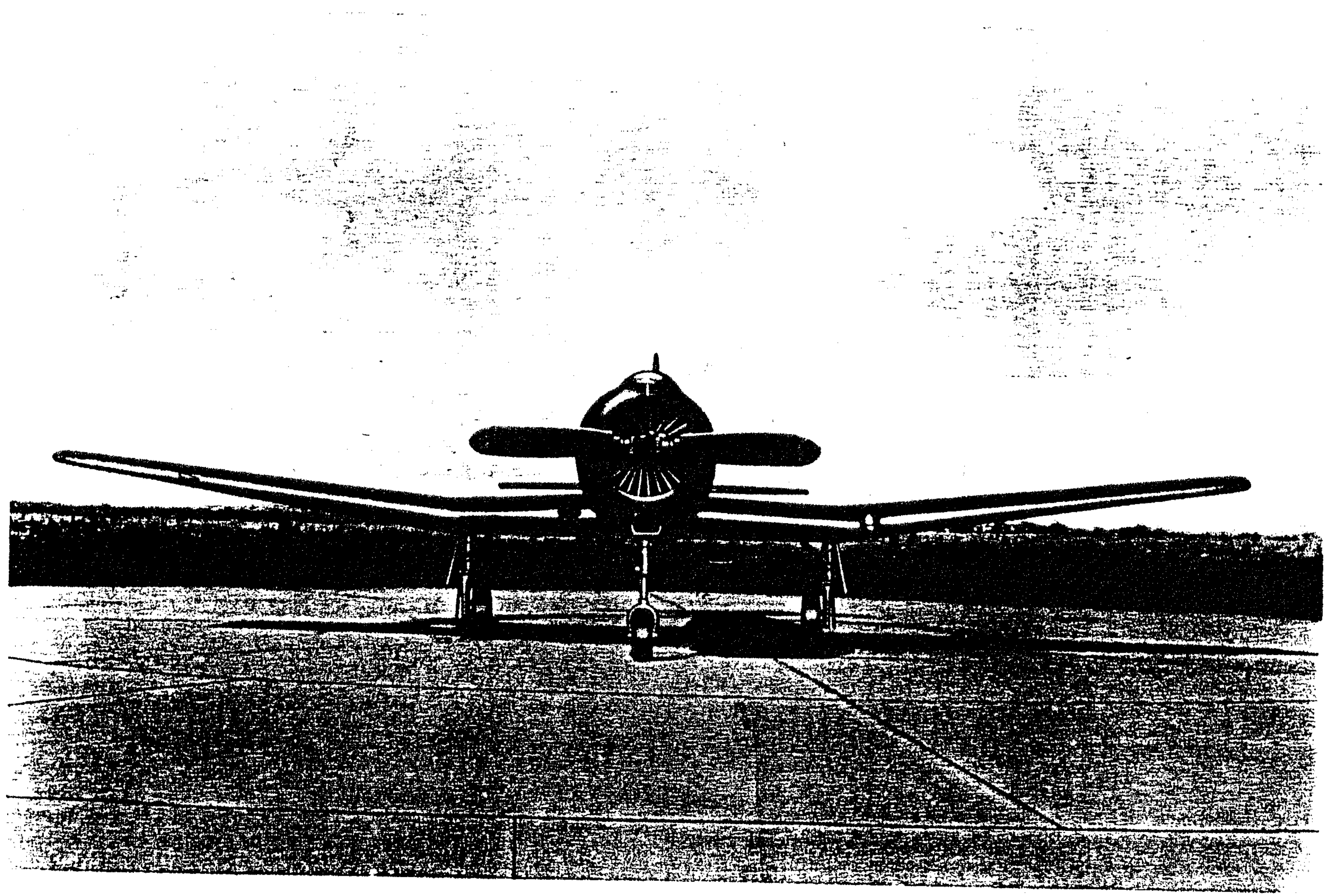

初教6型飞机正视图

Front view of the airplane type CHUJIAO-6

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The symbols used in this book are defined as follows:

H: Flight altitude.

V: Flight speed.

V_Y: Climbing speed.

t: Time.

n: Engine rotating speed.

V_X: Cruising speed.

b: Wing chord length.

b_A: Mean aerodynamic chord length.

G: Weight.

b_M: Measured chord.

$\overline{X}_T = \frac{X_T}{b_A}$: Longitudinal relative coordinate of the center of gravity of the airplane, i.e., the ratio in percent for the distance X_T from the center of gravity to the mean aerodynamic chord leading edge against the mean aerodynamic chord length b_A.

$\overline{Y}_T = \frac{Y_T}{b_A}$: Vertical relative coordinate of the center of gravity of the airplane, i.e., the ratio in percent for the vertical distance Y_T from the center of gravity to the mean aerodynamic chord against the mean aerodynamic chord length b_A.

The material mentioned in this book usually denotes some material of special designation, for example: The chromium-manganese-silicon alloy steel is defined as the 30CrMnSiA steel heat-treated to $\sigma_b = 120 \pm 10$ kg./mm^2.; the low carbon steel as the 20 steel; the medium carbon steel as the 45 steel; the dural as the LY12 alloy heat-treated to $\sigma_b \geqslant 40$ kg./mm^2.; the wrought aluminium as the LD5 alloy heat-treated to $\sigma_b \geqslant 36$ kg./mm^2.; the anticorrosive aluminium alloy sheet as the LF21-Y2 sheet; the anticorrosive aluminium alloy tube as the LF2—M tube; the cast aluminium as the ZL-101-T4 alloy; the albronze as the QAl10-3-15 alloy; the airplane fabric as the 112 primitive colour plain-woven fabric.

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CONTENTS

PART TWO

SERVICE AND MAINTENANCE OF THE AIRPLANE

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CAUTION

ENGINE MANAGEMENT

BEFORE STARTING THE ENGINE ENSURE INLET MANIFOLDS ARE DRAINED IN ACCORDANCE WITH THE MAINTENANCE MANUAL IF THE ENGINE HAS NOT BEEN STARTED FOR TWO DAYS OR MORE

AN ATTEMPT TO START THE ENGINE WITHOUT DRAINING THE INLET MANIFOLDS MAY RESULT IN DAMAGE TO THE ENGINE

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PART ONE

TECHNICAL SPECIFICATION OF THE AIRPLANE

CHAPTER I

THE MAIN FLIGHT AND TECHNICAL DATA OF THE AIRPLANE

I. MAIN FLIGHT DATA (With normal flight weight)

1. The maximum level flight speed

While the engine is operated at the maximum power n=2,350 r.p.m., the speed is:

On sea level ....287 km./hr.
At altitude H=1,000 m. ....284 km./hr.
At altitude H=2,000 m. ....278 km./hr.
At altitude H=3,000 m. ....269 km./hr.

The curves of the maximum level flight speed vs. the altitude are shown in Fig. 1.1.

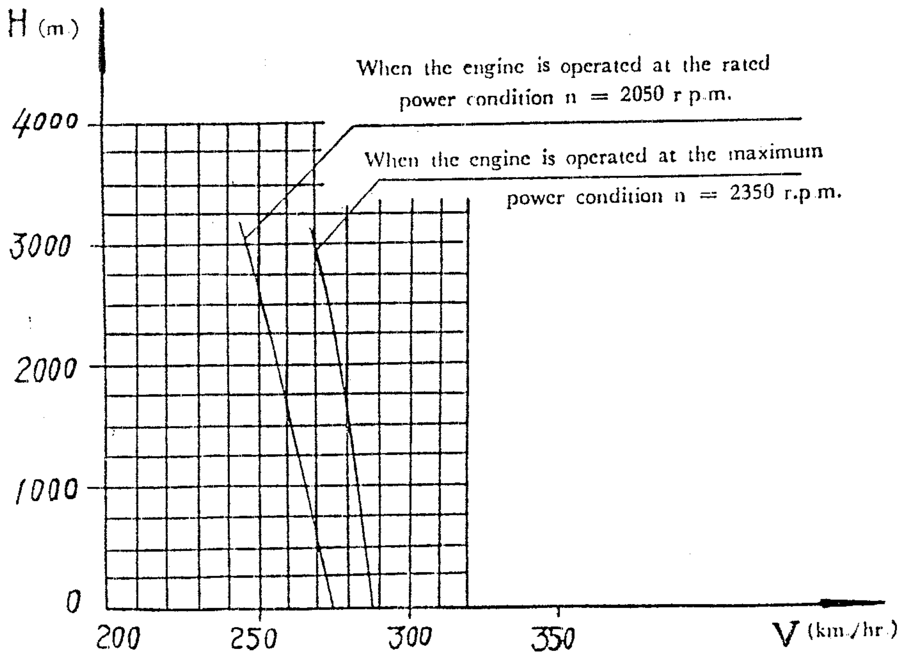


Fig. 1.1 Curves of the maximum level flight speed vs. the altitude

2. Time of climbing

When the engine is operated at the rated power condition n=2,050 r.p.m., the time of climbing (The time for take-off run not included) up to the following corresponding altitude is:

H=1,000 m. ....3.7 min.
H=2,000 m. ....8.5 min.
H=3,000 m. ....16 min.
H=4,000 m. ....26.7 min.

The curves of the maximum climbing speed and time of climbing vs. the altitude are shown in Fig. 1.2.

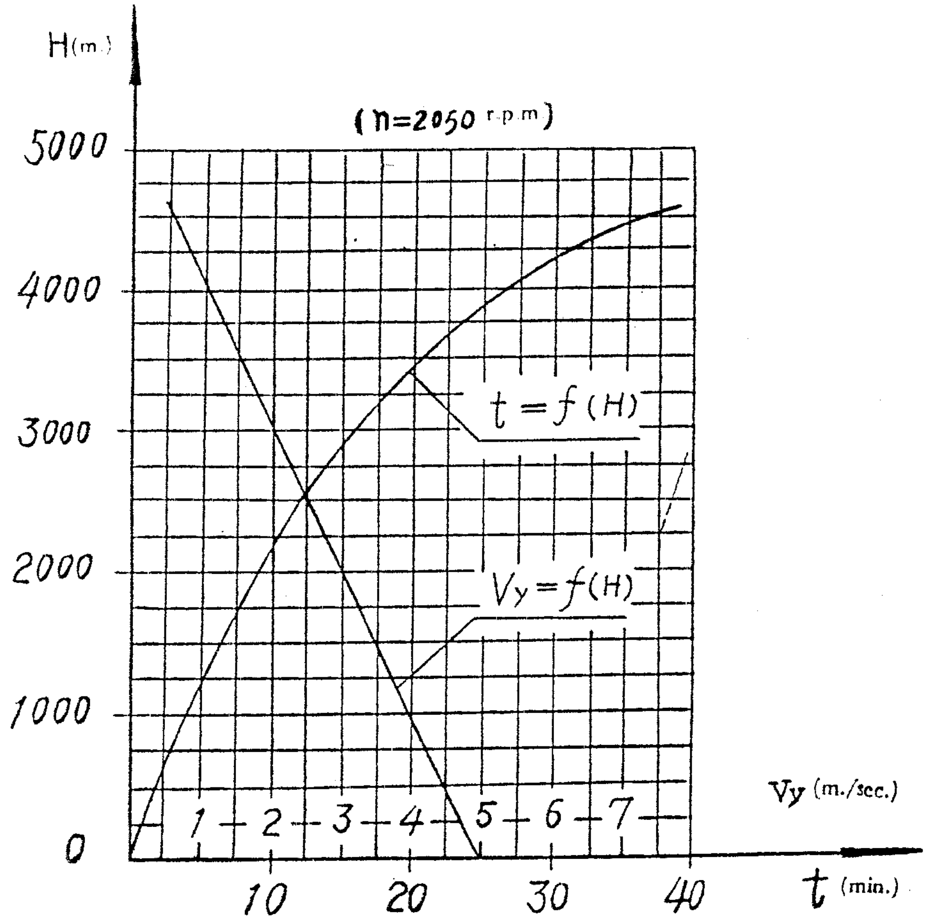


Fig. 1.2 Curves of the maximum climbing speed and time of climbing vs. the altitude

3. Operating ceiling
   With n=2,050 r.p.m. ....4,600 m.
   With n=2,350 r.p.m. ....5,200 m.
4. The time for climbing up to the operating ceiling ....39.5 min.
5. Landing speed (With remaining fuel 30%, and flight
   weight G=1,323 kg.) ....115 km./hr.
6. Landing run (On the cement runway, with flap down
   and wheel braked) ....350 m.
7. Take-off run (On the cement runway) ....280 m.

8. Technical air range (H=1,000 m., n=1,730 r.p.m.
$V_{indicator}$=170 km./hr., remaining fuel 10%)......640 km.

9. Duration (H=1,000 m., n=1,730 r.p.m.
$V_{indicator}$=170 km./hr., remaining fuel 10%) ......3.6 hr.

10. The maximum allowable diving speed......350 km./hr.

II. MAIN GEOMETRIC DATA

1. Wing

1) Gross area (Including the aileron area)......17 m^2.
2) Span length (Theoretical value, wingtip light not included) ......10.18 m.
3) Aspect ratio 6
4) Trapezoidal ratio 2
5) Sweepback angle (Along the focal line at the position 25% b)......0°
6) Setting angle ......2°30′
7) Chord length at the wing root ......2.244 m.
8) Chord length at the wingtip ......1.123 m.
9) Mean aerodynamic chord length b_A ......1.747 m.
10) Dihedral angle of the outer wing ......7°
11) Geometric angle of twist of the outer wing with
wingtip leading edge downward ......3°
12) Wing airfoil design:
Airfoil of the wing root NACA23016
Airfoil of junction plane between the midwing and
the outer wing NACA23015.2
Airfoil of the wingtip NACA4412

2. Aileron

1) Type ......Set-back hinge Frise aileron
2) Area ......2×0.649 m^2.
3) Span length (For one aileron)......1.91 m.
4) Chord length of the aileron in proportion to that of the wing
(Measured along the direction perpendicular to the focal line)......25%
5) Compensating chord length in proportion to the chord length of the aileron
(Measured along the direction perpendicular to the focal line) 20%
6) Compensating area of the aileron ......2×0.13 m^2.
7) The maximum deflection angle of the aileron
(Measured in the plane perpendicular to the aileron rotating shaft):
With trailing edge upward......22°
With trailing edge downward ......16°

3. Flap

1) Type......Split type
2) Area ......1.565 m^2.

3) Span length..3.33 m.
4) Down angle while: Take-off...0°
Landing ....40°

4. Fuselage

1) Overall length (Including engine cowl) ....8.126 m.
2) The maximum sectional area:
(With cockpit canopy) ....0.997 m^2.
(Without cockpit canopy)..0.833 m^2.

5. Horizontal empennage

1) Gross area (Including the horizontal stabilizer and elevator) ....3.058 m^2.
2) Span length ....3.39 m.
3) Aspect ratio 3.7
4) Trapezoidal ratio..1.6
5) Setting angle ....0°
6) Airfoil NACA0009M
7) Area of the elevator..2×0.5585 m^2.
8) Compensating area of the elevator ....2×0.07 m^2.
9) Deflection limit of the elevator (Measured in the plane
perpendicular to the elevator rotating shaft)
With trailing edge upward ....28°
With trailing edge downward ....20°
10) Area of the elevator trim tabs ....2×0.025 m^2.
11) Deflection limit of the elevator trim tab ....±15°

6. Vertical empennage

1) Exposed area of vertical empennage
(Including the fin and rudder) ....1.45 m^2.
2) Trapezoidal ratio 2
3) Airfoil..NACA0009M
4) Area of the rudder ....0.698 m^2.
5) Chord length of the rudder in proportion to
that of the vertical empennage 50%
6) The maximum deflection angle of the rudder
(Measured in the plane perpendicular to the rudder rotating shaft) ......±25°

7. Miscellaneous data

1) Overall length of the airplane
(Measured along the airplane axis) ....8.46 m.
2) Height of the airplane
As airplane in level position ....3.25 m.
As airplane in parking state ....2.94 m.

3) Span length of the wing
(The overall dimension including the wingtip lights) ....10.22 m.
4) Tread of the main landing gear ....2.87 m.
5) Distance between axles of the nose wheel and the main wheels (In parking state) ....2.284 m.
6) Parking angle (Under normal load) ....3°47′
7) Dimension of the main wheel tire ....500×150 mm.
8) Dimension of the nose wheel tire ....400×150 mm.
9) Distance from the propeller tip to the ground
(Airplane in parking position) ....about 450 mm.

III. WEIGHT AND CENTER OF GRAVITY LOCATION

1. Weight of empty airplane ....1,095 kg.
2. Normal flight weight..1,400 kg.
3. Payload in the normal flight:
   1) Two pilots (With parachutes)..180 kg.
   2) Fuel ....110 kg.
   3) Lubricating oil ....15 kg.

Total 305 kg.

Center of Gravity

Airplane state	Weight (kg.)	C. G. location (% of mean aerodynamic chord length)	Angle preventing nose-over
1. Empty airplane (With landing gear down)	1,095	18	21°40′
2. Normal flight weight (With landing gear down)	1,400	23.4*	17°

The C.G. location is shown in Fig. 1.3.

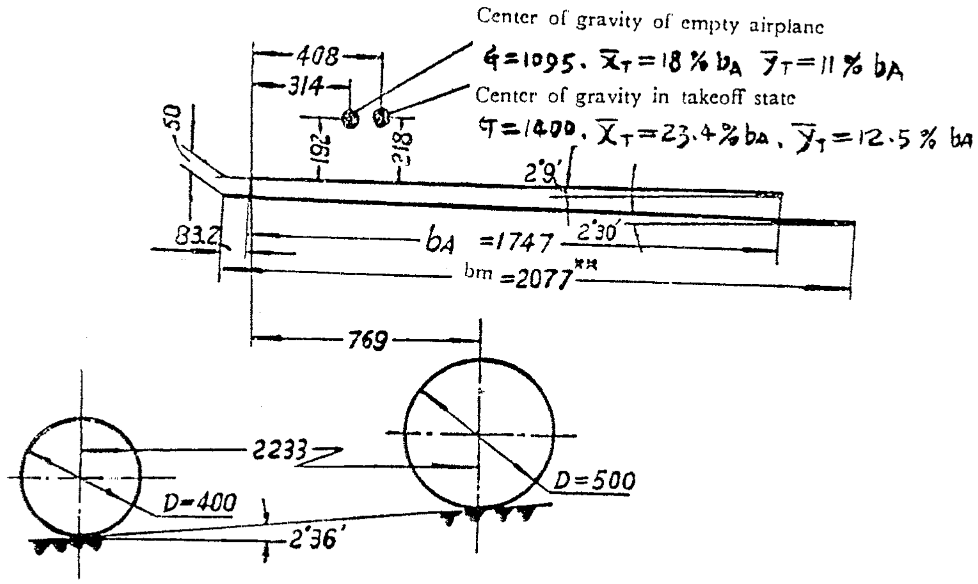


Fig. 1.3 Location of airplane C.G.

Limiting C.G. location applied

Rear C.G. location (In normal flight state and with landing gear up) .... 24.1% b_A

Front C.G. location (With front cockpit pilot, remaining fuel 10%, Lubricating oil 10 kg. and landing gear down) .... 17% b_A

*As the landing gears are retracted up, the airplane C.G. moves backwards by a distance of 0.7% mean aerodynamic chord length.

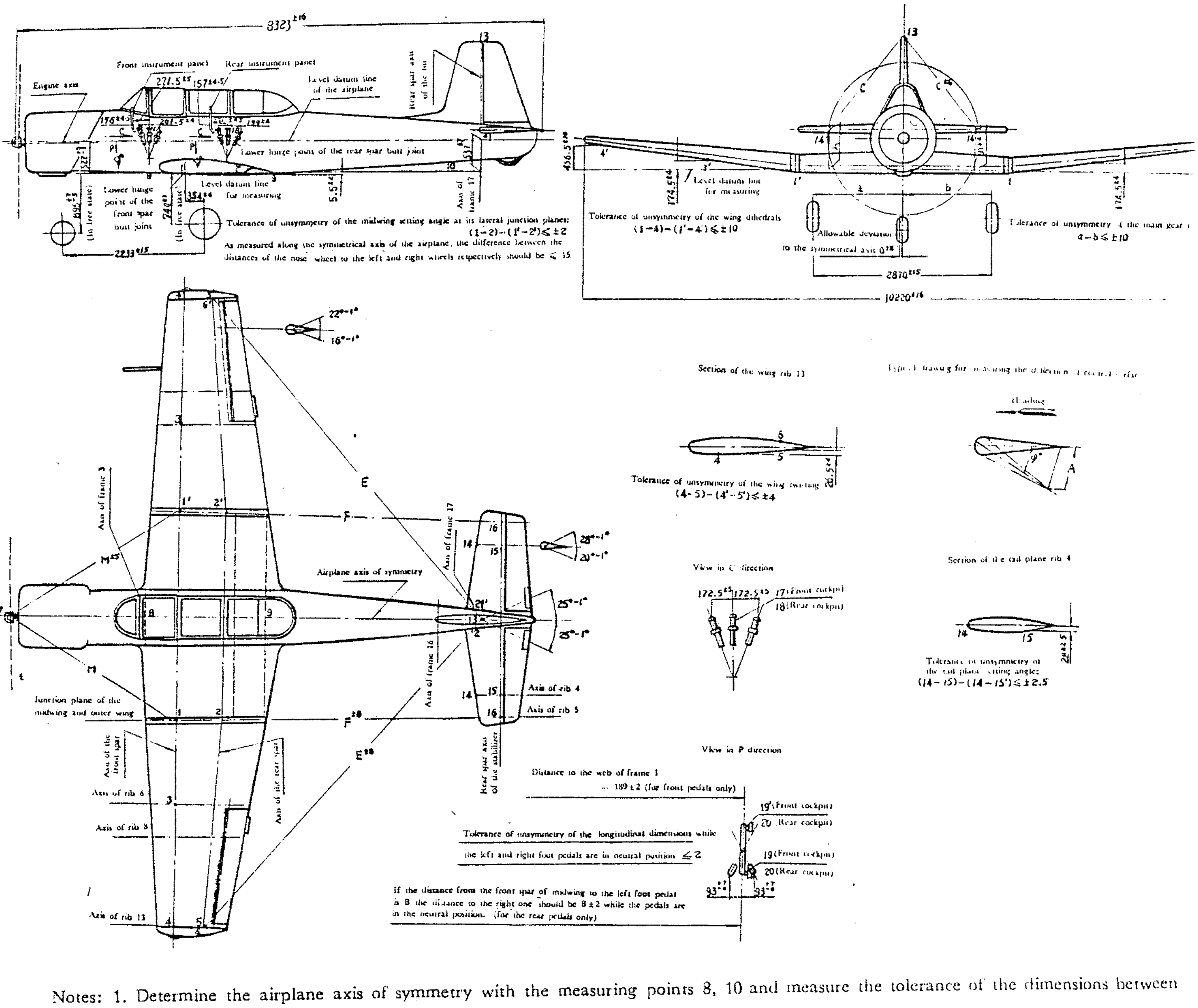
**At the position 756 mm. apart from the axis of symmetry.

IV. LEVEL MEASUREMENT AND ADJUSTMENT OF THE AIRPLANE

The purpose of the level measurement is to ascertain that the components of the airplane are properly assembled and that of the adjustment is to make the movements of all control mechanisms and the deflection angles of all the control surfaces within the prescribed numerical range.

The correctness of the position of each component relative to the airplane axis of symmetry and the level datum line, and the correctness of the relative position between components themselves are determined according to the data and the dimensions between marked points on the level measurement and adjustment diagram of the airplane (Fig. 1.4).

The adjustment of the airplane control system may be performed by way of adjusting the lengthes of the control pull-rods and cables with the adjusting bolts or turn-buckles in the system. The correctness of the movements of the control mechanisms is also check-



Notes: 1. Determine the airplane axis of symmetry with the measuring points 8, 10 and measure the tolerance of the dimensions between the wheels and the axis of symmetry.

2. Measure the aileron deflection angle along the axis of the wing rib 8. Measure the elevator deflection angle along the axis of the tail plane rib 4. Measure the deflection angle of the rudder along the axis of the vertical tail rib 3. Measure all the linear dimension of the control surfaces by drawing a straight line from the trailing edge point of the root rib of the control surface to that of the tip rib of the nearby fixed portion. Only the flap opening is measured at the point 9 in the symmetrical plane of the airplane.

Fig. 1.4 Level measurement and adjustment diagram of the airplane

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ed according to the dimensions between marked points on the level measurement and adjustment diagram of the airplane.

The deflection angle of each movable surface of the airplane should meet the prescriptions listed in the table 1.1.

Table 1.1 The deflection angle and numerical value of each movable surface of the airplane

Name	Direction	Deflection Angle φ°	Dimension A (mm.)
Aileron	up	$22^{\circ -1^{\circ}}$	122^{-5}
	down	$16^{\circ -1^{\circ}}$	$87^{-5.6}$
Flap	down	$40^{\circ}{}^{+1.5^{\circ}}_{-1^{\circ}}$	$317^{+11}_{-7.5}$
Rudder	left	$25^{\circ -1^{\circ}}$	257^{-11}
	right		
Elevator	up	$28^{\circ -1^{\circ}}$	185^{-6}
	down	$20^{\circ -1^{\circ}}$	$133^{-6.3}$
Elevator trim tab	up	$15^{\circ \pm 2^{\circ}}$	$20^{\pm 2.5}$
	down		

The schematic diagram of the airplane supporting for level measurement is shown in Fig. 1.5.

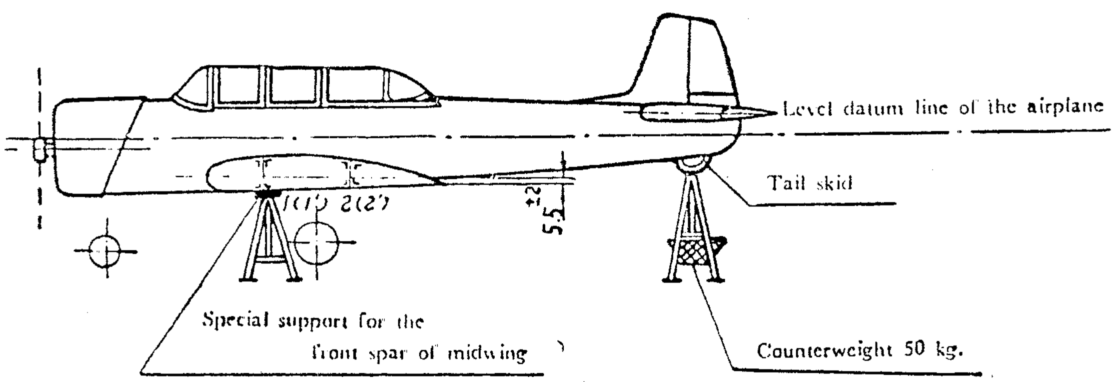


Fig. 1.5 Schematic diagram of the airplane supporting for level measurement

CHAPTER II

AIRPLANE STRUCTURE

The airplane body composed of the fuselage, wing and empennage includes ten sub-assemblies in all: one fuselage, one midwing, two outer wings, two ailerons, one horizontal stabilizer, one elevator, one vertical stabilizer and one rudder. The fuselage and midwing are permanently mounted, while the remaining sub-assemblies can be dismantled.

The airplane body takes dural as its structural material prior to other ones, such as anticorrosive aluminium alloy, wrought aluminium, CrMnSi alloy steel, carbon steel, airplane fabric and organic glass.

The skin of the fuselage, wing and stabilizers are made of the dural sheets, while that of the ailerons, elevator and rudder of the airplane fabric.

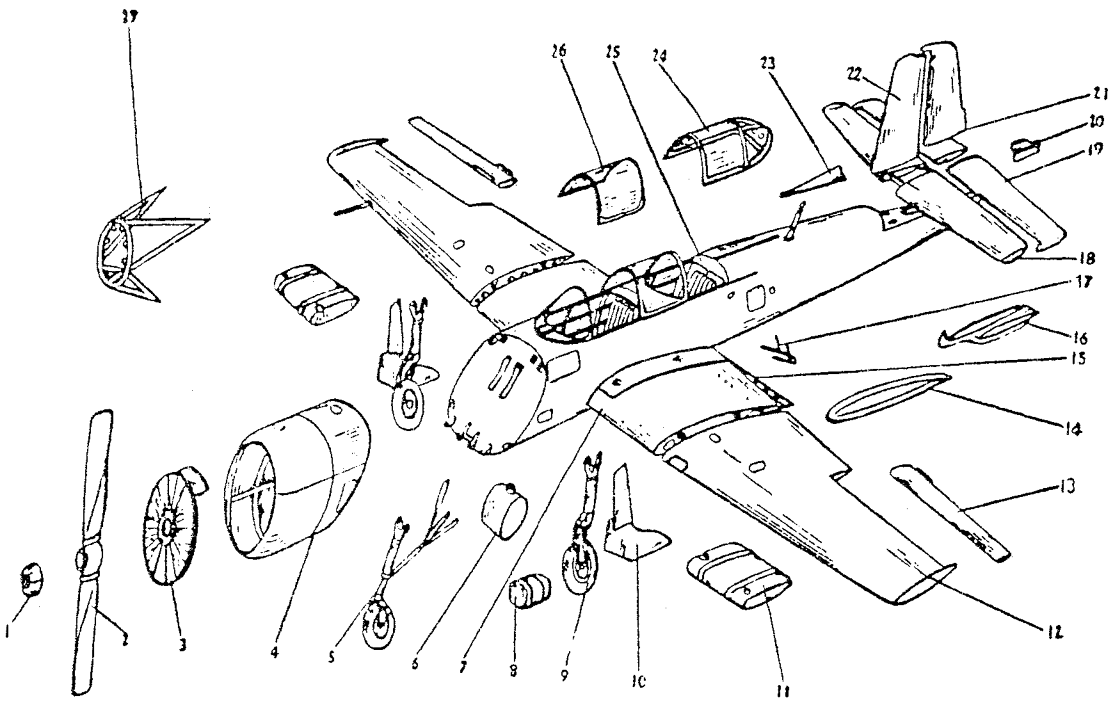


Fig. 2.1 Breakdown sketch of the airplane body

1. Propeller dome 2. Propeller 3. Engine gill 4. Engine cowl 5. Nose landing gear 6. Lubricating oil tank 7. Midwing 8. Feed tank 9. Main landing gear 10. Main landing gear fairing 11. Fuel tank 12. Outer wing 13. Aileron 14. Fairing strip for mid-outer wing 15. Flap 16. Empennage fairing 17. Foot step 18. Horizontal stabilizer 19. Elevator 20. Tail cone 21. Rudder 22. Vertical stabilizer 23. Ridge fairing 24. Rear sliding canopy 25. Fuselage 26. Front sliding canopy 27. Engine mount

In order to prevent their corrosion, all aluminium parts are surface-treated and steel parts plated or painted.

No matter whether the skin is made of the dural sheet or airplane fabric, it should be sprayed with the G52-1 perchloro-ethylene anticorrosive paint. The upper skin is painted grass green, the lower skin greyish blue.

The breakdown sketch of the airplane body is shown in Fig. 2.1.

I. FUSELAGE

The fuselage (Fig. 2.2) is of all metal semi-monocoque structure. Its skeleton is composed of twenty-one frames, four longerons and twenty-six stringers, and covered with dural skin of 0.6 and 0.8 mm. thickness.

Behaving as the fire wall, the frame 0 is equipped with fittings for attaching the engine mount, engine cowl and nose landing gear. On the frame 1 are installed the fittings for fixing the oblique jackstay and the actuating cylinder of the nose landing gear, on the lower part of the frames 5 and 8 the fittings to be connected with the midwing, on the frame 16 the front fitting for fixing the vertical stabilizer, on the frames 17 and 18 the front and rear fittings to be connected with the horizontal stabilizer respectively.

The upper and lower longerons are all made of dural sheets by bending. The upper longeron is composed of two segments, the front and rear segments. Its rear end is connected with the stringer 3 at the position of 100 mm. ahead of the frame 12. The lower ongeron is composed of three segments, the front, mid and rear segments. Its rear enp is connected with the stringer 10 at the position of 100 mm. ahead of the frame 12 too.

The nose wheel bay is located under the floor of the front cockpit between the frames 0 and 5, the pilots' cockpits between the frames 1 and 9, the avionics compartment between the frames 9 and 12. The front and rear instrument panels are put on the frames 2 and 7A respectively. The frame 9 is set obliquely, making an angle of 75° with the level datum line, so that it can act as the seat back for the rear pilot. The gate on the frame 9 together with the doors on the lateral skin between the frames 10 and 12 are provided for mounting, dismantling and servicing various devices. The tail cone is located behind the frame 18. The tail skid made of low carbon steel tube is fixed on the frame 18 and the tail cone with screws and anchor nuts.

The pilots' cockpits are ceiled with transparent canopies and furnished with adjustable seats and ventilation units.

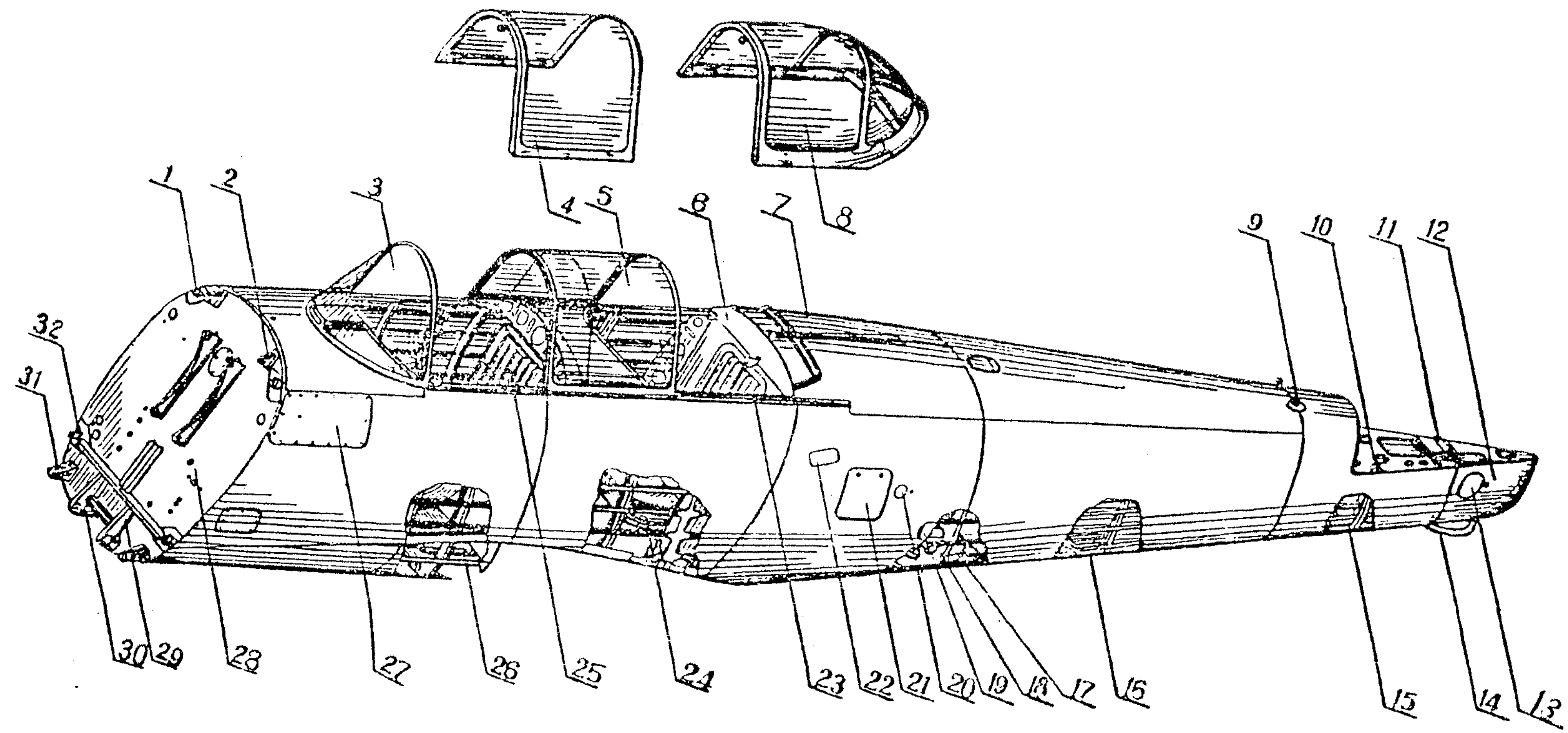
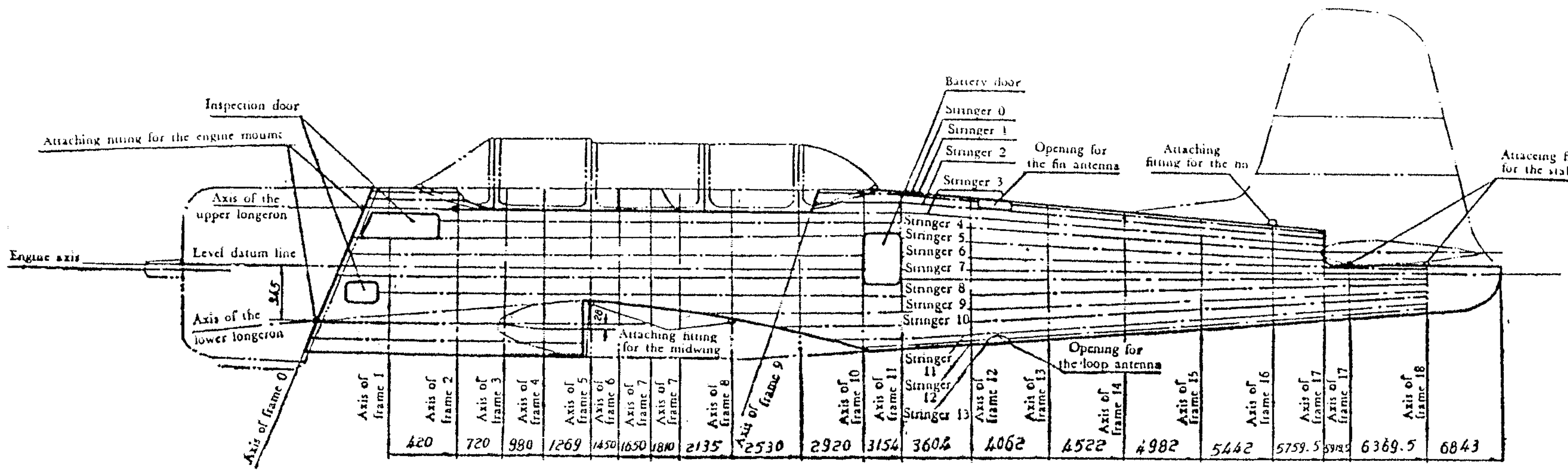


Fig. 2.2 Fuselage

1. Upper fitting for engine mount 2. Upper fitting for engine cowl 3. Front wind shield 4. Front sliding canopy 5. Middle fixed canopy 6. Frame 9 7. Mid track for rear sliding canopy 8. Rear sliding canopy 9. Front fitting for vertical stabilizer 10. Front fitting for horizontal stabilizer 11. Rear fitting for horizontal stabilizer 12. Tail cone 13. Inspection door for control cable 14. Tail skid 15. Frame 17 16. Frame 14 17. Access door for loop antenna 18. Frame 12 19. Field air charging nipple 20. Field power supply socket 21. Access door for battery box 22. Mounting handgrip 23. Side tracks for canopy 24. Rear seat 25. Front seat 26. Front cockpit floor 27. Inspection door 28. Frame 0 29. Fitting for nose landing wheel 30. Side panel of the nose wheel bay 31. Lower fitting for engine cowl 32. Lower fitting for engine mount



Data of stringer

Frame No. / Stringer No.	1 Y	1 X	11 Y	11 X	18 Y	18 X
0		0		0		0
1		±119		±119	+230	
2		±235		±235	+200	
3			+383.7		+157	
4	+285		+285		+113	
5	+170		+170		+68	
6	+70		+70		+23	
7	-46		-46		-23	
8	-150		-150		-68	
9	-253		-253		-113	
10			-379.7		-157	
11		±240		±240	-200	
12		±121		±121	-230	
13		0		0		0
Remark	The stringers between frame 1 and frame 0 are protractions of stringers between frame 11 and frame 1.					

Distribution of stringers

View in heading direction

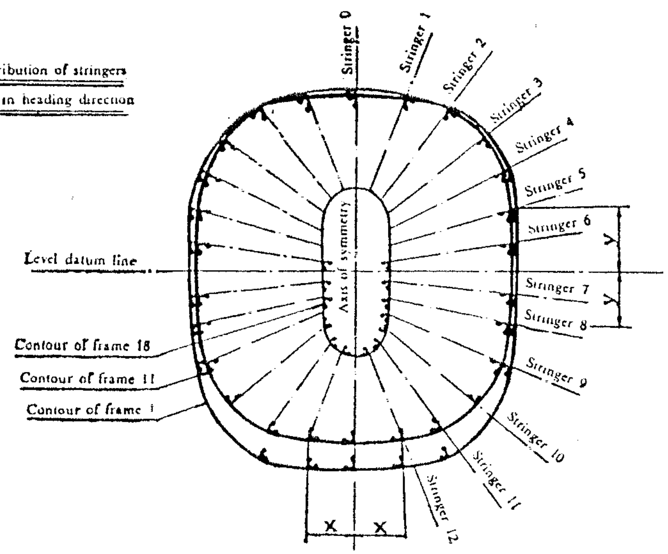


Fig. 2.3 Diagram of the fuselage skeleton

FUSELAGE SKELETON

The fuselage skeleton (Fig. 2.3) consists of the longitudinally and transversely stressed members, cockpit floor and side panels of the wheel bay.

TRANSVERSE MEMBERS

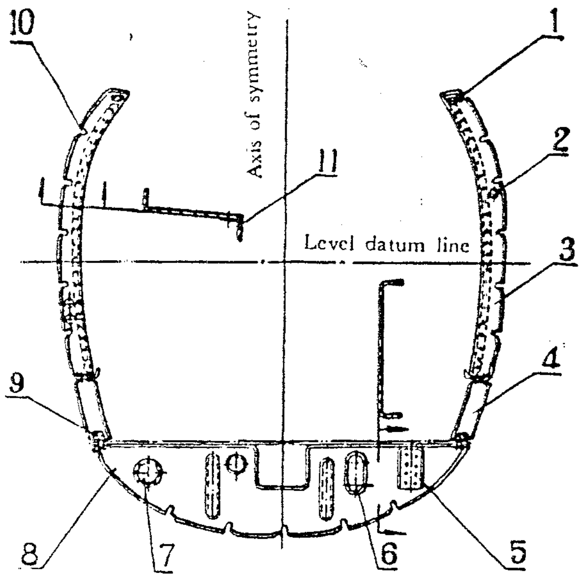
The transverse members comprise twenty-one frames.

According to their structural types, the frames may be generally classified into four groups: the front frames, the mid frames, the aft frames and the reinforced frames.

The front frames are composed of the arched segments with "⅂" shaped cross section, the mid and aft frames of the arched segments with "Π" shaped cross section. The arched segments made of 0.8 mm. thick dural sheets and notched for setting stringers are connected together with angular plates made of 1 or 0.8 mm. thick dural sheets.

FRONT FRAMES

As a characteristic specimen of the front frame, the frame 4 comprises side segments, segments with "Π" shaped cross section, lower web etc. (Fig. 2.4). The side segment has the "⅂" shaped cross section composed of the (XC111-1) dural section material and the 0.8 mm. thick dural sheet. It has its upper end connected with the upper longeron by means of the angular plates made of 1 mm. thick dural sheets by bending and its lower end with the lower longeron and the segment of "Π" shaped cross section made of 0.8 mm. thick dural sheets through its flange. The other end of the segment of "Π" shaped cross section is riveted with the lower web made of 0.8 mm. thick dural sheet through angular plates. The lower web reinforced with flanged access holes, stiffening grooves and boxes acts as the support of the cockpit floor and the wheel bay side panels.



1. Angular plates
2. Access hole for control cables and pipelines
3. Side segment
4. Segment
5. Angular box
6. Access hole for control cable and pipelines
7. Light hole
8. Lower web
9. Angular plate
10. Stringer notch
11. Stiffening section material

Fig. 2.4 Frame 4 (Typical front frame)

MID FRAMES (Frames 10, 11 and 12)

Behaving as the support of the avionics bracket, the lower web of the mid frame is composed of the dural panel of 0.8 mm. thickness, reinforcing plates and section materials. The panel is provided with light holes, stringer notches, and flanges riveted with the fuselage skin.

Having the "Π" shaped cross section, the upper and side segments of the mid frames are made of 0.8 mm. thick dural sheets by bending and jointed with the lower web to form a closed periphery. The typical mid frame is shown in Fig. 2.5.

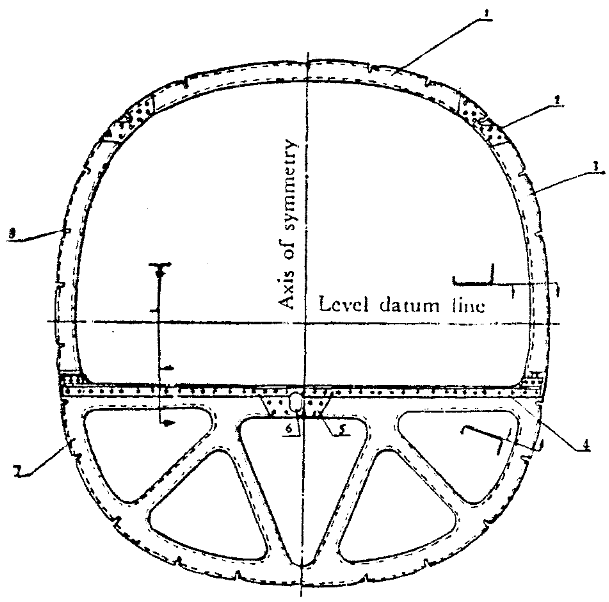


Fig. 2.5 Frame 12 (Typical mid frame)

1. Upper segment section material 2. Connecting plate 3. Side segment 4. Reinforcing 5. Reinforcing plate 6. Access hole for control cable 7. Lower web 8. Stringer notch

AFT FRAMES

The aft frames include such ones as numbered from 13 to 15 (Fig. 2.6) and are combined into a whole with the upper, side and lower segments with "Π" shaped cross sections by means of connecting plates to form a closed periphery. All the aft frames are made of 0.8 mm. thick dural sheets.

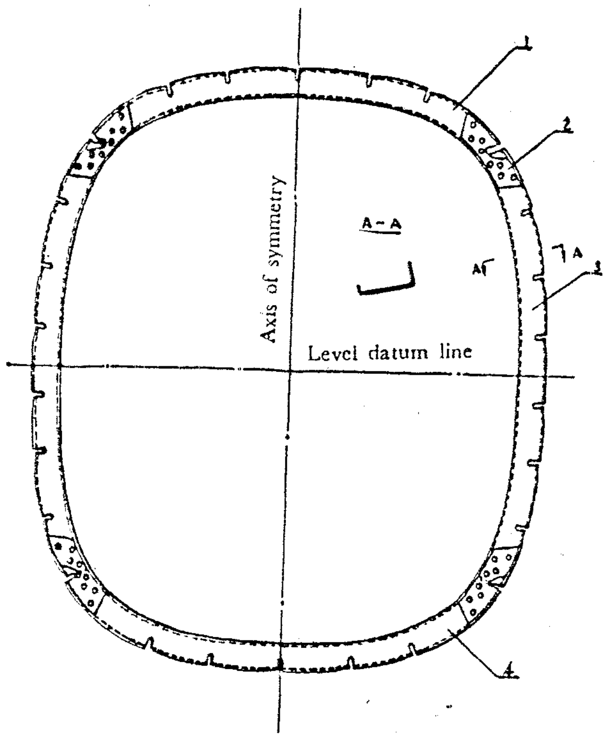


Fig. 2.6 Frame 14 (Typical aft frame)

1. Upper segment 2. Connecting plate 3. Side segment 4. Lower segment

REINFORCED FRAMES

The reinforced frames are those numbered 0, 1, 5, 8, 9, 16, 17 and 18. They are made of extruded or bended section materials and webs, and equipped with attachment fittings to be connected with other components and accessories.

The frame 0 is provided with the attachemnt fittings for the engine mount, engine cowl and nose landing gear and with saddle seats for the lubricating oil tank. The rear end of the engine mount attachment fitting made of CrMnSi alloy steel forging and sheets by welding is inserted in the longeron and riveted with the skin, longeron and web. The upper engine cowl attachment fitting made of 1.2 mm. thick low carbon steel sheets by welding are riveted on the web and its reinforcing angle sections. The lower engine cowl attachment fitting made of wrought aluminium by die pressing are riveted and bolted on the reinforcing section material of the frame and the longitudinal members of the fuselage. The nose landing gear attachment fittings made of wrought aluminium by die pressing are fixed on the reinforcing section material of the frame, wheel bay side panels and skin by bolts and steel rivets. Acting additionally as the fire wall, the web of the frame is composed of the 1 mm. thick dural sheet and extruded or bended section materials and opened with access holes for control cables and pipelines and access door with detachable cover.

On the upper part of the frame (Fig. 2.7) is set the attachment fitting for fixing the nose landing gear actuating cylinder, it is riveted and bolted to the reinforcing section materials and connecting plates of the frames 0 and 1. On the lower part of the frame 1 is set the attachment fitting for fixing the nose landing gear oblique jackstay, it is bolted to the reinforcing section materials of frame 1 and the cockpit floor. All the attachment fittings mentioned above are made of wrought aluminium by die pressing. The frame is composed of extruded and bended dural section materials and 0.8 mm. thick dural panel. On the web are cut the flanged light holes and access holes for the control cable and pipelines.

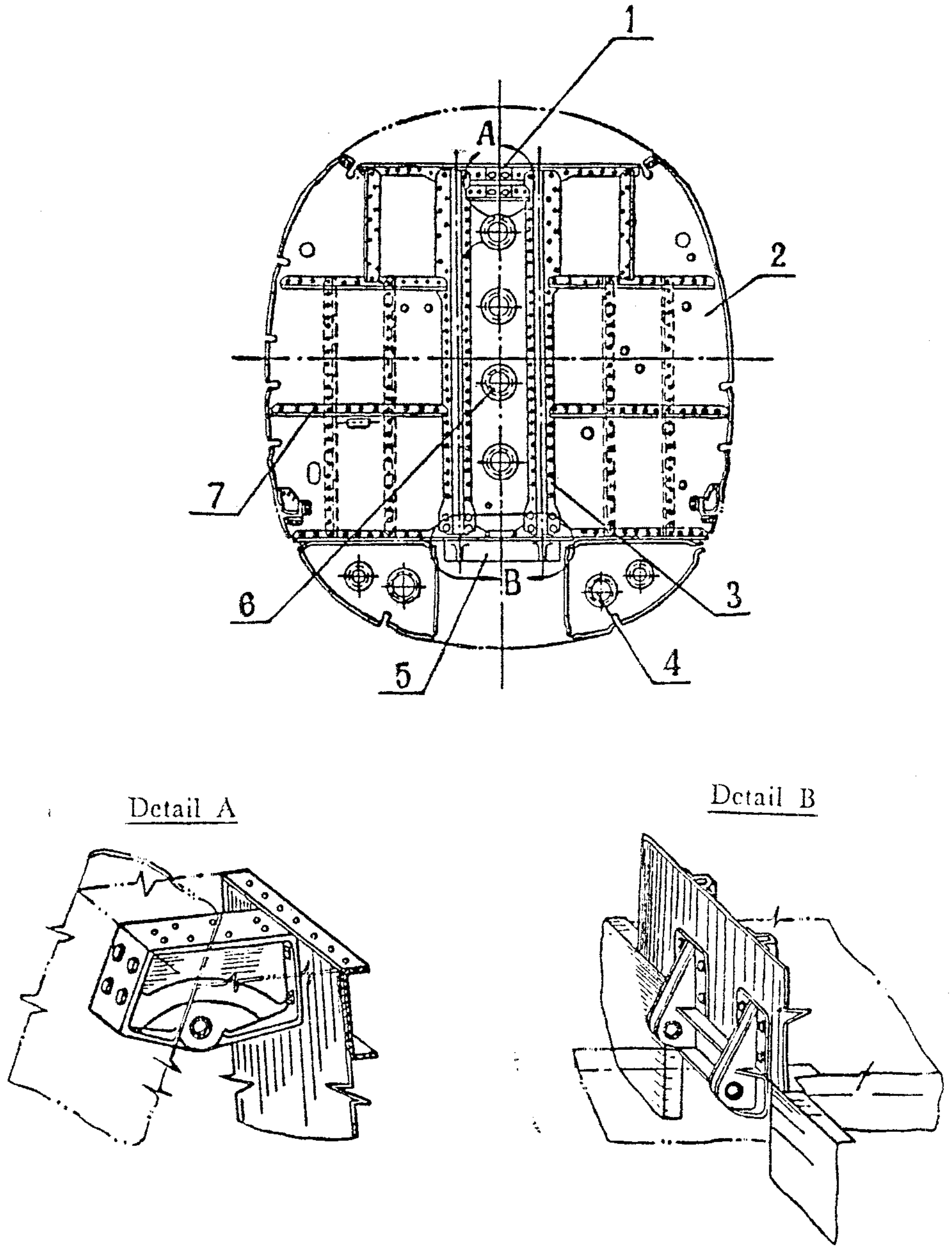


Fig. 2.7 Reinforced frame 1

1 Fitting for fixing the nose landing gear actuating cylinder 2. Web 3. Reinforcing section material 4. Access hole for control cables and pipelines 5. Fitting for fixing the nose landing gear oblique jackstay 6. Light hole 7. Section material

On the lower end of the side segments of the frames 5 and 8 are set the attachment fittings for fixing the midwing. The fittings are made of wrought aluminium by die pressing and riveted on the segments and the panel of the web with steel rivets. The segments themselves have the "I" shaped cross section, they are composed of the channels with "Π" shaped cross section made of 1.5 mm. thick dural sheets and angle sections. There are access holes for cables on them. The side segments have their upper ends riveted with the longerons thorugh angular plates made of 1 mm. dural sheets by bending (Fig. 2.8) and their boundary surfaces provided with dural peripheral strips of 1 mm. thickness for fixing the stringers.

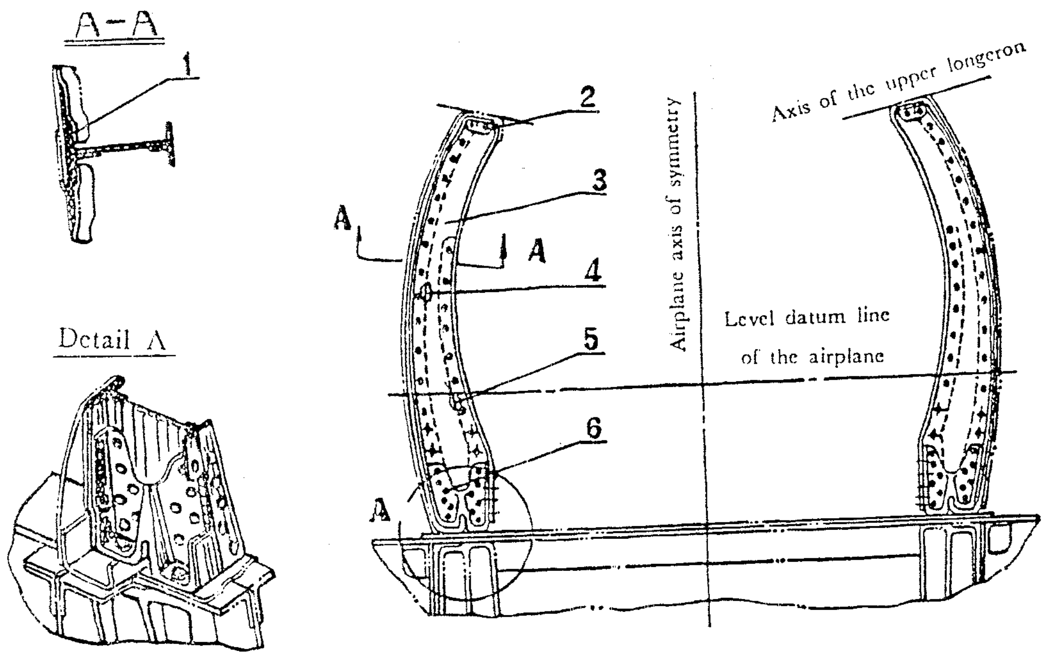


Fig. 2.8 Reinforced frame 5

1. Peripheral strip 2. Angular plate 3. Web 4. Angle plate 6. Fitting

The frames 16, 17 and 18, as shown in Fig. 2.9, consist of the extruded or bended section materials and webs made of 1 and 1.5 mm. thick dural sheets respectively. On the upper parts of these frames are installed the front attachment fittings for the fin and the front and rear attachment fittings for the horizontal stabilizer respectively. All these fittings are made of CrMnSi alloy steel sheets of 1.2,1.5 and 3 mm. thickness by welding and are riveted on the webs and stiffening section materials of the frames.

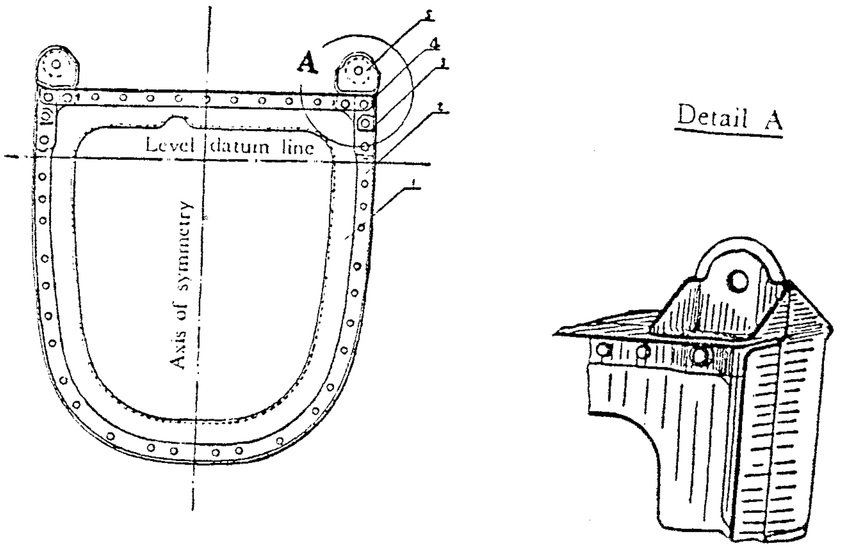


Fig. 2.9 Reinforced frame 17

1. Web 2. Section material 3. Gusset 4. Section material 5. Fitting

Acting additionally as the back of the rear cockpit seat, the frame 9 (Fig. 2.10) is set obliquely, making an angle of 75° with the level datum line. The frame is provided with a gate with two hinged doors as the access for mounting, dismantling and serving various devices in the aft compartments, and as the working passage for the rear fuselage. The doors overlaid and bolted with the back cushion of the rear seat are shut tightly with locking plates. The attachment fittings installed on the lower web for fixing the rear cockpit seat and flap actuating cylinder are made of CrMnSi alloy steel by precision casting and wrought aluminium by die pressing respectively and are bolted to the reinforcing section materials of the web. The web and gate are made of the 0.6 mm. thick dural sheets and extruded or bended section materials. The web is provided with the flanged light holes, access holes for cables and pipelines, stiffening dents and grooves. Along its periphery are cut stringer notches. The lower web is riveted with the upper skin of the midwing.

LONGITUDINAL MEMBERS

The longitudinal members (Fig. 2.3) comprise four longerons and twenty-six stringers.

The upper longeron made of 2 mm. thick dural sheets by bending is combined into a whole with its front and rear segments by means of the 2 mm. thick dural connecting plates at the position of 100 mm. ahead of the frame 10. It is also locally reinforced with the 1.5 mm. dural strips over the length from the frame 4 to the section at 20 mm. behind the frame 7. Its rear segment is connected to the stringer 3 with connecting plate made of (XC111-11) dural section material at the position of 100 mm. in front of the frame 12.

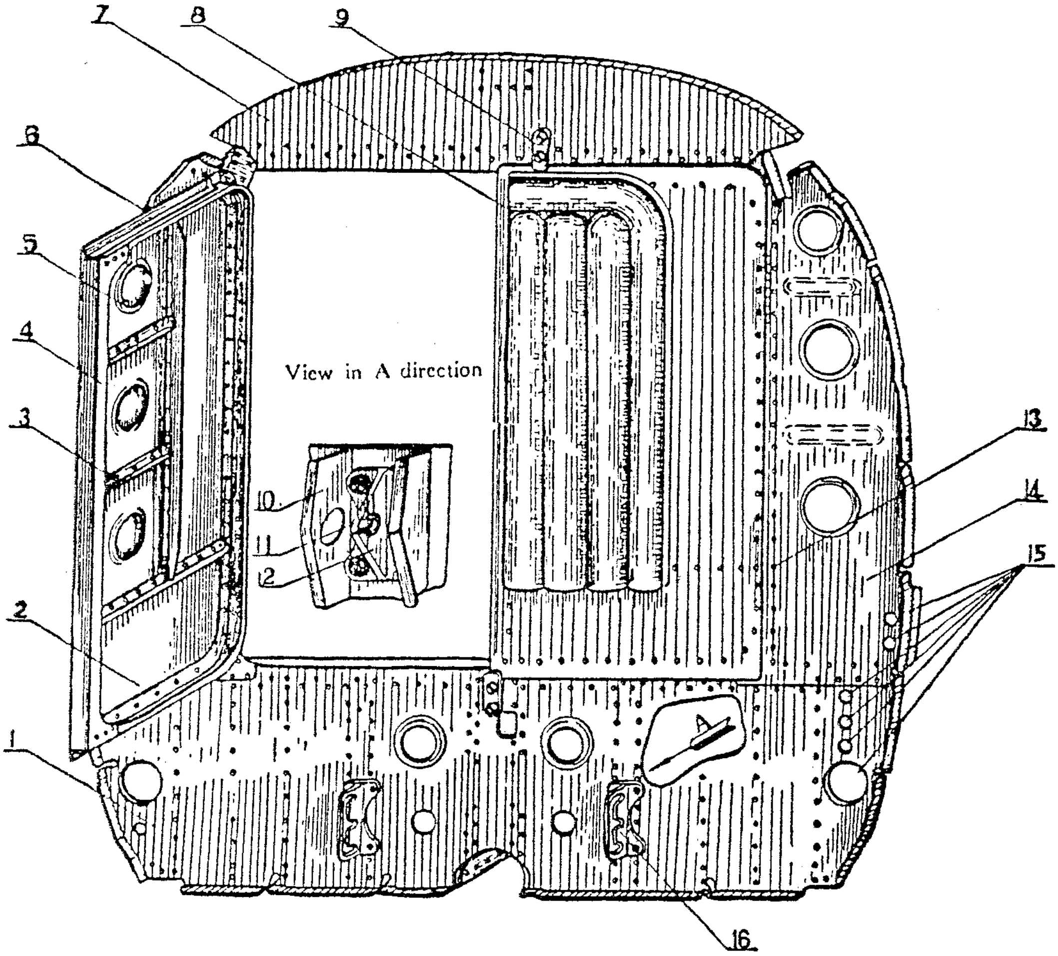


Fig. 2.10 Reinforced frame 9

1. Lower web 2. Reinforcing section material of the door 3. Reinforcing angle section of the door 4. Section materials of the door 5. Skin of the door 6. Rubber shim 7. Upper web 8. Back cushion of the rear seat 9. Locking plate of the door 10. Reinforcing strips of the lower web 11. Knuckle bearing 12. Fitting for the flap actuating cylinder 13. Hinge 14. Mid web 15. Access hole for cables and pipelines 16. Fitting for fixing the rear seat

The lower longeron made of 3 mm. thick dural sheets by bending is combined into a whole with its front, mid and rear segments by means of connecting plates made of 3 mm. thick dural sheets and the fittings made of 1.5 mm. thick CrMnSi alloy steel sheets by welding at the positions of 140 mm. behind the frame 3 and of the frame 9 respectively. It is also locally reinforced with the 1.5 mm. thick dural strips over the length from the frame 4 to frame 9 too. Its rear segment is connected to the stringer 10 with connecting plates made of (XC111-11) dural section material at the position of 100 mm. in front of the frame 12 too.

The fuselage is attached to the front and rear spars of the midwing with the fittings on the frames 5 and 8, besides, the lower longeron of the fuselage is locally connected to the edging strip of the center rib 1 of the midwing with rivets.

The stringers 3 and 10 are made of (XC111-6) dural section materials, those between frames 16 and 18 of (XC111-1) dural section materials, and the remaining ones of (XC141-2) dural section materials. The stringer segments along the periphery of the fuselage from the frame 1 to frame 11 are arranged parallelly, while those from the frame 11 to frame 18 radially. While passing across the frames, the stringers are inserted into the notches and fixed with one rivet for each intersection. At the very spots, where the stringers intersect the reinforced frames or stressed members, the stringers are at first broken and then connected with their intersected members with angular plates or strips.

The front and rear segments of the stringers are butt jointed with the stepped angular plates made of 1 mm. thick dural sheets at the technically dividing interface (Between the frames 11 and 12).

FRONT COCKPIT FLOOR AND NOSE WHEEL BAY

The front cockpit floor (Fig. 2.11) made of 0.8 mm. thick dural sheets and some dural section materials of different specifications is set on the level 345 mm. below the level datum line between frames 0 and 5. The floor stepping 28 mm. downwards between frames 3 and 4 in answer to the requirement of mounting the seat, has its side portions riveted to

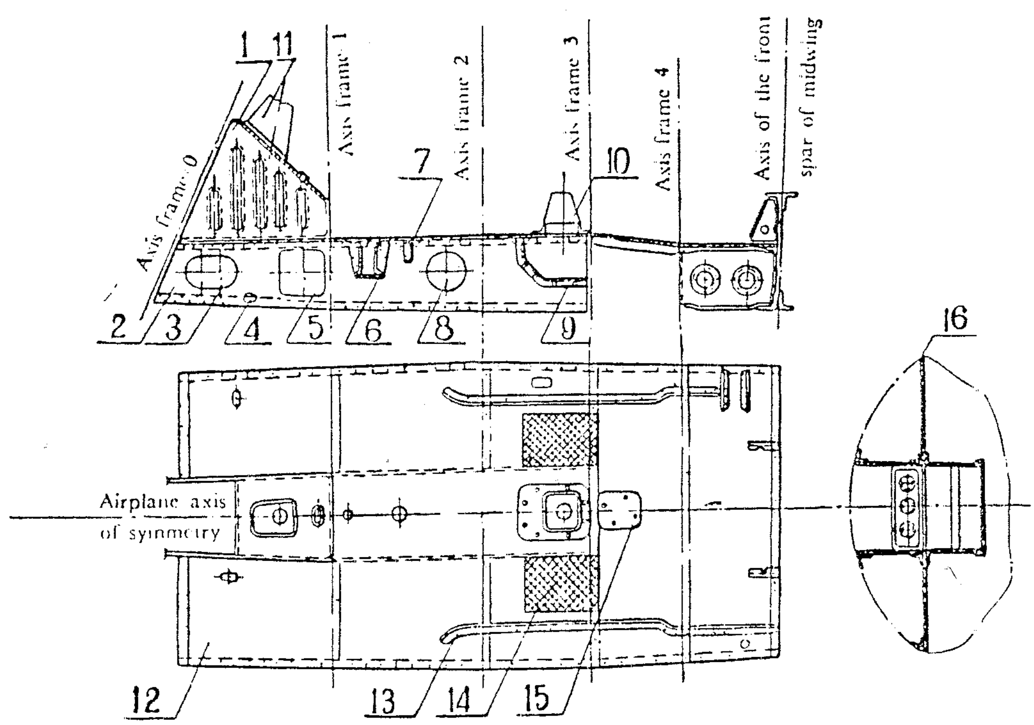


Fig. 2.11 Front cockpit floor and nose wheel bay

1. Side panel 2. Wheel bay side panel 3. Technical access 4. Reinforcing section material 5. Technical access 6. Support for fixing gear-up lock of the nose landing gear 7. Stiffening separator 8. Technical access 9. Dust shield 10. Canvas dust helmet for control stick 11. Canvas dust helmet for actuating cylinder of the nose landing gear 12. Floor 13. Section material for fixing console 14. Toothed foot board 15. Access door for the control system 16. Section material for fixing side flange

the skin with section materials, its front and rear portions riveted on the frame 0 and the angle section on the front spar web of the midwing and its middle portion supported by the lower webs of the frames 1,2,3 and 4 and the wheel bay side panels. The adjusting mechanism for the front seat, rudder pedal, control stick, console, attachment fittings for nose landing gear oblique jackstay and gear-up lock are all fixed on the reinforcing members of the floor. The floor is also provided with access holes for cables and pipelines. The boxlike dust shield made of 0.6 mm. thick dural sheet is riveted on the upper part of the wheel bay side panels between frames 0 and 1 to separate the fuselage cavity from the wheel bay.

The wheel bay side panels made of 1 mm. thick dural sheets and some dural section materials of different specifications are located under the front cockpit floor between frames 0 and 3 and provided with technical accesses stuck with canvas covers. The wheel bay side panels have their front and rear portions fixed on the landing gear attachment fittings on the frame 0 and the section materials of the frame 3, their middle portion riveted on the lower webs of frames 1 and 2 and their upper flanges riveted on the front cockpit floor.

AVIONICS COMPARTMENT

The avionics compartment is located from the frame 9 to frame 12 and furnished with brackets made of extruded and bended dural section materials. The frame 9 and both side skins of the compartment are provided with doors for installation and maintenance and covers for field power supply and field air charging devices.

SKIN

The fuselage skin is of the stressed structural member. It totals up to twenty-six component pieces including the shields of the front and rear cockpits and the skin of the tail cone. The side skin spreading from the frame 0 to frame 12 and the upper shields of both cockpits are of 0.8 mm thickness, while the remaining skin of 0.6 mm. thickness (Fig. 2.12). The component pieces of the skin are overlapped each other along the stringers and the frames.

All pieces of the skin are flush riveted with the (GB945-LY1) 120° counter-sunk dural rivets. The rivets used for fixing the skin and the frames are of 3 mm. diameter, except that those for fixing the skin and the frame 5 are of 3.5 mm. diameter. The rivets used for fixing the skin and the upper and lower longerons or located along the longitudinal lap joints are also of 3 mm. diameter, but those for fixing the skin and the stringers or other longitudinal structural members are of 2.5 mm. diameter.

When the skin is riveted with the stressed borders of the access doors and with the section materials of the reinforced frames, the rivets of 3 mm. diameter are chosen. The rivets used for other joints are of 2.5 mm. diameter.

The rivet pitch, along the stringers or the frame peripheries is 25 mm., along the skin lap joints 20 mm., except that the skin lap joints along the periphery of frame 12 has the pitch of 18 mm.

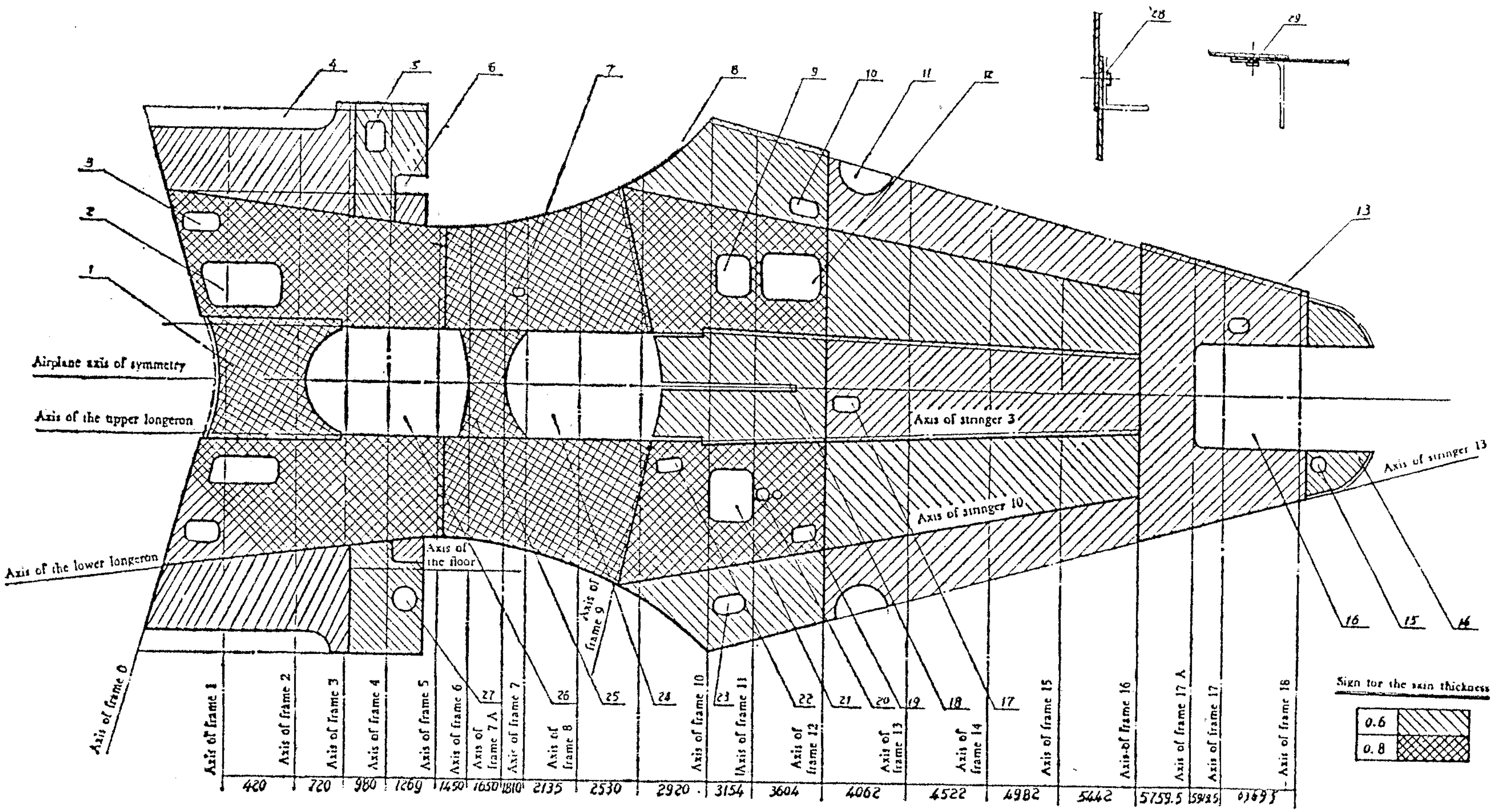


Fig. 2.12 Schematic developing diagram of the skin

1. Upper shield of the front cockpit 2. Inspection door 3. Inspection door for fuel ducts 4. Opening for the nose wheel bay 5. Inspection door for lubricating oil ducts 6. Opening for admitting oil radiator cooling air 7. Rear cockpit air vent 8. Edge for fitting the midwing 9. Opening for inverters 10. Opening for the main air bottle drain 11. Opening for the loop antenna 12. Opening for the receiver 14. Tail cone skin 13. 15. Inspection door for cables 16. Opening for the tail 17. Opening for the fin antenna 18. Kerf for the middle cockpit track 19. Opening for the field air charging nipple 20. Opening for the field power supply socket 21. Opening for the battery box 22. Opening for the mounting handgrip 23. Opening for the emergency compressed air bottle drain 24. Rear cockpit 25. Upper shield of the rear cockpit 26. Front cockpit 27. Technical access 28. Overlap joint of the skin along

COCKPIT

The front and rear cockpits covered with transparent canopy are separated each other by the rear instrument panel, beam and organic glass separator.

The cockpits are furnished with seats of riveted structure. The front seat (Fig. 2.13) has its back and pan made of 1 mm. thick dural sheets, reinforced with the "ɪг" shaped section materials and equipped with fittings (Two fittings on the pan, one on the back) made of 1.2 and 1.5 mm. thick low carbon steel sheets by welding. The fittings on the pan are connected to the support on the elevating shaft with pins, the elevating shaft is mounted on the brackets fixed on the front cockpit floor. The fitting of the back is connected to another support fixed on the beam with a pin. When the seat height is adjusted, the pin on the back moves upward or downward along the sliding slot of the support. A cushion sewed from varnished fabric is leaned against the back. On the back and pan are tied the safety belts.

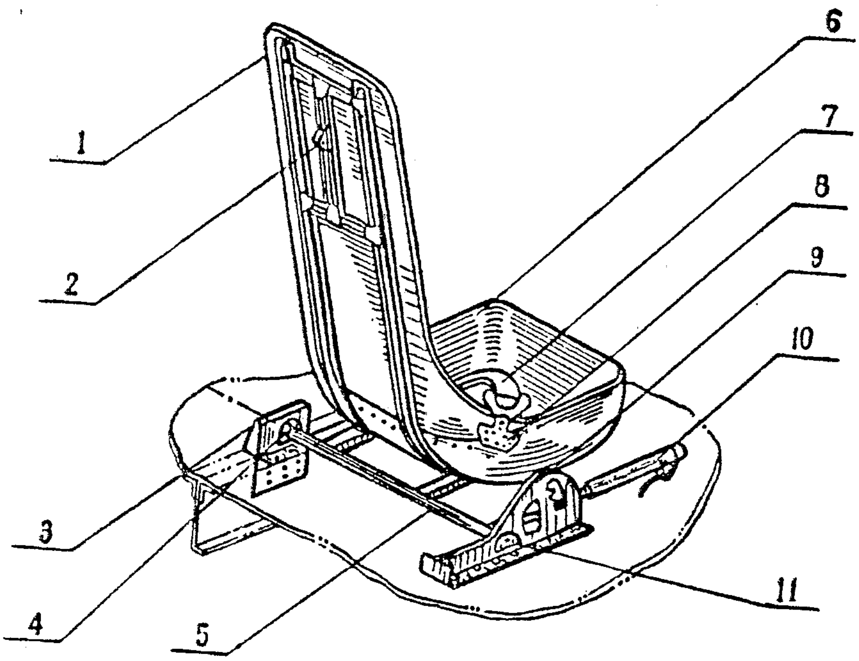


Fig. 2.13 Front seat

1. Back 2. Fitting 3. Left bracket 4. Left bearing 5. Elevating shaft 6. Pan 7. Safety belt 8. Fastener 9. Sector bracket 10. Handle 11. Right bearing

The rear seat (Fig. 2.14) consists of the seat pan made of 1 mm. thick dural sheet and "ɪг" shaped section materials. On the "ɪг" shaped section materials are set four supports made of 2 mm. thick low carbon steel sheets by welding. As mentioned in the preceding paragraph, the web of the reinforced frame 9 behaves as the back of the rear seat, and the cushion sewed from varnished fabric is bolted on its doors. The safety belts are tied on both the seat pan and the reinforced frame 9. The supports on the pan are connected with fittings on the midwing rear spar and reinforced frame 9 with pins. The seat can be adjusted to three positions of different heights by changing the attaching location of supports on fittings.

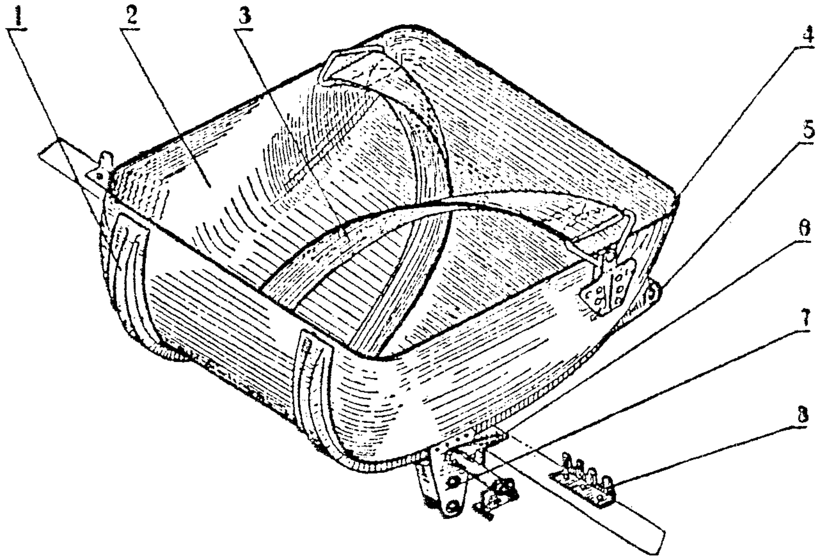


Fig. 2.14 Rear seat

1. Section material 2. Pan 3. Safety belt 4. Fastener 5. Rear support 6. Front fitting 7. Front support 8. Bracket

The canopy (Fig. 2.15) is composed of four components, namely, the front windshield, the middle fixed canopy and the front and rear sliding canopies.

The front windshield is composed of the wind screen fabricated from 4 mm. thick organic glass sheet, peripheral retainer made of 1.2 mm. thick anticorrosive aluminium alloy sheets, peripheral strip made of 1.2 mm. thick dural sheets and the camber beam with "П" shaped cross section made of 1.5 mm. thick dural sheets. On the peripheral retainer is opened the air vent about its axis of symmetry. The wind screen is screwed on the peripheral retainer and the camber beam, which is riveted and screwed on the longerons through the connecting plates. The peripheral retainer is screwed on the upper shield, a pad made of the cord wrapped in black varnished fabric is filled between them to give a tight sealing. Along the front windshield strip abutting with the front sliding canopy, a border made of sponge rubber cord wrapped in leather is edged by riveting to give a tight sealing.

The middle fixed canopy is composed of the 3 mm. thick organic glass cover, front and rear camber beams with "П" shaped cross section made of 1.5 mm. thick dural sheets, strips and peripheral retainer made of 1.2 mm. thick dural sheets. The fixed glass cover has its front and rear ends screwed to the front and the rear camber beams with strips, its lateral edges inserted into the peripheral retainers and fixed with rivets. The peripheral retainer is attached to the longerons by means of the brackets made of 1.2 mm. thick low carbon steel sheets by welding. The front and rear camber beams are connected to the fuselage in the same way as that of the front windshield. Along the rear strip of the middle fixed canopy abutting with the rear sliding canopy, the same sealing border as used in the front windshield is riveted. The front strip of the middle fixed canopy is

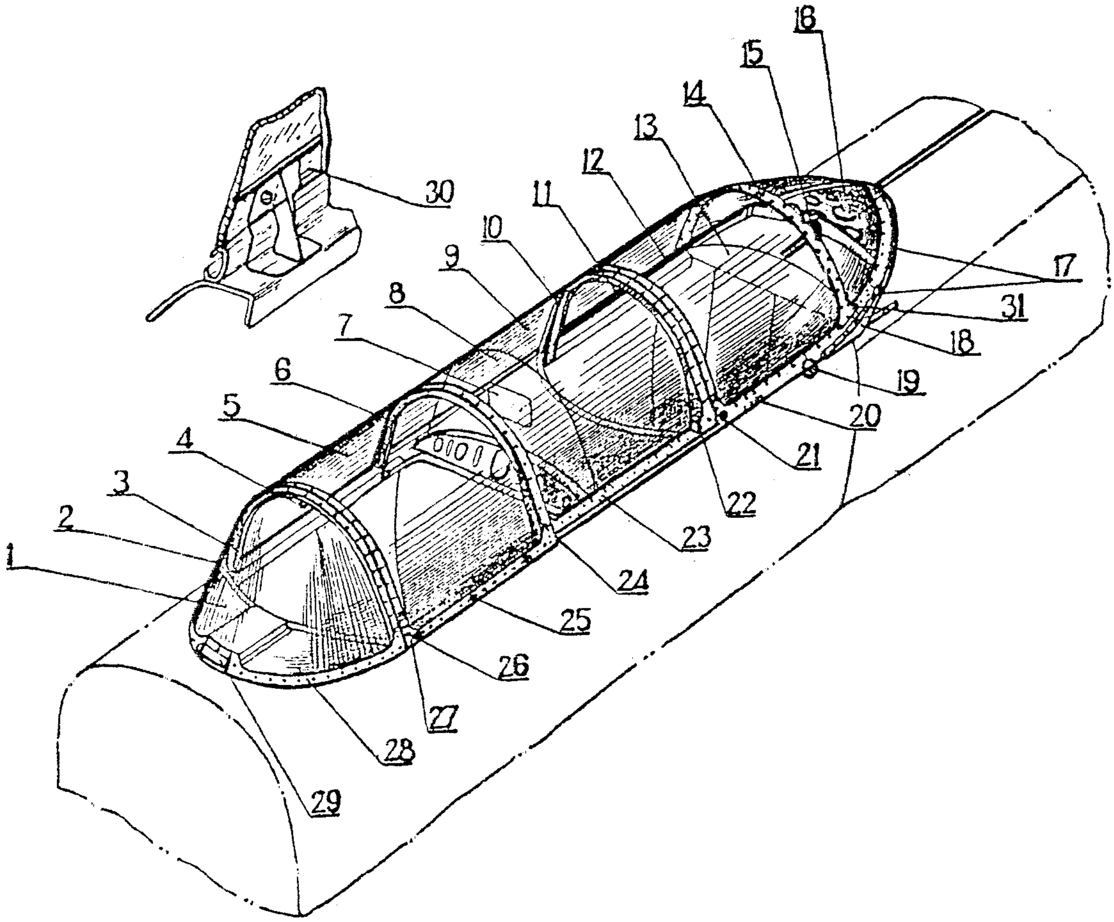


Fig. 2.15 Canopy

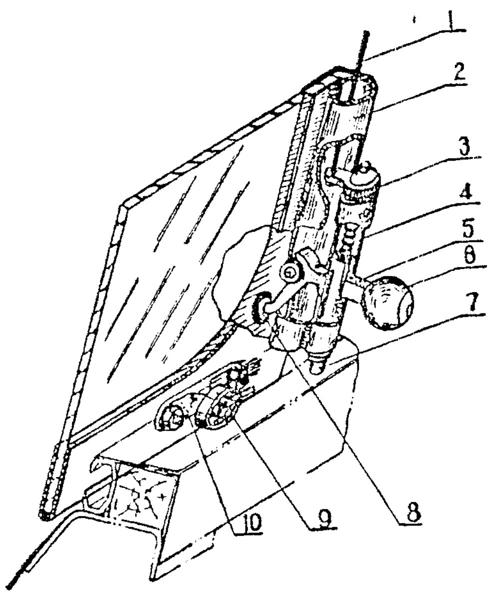
1. Front windshield 2. Camber beam 3. Peripheral retainer 4. Unlocking ball 5. Front sliding canopy 6. Camber beam 7. Movable separator 8. Separator 9. Middle fixed canopy 10. Peripheral retainer 11. Unlocking ball 12. Stiffening strip 13. Rear sliding canopy 14. Beam 15. Rear pulley set 16. Web 17. Peripheral strip 18. Shield 19. Shimmy damper 20. Side pulley 21. Outboard unlocking button 22. Camber beam 23. Peripheral retainer of the middle fixed canopy 24. Peripheral strip 25. Pulley 26. Outboard unlocking button 27. Lower section material 28. Peripheral retainer of the front windshield 29. Vent of the front cockpit 30. Mounting made for middle fixed canopy 31. Connecting plate

wrapped in black flannel to prevent the glass from being scraped during the opening and shutting of the front sliding canopy.

The front sliding canopy is composed of the glass cover fabricated from 4 mm. thick organic glass sheet, front welt and lower section material made of 1.2 mm. thick dural sheets, strengthening peripheral strips made of 1.2 mm. thick anticorrosive aluminium alloy sheets and camber beams made of low carbon steel tubes by welding. The glass cover has its front edge screwed to the steel camber beam through the front welt, its three remaining edges inserted into the lower section materials and the strengthening peripheral strips and fixed with rivets. On both the right and left lower section materials are mounted six pulleys, three on each side, so that the canopy may slide freely along its tracks.

The rear sliding canopy consists of the front and rear glass covers fabricated from 4 mm. thick organic glass sheets, peripheral strips, connecting plates and shield made of 1.2 and 0.8 mm. thick dural sheets, beam made of 1.5 mm. thick dural sheet, web made of 0.6 mm. thick dural sheet, stiffening strip made of (XC141-4) dural section material and camber beam made of low carbon steel tubes by welding. The galss cover is combined into a whole with its front and rear pieces by means of connecting plates and screws. It has its front and rear edges screwed onto the camber beams and peripheral strips, its lateral edges inserted into the side peripheral strips and fixed by riveting. The stiffening strips are riveted along the interface of the glass cover and peripheral strips to improve the lateral rigidity of the peripheral strips. The beam is attached to the peripheral strips by means of the brackets made of 1 mm. thick low carbon steel sheets by welding. The web has its front end riveted together with the lower flange of the beam and its flanges riveted to the rear peripheral strips, so that the back end of the rear sliding canopy is transformed into a boxlike structure of high rigidity. On each of the side peripheral strips is installed a pulley cooperating with the pulley set on the beam, so that the rear canopy can slide freely along the tracks on the fuselage.

On the lower portions of the camber beams at the fore left side of the front and rear canopies are installed two locks (Fig. 2.16) by means of which the sliding canopy can stay in three different positions. The locked canopy can be opened through drawing the locking pin out from the locking hole by each of the following ways: to lift the handle inside the cockpit; to pull the unlocking ball located on the top of the camber beam and connected with the locking pin through a cable and to press the outboard unlocking button located in the hole of the peripheral strip to move the locking lever.



1. Cable
2. Camber beam
3. Rocker arm
4. Spring
5. Locking lever
6. Handle
7. Locking pin
8. Button
9. Pulley
10. Holder

Fig. 2.16 Cockpit lock

A rubber shim (Rubber strip 1142) of 0.5 mm. thickness is padded between the organic glass cover and the metal parts. The glass cover should be screwed up by a torque wrench with a moderate moment of 7.5~11 kg.-cm. instead of an excessive one, otherwise, excessive assembly stress and thus miniature cracks in the organic glass may be induced.

The 3 mm. thick organic glass separator between the shield of the rear cockpit and the middle fixed canopy is held by the holders which are made of 0.8 mm. thick low carbon steel sheets and fixed on the middle fixed canopy and rear shield. On the center of the separator is set a window with sliding door for the communication between the front and rear cockpits (The window has been abolished from the batch 26.).

The ventilation unit for the front cockpit (Fig. 2.17) consists of the enclosure made of 1 mm. thick aluminium alloy sheets by pressing, throttle made of 1 mm. thick low carbon steel sheet by welding and the link made of 8×1 low carbon steel tube. The enclosure is screwed on the shield of the front cockpit. The throttle is held inside the vent on the peripheral retainer of the windshield in front of the enclosure by a medium carbon steel axle of 4 mm. diameter and connected with handle installed on the left side of the enclosure through a link. The forward or backward moving of the handle turns the throttle, thus controlling the air intake area of the ventilation opening and the flow rate of the air entering the cockpit.

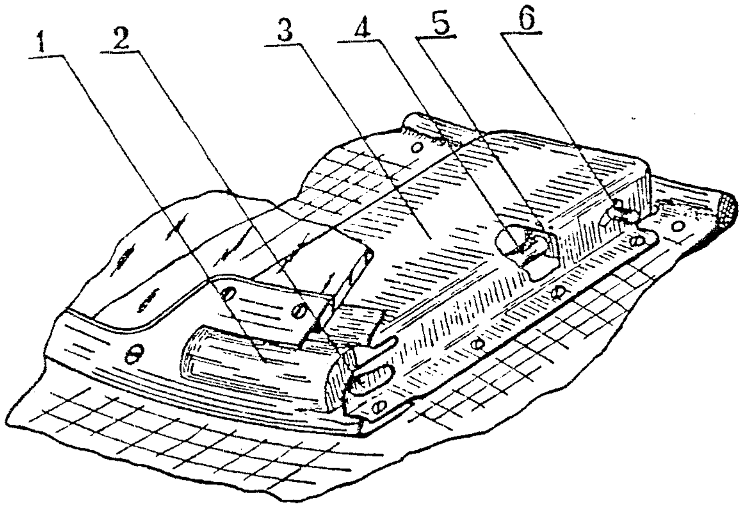


Fig. 2.17 Ventilation unit for the front cockpit

1. Throttle 2. Axle 3. Enclosure 4. Link 5. Support 6. Handle

The ventilation unit for the rear cockpit (Fig. 2.18) includes the ventilating scoop and the shutter made of dural sheets by riveting (Or spot welding), pin and handle made of low carbon steel by turning. The ventilating scoop is mounted on the right fuselage skin between stringers 4 and 5 in front of the frame 7. The shutter installed on the outside of the scoop and connected with the scoop through pin, handle and hinges can rotate within the scoop. As the handle slides outward along the sliding slot on the scoop, the shutter moves outward too, the air enters the cockpit through the cavity and the eyes of the scoop. The sliding slot is provided with notches for locking the shutter in the positions of "Full open", "Medium', and "Shut" respectively.

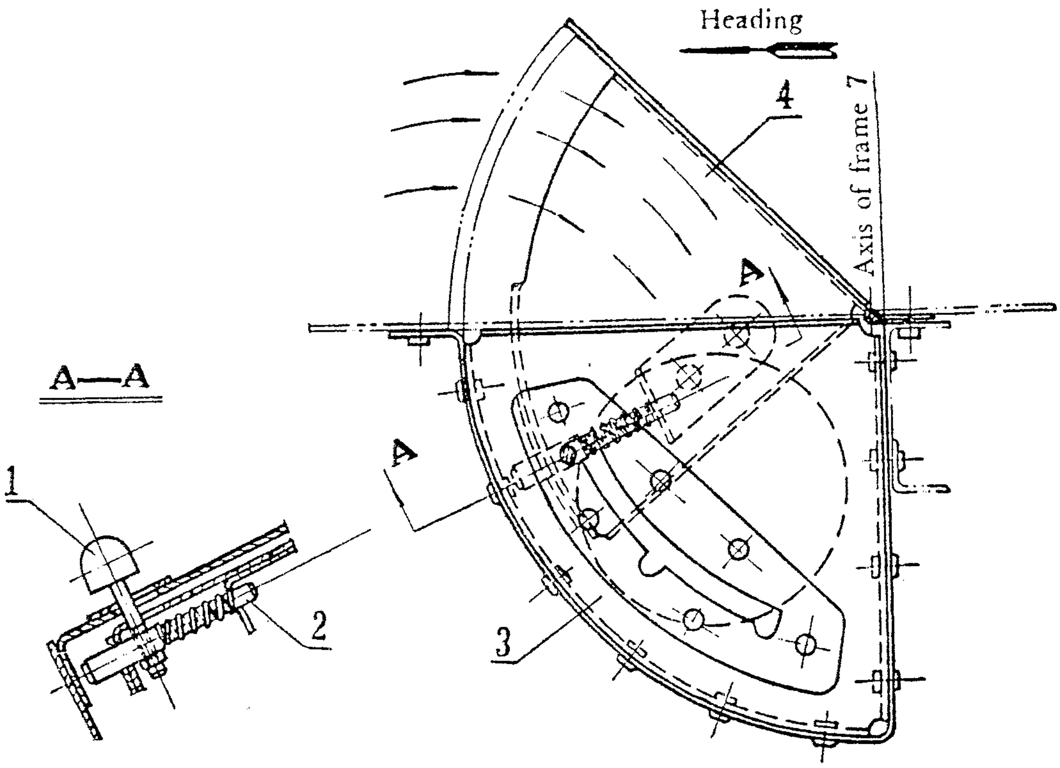


Fig. 2.18 Ventilation unit for the rear cockpit

1. Handle 2. Pin 3. Scoop 4. Shutter

Both the front and rear cockpits are provided with masks for instrument flight training. The mask consists of the riveted skeleton of dural tubes dressed with black cloth. It can be easily opened or shut in flight and mounted or removed with ease.

TAIL SKID

The tail skid (Fig. 2.2) is provided for preventing the stern of the fuselage from being damage during its collision with the ground in case of the forced landing with wheels up or abnormal landing and take-off. It also behaves as a part for mooring the airplane during parking.

The tail skid is made of the 30×1.5 low carbon steel tube and 1.5 mm. thick low carbon steel sheets by gas welding.

The tail skid is attached to the reinforced frame 18 and the anchor nuts on strengthening separator of the tail cone through eight screws.

II. WING

The wing, the all metal cantilever double-spar low wing, consists of one midwing and two detachable outer wings. The outer wings with an angle of twist 3° and dihedral 7°

are connected with the midwing by four sets of joints on the front and rear spars. The midwing is set on the lower part of the fuselage with 2°30′ setting angle. Along the abutting ends of the mid and outer wings, a detachable dural strip is wound.

MIDWING

The midwing (Fig. 2.19) composed of the skeleton, skin, rear cockpit floor, landing gear bays and oil radiator installation is connected with the fuselage by the fittings on its front and rear spars at the rib i and the upper edge strip of its center rib 1. The midwing has four sets of fittings on both ends of its front and rear spars to be connected with the outer wings. Its attachment fittings for fixing the main landing gear are located on its front spar at right and left ribs 5.

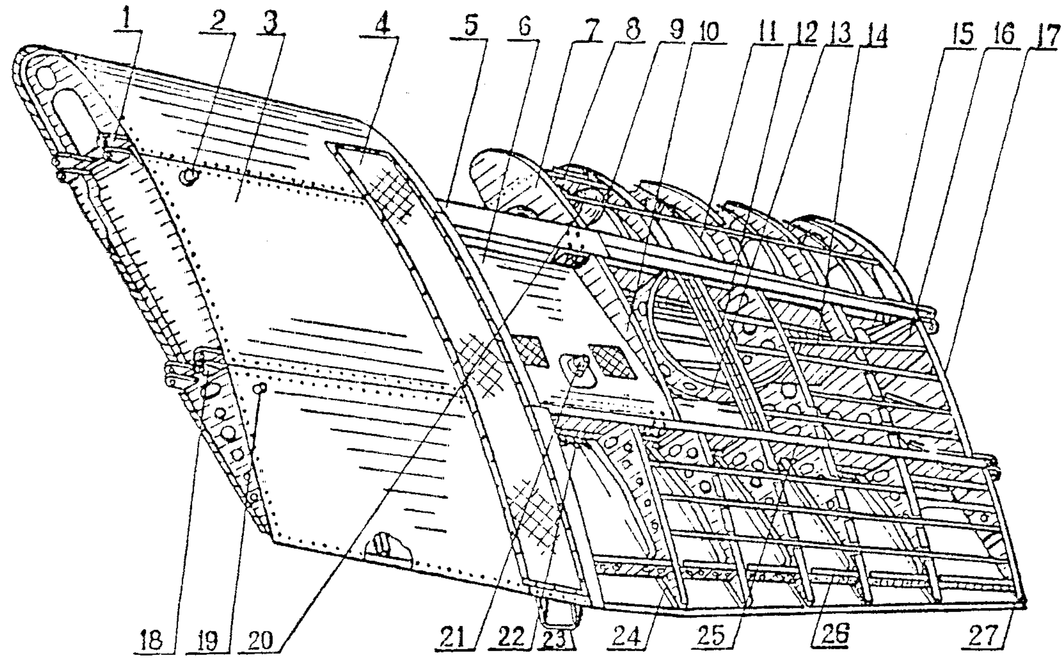


Fig. 2.19 Midwing

1 Front attachment fittings for connecting midwing and outer wing 2. Position indicator of the main landing gear 3. Skin 4. Tread 5. Front spar 6. Rear cockpit floor 7. Nose rib 1 8. Leading edge separator 9. Section material 10 Center rib 1 11. Stiffening strip 12. Center rib 2 13. Web of the wheel bay 14. Strip of the wheel bay 15. Nose rib 5 16. Attachment fitting for main landing gear 17. Center rib 5 18. Rear attachment fitting for connecting the midwing and outer wing 19. Position indicator of the flap 20. Cooling air inlet duct of the oil radiator 21. Dust helmet of the rear control stick 22. Flap hinge 23. Foot step 24. Rear rib 0 25. Rear spar 26. Trailing edge separator 27. Trailing edge strip

The midwing skeleton is composed of the front spar perpendicular to ribs at 25 percent chord, rear spar parallel to the front spar (With a distance of 869.5 mm.), ten nose ribs (Five for right and left each), ten center ribs (Five for right and left each), twelve rears ribs (Six for right and left each), stringers and rear separator etc.

The front spar (Fig. 2.20) composed of the edge strips, webs, top lap, fittings, supporters, diagonal stays, stiffeners and section materials is of the variable "I" shaped cross section type. The upper and lower edge strips are made of (XC111-59 and XC111-58) dural section materials. The web is made of 1.5 mm. thick dural sheets and the top lap of 1 mm. thick dural sheet, which covers the upper edge strips between the right and left ribs 1. On the web of the spar between ribs 3 and 4 are fixed the supporter made of wrought aluminium alloy by die pressing and the diagonal stay composed of CrMnSi alloy steel fitting and CrMnSi alloy steel tubes by welding. The diagonal stay has its upper end bolted on the steel strengthening section material at rib 2 and its lower end connected with the supporter through a rotating axle made of CrMnSi alloy steel rod, which is used for suspending the folding stay of the main landing gear. On the back of the supporter is bolted the arm made of wrought aluminium by die pressing and used as the jacking point of the airplane during its assembly and maintenance. On the front upper edge strip, rear upper edge strip and web at right and left ribs 1, the holders made of wrought aluminium by die pressing and boxes made of 1.5 mm. thick dural sheets are riveted to form four fittings to be connected with the fuselage fittings. The opening of the cooling air inlet duct of the oil radiator is located on the right side of the axis of symmetry of the airplane. Two stiffening plates made of 1.5 mm. and 2 mm. thick dural sheets are riveted on both sides of the opening. On the spar web are riveted

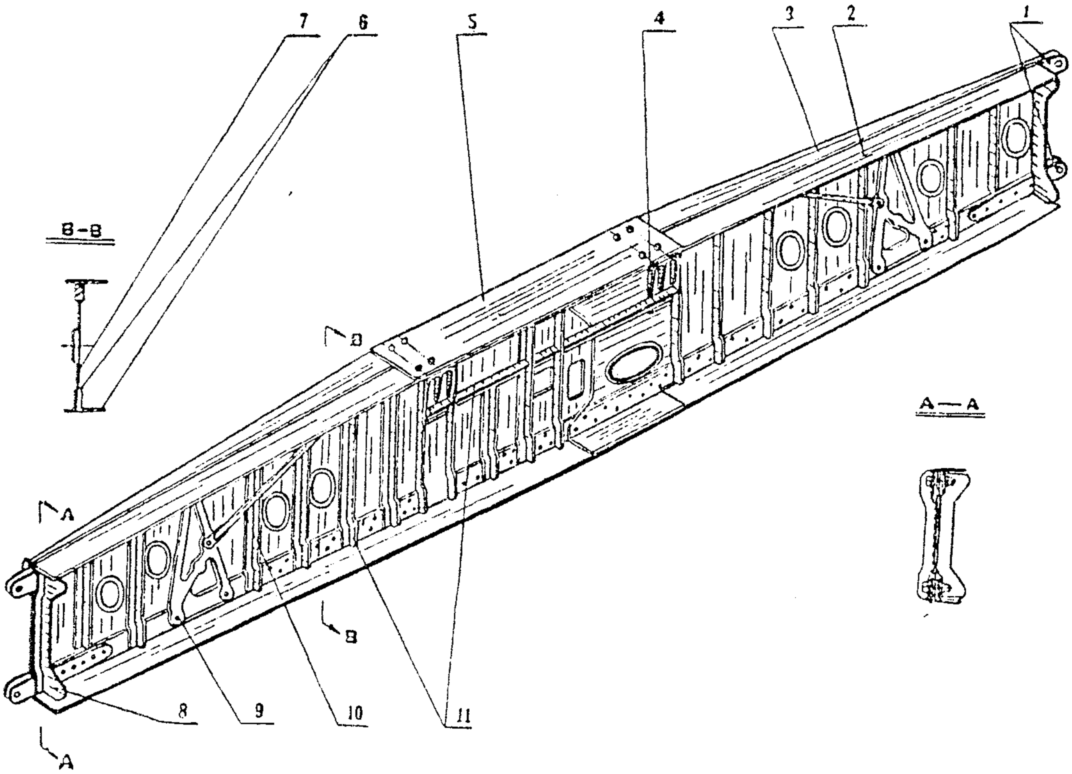


Fig. 2.20 Front spar of the midwing

1. Attachment fitting for connecting the midwing and outer wing 2. 3. Upper edge strips 4. Fitting 5. Top lap 6. Lower edge strip 7. Web 8. Section material 9. Supporter 10. Diagonal stay 11. Section material

section materials, of which the (XC111-4) dural ones between the right and left ribs 1 are used for fixing the front and rear cockpit floor, while the vertical ones for improving the stability of the web and fixing the nose and center ribs. Access holes for the control cables and pipelines are cut on the web.

The rear spar (Fig. 2.21) composed of the upper edge strip, web, lower edge plate, fittings, boxes, supporters and section materials is of the variable "Π" shaped cross section type. The upper edge strip is made of (XC111-59) dural section material. The web and lower edge plate are made of 1.5 mm. and 2.5 mm. thick dural sheets respectively. The two fittings on the rear spar to be connected with the outer wing act as the holders of the aileron control bellcrank as well. Access holes riveted with 1.5 mm. thick dural backing plates are cut on the web between ribs 2 and 3 for fuel ducts. On the front upper edge strip, rear upper edge strip and web at the right and left ribs 1, the holders made of wrought aluminium by die pressing and boxes made of 2 mm. thick dural sheets are riveted to form four fittings to be connected with the fuselage fittings. The web of the spar is provided with access holes for the links and cables of the aileron and elevator control system and inspection door for the fuel filter. On the web are riveted vertical section materials to improve the stability of the web and to fix the rear ribs. The flap hinge made of 0.6 mm. thick dural sheets is combined into a whole with three segments to get the same length as that of the rear spar and is riveted on the lower web flange. The abutting ends of the hinge segments are reinforced with connecting plates. The places where the lower edges of the rear spar are jointed to the rear ribs are riveted with dural angular boxes of 1 mm. thickness.

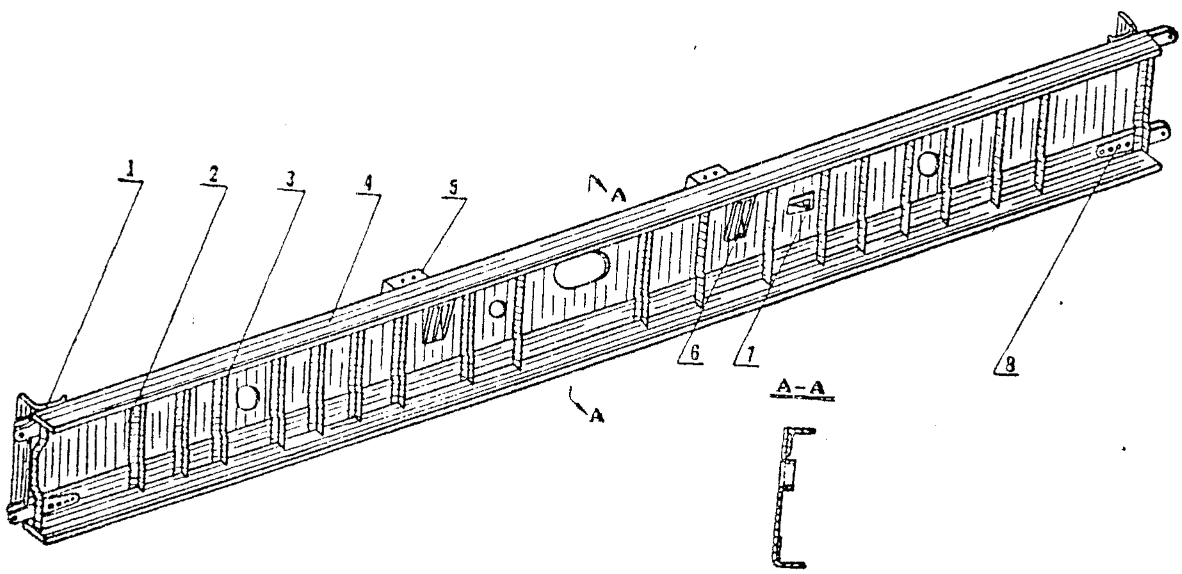


Fig. 2.21 Rear spar of the midwing

1. Box 2. Web 3. Section material 4. Upper edge strip 5. Front holder 6. Rear holder 7. Supporter for aileron control bellcrank 8. Fitting for connecting the midwing and outer wing

The rib is classified into three kinds, namely, the nose, center and rear ribs. The nose and center ribs 1 together with the nose and center ribs 5 are all manufactured as reinforced ones. The former are connected with the fuselage for transmitting the torque, the latter are connected with the outer wing and hung with the main landing gear. The remaining ribs, such as ribs 2, 3 and 4 are ordinary ones.

The nose rib 1 consists of the edge strips, web, angular boxes and section materials. Its upper or lower edge strip is made of (XC111-51) dural section materials, its web of 1 mm. thick dural sheet. On the spots where the web of the nose rib 1 and the upper and low edge strips of the front spar are connected together are riveted the angular boxes made of wrought aluminium alloy by die pressing. Moreover these very angular boxes and center rib 1 are bolted together by means of another boxes made of wrought aluminium by die pressing. The center rib 1 consists of the edge strips, web, angular boxes and section materials. Its upper and lower edge strips are made of 1.5 and 2 mm. thick dural sheets respectively, its web is made of 1 mm. thick dural sheet. On the web of the left center rib 1 are installed the deposit filter of the pneumatic system and the control bellcrank for the aileron. On the inner sides of the webs of the right and left center ribs 1 are riveted angle sections supporting the rear cockpit floor. The web of the right nose rib 1 is provided with an opening as the air intake opening of the oil radiator. To improve its stiffness, the opening has its side reinforced with flat rings made of 1 mm. and 2.5 mm. thick dural sheets respectively. For meeting the needs of riveting the upper-edge of the ribs to fuselage longerons, the center ribs 1 re such situated as having oblique projections on the wing chord plane.

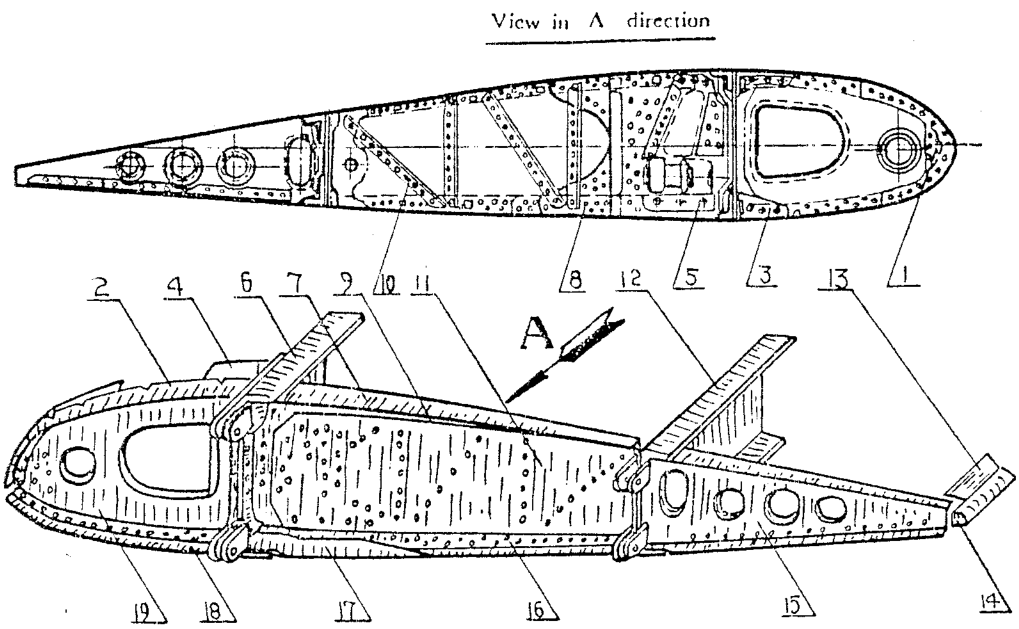


Fig. 2.22 , Rib 5

1. Angular box 2. Upper edge strip of the rib 5 3. Lower angular box of the nose rib 5 4. Upper angular box of the nose rib 5 5. Attachment fitting of the main landing gear 6. Front spar of the midwing 7. Upper angle section of the center rib 8. Backing plate 9. Upper angular box 10. Section material 11. Web of the center rib 12. Rear spar of the midwing 13. Rear separator 14. Filling block on the trailing edge 15. Rear rib 16. Lower angle section of the center rib 17. Lower angular box 18. Lower edge strip 19. Web of the nose rib

The nose rib 5 (Fig. 2.22) consists of the edge strips, web, angular boxes, etc. The upper or lower edge strips is made of dural (XC111-53) section material, the web of 1.5 mm. thick dural sheet. On the spots where the web of the rib 5 and the upper and lower edge strips of the front spar are connected together are riveted with angular boxes made of wrought aluminium alloy by die pressing and integrated with the main landing gear attachment fittings on center ribs 5. The center rib 5, the most highly strengthened, consists of the angle sections, angular boxes, web, backing plate, section materials etc. The upper and lower angle sections are of (XC111-53 and XC111-56) dural section materials. The upper angle sections is stiffened with the upper angular box with "Γ" shaped cross section made of 1 mm. thick CrMnSi alloy steel sheets and the lower angle sections with the lower angular box with "Π" shaped cross section made of 1.5 mm. thick CrMnSi alloy steel sheets.

The web is made of 1 mm. thick dural sheet, on its front portion is riveted a backing plate made of dural sheet of 1 mm. thickness.

The nose ribs 2, 3, 4 are all made of 0.8 mm. thick dural sheets. The webs with larger central light holes are riveted on the front spar through their flanges. In order to give enough space to house the tire of the main landing gear, the rib 2 is rid of its center rib. It is replaced by a stiffening section material of "ɪr" shaped cross section made of 1.5 mm. thick dural sheet and riveted on the upper wing skin along the axis of the rib 2. On center ribs 3 and 4 are cut openings to offer the space to be occupied by the half-wheel fork, shock absorbing strut and stay of the main landing gear. The center rib 3 composed of the web, backing plate and angle sections has its web made of 0.8 mm. thick dural sheet and provided with large access hole nearby the front spar for installing the lock locking the retracted main landing gear. The web has its lateral sides riveted with (XC141-12 and XC111-27) dural angle sections, its back riveted with dural backing plate of 1.5 mm. thickness for reinforcement. The center rib 4 is composed of the section material and web made of 0.6 mm. thick dural sheet.

The rear ribs 0, 1, 2, 3 and 4 with "Π" shaped cross sections are all made of 0.8 mm. thick dural sheets, and the rear rib 5 is also made of 0.8 mm. thick dural sheet, but has the "Z" shaped cross section and section material riveted on its web at the lower edge. All the rib webs are provided with light holes and through holes for the aileron control link. A bracket made of 1.5 mm. thick dural sheets is riveted on the rear rib 4 for fixing the pulley guiding the rubber damping cord of the flap control system.

The midwing has its front section riveted spanwise with one (XC111-4) dural section material on each of the upper and lower wing skin and its rear section riveted with three (XC111-4) dural section materials on the upper wing skin. Dural separator of 0.8 mm. thickness with pressed stiffening dents is riveted between every two rear ribs along the trailing edge, while dural filling blocks are riveted along the trailing edge. The skin arrangement of the midwing is shown in Fig. 2.23. The pieces of skin spreading over the leading edge and spreading on the upper wing surface between the front and rear spars are made of 0.8 mm. thick dural sheets, while the rest of 0.6 mm. thick dural sheets. The edges of the pieces of skin are jointed in different modes: the edges of the pieces of skin on the upper wing surface along the front spar are butt jointed, while those on the upper wing surface along the rear spar, on the lower wing

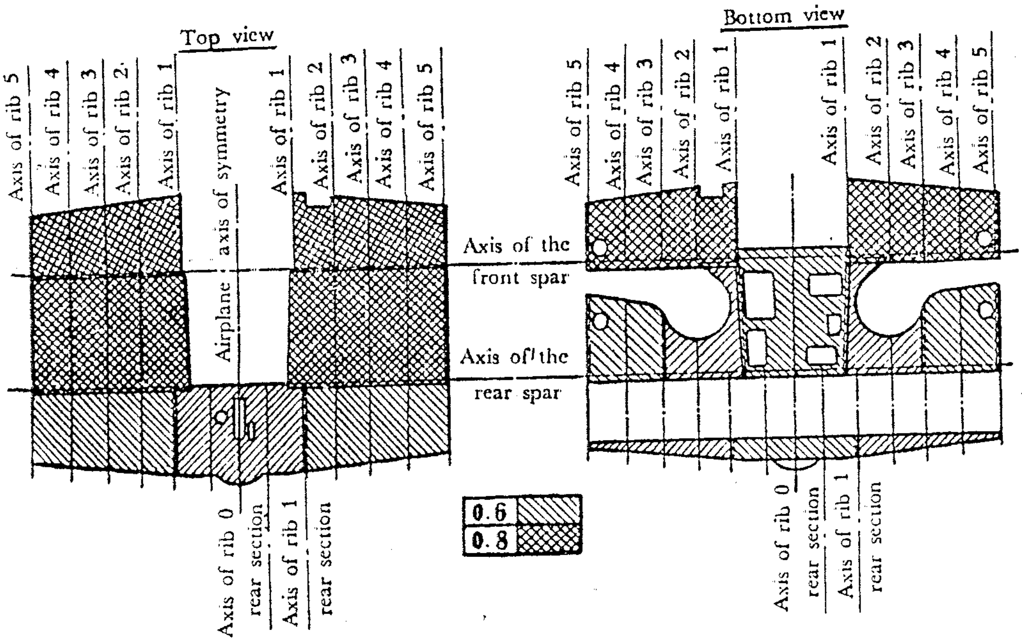


Fig. 2.23 Skin arrangement diagram of the midwing

surface along the front spar and the airfoil chords are all lap jointed.

The leading edge skin has dural stiffening strips of 0.8 mm. thickness riveted on the upper and lower wing surfaces between every two ribs to improve its stability.

On the upper left wing surface between ribs 1 and 2 is installed the tread made of 1 mm. thick (L6-M) deformable aluminium alloy sheet with toothed surface and fixed on the skin with anchor nuts and screws.

The foot step, a flexible cable structure, in combination with the tread is employed as the facility for getting on and off the airplane. It is composed of the tubes, bracket, holders, attaching lugs, cables and anti-slip plate and installed at the trailing edge of the left lower wing surface. Both the bracket and the holders are made of 1 and 1.5 mm. thick low carbon steel sheets by welding. The former is riveted on the trailing edge of the midwing and the latter is installed on the rear rib and separator between ribs 1 and 2. The bended dural tubes have their upper ends connected to the two holders through two attaching lugs and pins, their lower ends connected with the lower ends of the steel cables through another two attaching lugs and pins. The upper ends of the steel cables are connected to the brackets with pins.

The rear cockpit floor bordered by the front spar, rear spar, right and left center ribs 1 is composed of the floor skin, booms, stressed separators, stiffening section materials, stays, brackets, dust helmet, etc. On the floor are installed the pilot's seat, control stick, rudder pedals, console, etc., while under the floor the (QS-2) brake differential, (QS-1) pressure reducing valve, feed tank, (SRQ-14) oil radiator, etc. The floor skin is made of 0.8 mm. thick dural sheets. Booms with "Π" shaped cross section composed of (XC111-18) dural section material and dural webs of 0.8 mm. thickness are riveted along either side of the axis of symmetry of the airplane under the floor skin.

The brackets made of wrought aluminium by die pressing have their ends riveted on the rear ends of the booms, and their other ends connected with the stressed separator, which is made of 1.5 mm. thick dural sheets and reinforced with a length of section material by riveting. On the floor are riveted two plates with toothed surfaces made of 1 mm. thick (L6-M) deformable aluminium alloy sheets as the pilot's foot boards. The dust helmet made of water-proof green canvas by sewing is riveted between the foot boards. The rear control stick extends out from this helmet. In front of the helmet, an inspection door is set for checking the fixity of the rear control stick.

The landing gear wheel bay bordered by the front spar, rear spar, center ribs 1 and 5, consists of the webs, section materials, boxes, fittings, gussets, etc. The webs between center ribs 1 and 3, center ribs 3 and 4 and center ribs 4 and 5 are made of 0.6 and 0.8 mm. thick dural sheets respectively and are riveted on the upper and lower wing skin through (XC111-4, XC114-13 and XC111-37) dural section materials. The ends of the section materials are connected with rib 5 by dural boxes made of 1.5 mm. thick dural sheets and fittings made of wrought aluminium by die pressing respectively. The light holes on the webs are sealed by cloth covers stuck with Q98-1 adhesives to prevent foreign matter from entering the midwing.

The air cooling installation of the oil radiator (Fig. 2.24) consists of the air inlet duct, air outlet duct, circlips and separators. The air inlet duct, whose inlet opening is located between the right nose ribs 1 and 2 of the midwing turns and passes through the right nose rib 1 and the web of the front spar, and is finally connected with the

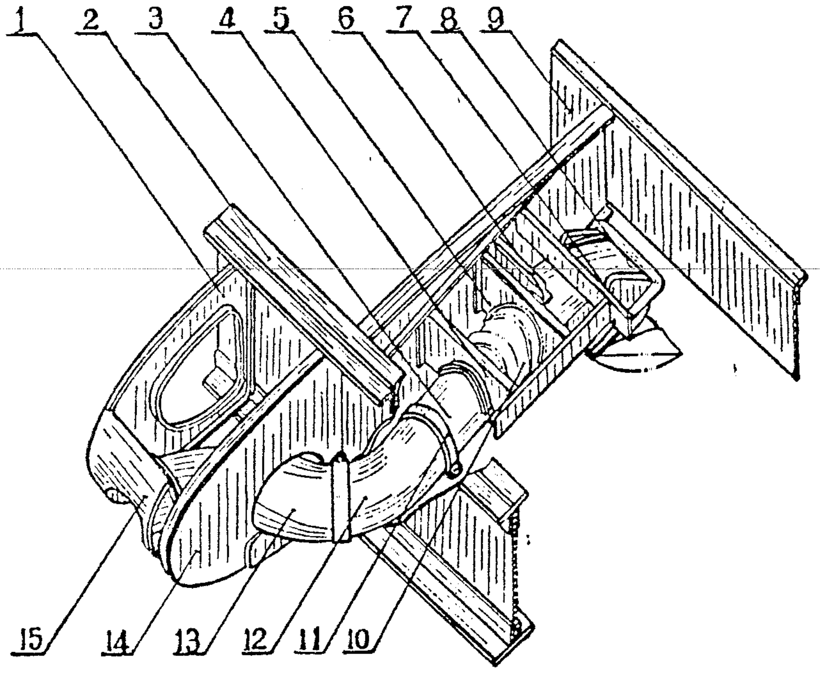
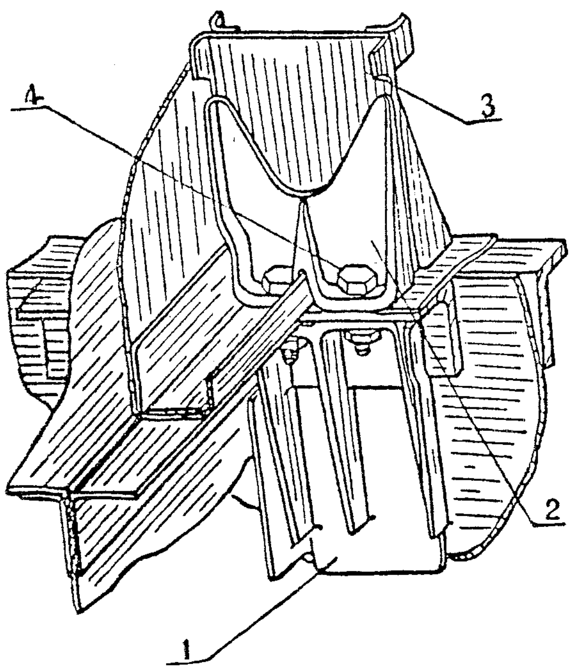


Fig. 2.24 Sketch for setting the oil radiator air cooling installation

1. Nose rib 2 2. Front spar 3. Rear segment of the air inlet duct 4. 5. 6. Separators 7. Throttle 8. Air outlet duct 9. Rear spar 10. Oil radiator (for reference) 11. Circlip 12. Mid segment of the air inlet duct 13. Front segment of the air inlet duct 14. Nose rib 1 15. Fairing

oil radiator. The air inlet installation consists of the fairing, front, mid and rear duct segments. The fairing made of anticorrosive aluminium alloy sheets of 1 mm. thickness by welding is fixed on the leading edge skin with anchor nuts and screws. The duct segments are all made of anticorrosive alluminium alloy sheets of 1 mm. thickness by welding. The front duct segment is fixed by angle section on the 0.8 mm. thick dural separator which is riveted with the nose ribs 1, 2 and the leading edge skin. The front duct segment is riveted with a low carbon steel flanged collar to be connected with the mid duct segment. The mid duct segment piercing through the front spar web is bolted to its stiffener and integrated with the rear duct segment by means of the circlip. The air outlet installation composed of the air outlet duct, throttle and holders is set on the lower right side of the rear cockpit floor. The air outlet dust made of 1 mm. thick anticorrosive aluminium sheet by welding is riveted on the rear cockpit floor, right center rib 1 and the lower skin of the midwing through the bracket made of 1 mm. thick dural sheets. The throttle made of 1 mm. thick dural sheet is hinged to the lower skin of the midwing and riveted with a holder to be connected with the throttle control system. The oil radiator is fixed on the rear cockpit floor and the right center rib 1 with two dural separator of 1 mm. thickness.

The midwing is connected with the fuselage by four sets of fittings on the front and rear spars (Figs. 2.25, 2.26). Each set of the fittings consists of two holders made of wrought aluminium by die pressing and fixed in front and rear of the upper edge strips of the front and rear spars. The connection of the fittings and the corresponding fittings of the fuselage is fulfilled with four vertical bolts made of CrMnSi alloy steel. The bolts for the front joints are of 10 mm. diameter and those for the rear joints 8 mm. diameter.



1. Rear fitting of the front spar of the midwing
2. Fitting of the fuselage frame 5
3. Frame 5 of the fuselage
4. Bolts

Fig. 2.25 Connection of the midwing and frame 5 of the fuselage

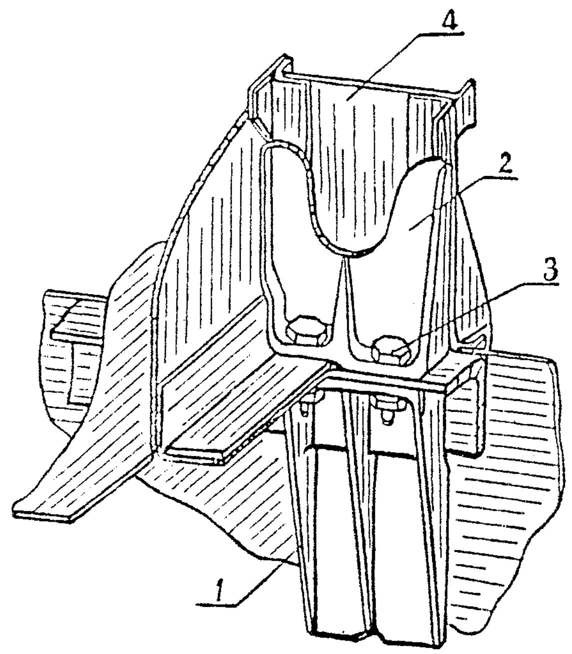


Fig. 2.26 Connection of the midwing and frame 8 of the fuselage

1. Rear fittings of the rear spar of the midwing 2. Fitting of the fuselage frame 8
3. Bolt 4. Fuselage frame 8

The both ends of the front and rear spars of the midwing are provided with two fittings to be connected with the outer wings (Figs. 2.28, 2.29). Each fitting consists of two eye plates fixed on the edge strips of the front and rear spars with CrMnSi alloy steel bolts of 10 mm. and 8 mm. diameter respectively. The eye plates on the front and rear spars are made of 5.5 mm. and 4.5 mm. thick CrMnSi alloy steel sheets respectively.

The attachment fitting of the main landing gear in which CrMnSi steel sleeve is pressed for holding the rotating axle (Fig. 2.27) is made of wrought aluminium by die pressing and fixed on the front spar and center rib 5 with rivets and CrMnSi alloy steel bolts.

The interfaces of the midwing and the fuselage are covered with fairings on the right and left sides to give continuous and smooth surfaces.

On the lower skin of the midwing is installed the flap behind the rear spar.

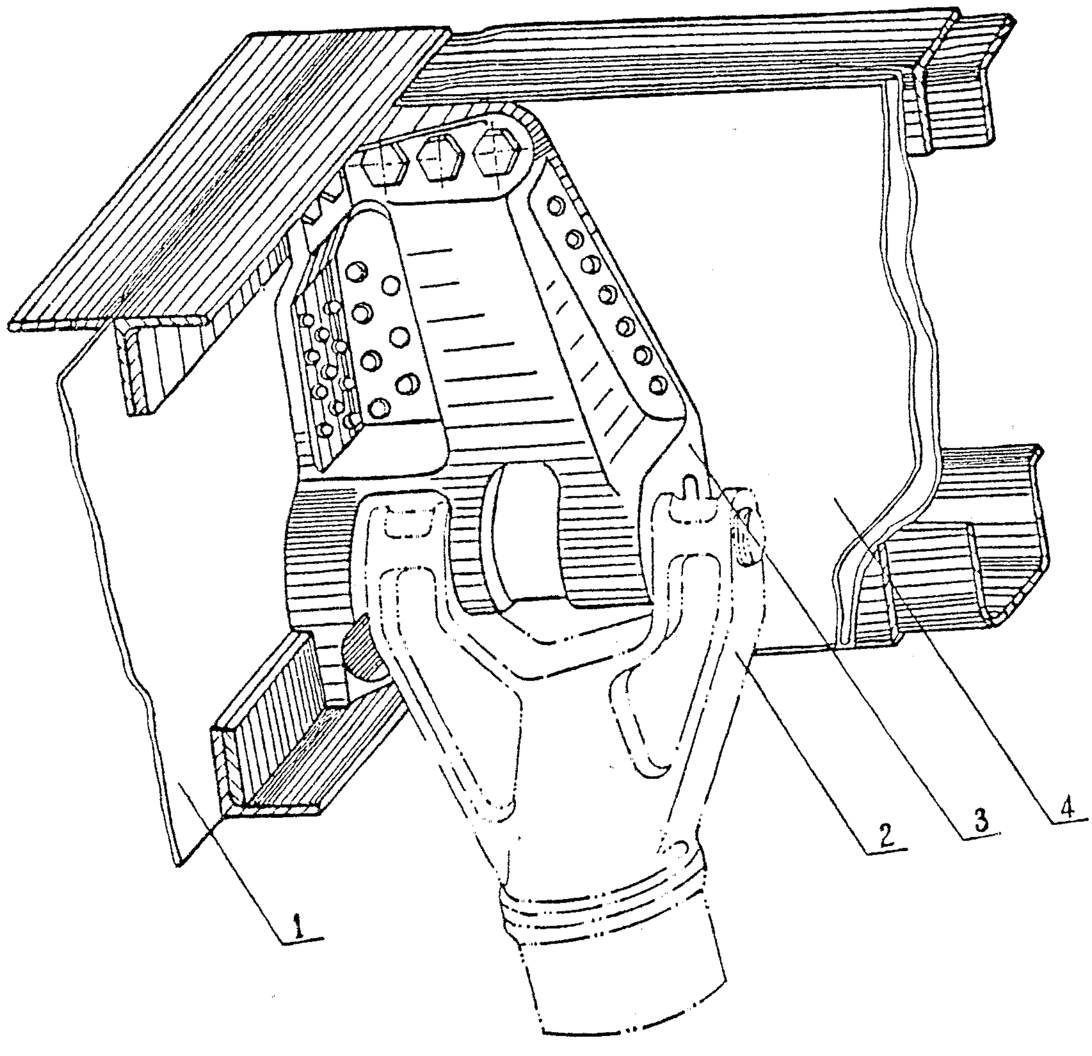


Fig. 2.27 Attachment fitting of the main landing gear

1. Web of the front spar 2. Strut of the main landing gear (for reference) 3. Attachment fitting of the main landing gear 4. Web of the center rib 5

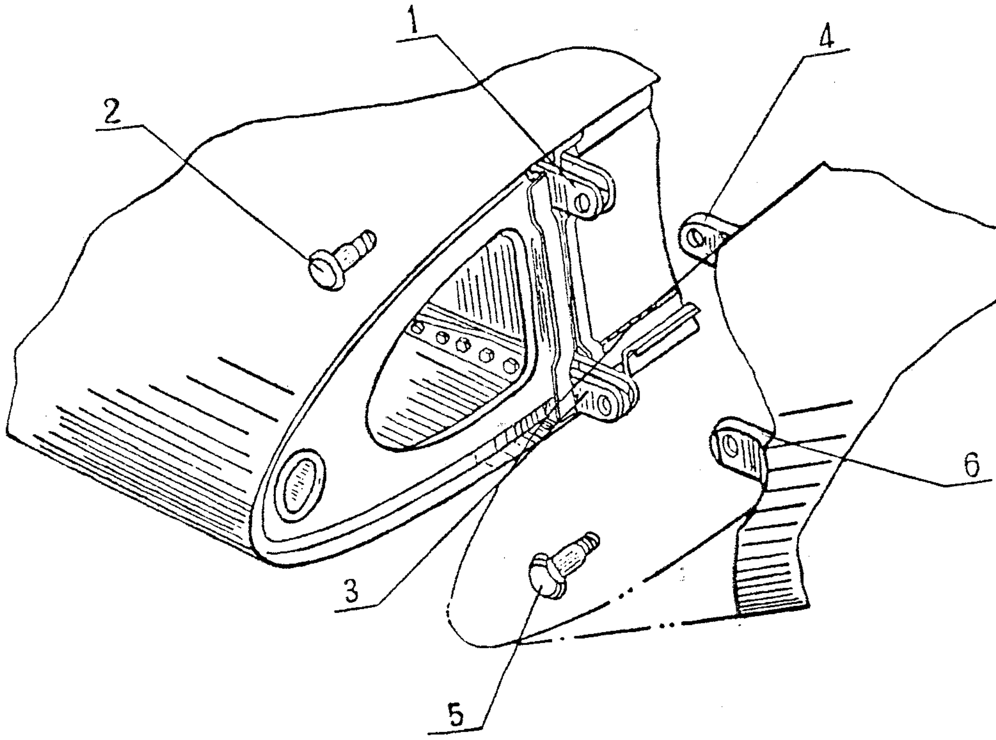


Fig. 2.28 Connection of the front spars of the mid and outer wings

1. Upper fitting on the front spar of the midwing 2. Bolt 3. Lower fitting on the front spar of the midwing 4. Upper fitting on the front spar of the outer wing 5. Bolt 6. Lower fitting on the front spar of the outer wing

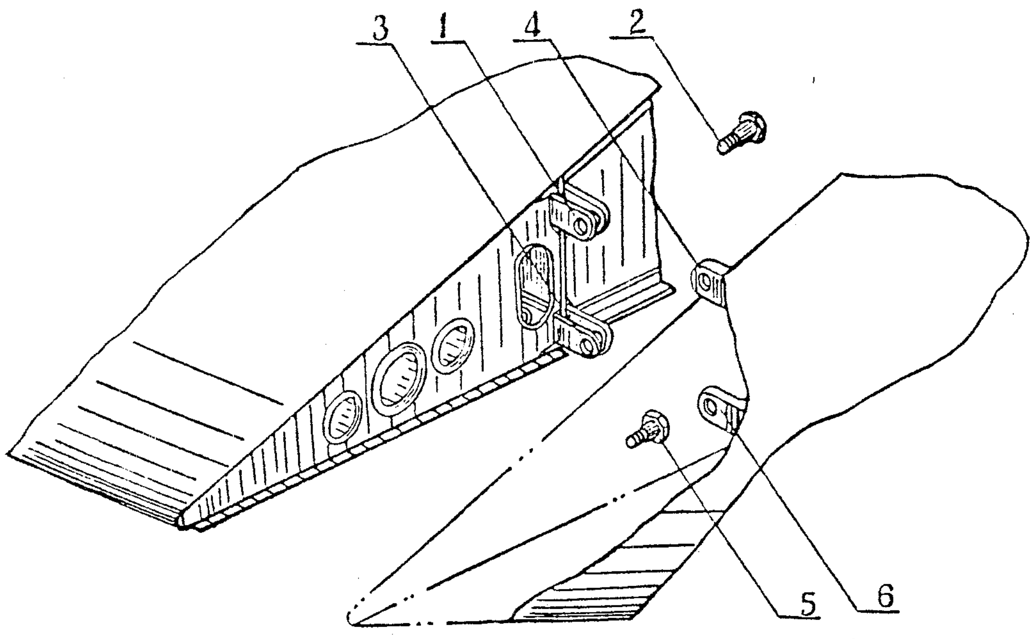


Fig. 2.29 Connection of the rear spars of the midwing and outer wings

1. Upper fitting on the rear spar of the midwing 2. Bolt 3. Lower fitting on the rear spar of the midwing 4. Upper fitting on the rear spar of the outer wing 5. Bolt 6. Lower fitting on the rear spar of the outer wing

OUTER WING

The outer wing (Fig. 2.30) consists of the skin, front spar, rear spar, thirteen ribs, eighteen stringers and wingtip. The roots of the front and rear spars are all provided with fittings to be connected with the midwing. The aileron bay is situated behind the rear spar between ribs 6 and 13. On the webs of the rear rib 6 and rear spar at rib 12 are installed the aileron attachment fittings. The fuel compartment is bordered by ribs 1 and 4, and the front and rear spars. The wing skin under the very compartment acts as its cover. The cavity of the landing lamp is situated at the leading edge between ribs 1 and 2 of the left outer wing and that of the bay for the magnetic heading sensor between ribs 11 and 12. On the nose rib 9 of the right outer wing is installed the holder of the pitot tube. The tubes for laying the cables are arranged within the wing leading edge.

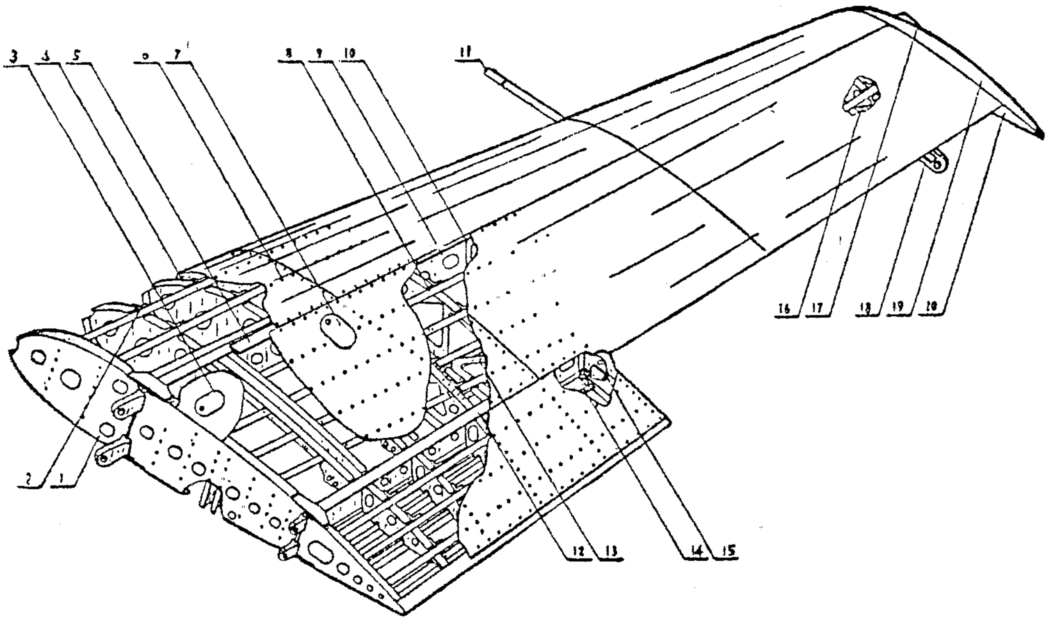


Fig. 2.30 Outer wing

1. Rib 1 2. Gusset 3. Fuel level gauge cover 4. Rib 3 5. Backing plate 6. Skin 7. Fuel filler cover 8. Stringer 9. Front spar 10. Rib 6 11. Pitot tube 12. Rear spar 13. Rib 5 14. Inspection door for checking aileron bellcrank 15. Attachment fitting for the aileron 16. Rib 12 17. Tip light 18. Attachment fitting for the aileron 19. Wingtip 20. Rib 13

The front spar (Fig. 2.31), a riveted structure with variable cross sections, consists of the web, upper and lower edge strips. The spar has its inner segment (from rib 1 to rib 4) of "I" shaped cross section, its outer segment of "Π" shaped cross section. The web is composed of the inner and outer pieces made of 1.5 and 1.2 mm. thick dural sheets respectively and butt jointed with dural connecting plates of 1.5 mm. thickness between ribs 8 and 9. Light holes are cut on the webs. Both the upper and lower edge strips are composed of three dural section materials with milled ends. The front upper edge strip (XC111-56) is installed between ribs 1 and 7. The rear upper edge strip is composed of the inner segment (XC111-56) and outer segment (XC111-

38), they are butt jointed with dural upper gussets of 3 mm. thickness between ribs 8 and 9. The front lower edge strip (XC111-56) is installed between ribs 1 and 7. The rear lower strip is composed of the inner segment (XC111-53) and outer segment (XC111-27), which are butt jointed with dural lower gusset of 2.5 mm. thickness between ribs 7 and 8. The flanges of the edge strips are bended with such bevel angles as are suitable to the designed outline. On the web of .the front spar are riveted the vertical angle sections to be connected with the nose and center ribs. On the root of the front spar at the upper and lower edge strips are installed the fittings made of CrMnSi alloy steel by die forging and butt jointed with the midwing. The upper and lower fittings each are fixed with CrMnSi alloy steel bolts, six of 8 mm. diameter and two of 6 mm. diameter. On the lower edge of the front spar at rib 6 is installed the attaching lug made of 2 and 4 mm. thick low carbon steel sheets by welding for mooring the airplane.

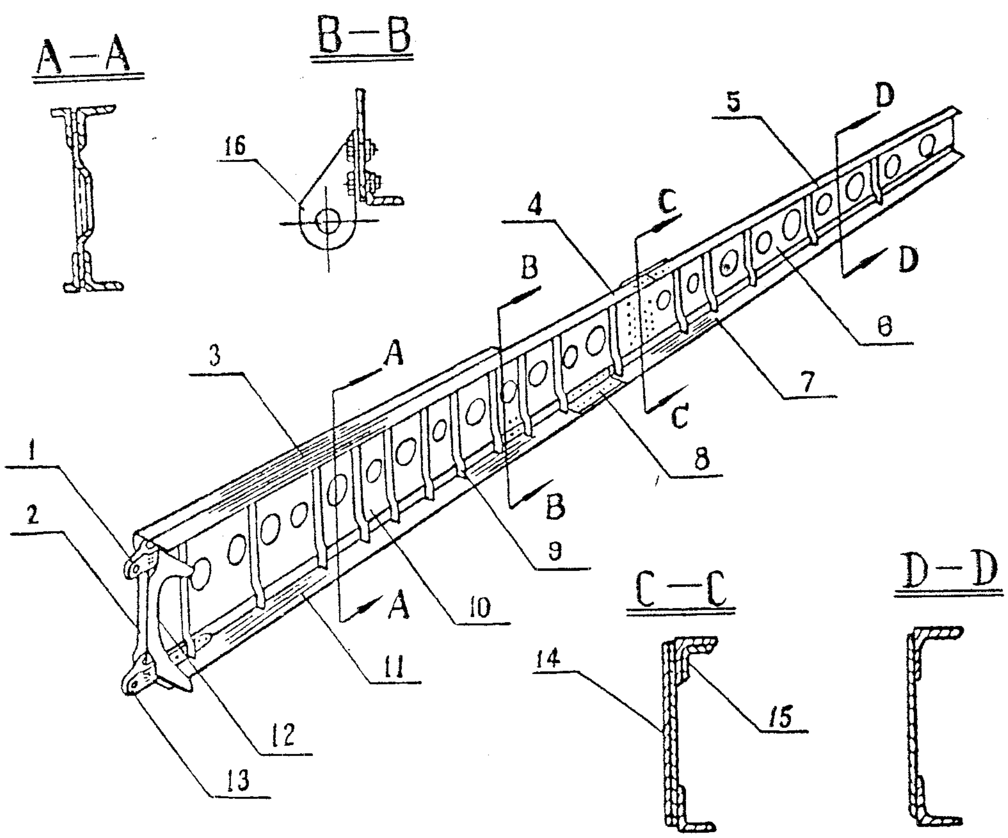


Fig. 2.31 Front spar of the outer wing

1. Upper fitting 2. Angle section 3. Front upper edge strip 4. Rear upper edge strip 5. Rear upper edge strip 6. Web of the outer segment 7. Rear lower edge strip 8. Lower angular plate 9. Angle section 10. Web of the inner segment 11. Rear lower edge strip 12. Angle section 13. Lower fitting 14. Connecting plate 15. Upper angular plate 16. Attaching lug

The rear spar (Fig. 2.32), a riveted structure with "Π" shaped cross section, consists of the webs, upper and lower edge strips and angle sections. The web is composed of two pieces with lower flanges made of 1.2 mm. thick dural sheets and connected together with dural connecting plates of 1.5 mm. thickness between ribs 9 and 10. The upper edge strip is composed of two segments of (XC111-53 and XC111-27) dural section materials, which have their ends milled and butt jointed with the 2 mm. thick dural connecting plates. The seam of the strip joint coincides with that of the web joint. The lower edge strip consists of the web flange and the angle section which is made of 1.2 mm thick dural sheet and riveted on the inner side of the web between ribs 1 and 12. The lower edge strip is further strengthened with a dural strip of 2.5 mm. thickness along the lower inner edge of the web between ribs 1 and 7. On the web between ribs 5 and 6 is cut through hole for aileron control bellcrank, the hole is riveted with dural backing plate of 2.5 mm. thickness and (XC111-4) dural section material along its periphery for reinforcement. At the rib 12 is installed a box made of 2 mm. thick dural sheets for fixing the aileron attachment fitting. Between ribs 1 and 6 are riveted vertical (XC111-4) dural section materials for fixing the rear ribs. At the inner ends of both the upper and lower edge strips are installed fittings made of CrMnSi alloy steel by die pressing for butt jointing the midwing. Each of the upper and lower fittings is bolted with five CrMnSi alloy steel bolts, three of 8 mm. diameter and two of 6 mm. diameter.

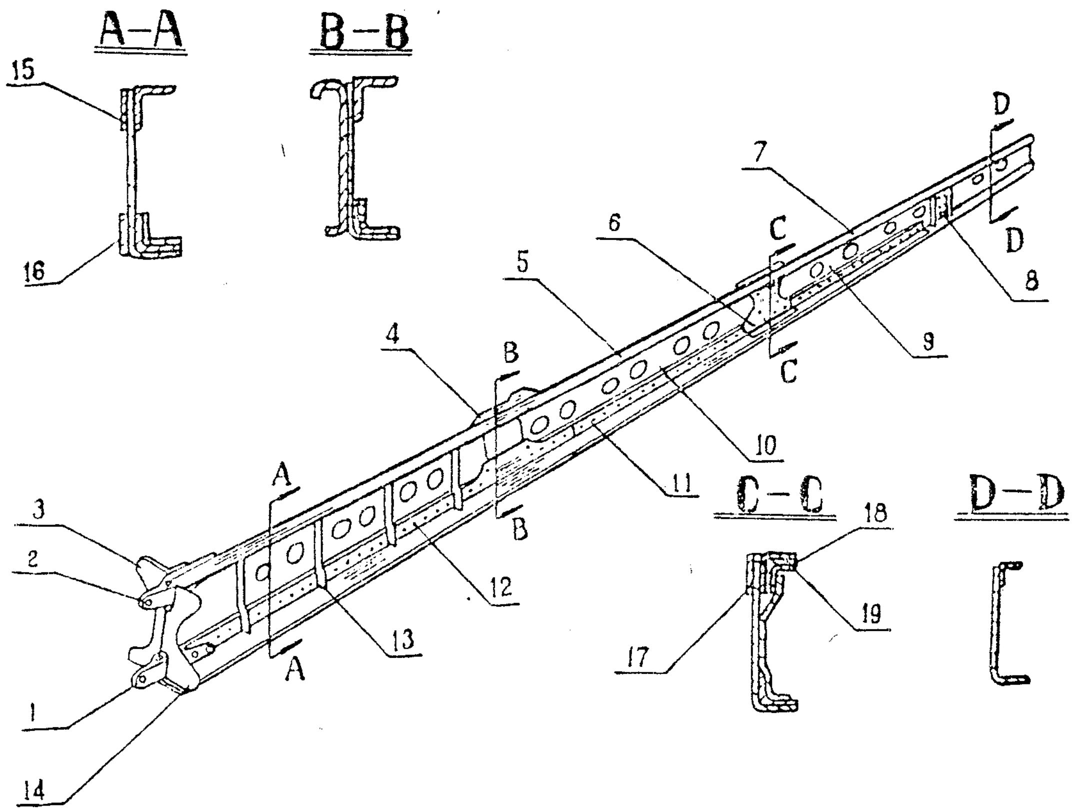


Fig. 2.32 Rear spar of the outer wing

1. Lower fitting of the rear spar 2. Upper fitting of the rear spar 3. Section material 4. Backing plate 5. Upper edge strip 6. Connecting plate 7. Upper edge strip 8. Box 9. Rear spar web 10. Rear spar web 11. Angle section 12. Lower edge strip 13. Section materials 14. Section material 15. Backing plate 16. Backing plate 17. Backing plate 18. Angle section 19. Connecting plate

According to their structural form, the ribs of the outer wing are classified into three groups.

Group 1 comprises ordinary ribs, such as ribs 4, 5, 7, 8, 9 (left), 10 and 11. Each rib can be divided into three sections, namely, the nose, center and rear ribs connected together at the front and rear spars respectively. All the rib webs are made of 0.6 mm. thick dural sheets (except that the web of the center rib 4 is made of 0.8 mm. thick dural sheet). Circular light holes are cut on the nose rib webs, un-conventional triangular light holes on the center rib webs, circular light holes and ellipitc through holes for the aileron control link on the webs of the rear ribs 4 and 5. The upper and lower flanges of the ribs (except the lower flange of rib 4) are notched for setting stringers. The nose and center ribs are of "Π" shaped cross section, while the rear ones of "ᒣ" shaped cross section.

Group 2 comprises particular ribs, such as ribs 2 and 3 located in the fuel tank compartment. Each rib is composed of the nose, center and rear sections too. The nose rib 2 is made of 0.8 mm. thick dural sheet, but the left nose rib 2, located at the cavity of the landing light has its upper and lower flanges strengthened with (XC111-4) dural section materials. The center rib 2 is free from web and of "ɪɾ" shaped cross section. The interface between the center rib 2 and fuel tank is filled with a piece of 2 mm. thick (205) plywood. On both of the front and rear ends are riveted box holders to tie the fuel tank belts. The rear rib made of 0.6 mm. thick dural sheets has the "ᒣ" shaped cross section. The rib 3 has the same structural form as that of the rib 2.

Group 3 comprises the reinforced ribs, such as ribs 1, 6, 9 (right), 12 and 13. The rib 1 is composed of the nose, center and rear sections. The nose rib 1 is made of 0.8 mm. thick dural sheet, on which is cut the light hole and riveted the (XC111-4) dural section material. The center rib 1 has its web made of 1 mm. thick dural sheet, and its upper and lower edge strips made of (XC111-4, XC111-11) dural section materials by bending. On the web is riveted the angular stay made of 1 mm. thick dural sheet for supporting the fuel tank. The rear rib 1 made of 1 mm. thick dural sheet has its web cut with through hole for aileron control link and light hole. The rib 6 is also composed of the nose, center and rear sections made of 0.6 and 0.8 mm. thick dural sheets respectively. The nose and rear ribs 6 are of "Π" shaped cross section. The center rib 6 is of "I" shaped cross section and riveted with upper and lower edge strips made of 0.8 mm. thick dural sheets. On the rear rib 6 is riveted the strengthening box for fixing the aileron attachment fitting. The center and rear ribs 6 are bolted to the upper and lower edge strips of the rear spar through the lugs made of wrought aluminium by die pressing. Being equipped with the holder of the pitot tube, the rib 9 of the right outer wing has its nose rib web made of 1.5 mm. thick dural sheet and riveted with vertical (XC111-6) dural section materials and its center and rear ribs such manufactured as the ordinary rib. On account of the aileron attachment fitting being installed on the rear spar at rib 12, the rib 12 should have two ribs, while the webs of its nose, center and rear sections are all made of 0.6 mm. thick dural sheets. On the upper and lower flanges of the center rib 12 are riveted dural strips of 0.8 mm. thickness and box, which is made of 1.5 mm. thick dural sheets and bolted to the rear spar and aileron attachment fittings. The rib 13 is an intergral on and connected to the front and rear spars with (XC111-4) dural section materials. Its web is of 0.6 mm. thickness. Its upper and lower flanges are riveted with (XC111-4) strips on which are installed the anchor nuts for fixing the wingtip.

The wingtip is composed of the skin and three spanwise arranged partitions by spot welding (or riveting). The skin is made of two pieces of 0.8 mm. thick anticorrosive aluminium alloy sheet by welding, and reinforced with inside stiffening strip of the same aluminium alloy by spot welding (or riveting) along the border where the skin laps over the rib 13. The partitions with light holes are made of 0.6 mm. thick dural sheets. At th extreme point of the wingtip is installed the navigation light.

The main fittings on the outer wing are such as the attachment fittings (both on the front spar and rear spar) for connecting the midwing and the attachment fittings (both on the rear rib 6 and on the rear spar at rib 12) for suspending the ailerons. The mid and outer wings are connected together at the ends of the front and rear spars with the help of CrMnSi alloy steel bolts of 18 mm. and 10 mm. diameters respectively. The fitting made of wrought aluminium by die pressing and fitted with a (GX1026) double-row ball bearing is installed on the rib 6. On the rear spar at the rib 12 is installed another set of attachment fittings whose seat with double horizontal luge made of wrought aluminium by die pressing are fixed on the rear spar through four CrMnSi alloy steel bolts of 5 mm. diameter. On the seat is fastened a fork-end fitting made of wrought aluminium by die pressing with the CrMnSi alloy steel bolt of 6 mm. diameter. Being able to rotate about the vertical axis, the fork-end fitting is fitted with a (GX1026) double-row ball bearing. The aileron is attached to the fittings located at the ribs 6 and 12 with CrMnSi alloy steel bolts of 6 mm. diameter.

Both the upper and lower outer wing skin are composed of eleven pieces of dural sheets (Fig. 2.33). The thickness of the skin is 0.6 mm. except that the one over the fuel

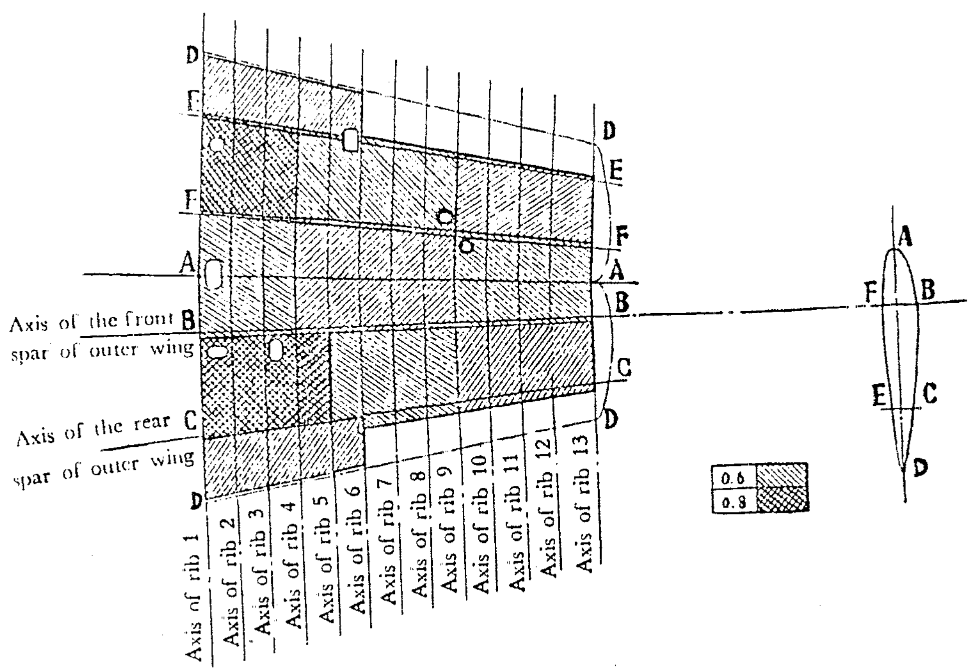


Fig. 2.33 Schematic diagram of wing skin arrangement

tank compartment is of 0.8 mm. thickness. The skin sections are bordered from each other by the front spar, rear spar, rib 4 (or 5) and rib 9. As for their being connected chordwise, the nose and mid skin sections are butt jointed with the 0.6 mm. thick dural strips along the upper and lower edges of the front spar, the mid and rear skin sections lap jointed along the upper and lower edge of the rear spar. As for their being connected spanwise, the skin sections are lap jointes at the rib 4 (or 5) and rib 9 respectively. The lower mid section of skin extending from the rib 1 to rib 4 acts as the cover of the fuel tank compartment, which is fixed with screws and anchor nuts arranged along the lower edges of the front spar, the rear spar and the lower flanges of the ribs 1 and 4.

The piece of the skin acting as the fuel compartment cover is made of 0.8 mm. thick dural sheet, inside which are riveted (or spot welded) peripheral strips and section materials. The peripheral strips and longitudinal section materials made of 0.8 mm. thick dural sheets have "˥" shaped cross section, while the transversal stiffeners are the (XC111-1) dural section materials. The fuel compartment cover is provided with fuel bleeding door shut by Dzus fasteners. Along the periphery of the fuel compartment cover is glued the rubber strip of 0.5 mm. thickness with XY-401 adhesive for sealing and antiabrasion.

The landing light cavity is located between the nose ribs 1 and 2 of the left outer wing. The opening of the cavity on the leading edge skin is reinforced with dural border with anchor nuts arranged along its periphery. The organic glass lid of 3 mm. thickness held by a dural retainer is fitted with the border by screws. The cavity is provided with dural stiffening sheet of 1 mm. thickness. The landing light is fixed on the "Π" shaped section material, which is made of 1 mm. thick dural sheet and installed on the lower wing skin.

In order to ensure an aerodynamically smooth and continuous profile, a fairing strip made of 0.5 mm. thick dural sheet is wound around the wing skin at the interface of the mid and outer wings, fastened and tightened with two sets of adjusting screws. The fixers riveted inside the fairing strip make it settled along the interface and kept from being spanwise shifted.

III. AILERON

The aileron (Fig. 2.34) is of the set-back hinge type and installed from rib 6 to rib 13 of the outer wing. The components of the aileron are all made of dural sheets except the attachment fittings and airplane fabric.

The aileron skeleton consists of the spar of "Π" shaped cross section, ten ribs and one rear strip.

The spar with light holes is made of 1 mm. thick dural sheets. On the end of the spar at rib 1 are riveted drual gussets of 0.8 mm. thickness for fixing the attachment fitting.

The aileron ribs include two integral ribs (ribs 1 and 10), eight rear ribs and nine nose ribs. Each of the ribs numbered from 2 to 7 and rib 9 has its nose rib installed in front of the spar. The nose ribs 8_A and 8_B are installed on the lateral sides of the notch

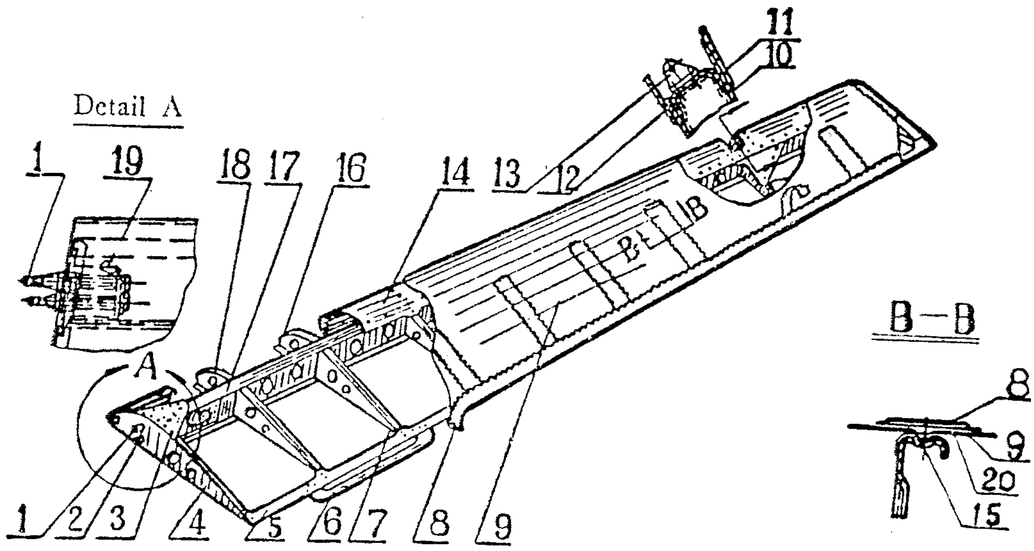


Fig. 2.34 Aileron

1. Bolt (for connecting control bellcrank) 2. Bolt (rotating axle) 3. Upper gusset at rib 1 4. Rib 1 5. Trailing edge strip 6. Trim tab 7. Rear rib 8. Fabric tape 9. Airplane fabric 10. Slant rib 11. Upper strengthening plate at rib 8 12. Lower strengthening plate at rib 8 13. Attachment fitting 14. Leading edge skin 15. Sewing thread 16. Nose rib 17. Spar 18. Nose rib 19. Fitting 20. Paper strip

for the attachment fitting on the leading edge. The notch is located between the ribs 8 and 9. The nose ribs are all made of 0.6 mm. thick dural sheets, except for the nose rib 8_A of 0.8 mm. thick dural sheet. The ribs 1 and 10 with "Π" shaped cross section are made of dural sheets of 0.8 mm. and 0.6 mm. respectively. The rear ribs 2 to 9 have "Π" shaped cross section too, but their flanges are pressed with grooves drilled with needle holes for fixing and stitching the airplane fabric. All the rear ribs are made of 0.6 mm. thick dural sheets. The slant rib made of 0.6 mm. thick dural sheet is set between the rear rib 8 and spar to improve the local rigidity of the portion of the spar where the attachment fitting is fixed. The nose section skin is made of 0.8 mm. thick dural sheets. The rear ribs have their front ends connected with the spar, while their rear ends to aileron trailing edge strip made of 0.5 mm. thick dural sheets. The fixed trim tab made of 1 mm. thick dural sheet is riveted on the trailing edge strip between ribs 2 and 3 for eliminating the bank appeared during flying.

The aileron has two attachment fittings. The fitting riveted on the spar root and rib 1 is a weldment of CrMnSi alloy steel with two outstretched CrMnSi alloy steel bolts of 6 and 8 mm. diameter respectively. These bolts are used for attaching the aileron and connecting the control bellcrank. The other fitting is a bracket made of wrought aluminium by die pressing and bolted on the spar between the ribs 8 and 9. A CrMnSi alloy steel bushing is pressed into the bracket lug eye. Dural stiffening strips of 0.8 mm. thickness are riveted in the inside of the upper and lower leading edge skin at the two attachment fittings.

The aileron is covered with the airplane fabric. The aileron skeleton is at first enclosured with a single stitched bag made of the airplane fabric with No. 10 thread by sewing. The bag is then stitched on the rib with the waxed flaxen thread through the needle holes on the rib flange. The fabric tape with serrated edges is glued along the seam. Drain holes stuck with celluloid backing ring are cut on the lower fabric along the aileron trailing edge.

IV. FLAP

Having the same length as that of the midwing span, the flap is installed beneath the trailing edge of the midwing for reducing the landing speed and shortening the landing run. The flap is hung with the high carbon steel wire (IIa) axle of 2.5 mm. diameter through the hinges riveted on the flap leading edge and lower flange of the midwing rear spar.

The flap is retracted or lowered with compressed air through the actuating cylinder and closed with the tightened rubber cord.

The skeleton of the flap (Fig. 2.35), a dural riveted structure, consists of skin, spar of "II" shaped cross section, twenty-seven nose ribs, fourteen rear ribs, two integral end ribs, stiffening strips, trailing edge strip, box and angle sections.

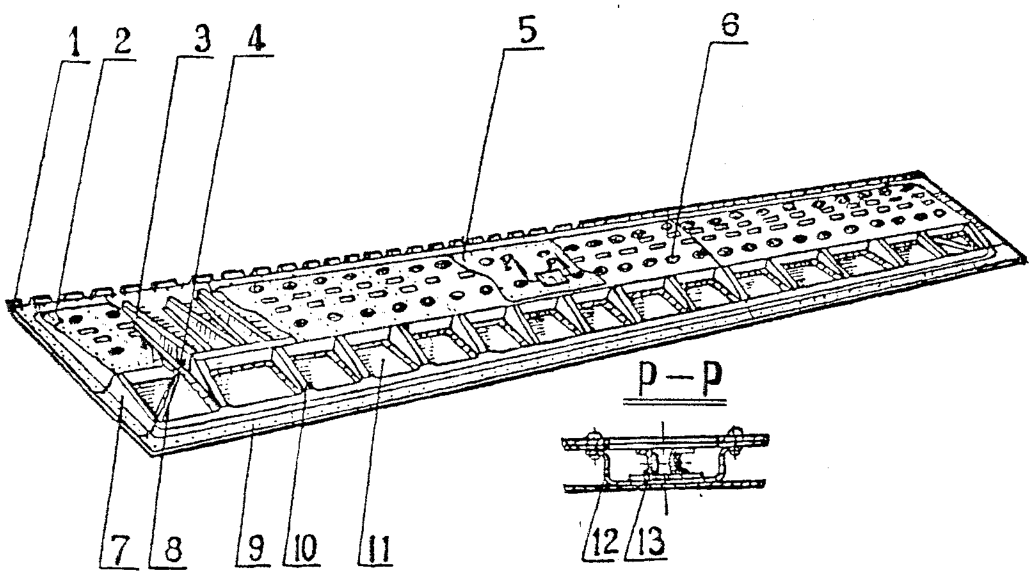


Fig. 2.35 Flap

1. Hinge 2. Attaching lug for flap position indicator 3. Nose rib 4. Holder for rubber cord 5. Reinforcing plate 6. Inner skin 7. Rib 8. Angle section 9. Trailing edge strip 10. Rear rib 11. Outer skin 12. Box 13. Bracket for fixing the flap actuating cylinder

The spar of the flap made of 1.5 mm. thick dural sheets is composed of two segments, which are butt riveted through dural reinforcing strips of 1.5 mm. thickness between right ribs 3 and 4. The nose and rear ribs with "⅂" shaped cross section are made of 0.6 mm. and 0.8 mm. thick dural sheets respectively. On the rear ends of the ribs is riveted the trailing edge strip made of dural sheet of 0.8 mm. thickness.

The inner pieces of the skin with light holes and pressed stiffening grooves are made of 0.8 mm. thick dural sheets and overlapped at the right rib 2. The hinge consisting of three sections is made of 0.6 mm. thick dural sheets and riveted on the flap leading edge between the inner and outer skin. The three sections of the outer skin made of 0.6 mm. thick dural sheets are lap jointed at the right and left rib 3.

At the axis of the left rib 0 is installed the bracket for fixing the flap actuating cylinder link. The bracket is a heat-treated weldment of CrMnSi alloy steel sheets and section materials of 1.2 and 1.5 mm. thickness. Beneath the bracket a dural box made of 1 mm. thick sheets is riveted.

Two holders made of low carbon steel sheets of 1 and 3 mm. thickness by welding for fixing the rubber cord are riveted on the right and left nose ribs 6.

The attaching lug for the flap position indicator made of dural section material (or nylon 1010) is riveted on the left nose rib 7.

V. EMPENNAGE

The empennage (Fig. 2.36) composed of the horizontal stabilizer, elevator, fin and rudder is of the cantilever structure.

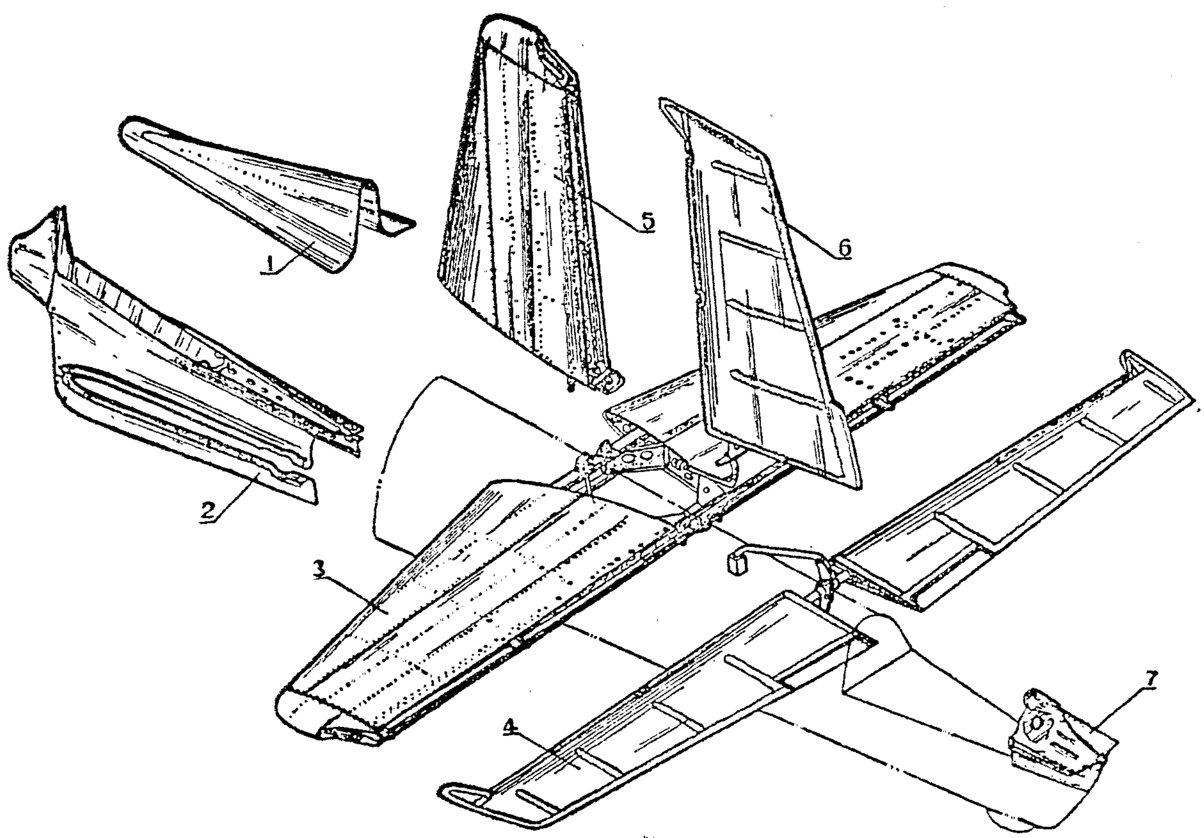


Fig. 2.36 Empennage

1. Ridge fairing 2. Fairing 3. Horizontal stabilizer 4. Elevator 5. Fin
6. Rudder 7. Tail cone

The empennage has symmetric airfoils and dural skeletons of riveted structure. Both the horizontal stabilizer and fin have their skins made of dural sheets riveted on the skeleton, but the elevator and rudder whose whole surfaces are covered with the airplane fabric have the metal skins riveted over their leading edges only. The empennage is bolted to the fuselage frames 16, 17 and 18 through corresponding pairs of fittings, i.e., through two attachment fittings on the front spar of the fin and another two pairs of attachment fittings on both the front and rear spars of the horizontal stabilizer. The fin and horizontal stabilizer themselves are connected together by means of two joints, two attachment fittings of which are located on the rear spar of the former and another two of which on the front spar of the latter. All the connecting bolts are made of CrMnSi alloy steel and of 10 mm. diameter.

The interfaces between the empennage and fuselage are all streamlined with fairings, which include the ridge fairing made of 0.6 mm. thick dural sheets, fairing and tail cone made of 0.8 mm. thick anticorrosive aluminium alloy sheets. The ridge fairing is riveted to the fuselage. The other fairing and tail cone are jointed to the fuselage, the horizontal and vertical stabilizers with anchor nuts and screws. A tail navigation light is installed at the end of the tail cone.

HORIZONTAL STABILIZER

The horizontal stabilizer (Fig. 2.37) is a double-spar all metal structure composed of the symmetric skeletons, fittings, pieces of skin and tips. The right and left halves of the stabilizer is combined into a whole with the front and rear integral spars.

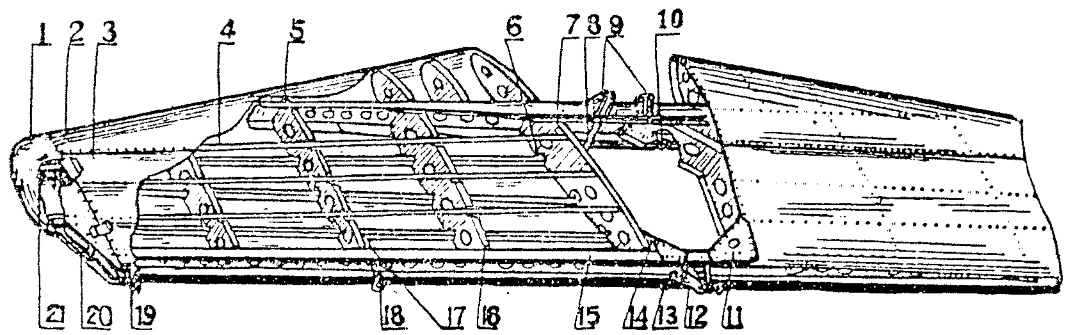


Fig. 2.37 Horizontal stabilizer

1. Tip skin 2. Leading edge skin 3. Skin 4. Stringer 5. Nose rib 6. Gusset 7. Front spar 8. 14. Reinforcing slant ribs 9. Fitting for connecting horizontal stabilizer with fin 10 Front fitting for connecting fuselage with horizontal stabilizer 11. Gusset 12. 18. 19. Attachment fittings for suspending elevator 13. Rear fitting for connecting fuselage with horizontal stabilizer 15. Rear spar 16. Rib 17. Angular box 20. Slant separator 21. Partition of the tip

The skeleton of the horizontal stabilizer is composed of the front and rear spars, ten ribs (five on each side), eight nose ribs (four on each side), twelve stringers (six on each side), reinforced slant ribs between left and right ribs 1, reinforcing plates, gussets, angle sections and so on.

The front and rear spars consist of the edge strips, webs and members of "П" shaped cross sections. The edge strips and webs of the front spar are made of dural sheets of 2 and 1 mm. thickness respectively. The rear spar edge strips made of the milled 4 mm. thick dural sheets have their thickness varying from 4 mm. to 1.5 mm. The rear spar web made of 1.2 mm. thick dural sheet is composed of two sections, which are connected together at the axis of symmetry of the airplane with the member of "П" shaped cross section made of 2 mm. thick dural sheet.

All the ribs of the horizontal stabilizer are of "П" shaped profile and have light holes on their webs. The ribs 1, 3 and 5, nose ribs 1 and 3 and the auxiliary nose ribs between the ribs 1 and 2 are all made of 0.8 mm. thick dural sheets, the ribs 2 and 4 and nose rib 2 of 0.6 mm. thick dural sheets. The ribs are connected to the spars with their flanges except for ribs 3 and 5 together with ribs I and 2. The former are connected to the rear spar with angular boxes and the latter with gussets. The upper and lower flanges of ribs 2, 3 and 4 are cut with stringer notches.

Two attachment fittings are fixed on the upper edge of the front spar for connecting with the fin and another two attachment fittings on the lower edges of the front and rear spars each for connecting with the fuselage. All these six attachment fittings are made of CrMnSi alloy steel by die forging. The lateral attachment fittings for the elevator are composed of the angular boxes welded from 1 mm. thick CrMnSi alloy steel sheets and the die forged wrought aluminium fittings fitted with (GX1026) ball bearings. They are installed on the rear spar of the horizontal stabilizer at the right and left ribs 3 and 5. The mid attachment fitting for the elevator is composed of a pair of brackets made of wrought aluminium by die pressing and fitted with the medium carbon steel bushings. It is installed on the left side of the axis of symmetry and at a distance of 15 mm. apart from it.

The right and left skin each is composed of three pieces, one piece on the leading edge, two pieces at the rear. (The upper one and the lower one, overlapped along the stringer 1.) They are made of the 0.6 mm. thick dural sheets.

The stabilizer tip consists of the skin made of 0.8 mm. thick anticorrosive dural sheets and partitions made of 0.6 mm. thick dural sheets. On the trailing edge of the tips are provided notches for balance weights of the elevator.

ELEVATOR

The elevator (Fig. 2.38) is of the monospar structure, it has its skeleton covered with the airplane fabric and its two symmetric halves connected together with four bolts passing through flanges. The elevator with adjustable trim tab on its near edge is of the setback hinge type too. The balance weights are installed in front of the rotation axis.

The components of the right or left half elevator skeleton are: one spar, five ribs, six nose ribs, five slant ribs, one trailing edge strip made of 0.8 mm. thick drual sheet, one section material made of 1 mm. thick dural sheet for suspending trim tab, gusset, etc.

The spar with "П" shaped cross section is made of 1 mm. thick dural sheet and riveted with reinforcing angular boxes opposite to the notches at ribs 3 and 5. The reinforcing angular boxes are made of 1 and 1.5 mm. thick CrMnSi alloy steel sheets respectively.

The ribs 1, 3 and 5 are made of 0.8 mm. thick dural sheets, the ribs 2, 4 and all nose

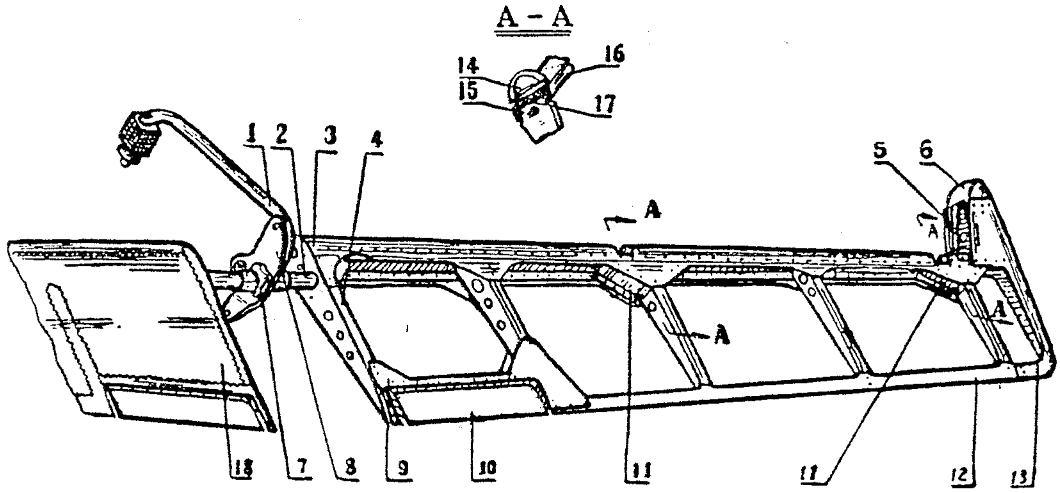


Fig. 2.38 Elevator

1. Balance weight 2. Joint 3. Leading edge skin 4. Rib 5. Reinforcing rib 6 Balance weight 7. Flange 8. Bellcrank 9. Gusset 10. Trim tab 11. Slant rib 12. Trailing edge strip 13. Tip 14. Nose rib 15. Suspending shaft pin of the elevator 16. Spar 17. Angular box 18. Fabric

ribs of 0.6 mm. thick dural sheets. On the webs of ribs 1, 2, 3, and 4 are cut light holes, while on the flanges of ribs 2, 3, 4 and 5 pressed with grooves with needle holes for fixing and stitching the airplane fabric. The slant ribs are all made of 0.8 mm. thick dural sheets except that the slant ribs located at the rib 3 is made of 1 mm. thick dural sheet.

On the spar at ribs 3 and 5 are installed suspending brackets composed of the low carbon steel boxes and the CrMnSi alloy steel pins of 6 mm. diameter by welding, at rib 1 the fittings made of wrought aluminium by die pressing. The extended tubular end of the left half elevator is connected to the welded CrMnSi alloy steel flange, while that of the right half elevator to the flange with adjustable balance weight. A bellcrank made of 7 mm. thick dural sheet is installed between these two flanges. Each of the bellcrank arms has a hole pressed with a copper alloy bush to be connected with the elevator control cable. The hole for the rotating axis of the bellcrank is pressed with the (GX1018) ball bearing and used for suspending the elevator from the stabilizer.

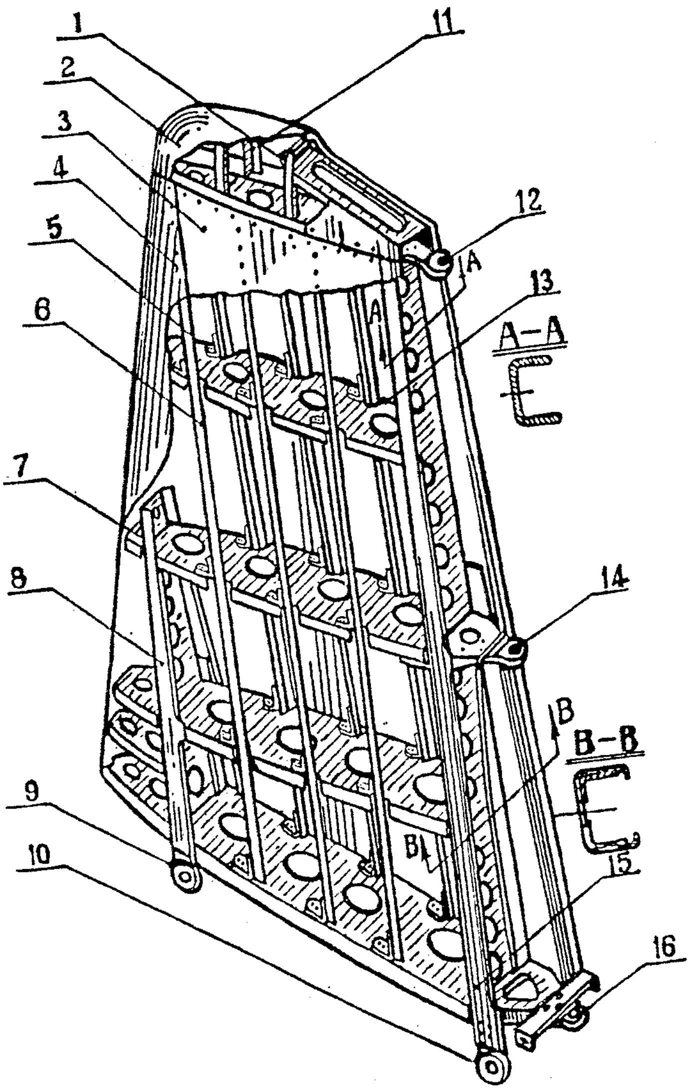
The balance weights of the elevator can be classified into two kinds, the non-adjustable and the adjustable. The non-adjustable balance weights are the low carbon steel forgings riveted on the front part of both elevator tips. The adjustable balance weight composed of the welded CrMnSi alloy steel flange, tube and low carbon steel weight block is riveted on the extended tubular end of the right half elevator. The balance adjustment is accomplished by varying the number of the low carbon steel washers fixed in front of the weight block with nut.

The elevator has its leading edge riveted with skin made of 1 mm. thick dural sheets and its lateral ends riveted with tips, which are made of 0.8 mm. thick anticorrosive aluminium alloy sheets and reinforced with inside ribs. The elevator is covered with the airplane fabric. The elevator skeleton is at first enclosured with a single stitched bag made of the airplane fabric with No. 10 thread, then the fabric is stitched on the rib with the waxed flaxen thread and finally the opening edge of the bag is stitched with No. 0 thread. The airplane fabric tape with serrated edges is stuck along the seam. Drain holes stuck with celluloid backing rings are cut on the lower fabric along the trailing edge.

The elevator trim tabs are of fiberglass-reinforced plastic structure, made of foamed plastic block wrapped up with fiberglass-reinforced plastic and suspended from the section material between the elevator ribs 1 and 2 with hinges. The bracket made of low carbon steel by welding and riveted on the filler block is connected with the control link. The filler block made of the fiberglass-reinforced plastic is fitted in the center of the trim tab. The control of the trim tabs may be carried out within the cockpit through the hand wheel and control cables.

FIN

The fin (Fig. 2.39) is of the double-spar all metal structure consisting of the skeleton, fittings, skin and tip.



1. Antenna support
2. Tip
3. Skin
4. Leading edge skin
5. Angular plate
6. Stringer
7. Nose rib
8. Front spar
9. Front attachment fitting
10. Rear attachment fitting
11. Partition on the tip
13. Rib
12. 14. 16. Rudder suspending brackets
15. Rear spar

Fig 2.39 Fin

The fin skeleton is composed of the front and rear spars, five ribs, four nose ribs and six stringers made of the extruded dural section materials.

The front and rear spars have their webs of "Π" shaped cross section and their edge strips of "Γ" shaped cross section. All the edge strips made of 1 mm. thick dural sheets have their height about a half of that of the corresponding spar. The webs with light holes are made of dural sheets of 0.8 and 1 mm. thickness respectively.

The ribs are classified into nose and center ribs. The nose rib 1, center ribs 1 and 3 and rib 5 are all made of 0.8 mm. thick dural sheets, nose ribs 1 A, 2 and 3, center rib 2 and rib 4 of 0.6 mm. thick dural sheets. All the ribs are of "Π" shaped cross section and provided with light holes on their webs. The connections of the center rib 1 with the front spar and the center rib 2 with the rear spar are realized by means of angular plates, those of the center rib 3 and rib 5 with the rear spar by means of the boxes made of the 1.2 mm. thick dural sheets and the gussets made of the 1 mm. thick dural sheets respectively, while those of the remaining ribs with the front and rear spars by means of the rib flanges only. On the flanges of ribs 2, 3 and 4 are cut stringer notches.

Two attachment fittings are riveted on the lower ends of the front spar to be connected with the fuselage, another two attachment fittings on the lower ends of the rear spar with the horizontal stabilizer. All these fittings are made of 1.5 mm. thick CrMnSi alloy steel sheets, welded with slant washers on their lugs and subjected to a heat-treatment after welding. Three brackets for suspending the rudder are riveted on the rear spar at ribs 1, 3 and 5 respectively. The upper bracket is made of wrought aluminium by die pressing and fitted with the (GX1026) ball bearing in its lug eye. The center bracket is a riveted structure composed of the box and the die pressed wrought aluminium bracket. The former is made of CrMnSi alloy steel sheets, and the letter is pressed with the (GX1026) ball bearing in its center hole. The lower bracket is an assembly composed of the box and bracket and connected with bolts. The box is made of 1.5 mm. thick CrMnSi alloy steel sheets by welding, the bracket is made of wrought aluminium by die pressing and fitted with (GX1018) ball bearing in its center hole. The bolts in the lower bracket are also used to fix the dural connecting plate for installing the fairings.

The skin is fabricated from three pieces made of 0.6 mm. thick dural sheets, one piece over the leading edge, two pieces at the rear (the right one and the left one, overlapped along the stringer 1.)

The tip is made of the anticorrosive aluminium alloy sheets of 0.8 mm. thickness by welding and fixed on the flange of the rib 5 with screws and anchor nuts. It has nose, center and slant ribs made of 0.6 mm. thick dural sheets and riveted in its inside. The notch for the rudder balance weight is located on its trailing edge. On the center rib is installed an antenna support.

RUDDER

The rudder (Fig. 2.40) is a monospar structure of set-back hinge type. It has the skeleton covered with the airplane fabric, the balance weight installed in front of the rotating axle and the fixed trim tab made of 1 mm. thick dural sheet and riveted on the trailing edge.

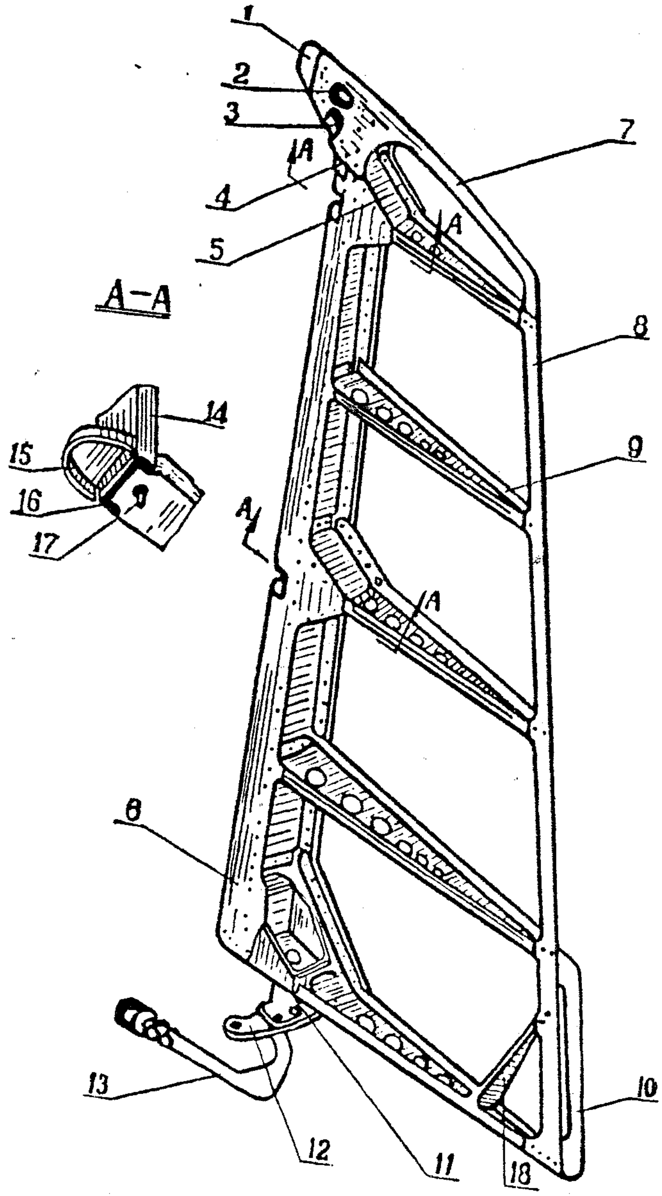


Fig. 2.40 Rudder

1. Balance weight 2. 3. Stiffening ribs 4. Connecting part 5. Partition 6. Leading edge skin 7. Tip skin 8. Trailing edge strip 9. Rib 10. Fixed trim tab 11. Bellcrank support 12. Bellcrank 13. Balance weight 14. Spar 15. Nose rib 16. Stiffening angular box 17. Suspending pin 18. Slant rib

The rudder skeleton consists of one spar, five ribs, eight nose ribs, five partitions, one trailing edge strip made of 0.8 mm. thick dural sheet and one slant stiffening rib made of 0.6 mm. thick dural sheet.

The spar with "Π" shaped cross section is made of 1 mm. thick dural sheet. The stiffening angular boxes made of 0.8 mm. thick dural sheets are riveted at the notches opposite to ribs 3 and 5 respectively.

The rib 1, nose rib 1, two nose ribs adjacent to the notch on the leading edge at rib 3, and partitions at rib 1 and under rib 3 are all made of 0.8 mm. thick dural sheets, while the remaining ribs, nose ribs and partitions of 0.6 mm. thick dural sheets. The ribs 2, 3, 4, 5 and partition at rib 1 are all provided with light holes. The web of rib 1 is pressed with stiffening dents. On the flanges of ribs 2, 3, 4 and 5 are pressed grooves with needle holes for stitching the airplane fabric. All the ribs, nose ribs and partitions are connected to the spar through their flanges.

The suspending bracket installed on the spar at ribs 3 and 5 is just the box made of low carbon steel sheets and welded with the CrMnSi alloy steel pin of 6 mm. diameter. On the end of the spar at rib 1 is set the bellcrank support on which a 8 mm. diameter CrMnSi alloy steel axle pin with threaded end is fixed. The bellcrank support is made of wrought aluminium by die pressing and bolted to the bellcrank. The bellcrank is made of 5 mm. thick dural sheet with copper alloy bushes pressed in its arm holes for connecting the rudder control cables.

The balance weights may be classified into two kinds, the nonadjustable and the adjustable. The non-adjustable balance weight is a low carbon steel forging riveted in front of the tip. The adjustable balance weight is composed of the CrMnSi alloy steel tube and the low carbon steel weight block. The tube has its elbow welded with gusset made of CrMnSi alloy steel sheets, its root fixed on the bellcrank with two tapered bolts and its front end set with the weight block and several low carbon steel washers by nut. The balance adjustment is accomplished by varying the number of washers set in front of the weight block.

The rudder has its leading edge covered with the skin made of 0.8 mm. dural sheets, its tip reinforced with two inside reinforcing ribs and covered with 0.8 mm. thick anticorrosive aluminium alloy sheet and its outer surface covered with the airplane fabric. The rudder skeleton is at first enclosured with a single stitched bag made of the airplane fabric with No. 10 thread by sewing, then the fabric is stitched on the rib with the waxed flaxen thread and finally the opening edge of the bag is stitched with No. 4 thread. The seam is stuck with the airplane fabric tape with serrated edges.

VI. ARRANGEMENT OF ACCESS DOORS

The maintenance and inspection of the airplane can be carried out through the access doors set on the fuselage, midwing, outer wing and engine cowl. A easy access to the joints of the members to be inspected is offered as soon as the fairings over the interfaces of the midwing and outer wing and the "Y" shaped fairing between the fuselage tail and empennage are removed.

According to their stress and usage, the access doors of the airplane can be classified into three types.

Doors of small size to be opened frequently, such as the door of the field compressed air charging nipple which can be opened by pushing the locking pin with fingers.

Doors of larger size to be opened frequently, such as the door of the battery box. The skin along the peripheries of doors are flanged with stressed border. The doors are fixed with Druz fasteners.

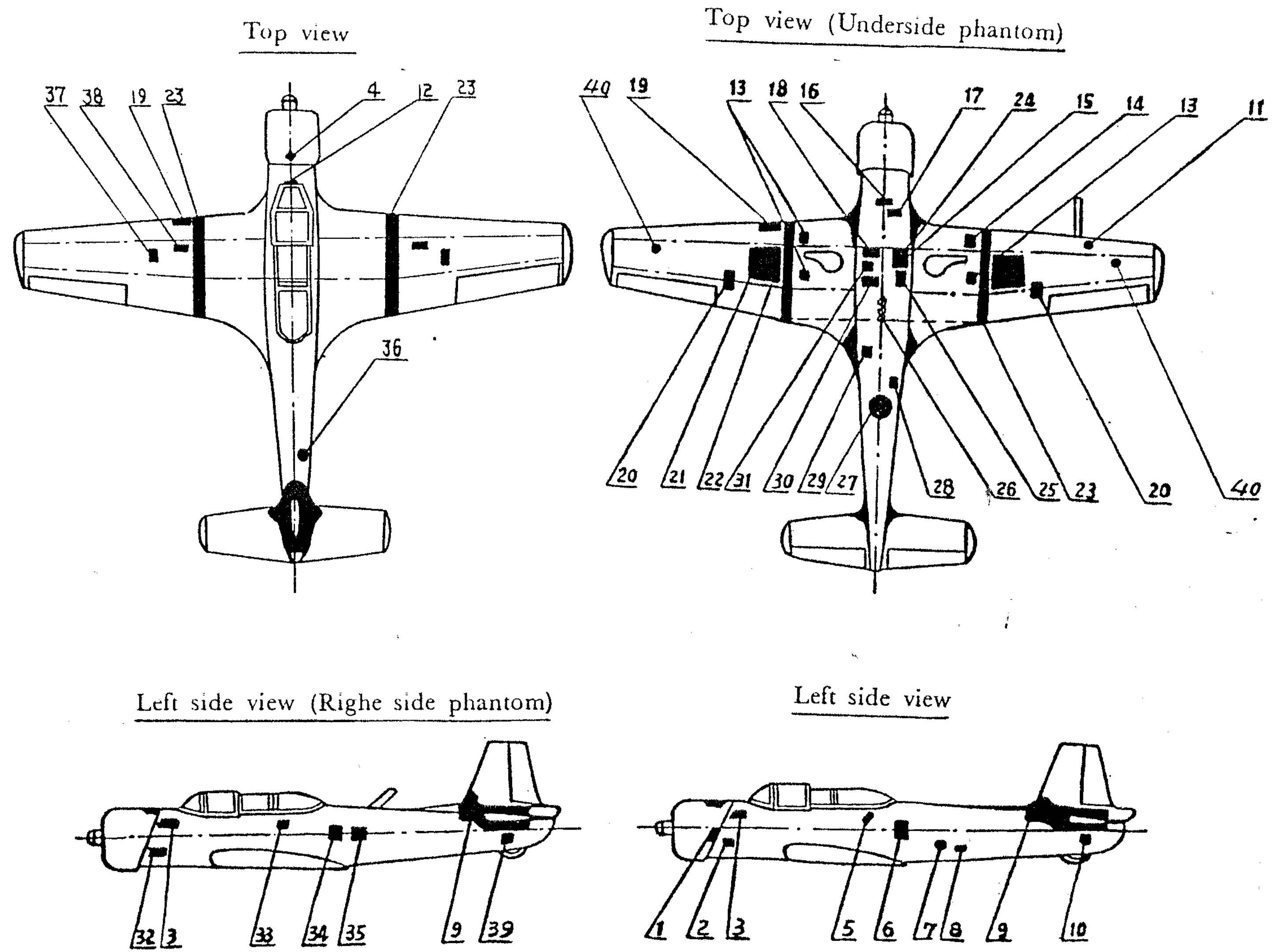


Fig. 2.41 Diagram of access doors

1. Inspection door for engine accessories 2. Inspection door for fuel ducts 3. Inspection doors for instruments 4. Oil filler cap 5. Mounting hand grip 6. Door for the battery box 7. Door for the field power supply socket 8. Door for the field air charging nipple 9. Detachable "Y" shaped fairing between the fuselage and the empennage 10. Inspection door for control cables 11. Inspection door for the pitot tube 12. Vent of the front cockpit 13. Main landing gear joints doors 14. Access door for main landing gear joint and pitot tube deposit filter 15. Oil bleeder of the oil radiator 16. Inspection door for hand control hinges (in wheel bay) 17. Inspection door for oil ducts 18. Access door for pneumatic and control systems 19. Detachable glass lid of the landing light 20. Inspection doors for aileron control systems 21. Cover of the fuel tank compartment 22. Cover for the fuel bleeder 23. Mid-outer wing fairings 24. Access door for oil radiator maintenance and inspection 25. Adjustable throttle of oil radiator air outlet 26. Inspection door for elevator control bellcrank (in flap bay) 27. Cover for loop antenna 28. Cover for drain of the compressed air bottle 29. Cover for drain of the emergency air bottle 30. Access door for feed tank 31. Inspection door for aileron control system 32. Access door for engine accessories maintaince and inspection 33. Ventilation unit of the rear cockpit 34. Inspection door for inverters 35. Access door for the receiver 36. Inspection door for the magnetic heading sensor 37. Door for fuel feeder 38. Inspection door for fuel level gauge transmitter 39. Inspection door for control cable 40 Technical access doors

Doors to be seldom opened, such as the door of the receiver. The skin along the periphery of doors are flanged with stressed borders too. The doors are fixed on their borders with screws and anchor nuts.

CHAPTER III

LANDING GEAR SYSTEM

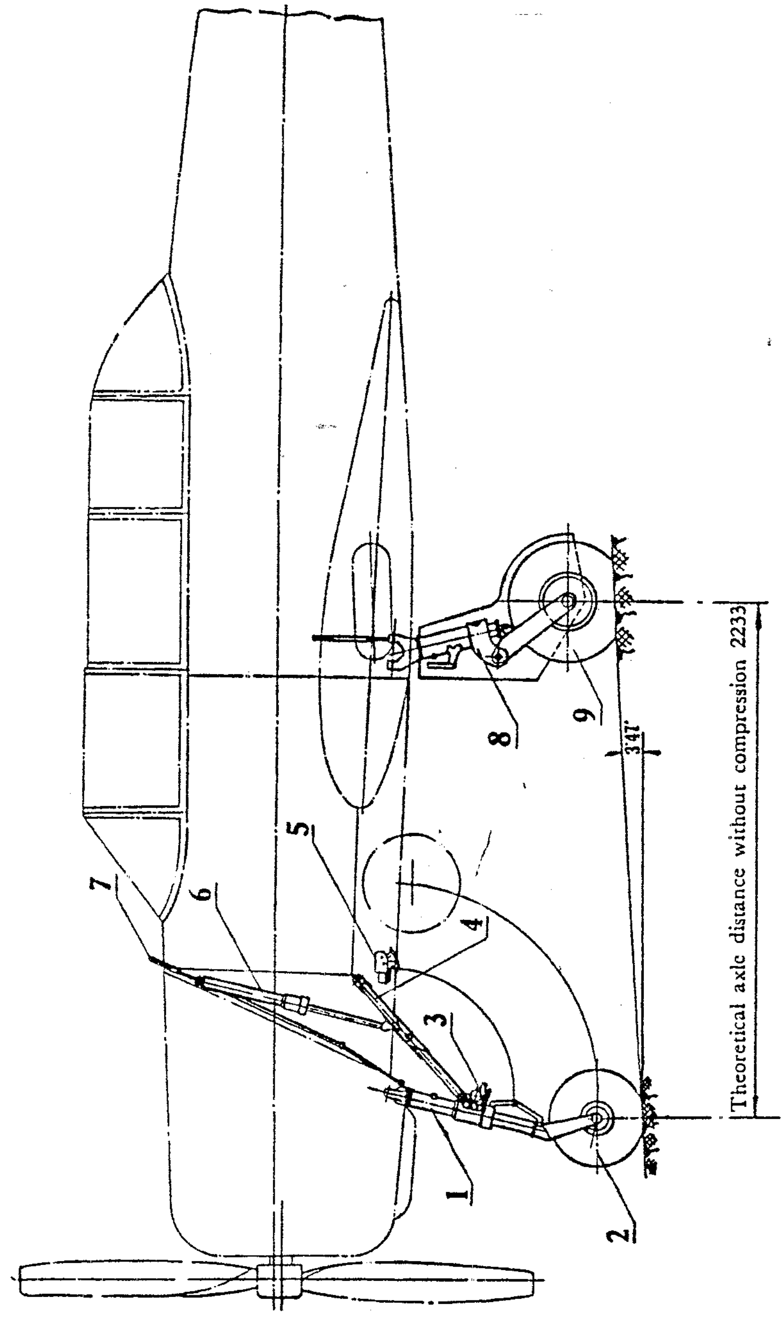
The landing gear is of the retractable tricycle type. The nose gear retracts backward into the gear bay located in the fuselage and the main gears retract inward along the wing span into the gear bays located in the midwing.

The nose gear is of the strut type and equipped with a 400×150 low-pressure wheel.

The main gear is of the semi-rocking arm type and equipped with 500×150 medium-pressure wheels with rubber bag brake.

The shock absorber strut of the landing gear is of the nitrogen-oleostrut type. Its retracting and extending movement is fulfiled by the compressed air through the actuating cylinder.

The landing gear (Fig. 3.1) mainly consists of the shock absorber strut, folding jack-stay assembly, actuating cylinder and gear up-lock.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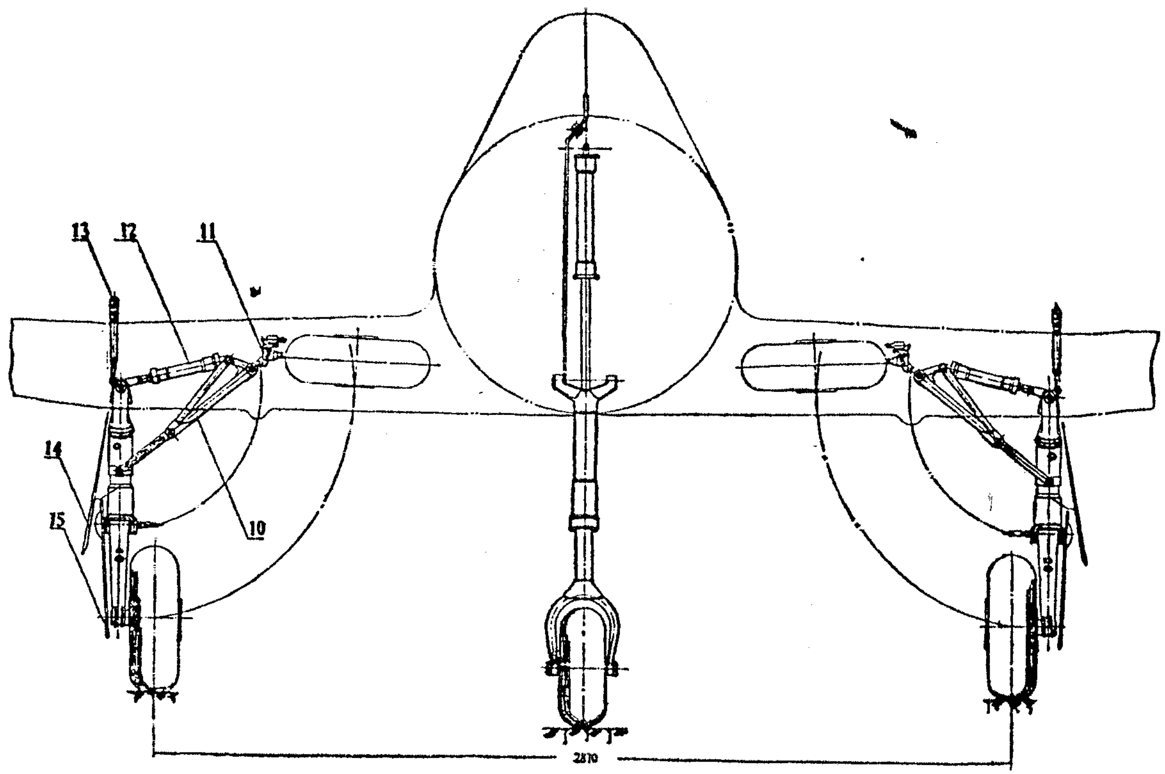


Fig. 3.1 Landing gear system

1. Nose gear strut 2. 400×150 nose wheel 3. Shimmy damper 4. Folding jackstay assembly for the nose gear strut 5. Gear up-lock for the nose gear strut 6. Actuating cylinder for the nose gear strut 7. Position indicator for the nose gear strut 8. Main gear strut 9. 500×150 brake wheel 10. Folding jackstay assembly for the main gear strut 11. Gear up-lock for the main gear strut 12. Actuating cylinder for the main gear strut 13. Position indicator for the main gear strut 14. Upper fairing of the main gear 15. Lower fairing of the main gear

Table 3.1

Main parameters for the shock absorbing system of landing gears

Ser. No.	Name	Nose gear	Main gear
1	Shock absorber type of the strut	nitrogen-oleo-fluid	nitrogen-oleo-fluid
2	Nitrogen gas pressure in the shock absorber strut	20 ± 1 atm.	48 ± 1 atm.
3	Hydraulic fluid	YH-10	YH-10
4	Capacity of the hydraulic fluid	640 ± 10 cm^3.	550 ± 20 cm^3.
5	Shock strut length without compression (the length measured from the wheel axle to the suspending axle along the axis of the shock strut)	958 mm.	817 mm.
6	Compressive travel of the strut in parking	0 mm.	0 mm.
7	Max. travel of the strut piston skirt	185 mm.	113 mm.
8	Travel pressure of the strut piston skirt: Initial pressure	393 ± 20 kg.	1,268 ± 30 kg.
	Final pressure (according to the compression travel of the piston skirt, the influence of the rubber cup friction not considered: 100 mm. for the main gear; 150 mm. for the nose gear.)	1,100 ± 50kg.	4,020 ± 80 kg.
9	Wheel size	400 × 150	500 × 150
10	Inflating pressure in the wheel tire	2.3 atm.	3.2 atm.
11	Weight of the shock strut (wheel excluded)	15 kg.	18 kg.

On the midwing and fuselage are installed the special landing gear mechanical position indicators and on the instrument panel of the front and rear cockpits are mounted the signal lights for indicating the retraction and extention of the landing gear.

The landing gear "up" position (AKP2-1) contact switch is installed on the case of the gear up-lock and turned on by the rotating of the lock hook.

The main landing gear "down" position (AKP2-1) contact switch is fixed on the web of the midwing front spar through the supporting stand.

The nose gear "down" position (AKP2-1) contact switch is fixed on the lower part of the fuselage frame 1 through the supporting stand.

All the circuits for the "down" position contact switches mentioned above are switched on by the special screws on the folding jackstay assembly.

I. MAIN GEAR

The main gear is of the semi-rocking arm type and consists of the shock absorber strut, folding jackstay assembly, actuating cylinder, gear up-lock and brake wheel.

The shock absorber strut is connected to the suspensing fitting for the landing gear located in the midwing through the hollow axle by means of the (HB1-125-6×67) conical bolts.

The hollow axle is made of CrMnSi alloy steel and its working surface is plated with chromium. While operating, the surface can be greased through the grease nipples installed on the upper fittings of the damper cylinder.

One end of the folding jackstay assembly is connected to the cantilever fitting welded on the damper cylinder with the help of the ball joint and the other end to the fitting on the midwing front spar web. Its connecting places are greased through the grease nipples on the jackstay.

The end of the actuating cylinder at its case is connected with the rotating bolt installed on the upper jackstay by the HB1-103-8×30×4 bolt and the piston rod end is connected to the supporting arm welded on the upper fitting of the damper cylinder with the fork-end bolt. The (U8GB304-64) ball-knuckle bearing is installed in the supporting arm and connected by means of the (HB1-103-8×26×4) bolt.

With the help of the (H2-4100-04) pin, the indicating rod of the landing gear position indicator is connected to the small supporting arm welded on the upper fitting of the damper cylinder through the eyebolt. The indicating rod extends out and retracts in the midwing skin along with the actuating movement of the shock absorber strut.

The gear up-lock for the main gear is fixed on the rib 3 of the midwing with four bolts (two of HB1-102-6×18, another two of HB1-102-6×20).

THE SHOCK ABSORBER STRUT OF THE MAIN GEAR

The shock absorber strut of the main gear (Fig. 3.2) consists of the damper cylinder, piston with its skirt and half-wheel fork.

The damper cylinder is in essence a cylinder, on one end of which is welded the upper fitting to be connected with the fitting on the midwing.

The upper fitting has two lugs fitted with the albronze bushings for suspending the main gear strut and welded with two supporting arms, one for connecting the landing gear position indicator and the other for the actuating cylinder.

At the upper part of the working chamber of the damper cylinder is fixed a tubular core together with the sealing ring by two nuts.

The tubular core is made of CrMnSi alloy steel.

The tubular core has its wall drilled with five holes of 6 mm. diameter and its lower end connected to a cap with threads and the H2-4110-31 fixing pins. The cap is collared with a ring. The two holes of $2.2D_4$ size and one hole of $2.3D_4$ size on the cap act as the channels joining the chambers of the piston skirt and the damper cylinder and the chambers of the piston skirt and the tubular core respectively.

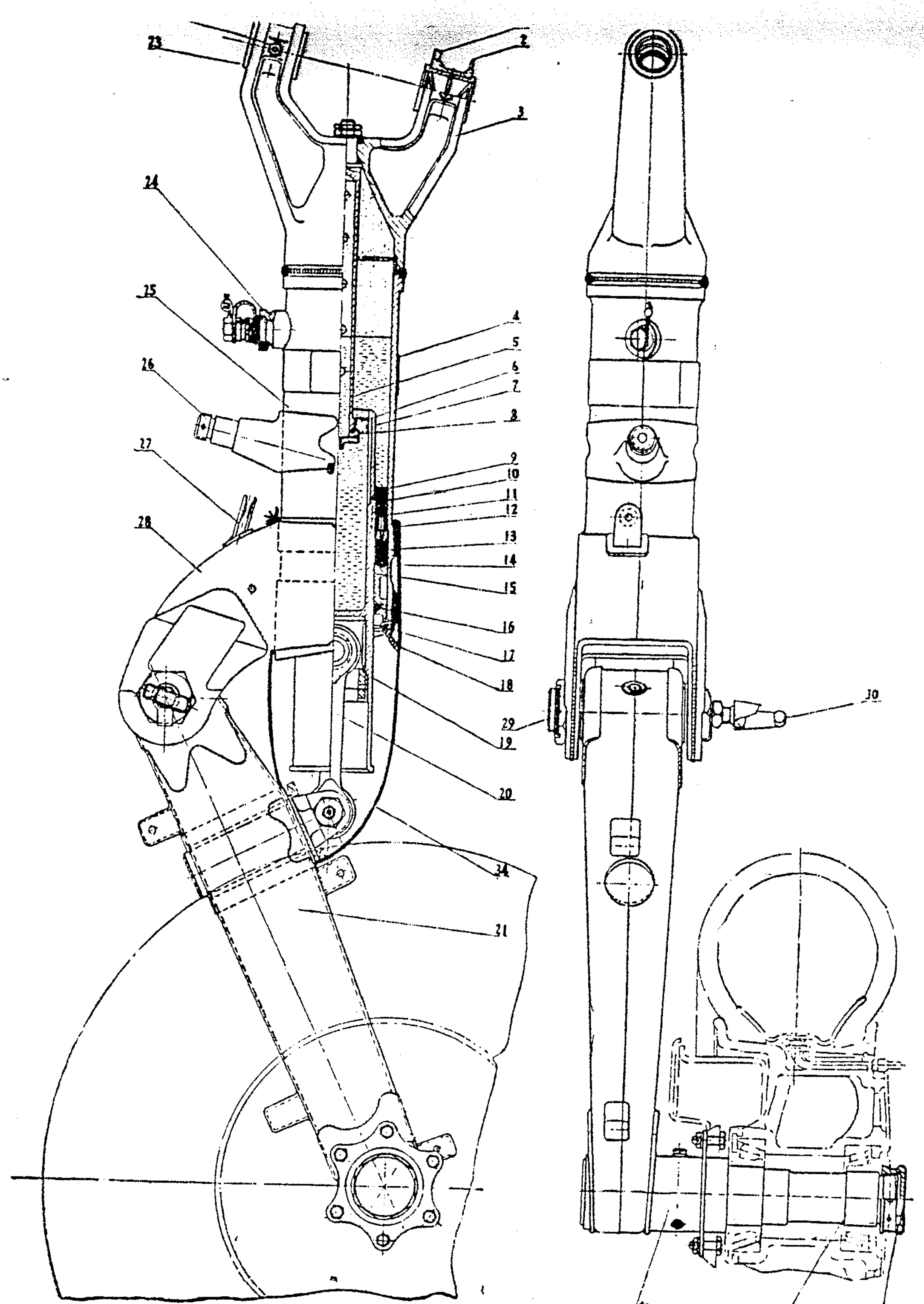


Fig. 3.2 Shock absorber strut for the main gear

1. Supporting arm for connecting the actuating cylinder 2. Supporting arm for connecting the landing gear position indicator 3. Upper fitting 4. Label 5. Tubular core 6. Cap 7. Ring 8. Locking pin 9. Piston 10. Locking screw 11. Valve 12. Piston 13. Supporting ring 14. Rubber cup 15. Supporting ring 16. Felt sealing ring 17. Nut 18. Safety wire 19. Piston skirt 20. Link 21. Half-wheel fork 22. Grease nipple 23. Bushing 24. Gas filler 25. Damper cylinder 26. Fitting for connecting the lower jackstay 27. Supporting arm with two lugs for connecting the pull-push rod of the fairing 28. Bent arm 29. Bolt 30. Lock-ring 31. Astral bush 32. Wheel axle 33. Nut 34. Canvas dust bag

The cap is made of CrMnSi alloy steel.

The ring is made of gray iron and heat-treated to Rockwell hardness HR_B=97-103.

The damper cylinder wall has its upper part welded with the seat for the gas filler, its middle part with the cantilever fitting for connecting the lower jackstay and its lower part with the bent arm which is used for connecting the half-wheel fork and made of the anchor plates and two lugs.

On the bent arm is welded a supporting arm with two lugs used for connecting the pull-push rod of the upper fairing.

The damper cylinder has its main parts made of CrMnSi alloy steel and its surface coated with the C04-42 gray enamel.

The piston skirt is a cylinder with a isolated working chamber. On the working chamber wall are cut tapered grooves. The grooves and the tubular core form a fluid passage, the sectional area of which can be changed in the compressive travel. The piston skirt is made of CrMnSi alloy steel and its working surface is plated with chromium.

In the lower chamber of the piston skirt is installed the cylindrical joint secured by two nuts. With the help of the joint, the piston skirt is connected with the sleeve fitting on the half-wheel fork through the link.

The link is made of CrMnSi alloy steel.

On both ends of the link are fitted the ball bushings with oil-grooves and the end attached to the half-wheel fork is connected by the bolt with grease nipple to ensure the flexibility for the connection of the half-wheel fork and piston skirt.

The piston is fixed on the middle of the outer wall of the piston skirt.

The piston consists of two bronze rings. On the upper ring, there are twenty-eight holes of 4 mm. diameter and on the lower ring thirty holes of 4 mm. diameter. The piston is connected with its skirt through the thread and locked by two screws located between the holes on the upper ring.

Between the upper and lower piston rings is situated an annular valve which can move freely. Two holes of 1.5 D_8 diameter are drilled in the valve and communicated with the annular groove on its end surface.

The half-wheel fork is made of two pressed panlike plates of 2 mm. thick CrMnSi alloy steel sheets by butt welding.

On the upper end of the half-wheel fork are welded two symmetrical stiffening pieces and a cylinder in which a bushing is inserted. With the help of the bushing and bolt, the half-wheel fork is connected with the bent arm on the lower part of the damer cylinder. The connecting place is greased through the grease nipple on the end of the half-wheel fork.

On the middle of the half-wheel fork is welded a sleeve fitting for the connection of the link and the half-wheel fork.

On the lower end of the half-wheel fork are welded two symmetrically arranged stiffening pieces and an astral bush, which is used for fitting the wheel axle and fixing the brake disks.

The brake disk is secured through the six holes of $6D_4$ diameter on the astral bush.

All parts of the half-wheel fork are made of CrMnSi alloy steel and their surfaces are coated with C04-42 gray enamel.

The wheel axle is a stepped cylinder with two bearing necks (diameter 45d and 40d) for installing the bearings of the brake wheel. After being pressed onto the astral bush, the wheel axle is further fixed by means of the (HB1-125-10 × 62) conical bolt.

In order to prevent the dirt from entering the chamber of the axle, a dust proof cover is fitted in its end pressed into the half-wheel fork.

The wheel axle is made of CrMnSi alloy steel.

The working chamber of the shock absorber strut is charged with YH-10 hydraulic fluid and nitrogen gas.

The sealing set composed of three rubber cups and three supporting rings is set between the walls of the piston skirt and damper cylinder. It is fastened by the nuts screwed on the lower end of the damper cylinder and the nuts are locked tightly by the safety wires passing through the damper cylinder wall.

The felt sealing ring is fitted in the nut.

The supporting ring made of albronze is fitted under the sealing set, serving as the buiding part for the piston skirt and the support of the sealing set as well.

The shock absorber strut of the main gear is charged with hydraulic fluid to the capacity of 550 ± 20 cm^3 and the nitrogen gas to the pressure of 48 ± 1 atm.

As the gas filler is removed, the hydraulic fluid may be infused through the hole in the gas filler seat. The position of the filler seat is designed in accordance with the normal working hydraulic fluid level, i.e., as the shock absorber strut is in the vertical position and the piston skirt is in the free state, the hydraulic fluid level should be flush with the hole on the filler base.

The nitrogen is charged directly through the gas filler. In charging, the nitrogen presses the spring of the valve and makes the rubber cone on the valve rod stand disengaged from the valve seat, thus causing the nitrogen to enter the working chamber of the damper cylinder.

As the wheel touches the ground, the piston skirt rises, the nitrogen gas is compressed and the annular valve presses to the lower ring of the piston.

The hydraulic fluid in the chamber of the piston skirt flows into the annular chamber formed by the sealing set and piston skirt in such a way that it passes through the three small holes on the cap of the tubular core, four tapered grooves on the inner wall of the piston skirt, the annular clearance constituted by the annular valve and damper cylinder and the two small holes on the annular valve.

When the piston skirt rises within the range of 38 mm., the sectional area of the four tapered grooves in the inner wall of the piston skirt is not varied. In this range, as the compressive travel of the piston skirt is not great, the fluid resistance is low and the main strut has good softness.

When the piston skirt rises up above 38 mm., the sectional area of the four tapered grooves in the inner wall of the piston skirt will decrease along with the increasing of the piston skirt travel.

The nitrogen gas absorbs the impact and tends to expand immediately, thus causing the piston skirt of the strut to return to its original position.

In reverse travel, the annular valve is pressed to the upper ring of the piston, the hydraulic fluid flows into the working chamber of the damper cylinder only through the two small holes on the valve.

The chamber of the piston skirt can be replenished with hydraulic fluid from the working chamber of the damper cylinder through the original passages.

When passing through the samll holes on the annular valve, the fluid undergoes a great fluid resistance. This resistance decreases the impacting force of the piston in reverse travel, thus ensuring the smoothness and stability for taking off, landing and taxing of the airplane.

The schematic for the work of the shock absorber of the main gear is shown in Fig. 3.3.

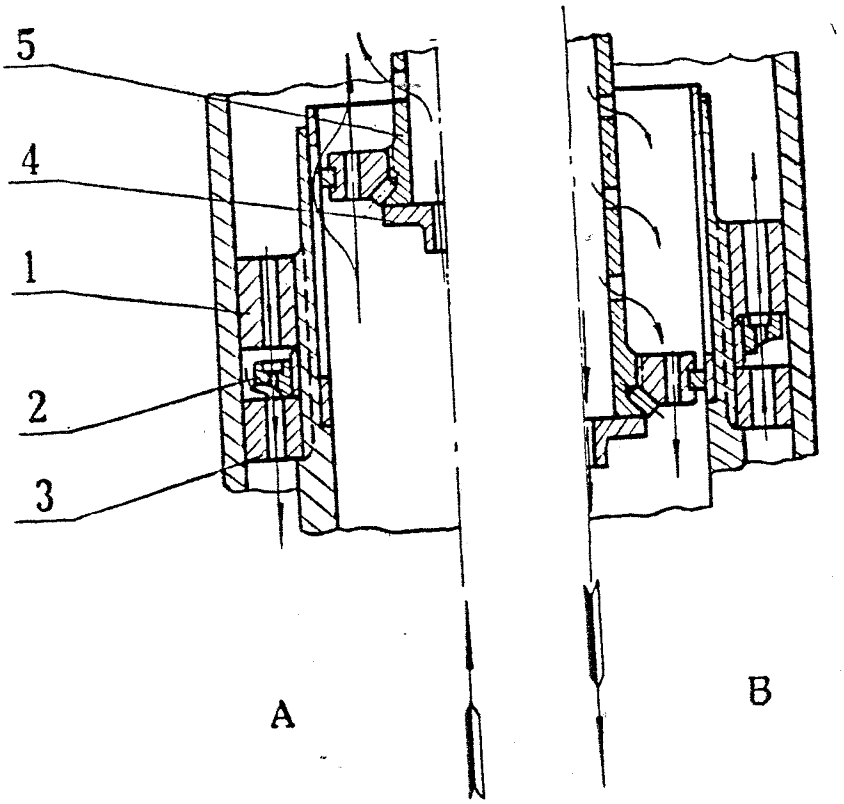


Fig. 3.3 Operating drawing for the main shock absorber strut

1. Upper piston 2. Annular valve 3. Lower piston 4. Cap 5. Tubular core

A. In compressive travel, the annular valve is pressed against the lower piston. The hydraulic fluid flows through the small holes on the cap of the tubular core, tapered grooves on the inner wall of the piston skirt, annular clearance between the annular valve and damper cylinder wall and the two small holes on the annular valve.

B. In reverse travel, the valve is pressed against to the upper piston. The hydraulic fluid flows only through the two holes in the annular valve.

JACKSTAY ASSEMBLY OF THE MAIN GEAR

The folding jackstay assembly (Fig. 3.4) for the main gear consists of the upper jackstay and the lower jackstay connected together by the hollow bolt.

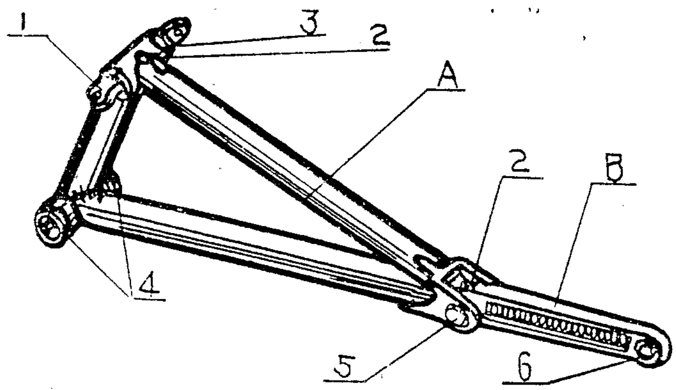


Fig. 3.4 Folding jackstay assembly for the main gear

1. Eyebolt for fixing the actuating cylinder 2. Grease nipple 3. Nut 4. Bushing
5. Hollow bolt 6. Ball bushing

The hollow bolt is made of CrMnSi alloy steel and its working surface is plated with chromium.

The connecting place of the upper and lower jackstays is greased through the grease nipple on the lower jackstay.

The upper jackstay is made of three CrMnSi alloy steel tubes by welding to form a triangle. On two apexes of the triangle are welded fittings, in each of which the albronze bushing is pressed. On the third apex is welded a forked-end fitting for connecting the lower jackstay.

A. Upper jackstay.

B. Lower jackstay.

The fittings and tubes of the jackstay are all made of CrMnSi alloy steel.

In one bushing at the upper part of the upper jackstay is installed the rotatable eyebolt for connecting the actuating cylinder.

A special screw is screwed into the other and of the eyebolt for connecting the "down" position contact switch of the landing gear.

The eyebolt is made of CrMnSi alloy steel. Its working surface is plated with chromium and greased through the grease nipple on the fitting of the jackstay.

The lower jackstay is a die forging made of CrMnSi alloy steel. Its section is of "I" shaped.

One end of the lower jackstay is shaped as a block with bolt hole to be fitted and connected with the forked end fitting of the upper jackstay. The other end of the lower jackstay is fitted with a ball bushing to be connected with the fitting welded on the damper cylinder.

The ball bushing is made of (12CrNi3A) chromium nickel alloy steel heat-treated to the strength $6_b=90—130$ kg/mm². and carburized on its working surface to HRc=60—65.

When the landing gear is in "down" position, the block on the lower jackstay is held up in the channel of the upper jackstay forked end fitting. The bolt for connecting the upper and lower jackstays is situated with a 5 mm. offset from the line of action, and therefore as the wheel is under the action of external load, the jackstay can still stand stably in the "Supporting mode" and withstand the load.

The jackstay arriving at the position mentioned above by the extension of the actuating cylinder, the piston rod of the actuating cylinder is locked by the ball lock.

ACTUATING CYLINDER FOR THE MAIN GEAR

The external cylinder of the actuating cylinder for the main gear (Fig. 3.5) is a cylinder with the piston and piston rod fitted in its inside.

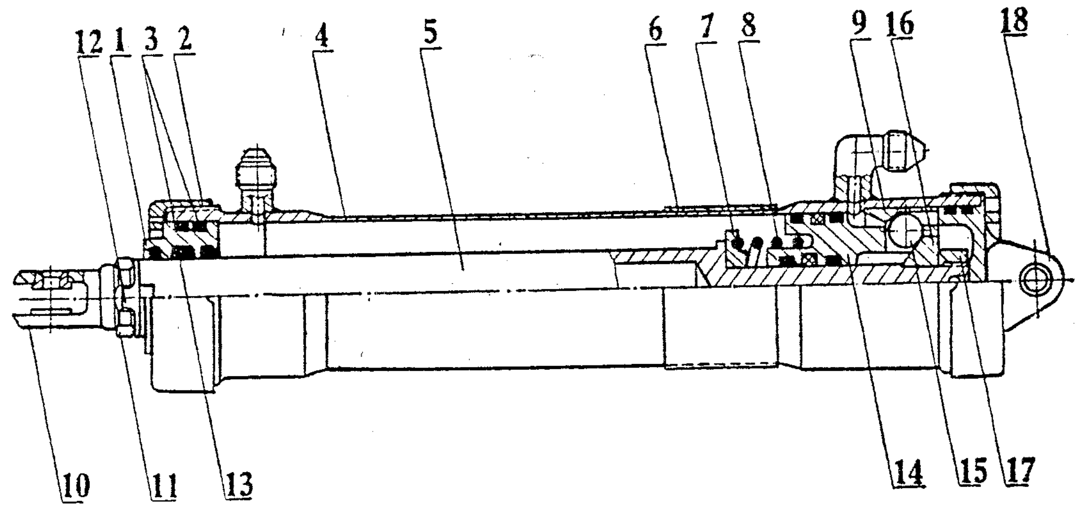


Fig. 3.5 Actuating cylinder for the main gear

1. Sleeve 2. Nut 3. Sealing ring 4. Actuating cylinder 5. Piston rod 6. Label 7. Spring seat 8. Spring 9. Bushing 10. Forked end bolt 11. Lock-nut 12. Nut-lock washer 13. Felt ring 14. Piston 15. Ball 16. Conical ring 17. Nut 18. Fitting

The main parts of the actuating cylinder such as the piston rod, external cylinder, etc. are all made of CrMnSi alloy steel.

The working surface of the piston rod is chromium plated to increase its anti-abrasive ability and surface smoothness.

On one end of the actuating cylinder is installed a dural fitting, by which the actuating cylinder is connected with the eyebolt on the upper jackstay. On the other end is fitted a dural sleeve, on which is cut a hole guiding the piston rod.

The annular grooves are cut on the outer peripheries of the fitting and sleeve to retain the rubber sealing rings. In addition, on the inner wall of the sleeve are also fitted the felt sealing rings.

The fitting and sleeve are all fixed by the nuts screwed on both ends of the external cylinder.

On one end of the external cylinder is welded a elbow nipple and on the other end a straight nipple for fitting the emergency valve. With the help of the hose and these nipples, the actuating cylinder is connected with the airplane pneumatic system.

The actuating cylinder is connected to the supporting arm with ball knuckle bearing welded on the upper fitting of the damper cylinder by means of the forked end bolt screwed on the end of the piston rod.

The forked end bolt is locked tightly on one-end of the piston rod by nut and nut-lock washer, and on the other end of the piston rod are fitted a conical ring and a piston with ball lock.

The piston made of dural divides the actuating cylinder into two working chambers. On the outside and inside surfaces of the piston are cut the annular grooves fitted with rubber sealing rings and felt sealing rings. The felt sealing rings soaked with oil are used to lubricate the working surfaces of the piston rod and actuating cylinder.

As the landing gear is in the "down" position, the ball lock in the actuating cylinder is locked. Under the action of the spring, the piston pushes the conical ring and the balls are squeezed out from the space between the piston and the conical ring and thrown into the space between the conical ring and conical bushing.

In retracting of the landing gear, the compressed air entering the actuating cylinder pushes the piston, compresses the spring and squeezes out the balls between the conical ring and conical bushing, thus pushing the piston rod for moving. In the meantime, the actuating cylinder is extended. As the both ends of it are connected to the eye-bolt on the upper jackstay and to the cantilever fitting on the middle of the damper cylinder respectively, the jackstay will rotate around the fitting located on the front spar web of the midwing, thus folding the jackstay and rotating the shock absorber strut of the landing gear around the suspending axle till the landing gear is fully retracted and locked by the up-lock.

As the landing gear is extended, the compressed air entering the actuating cylinder pushes the piston rod through the piston till the ball lock is locked.

The operating schematic of the ball lock is shown in Fig. 3.6. The A,B,C in the figure indicate the locking procedure of the ball-lock.

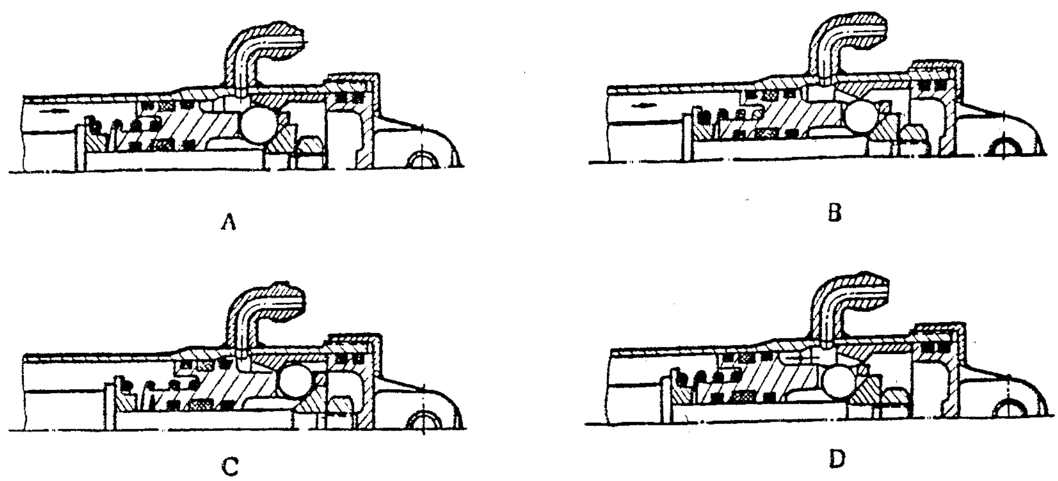


Fig. 3.6 Operating schematic for the ball lock of the actuating cylinder

As the piston moves to the "down" position, the balls touch the conical surface of the conical bushing in the actuating cylinder and are pressed against the piston rod immediately. When moving along the conical ring surface fastened on the piston rod, the balls push the piston and compress the spring simultaneously.

After having passed through the minimum circular section of the conical bushing, the balls are squeezed out along the conical surfaces of the bushing and conical ring under the action of the compressed air and spring and lock the piston rod in the "down" position of the landing gear.

The moment for opening the ball lock is shown in Fig. 3.6 D.

Under the action of the compressed air, the piston presses the spring, the balls move to the piston rod along the conical surface.

The ball lock is fully opened till the balls have passed through the minimum circular section of the conical bushing.

The full travel (or structural travel) for the piston rod of the actuating cylinder is 145 ± 2 mm., while the design travel for retracting and extending the landing gear is 142 mm.

UP-LOCK FOR THE MAIN GEAR

The up-lock for the main gear consists of the hook, bellcrank, support, acutating cylinder and contact switch.

The hook and bellcrank are all made of CrMnSi alloy steel.

For decreasing the friction between the axle and hook or axle and bellcrank, in the rotating places are inserted the albronze bushings.

The support is made of CrMnSi alloy steel sheet of 1.5 mm. thickness and formed into a box by welding.

The support has its places for fixing the hook and bellcrank welded with the steel bosses and its four corners at the bottom drilled with locating holes of 6D6 diameter for fastening the lock on the rib 3 of the midwing.

The actuating cylinder for the hook is a cylinder in which is installed a piston rod with piston. On one end of the cylinder is screwed a nut and the return spring is located between the nut and piston, as shown in Fig. 3.7.

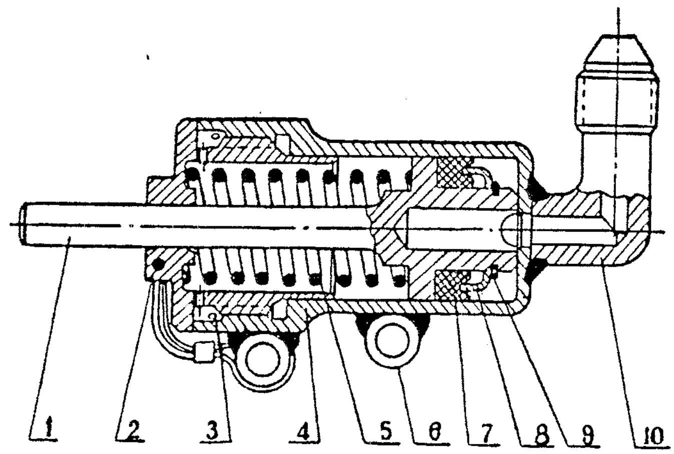


Fig. 3.7 Actuating cylinder for the hook

1. Piston rod 2. Nut 3. Vent 4. Case 5. Spring 6. Tube 7. Rubber cup 8. Cup 9. Circlip 10. Elbow nipple

The piston and piston rod constitute an integrated part made of CrMnSi alloy steel. The working surface of the piston rod is chromium plated.

The working chamber of the cylinder is communicated with the pneumatic system through the elbow nipple welded on the end surface of the cylinder case. The rubber cup is fitted on the piston to improve the air-tightness of the working chamber.

The return spring is located at the other end of the cylinder chamber, which is communicated with the atmosphere through the holes on the nut, annular groove and vent on the case.

The case is made of CrMnSi alloy steel and two tubes are welded on it for fitting with the support.

The operating schematic of the up-look is shown in Fig. 3.8.

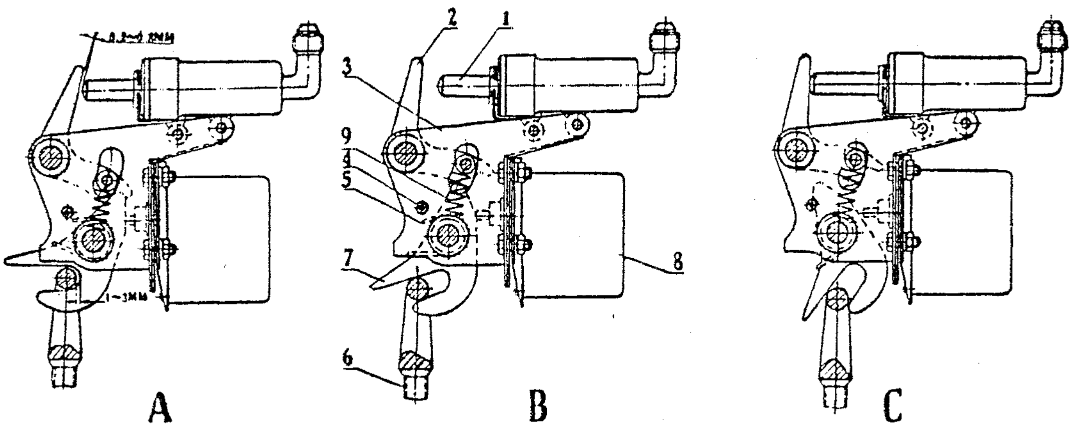


Fig. 3.8 Operating schematic of the up-lock for the main gear

1. Actuating cylinder for the hook 2. Bellcrank 3. Support 4. Limiter 5. Hook spring 6. Suspending eyebolt of the landing gear in "up" position 7. Hook 8. Contact switch 9. Bellcrank spring

A. At locked position: Under the action of the spring, the bellcrank is pressed onto the hook and engaged with it.

B. In initial locking: The eyebolt pushes the hook and makes it rotate around its axle, thus rocking the bellcrank and stretching the spring.

C. At unlocked position: The piston rod of the actuating cylinder pushes the bellcrank and makes it disengaged with the hook. Under the action of the spring, the hook rotates around its axle and is stopped by the limiter, thus loosening the eyebolt on the landing gear.

BRAKE WHEEL

The main gear is equipped with 500×150 mm. (LS-2) medium-pressure brake wheel. The brake device of the wheel is of the compressed air rubber bag type.

The wheel for the landing gear (Fig. 3.9) consists of the tube, tire, drum and brake device with rubber bag.

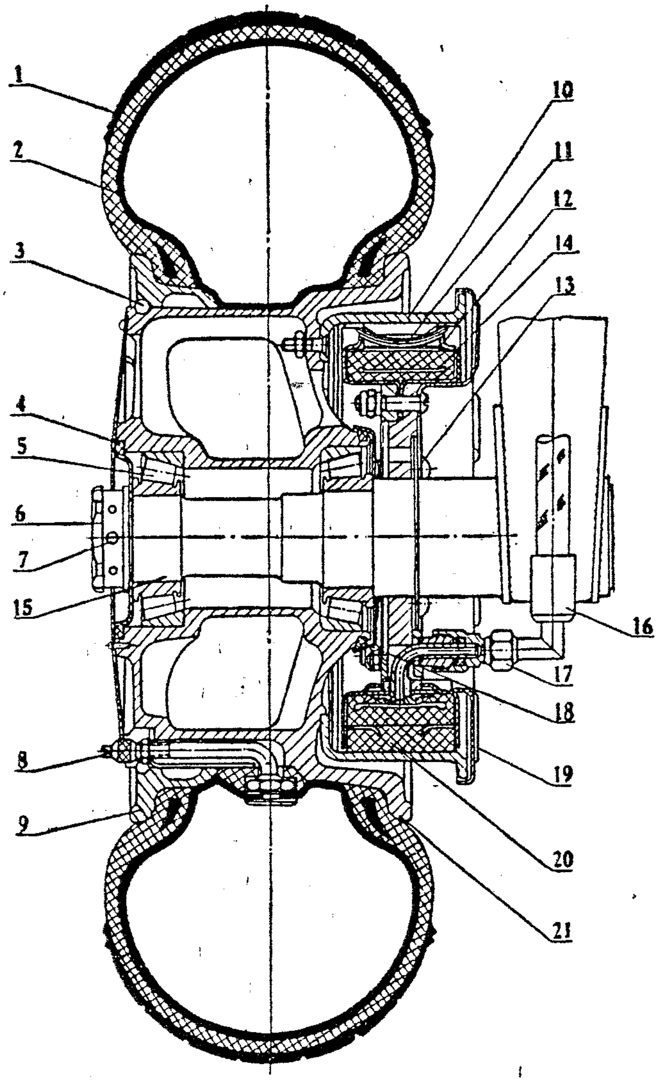


Fig. 3.9 Brake wheel for the main gear

1. Tire 2. Tube 3. Half lock-ring 4. 18. Sealing covers 5. Roller bearing 6. Nut 7. Lock-bolt 8. Air filler 9. Removable rim 10. Brake drum 11. Return spring 12. Special disc 13. Bolt 14. Brake rubber bag 15. Wheel axle 16. Compressed air hose 17. Nipple 19. Dust cover 20. Braking block 21. ~~Drum~~ WHEEL

The wheel drum with tire is fitted on two radial tapered roller bearings of the wheel axle. The outer retainers of the bearings are pressed into the drum and the inner retainers on the wheel axle. The bearings are locked by the nut screwed on one end of the wheel axle. The nut is secured by a bolt.

The sealing covers are fitted at the outer parts of the bearings to prevent the bearings from being clogged and the lubricant from being squeezed out.

The wheel drum is casted from magnesium alloy and fitted with a removable rim for mounting the tire.

The removable rim is fixed on the drum with the help of the half lock-ring and bushing riveted together with the half lock-ring.

The brake drum is bolted to the drum and centered in accordance with the annular cylindrical surface of the drum.

Within the brake disk is installed the brake device of the single row rubber type. The pressed special disk is bolted to the case of the brake device, so that the special disk and the brake drum constitute an annular channel for retaining the annular brake rubber bag. Along the periphery of the rubber bag are set the brake blocks.

The braking block is molded from plastic and metallic wires.

On the flanges of the pressed special disk are protruded narrow grooves serving as the guiding grooves for the braking blocks in their radial movement.

The compressed air enters the brake rubber bag through the air filler and nipple. The braking blocks move in the radial direction under the action of the compressed air.

The leaf return springs are located in the grooves made by the two braking blocks and jammed in the holes of the protruded narrow grooves on the special disk.

The dust cover is installed on the brake device for keeping it clean.

The clearance between the braking block and braking drum can not be adjusted. When the brake being in "releasing" condition, the minimum clearance of 0.05 mm. is allowed.

There are four slots on the dust cover for inspecting the clearance.

The brake device of the rubber bag type is distinguished by its stable braking and simple adjustment.

In braking, the compressed air from the pneumatic system of the airplane, which is reduced to 8-9 atm. through the (QS-1) pressure reducing valve enters the braking rubber bag through the (QS-2) braking differential and braking pipeline. As the braking rubber bag swells out, the braking blocks contact with the braking drum closely, thus creating the moment required for braking.

After the compressed air in the braking rubber bag is released, the braking blocks are pulled back to its original position immediately from the braking drum by the return springs, the brake is released.

The wheel tire consists of the inner tube and cover tire. The former is used to withstand the load in serving and prevent the latter from being damaged. The tread pattern of the cover tire is of the concave-convex pattern for improving the contact condition of the wheel with the ground.

The unloaded wheel tire can be inflated to 3.2 atm. through the check valve of the air filler.

When the airplane being in parking with normal flying weight, the compression of the wheel tire is 30 mm.

FAIRING

As the main gear has been retracted up, the fairings close the wheel bays and become flush with the lower skin of the wing for reducing the drag in flight.

The fairings of the main gear consist of the upper and lower fairings. The upper fairing is hinged with the lower skin under the midwing rib 5 and connected with the main strut support through the pull-push rod. The lower fairing is fastened on the half-wheel fork with four bolts.

When the landing gear being retracted or extended, the upper fairing rotates around the hinge shaft, and the lower fairing rotates together with the half-wheel fork around the suspending axle of the strut.

When the landing gear is extended, the upper and lower fairings are separated from each other. When the landing gear is retracted up, the both fairings are flush with the lower skin of the midwing.

The upper and lower fairings are all made of the aluminium skin and backing plates by spot welding.

With the landing gear being up, the local fitting clearance between the flange of the fairing and the lower skin of the midwing is allowed to be not more than 1.5 mm.

II. NOSE GEAR

The nose gear is of the strut type and equipped with a wheel and a shimmy damper for slef-shimmy.

The nose shock absorber strut is attached to the fitting located at the lower part of the fuselage frame 0 by a long bolt having two hollow ends, on which are installed two grease nipples.

The long bolt is made of CrMnSi alloy steel and its working surface is plated with chromium. The bolt connection is lubricated with grease through the grease nipples on its two ends.

With the help of the ball hinge fitting, the lower jackstay is attached to the bracket of the nose strut damper cylinder by a hollow bolt.

The hollow bolt is made of CrMnSi alloy steel.

The upper jackstay is connected with the fitting located on the lower part of the fuselage frame 1 by a bolt made of (12CrNi3A) chromium nickel alloy steel heat-treated to $6_b = 90\text{-}130$ kg./mm^2. and surface carburized to HRc=58-64.

The piston rod of the nose gear actuating cylinder has one end connected with the intermediate fitting of the upper jackstay by the HB1-106-8×22×3.5 bolt (till the end of the batch 29) or HB1-106-8×28×3.5 bolt (from the beginning of the batch 30) and its other end connected with bridgelike fitting between fuselage frames 0 and 1 by the (HB1-106-8×30×3.5) bolt.

The up-lock for the nose gear is fixed on the box located at the bottom of the cock-pit floor by four (HB1-103G6×20×3) bolts.

One end of the coactive cable of the gear position indicator is connected to the lug welded on the nose strut fitting with a forklike part, the other end of the cable connected upward to one arm of the bellcrank. The other arm of the bellctank is connected with the indicating rod of the gear position indicator by a forked end bolt.

The both ends of the guide tube for the coactive cable are fixed on the support of the fuselage frame 0.

The bellcrank is fixed on the support of the fuselage frame 0 and can rotate around a fixing point.

On the support is mounted a torsional conic helical spring, one end of which is fixed on the support and the other end of the bellcrank.

When the landing gear being extended down, with the help of the lug welded on the nose strut fitting, the cable can make the bellcrank rotate, and along with it, the indicating rod for the landing gear position indicator will protrude out from the fuselage skin.

When the landing gear being retracted up, the bellcrank returns to its original position under the action of the conic helical spring.

SHOCK ABSORBER STRUT FOR THE NOSE GEAR

The shock absorber strut for the nose gear (Fig. 3.10) consists of the strut, damper cylinder and shimmy damper.

The piston skirt is a thin wall tube with upper and lower chambers separated from each other by an intermediate partition. On the inner wall of the upper chamber are cut four grooves with tapered cross section. On the lower part of the piston skirt are a shoulder and a lug, the former serves as a limiter to restrict the travel of the shock absorber strut, the latter is used for fastening the torque arm. On the end of the piston skirt is welded a blocking piece.

The wheel fork is made of pressed CrMnSi alloy sheets of 2 mm. thickness by butt welding. On the ends of the wheel fork are lugs with bushings for installing the wheel axle.

The piston skirt of the strut is made of CrMnSi alloy steel. It is heat-treated after being welded together with the wheel fork and its working surface is chromium plated.

The piston is fixed on the upper end of the piston skirt.

The piston consists of two albronze rings. There are twenty-eight holes of diameter 4 mm. on the upper ring, thirty holes of the same diameter on the lower ring. The piston rings are connected with the piston skirt by threads and locked with two screws between the holes of the upper ring.

Between the upper and lower piston rings is located the annular valve which can move freely. On the valve there are four holes of 2D6 diameter, which are communicated with each other by means of the annular groove.

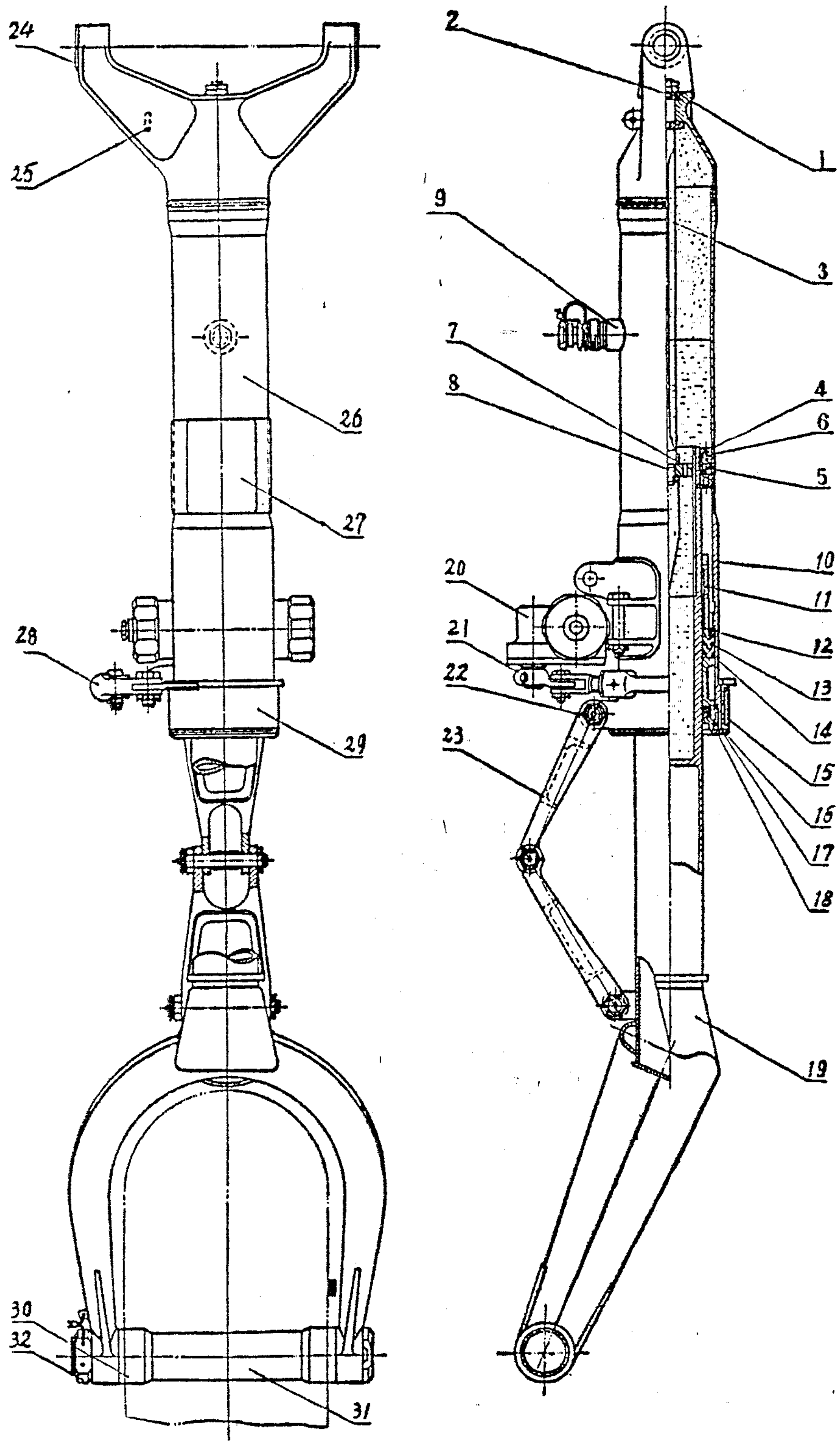
The wheel axle for the nose gear is a hollow axle made of CrMnSi alloy steel.

Two dural bushings are fitted on the wheel axle for fastening the wheel bearing.

The damper cylinder for the nose gear is a hollow cylinder, in which the piston and piston skirt are fitted.

On the up part of the damper cylinder is welded a forklike fitting for connecting the fuselage attachment fitting.

In both lugs of the forklike fitting are inserted albornze bushings for suspending the nose shock absorber. On one lug of the fitting is welded a small lug for connecting the cable of the nose gear position indicator.



1. Cover
2. Washer
3. Core stick
4. Piston
5. Annular valve
6. Screw
7. Seal ring
8. Piston
9. Gas filler
10. Upper cam
11. Lower cam
12. Washer
13. Rubber cup
14. Washer
15. Bush ring
16. Felt ring
17. Nut
18. Safety screw
19. Strut
20. Shimmy damper
21. Rocking arm
22. Bolt
23. Torque arm
24. Bushing
25. Lug
26. Damper cylinder
27. Label
28. Rocking arm
29. Ring body
30. Bushing
31. Axle
32. Nut

Fig. 3.10 Nose gear shock absorber strut

A core stick is fastened on the top of the upper damper cylinder chamber with two nuts and a sealing washer.

The core stick made of CrMnSi alloy steel has the cruciform cross section.

The piston is fixed on the lower end of the core stick by nut. The groove on the piston periphery is fitted with a seal ring drilled with two holes of 2.8 mm. diameter and another two holes of 2.5 mm. diameter.

The seal ring is made of gray iron and heat-treated to Rockwell hardness HR_B= 97-103.

The damper cylinder is made of CrMnSi alloy steel. On its lower part are welded the supports for fixing the shimmy damper and connecting the folding jackstay assembly.

The cylindrical ring body is fastened on the lower end of the damper cylinder by the nut used for fastening the sealing parts.

The ring body is connected to the piston skirt through the torque arm and to the wobbler of the shimmy damper through a rocking arm.

The ring body can transmit the shimmy of the wheel and wheel fork to the shimmy damper.

For reducing the friction, in the ring body is inserted an albronze bushing, which is lubricated through two grease nipples on the outer wall of the ring body.

The torque arm can rotate around the hollow bolt, which is made of CrMnSi alloy steel and plated with chromium on its working surface. A grease nipple is screwed into the end of the bolt for greasing the connecting place.

A bushing which can rotate freely is hitched on the middle of the bolt connecting the upper and lower torque arms. With this bushing the landing gear can be suspended on the hook of the up-lock when the landing gear is in "up" position.

The nose gear is equipped with an automatic resetting mechanism. The wheel can deflect right or left by an angle of $52° \pm 3°$ due to the stop of the flange lip welded on the damper cylinder.

The shock absorber strut is equipped with a deflection eleminating cam mechanism, or so called the automatic resetting mechanism, with the help of which the deflected wheel can return automatilly to its neutral position.

The cam mechanism is composed of two cams with metched curvilineal contours. The lower cam is fixed to the inner wall of the damper cylinder with the skirt keys, the upper cam is fixed in the holes of the piston skirt by two screws.

The lower cam is made of CrMnSi alloy steel and the upper cam of albronze for reducing friction.

As the external load, the cause for wheel deflection, has gone, the strut and wheel can return to the neutral position under the action of the nitrogen gas pressure in the working chamber of the shock absorber strut.

The operating schematic for the cam mechanism is shown in Fig. 3.11.

a. The wheel is in the neutral position.

b. The wheel is rotating: The upper cam slides along the curvilineal contour of the lower cam.

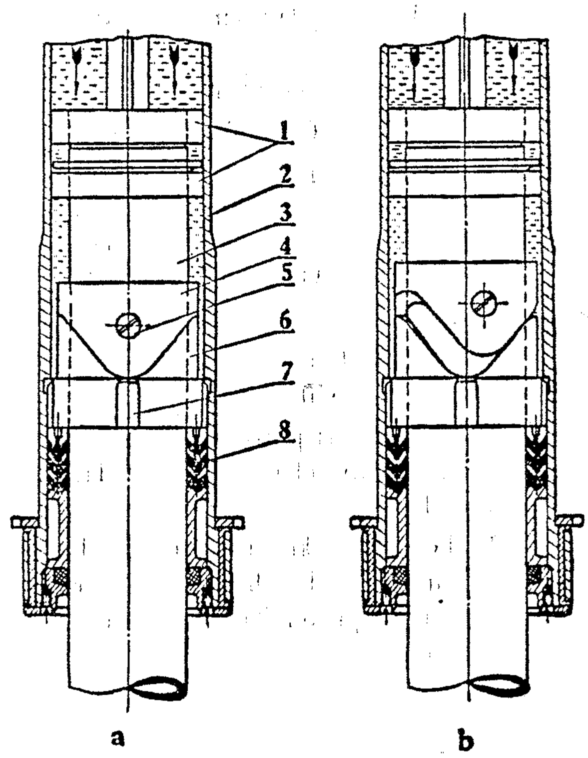


Fig. 3.11 Operating schematic of the cam mechanism

1. Piston 2. Damper cylinder 3. Piston rod 4. Upper cam 5. Screws for fixing the cam on the piston rod 6. Lower cam 7. Skirt key of the lower cam 8. Sealing set of the strut

The working chamber of the shock absorber strut is charged with nitrogen gas and YH-10 hydraulic fluid.

The sealing set composed of three rubber cups and three supporting washers is located between the piston skirt and the lower end of the damper cylinder and fastened with the nut screwed on the lower end of the damper cylinder. The nut is locked with screws through the wall of the damper cylinder.

A felt sealing ring is fitted in the nut.

Under the sealing set is installed the albronze bush ring serving as the guiding part for the piston skirt and the support for the sealing set.

The capacity of hydraulic fluid charged in the shock absorber strut of the nose gear is 640 ± 10 cm^3. The nitrogen gas pressure within the working chamber is 20 ± 1 atm.

The structural form of the gas filler for charging the shock absorber strut with the fluid and nitrogen gas of the nose gear is the same as that of the main gear.

As the wheel contacts with ground, the piston rod rises up, the nitrogen gas is compressed and the annular valve is pressed against the lower piston.

In the meantime, the hydraulic fluid in the upper chamber of the piston skirt flows into the annular chamber constituted by the sealing set and piston skirt in such a way that it passes through the four holes on the piston fixed on the core stick end and four tapered section grooves on the inner wall of the piston skirt as well as the annular clearance between the annular valve and damper cylinder and the four holes on the annular valve.

As the piston skirt rises up in the range of 40 mm., the sectional area of the four tapered section grooves in the inner wall of the piston skirt is unchanged. In this range, as the fluid resistance is low and the compressive travel of the piston skirt is not great, the nose strut has good softness.

As the piston skirt rised up above 40 mm., the section of the four tapered section grooves on the inner wall of the piston skirt will reduce along with the increasing of the compressive travel.

After the nitrogen gas has absorbed the impact load, it expands immediately, thus making the piston skirt return to its original position.

In reverse travel, the annular valve is pressed upward against the upper piston and the hydraulic fluid flows into the working chamber of the damper cylinder only through the four holes on the annular valve.

The working chamber of the piston skirt is replenished with hydraulic fluid from the working chamber of the damper cylinder through the very holes, through which the fluid from the working chamber of the piston skirt flows out.

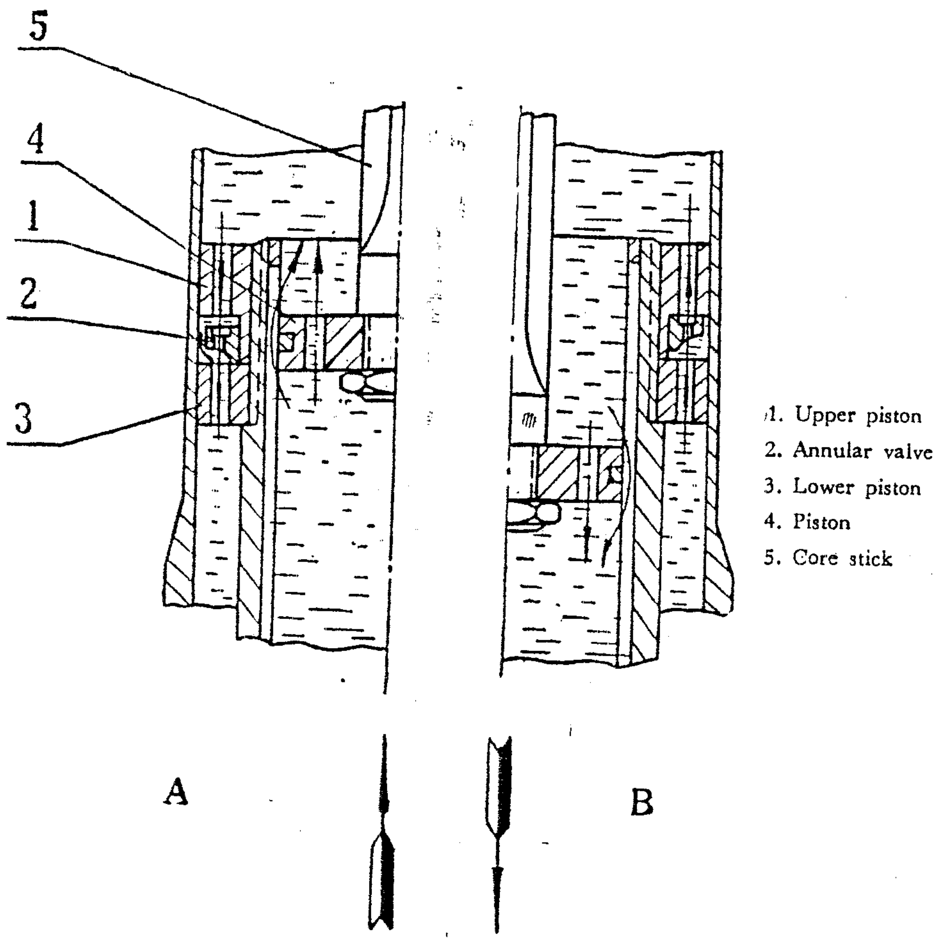


Fig. 3.12 Operating schematic for the nose shock absorber strut

While passing through the holes on the annular valve, the hydraulic fluid undergoes a greater resistance, the impact force acting on the piston in the reverse travel is reduced, thus making the airplane have a stable take-off, landing and taxiing.

The operating schematic of the shock absorber of the nose gear is shown in Fig. 3.12.

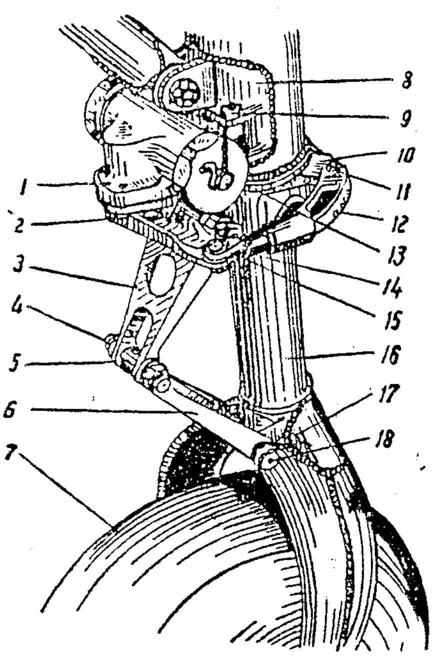
A. In compressive travel: The annular valve is pressed against the lower piston and the hydraulic fluid passes through the holes on the annular valve, tapered section grooves on the inner wall of the piston skirt, the annular clearance between the valve and damper cylinder and four holes on the annular valve.

B. In reverse travel: The valve is pressed upward against the upper piston and the hydraulic fluid passes only through the four holes on the annular valve.

SHIMMY DAMPER

The shimmy damper for the nose gear wheel is fixed on the bracket of the shock absorber strut.

A piston is located in the case of the shimmy damper and it is attached to the ring body of the shock absorber strut by means of the wobbler and rocking arm. The case of the shimmy damper is fixed to the bracket of the shock absorber strut by two bolts of 8 mm. diameter. The shimmy damper is shown in Fig. 3.13.



1. Shimmy damper
2. Rocking arm
3. Upper torque arm
4. Bolt for connecting the upper and lower torque arms
5. Bushing
6. Lower torque arm
7. Wheel
8. Bracket
9. Bolt for fixing the shimmy damper to the bracket
10. Ring body
11. Bolt for fixing the rocking arm to the ring body
12. Rocking arm
13. Flange with lip stopper
14. Forked end bolt
15. Bolt for connecting both rocking arms
16. Piston rod
17. Bolt for connecting the torque arm to the strut
18. Grease nipple

Fig. 3.13 Shimmy damper

The wobbler and the rocking arm are connected together with the spline.

As there is a deep cut on the rocking arm, the spline can be matched properly after the bolt is tightened.

The rocking arm 2 is connected with the rocking arm 12 by the U6GB304-64 knuckle bearing on the lug base.

The rocking arms 12 and 2 are made of CrMnSi alloy steel.

The rocking arm 12 is connected with the ring body on the shock absorber strut of the landing gear by the bolt made of CrMnSi alloy steel.

The case of the shimmy damper is a hollow cylinder. On its both ends are screwed the nuts. A screw plug is provided on the nut of one end and a rubber washer is filled between the nut and the case. Between the screw plug and the nut is provided a lead washer for sealing.

The case and nut are all made of CrMnSi alloy steel.

The piston divides the chamber of the case into three parts. The lateral chambers on both sides of the case are communicated with each other by the metering hole on the piston. The mid-chamber is covered with the rubber sealing ring, cover and bush ring, which are fixed on the case with bolts, and communicated with the lateral chambers through the release valves on the piston.

The release valve is composed of the valve, spring, bushing and lock-ring.

The piston is made of (12CrNi3A) chromium nickel alloy steel heat-treated to the strength $\sigma_b = 95\text{-}135$ kg./mm².

The wobbler is connected to the bush ring on the case with the axle neck at the lower end of the spline and fitted in the case with the axle neck on its root.

Under the axle neck at the lower end of the spline are two protruded cylindres, between which is fitted the rubber sealing ring.

The wobbler is made of CrMnSi alloy steel.

The wobbler surface is plated with chromium except its spline.

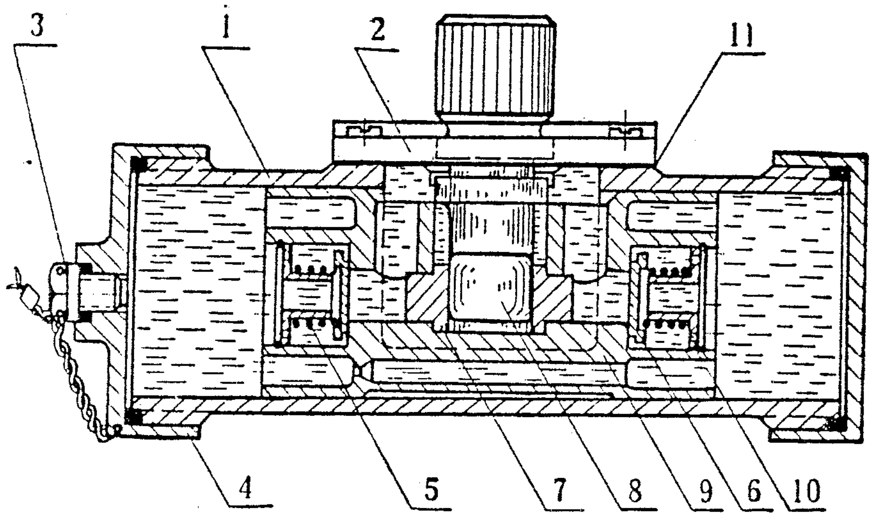
The cap made of (12CrNi3A) chromium nickel alloy steel with its working surface carburized and heat-treated to Rockwell hardness HRc=59-65 is installed at the place where the piston and the wobbler head are matched.

The chamber of the shimmy damper is charged with YH-10 hydraulic fluid. In charging, one should swing the wobbler slowly to release the air so that the chamber may be fully charged. The capacity of the chamber is about 100 cm³.

The torque arm can transfer the shimmy of the wheel to the ring body installed on the strut, then through the shimmy damper rocking arm to the rocking arm connected with the wobbler. The wobbler head pushes the piston from one side to the other, thus making the hydraulic fluid in one lateral chamber of the case flow into the opposite lateral chamber through the metering hole on the piston.

When passing through the small hole, the hydraulic fluid undergoes a great fluid resistance, therefore, the dynamic energy of the wheel swing is absorbed.

When the wheel is subjected to an external side load, the piston is pressed to one side (the direction is shown by the arrow in the schematic) and the hydraulic fluid in the lateral chamber A is pressed to flow into the opposite lateral chamber C through the metering hole D on the piston. In the meantime, the valve 6 is opened, the hydraulic fluid in the working chamber is replenished continously from the compensating chamber B (Fig. 3.14).



In neutral position

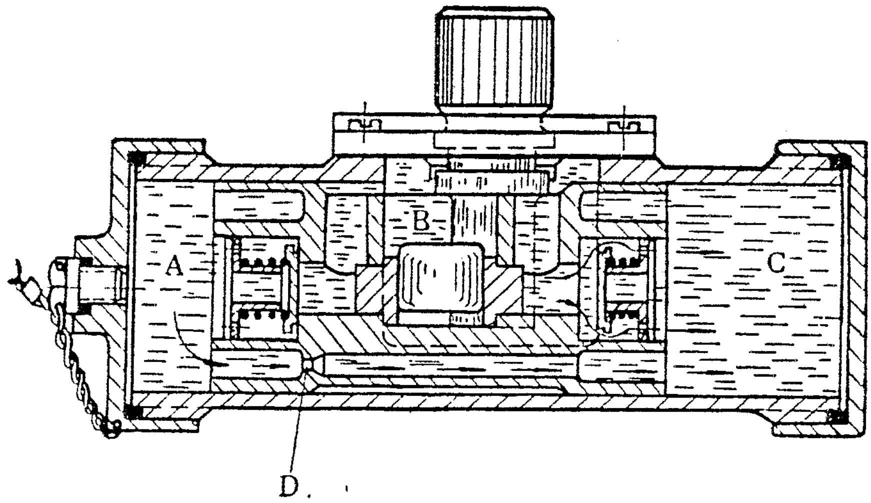


Fig. 3.14 Operating schematic for the shimmy damper

1. Case 2. Cover 3. Screw plug 4. Nut 5. Spring 6. Valve 7. Cap
8. Wobbler head 9. Piston 10. Bushing 11. Sealing ring

A. Working chamber (or the high pressure inner chamber) of the shimmy damper.

B. Compensating chamber of the shimmy damper.

C. Working chamber (or the lower pressure inner chamber) of the shimmy damper.

D. Metering hole on the piston.

JACKSTAY ASSEMBLY FOR THE NOSE GEAR

The folding jackstay assembly for the nose gear (Fig. 3.15) consists of the upper and lower jackstays. With the nose gear being "down", the folding jackstay assembly is in the same staying state as that of the main gear.

A. Lower jackstay.
B. Upper jackstay.

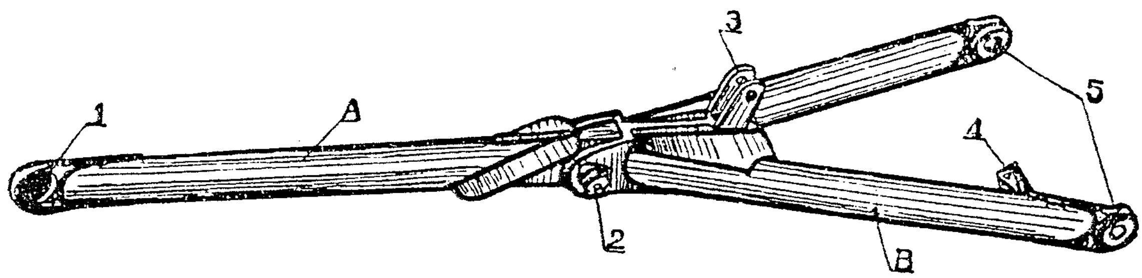


Fig. 3.15 Folding jackstay assembly for the nose gear

1. Ball bushing 2. Bolt for connecting the upper and lower jackstays 3. Lug seat for connecting the actuating cylinder 4. Supporting arm for fixing the electric indicator contact screw of the nose gear "down" position 5. Lugs

The upper jackstay is connected with the lower jackstay by hollow bolt.

The hollow bolt is made of (12CrNi3A) chromium nickel alloy steel, its working surface is carburized and heat-treated to Rockwell hardness HRc=58-64.

At the bolt head is provided a grease nipple for lubricating its connecting place.

The upper jackstay is a "Y" shaped structural member made of two tubes welded on the fork with gussets.

On the stem of the fork is the forked end fitting for connecting the piston rod of the actuating cylinder, while the fork itself is to be connected with the lug fitting of the lower jackstay.

The other end of each tube is welded with a lug connecting with the attachment fitting of the fuselage frame 1.

On the end of the left hand tube is welded a supporting arm for fixing the electric indicator contact screw of the nose gear "down" position.

The lug, fork, gussets and tubes on the upper jackstay are all made of CrMnSi alloy steel.

The lower jackstay is a tubular member with its ends welded with the lug and the fitting, which is connected with the upper jackstay.

The tube, lug and fitting of the lower jackstay are all made of CrMnSi alloy steel.

The fitting at one end of the lower jackstay is provided with a bolt hole for connecting the upper jackstay and also with a protruded shoulder for supporting the fork of the upper jackstay. The lug at the other end of the lower jackstay is provided with a ball bushing for connecting with the supporting arm on the shock absorber strut.

The ball bushing is made of (12CrNi3A) chromium nickel alloy steel, its working surface is carburized and heat-treated to Rockwell hardness HRc=60-65.

ACTUATING CYLINDER FOR THE NOSE GEAR

The actuating cylinder for the nose gear (Fig. 3.16) is basically similar to that for the main gear in structure and operating principle.

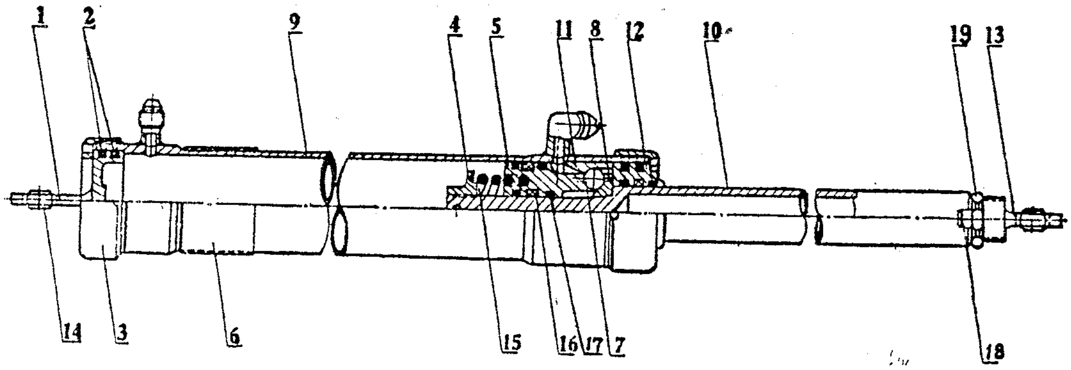


Fig. 3.16 Actuating cylinder for the nose gear

1. Lug 2. Gasket 3. Nut 4. Stopper 5. Piston 6. Label 7. Ball 8. Conical ring 9. Actuating cylinder 10. Piston rod 11. Bushing 12. Sleeve 13. Eye-bolt 14. Knuckle bearing 15. Spring 16. Felt ring 17. Sealing ring 18. Safety piece 19. Nut

The actuating cylinder for the nose gear distinguishes itself from that for the main gear by the specialities that its ball lock is installed in the other end of the cylinder and that each of its ends is connected with a single lug fitting fitted with U6GB304-64 knuckle bearing.

The piston rod in the "down" position is locked by the ball lock.

The full travel (structural travel) of the piston rod for the actuating cylinder is 333 ± 2 mm.

The operating travel (designed travel) of the piston rod for the actuating cylinder is 298.5 mm.

UP-LOCK FOR THE NOSE GEAR

The up-lock for the nose gear consists of the hook case, bump hook, locking part, spring and actuating cylinder.

The bump hook, locking part and locking pin are all made of CrMnSi alloy steel.

The bump hook and locking part are all installed in the case with dividing bushings and fixed with (HB1-103G8 × 24) bolts.

The albronze bushings are inserted in the bump hook and locking part respectively for reducing friction.

On the locking part is installed a locking pin. When the piston rod of the lock actuating cylinder is actuating, it will act on this locking pin.

The actuating cylinder of the lock is installed in the tube welded on the hook case by two bolts.

The hook case is made of 1.5 mm. thick low-carbon steel sheet.

The hook case is provided with four elliptical holes and welded with steel washers for fixing the lock on the box located at the lower part of the cockpit floor. The two fore steel washers are scored with the transversal ridges with a pitch of 1.5 mm.

The elliptical holes on the hook case are used to adjust the clearance between the bump hook opening and the bushing on the bolt connecting the upper and lower torque arms.

The elliptical holes on the support of the cockpit floor box are used to adjust the side clearance between the bump hook and the torque arm lug.

The ridges on the hook case washer are engaged with the grooves on the washer of the cockpit floor support, thus preventing the hook from displacing.

The operation of the nose gear up-lock is the same as that of the main gear up-lock.

The operation of the nose gear up-lock is shown in Fig. 3.17.

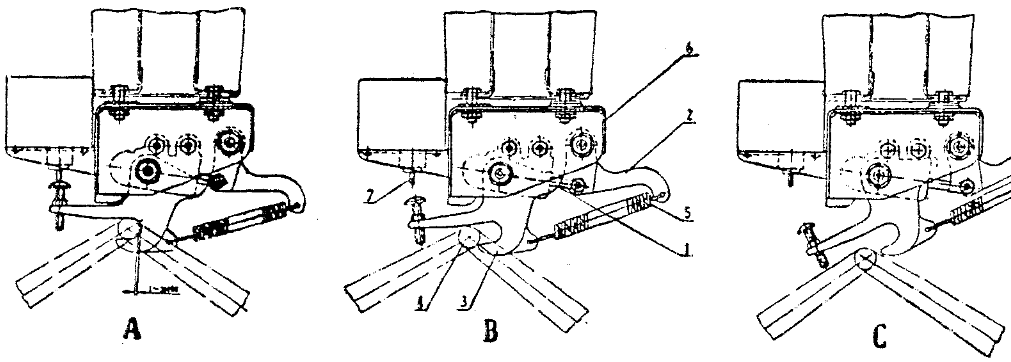


Fig. 3.17 Operating schematic for the nose gear up-lock

1. Hook actuating cylinder 2. Locking part 3. Bump hook 4. Bolt for connecting the upper and lower torque arms 5. Spring 6. Lock case 7. Contact switch
A. In locking B. In initial unlocking C. In unlocking

WHEEL FOR THE NOSE GEAR

The nose gear is equipped with a 400×150 wheel without brake, which is composed of the drum, an inner tube and a cover tire.

One end of the drum is equipped with a detachable rim for facilitating the installation of the tire.

In the drum are fitted two conical roller bearings, the outer sides of which are sealed with dust covers.

The unloaded wheel tire (or free wheel tire) is inflated to a pressure of 2.3 atm.

When the airplane being in parking with normal flying weight, the tire compression is 15.5 mm.

III. LUBRICATION FOR THE JOINTS OF THE LANDING GEAR

All the movable joints can be lubricated periodically through the grease nipples installed on them.

ARRANGEMENT OF THE GREASE NIPPLES

The grease nipples on the main gear are located respectively on:

1. The upper fitting of the main shock absorber strut;
2. The fitting for connecting the actuating cylinder and upper jackstay;

3. The fitting for connecting the upper jackstay and support on the midwing;
4. The fitting for connecting the upper and lower jackstays;
5. The fitting for connecting the rotating axle of the half-wheel fork and the shock absorber strut;
6. The bolt connecting the link of the shock absorber strut and the half-wheel fork.

The grease nipples on the nose gear are located respectively on;

1. The upper fitting of the nose shock absorber strut;
2. The bolt connecting the upper and lower jackstays;
3. The bolt connecting the lower jackstay and the nose shock absorber strut;
4. The ring body at the lower part of the nose shock absorber strut;
5. Bolt connecting the torque arms.

All the grease nipples on the fittings are accessible and can be greased with the grease gun.

Except that the bolts (arranged in three places) connecting the torque arms of the nose gear and the connection between the ring body on the nose strut and the lower part of the damper cylinder are lubricated with (ZL7-2) grease and 15% graphite, the other joints are all lubricated with (ZL7-2) grease.

CHAPTER IV

CONTROL SYSTEM OF THE AIRPLANE

The airplane control system consists of the following components: the elevator, aileron, rudder, elevator trim tab, flap and wheel brake controls.

The control system is of the dual type i.e., the above-mentioned controls can be controlled in both cockpits.

The elevator control is of mixed type and composed of the HB7×7-3.6-Z-YB261-64 steel cable, the push-pull rod made of dural tube and the another push-pull rod made of CrMnSi steel tube. The aileron control is of rigid type and employs the push-pull rod made of dural tube. The rudder control is of flexible type and composed of the HB7×7-3.6-Z-YB261-64 and HB7×7-3-Z-YB261-64 steel cables. The elevator trim tab control is of mixed type. The flap is controlled by the compressed air actuating cylinder. The wheel brake control consists of the brake handle on the control stick, brake cable, compressed air pressure reducing valve QS-1, brake bellcrank and brake differential QS-2.

I. ELEVATOR CONTROL

The elevator control system (Fig. 4.1) consists of:

1. the control sticks located in the front and rear cockpits;
2. control push-pull rod and bellcrank;
3. a pair of steel cables, turn-buckle and eye-yoke.

When the control stick moves forward and backward, its movement is transmitted to the bellcrank 7 at the fuselage frame 9 through push-pull rod 5 (Fig. 4.1). The push-pull rod is made of ($\phi 24\times 1$) dural tube. One end of the push-pull rod 5 connected with the bellcrank 7 is fitted with a special hinge joint (Detail A of Fig. 4.1). The hinge joint includes a forked end bolt, a bushing, etc. The forked end bolt is fixed in the bushing made of steel by a crown nut and can rotate freely around the bushing axis. In order to make the forked end bolt rotate freely in the bushing without axial play, on the bushing is installed a slotted nut, which can be locked up tightly with a clamp after regulating. In the hinge joint is installed a bronze washer for reducing the friction of the forked end bolt in rotating.

The elevator control system in the cockpit (Fig. 4.2) consists of the control sticks located in the front and rear cockpits, torque tubes and push-pull rods.

When the elevator is in the neutral position, the control stick is inclined backward 6°. The elevator rear lip is deflected down 20° when the control stick moves forward 17° from the neutral position and up 28° when the control stick moves backward 23° from the neutral position. The inclination angle of the control stick is controlled by the limiter 11, in which is inserted a rubber pad.

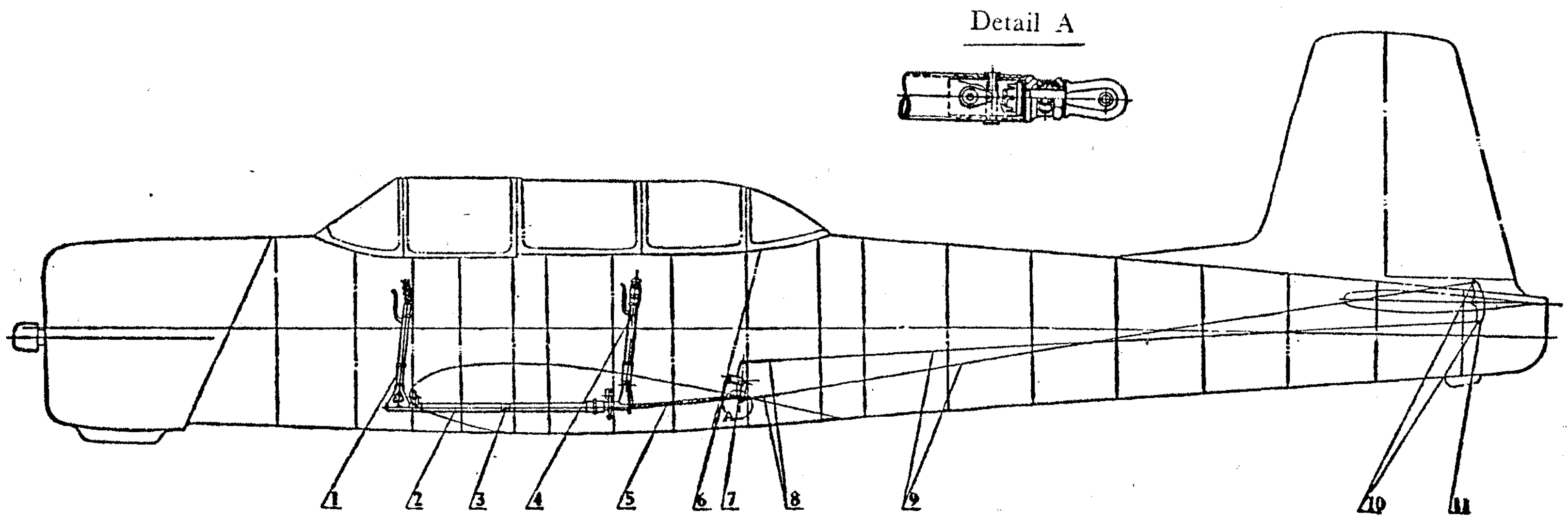


Fig. 4.1 Schematic of the elevator control

1. Control stick in the front cockpit 2. Torque tube 3. Push-pull rod 4. Control stick in the rear cockpit 5. Push-pull rod 6. Support 7. Bellcrank 8. Turn-buckles 9. Cables 10. Eye-yokes for connecting cable 11. Bellcrank of the elevator

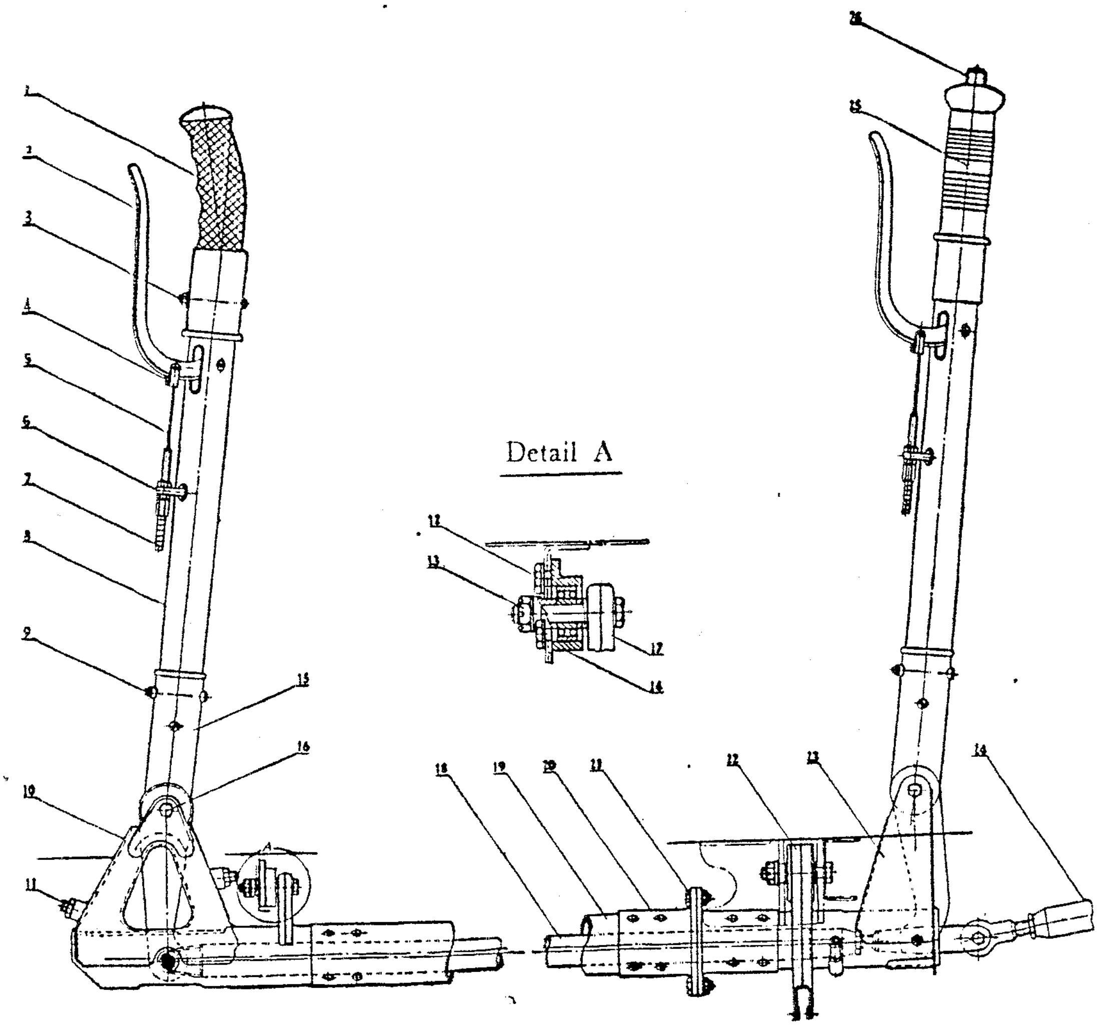


Fig. 4.2 Schematic of the elevator control in the cockpit

1. Control stick handle 2. Brake handle 3. Tapered bolt 4. Eye-yoke 5. Control cable for hand brake 6. Bolt 7. Anti-abrasive sleeve 8. Tube 9. Tapered bolt 10. Front support 11. Limiter 12. Bolt 13. Nut 14. Pedestal 15. Control stick rocking arm 16. Bolt 17. Front supporting mount 18. Push-pull rod 19. Tube 20. Flange 21. Bolt 22. Rear supporting mount and aileron control bellcrank 23. Rear support 24. Push-pull rod 25. Control stick handle in the rear cockpit 26. Wheel brake release button

The control sticks located in the front and rear cockpits are connected respectively to the front support 10 and rear support 23 of the torque tube by means of bolts. The torque tube consists of the following parts: the front welded support 10, tube 19 made of dural tube ($\phi 48 \times 1.5$), flange 20 made of wrought aluminium and rear welded support 23. The tube 19 is riveted respectively with the front support 10 and the flange 20, and the rear support 23 is riveted also with the flange 20. The flange has divided the torque tube into two sections: the front section and rear section. The front and rear flanges are connected each other by bolts 21 (three in all).

The torque tube is bolted on the airplane structure with the help of the front supporting mount 17 and rear supporting mount 22. In the rear supporting mount 22 is fitted a single-row radial-thrust ball bearing for withstanding the radial and axial forces. The bearing is pressed in the spherical bushing. When the torque tube or airplane structure is deformed, the bearing bushing can rotate in the rear supporting mount 22 to prevent the control system from jamming.

The rear supporting mount 22 is bolted on the special support located under the rear cockpit floor. The rocking arm located at the lower part of the rear supporting mount 22 is connected with the aileron control push-pull rod.

The front supporting mount 17 is connected to the pedestal 14 by bolt. The pedestal 14 is fixed on the fuselage frame 3 by four bolts 12. In the pedestal 14 is fitted a self-aligning double-row ball bearing, and the bearing withstands the redial force only. When the torque tube or the airplane structure is deformed, the bearing can move along the axial direction in the pedestal.

The control stick consists of a handle, a tube made of ($\phi 35\times 1.5$) dural tube and a control stick rocking arm made of worught aluminium.

The control stick handle located in the front cockpit is made of 1010 nylon. (The handle to the batch 28 is casted of aluminium and wrapped up with a layer of rubber at the place for gripping.) The handle is connected with tube 8 by means of tapered bolt 3.

In the rocking arms 15 of the front and rear control sticks are inserted two self-aligning double-row ball bearings respectively to ensure that the control sticks can rotate freely after they are mounted on the front and rear supporting mounts 10 and 23. This rocking arm is connected with tube 8 by tapered bolt 9.

The rocking arms 15 of the front and rear control sticks are connected each other through the push-pull rod 18. The push-pull rod is made of ($\phi 27\times 1$) CrMnSi steel tube heat-treated to $\sigma_b = 80\pm$ kg./mm². and its length can be adjusted.

The control stick handle 25 located in the rear cockpit is made of 1010 nylon. (The handle to 30 batch is made of ebonite.) The wheel brake release mechanism is installed in the handle and the wheel brake release button 26 is located at the upper end of the handle. The control stick handle 25 located in the rear cockpit is connected with the control stick tube by screws.

The rotational axis of the front supporting mount 17 for torque tube coincides with that of the rear supporting mount 22 for torque tube and passes through the center point of the hinge joint mentioned above (Detail A of Fig. 4.1). For this reason, the control stick being moved right or left to control the aileron, the follow-up motion of the push-pull rod 24 at the above-mentioned special hinge joint and thereby, the interaction for the elevator control system and aileron control system in operating are eliminated.

The bellcrank 2 at the fuselage frame 9 (Fig. 4.3) is made of dural plate with thickness 7 mm. On the bellcrank 2 are riveted two bearing pedestals 3, in each of which is inserted a double-row ball bearing, and the bellcrank is mounted on the support 6 with bolt 4.

In the lower end of the bellcrank 2 is inserted a self-aligning double-row ball bearing for connecting the push-pull rod 5.

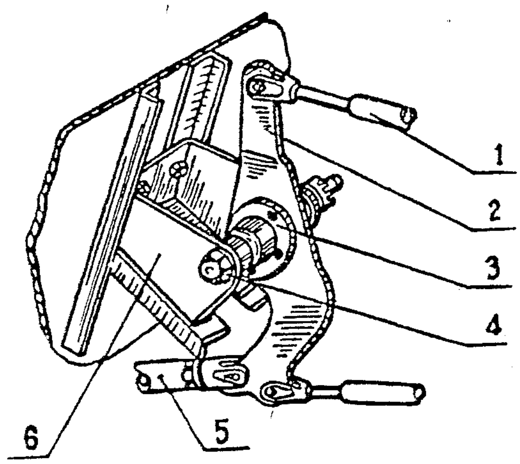


Fig. 4.3 Installation of the bellcrank

1. Turn-buckle 2. Bellcrank 3. Bearing pedestal 4. Bolt 5. Push-pull rod 6. Support

The support 6 is made of cast aluminium and connected to the fuselage frame 9 by two side bolts, while the support bottom to the longitudinal reinforcing section material of the fuselage by four bolts.

The bellcrank 7 is connected with the bellcrank 11 of the elevator (Fig. 4.1) through two intercrossing cables 9. The cable is of HB7×7-3.6-Z-YB261-64 type.

With the help of the flange, the bellcrank on the elevator is fastened with the tube beam of the elevator by means of four bolts (Fig. 4.4).

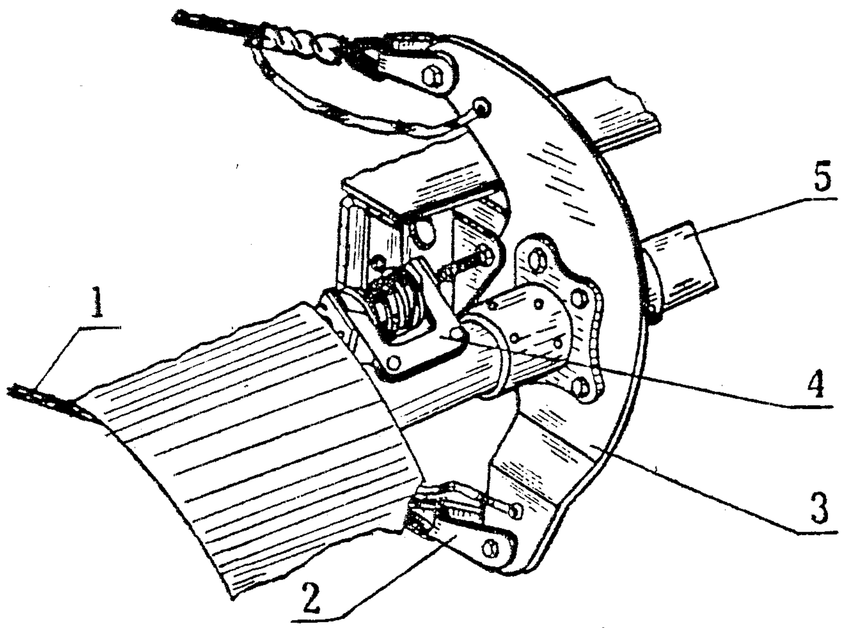


Fig. 4.4 Elevator control bellcrank

1. Cable mechanism 2. Eye-yoke for connecting cable 3. Bellcrank 4. Support for trim tab 5. Elevator tube beam

The tightness of the cable 9 can be adjusted through the turn-buckle 8 and the turnbuckle should be tied with soft steel wire after adjusting for safety (Fig. 4.1).

II. AILERON CONTROL

The aileron control (Fig. 4.5) is fulfilled with the help of the control sticks located in the front and rear cockpits.

The control stick located in the front cockpit is linked with that located in the rear cockpit through the torque tube 2 for ensuring their synchronization. The rocking arm 14 is welded on the torque tube 2. When the control stick moves right and left, the rocking arm 14 will move right and left along with it and thereby drive the push-pull rod and the bellcranks for deflecting the aileron up and down.

All the push-pull rods are made of dural tubes with the exception of the push-pull rod 16 made of mid-carbon steel. The fitting of the push-pull rod is connected with the tube by blind rivets. The length of all the push-pull rods can be adjusted with the eye-bolt or forked end bolt.

The bellcrank 8 is mounted on the center rib 1 located at the left side of the midiwng and its support is fixed with the rib by four bolts. The bellcrank 7 is mounted on the rear spar and the center rib 1 located at the left side of the midwing, and its support is fixed with rib by two bolts and with the the rear spar by four bolts.

The forklike bellcranks 7 and 8 can change the direction of the motion of the moving chain and the magnitude of controlling force.

The follow-up rocking arm 4 is mounted on the rear spar of the midwing and the mounting position of its pedestal is nearby the trailing rib 1 located at the right side of the midwing. This rocking arm serves only as the following bracing in the system of the moving chain.

The installation of the control bellcrank in the midwing is shown in Fig. 4.6.

The double-lug rocking arm 1 (Fig. 4.5 detailed in Fig. 4.7) is installed on the upper fitting of the midwing rear spar. With the rocking arm, the push-pull rods 6 and 12 in the midwing can be connected with the push-pull rods 5 in the outer wings.

The differential bellcrank 15 is mounted on the outer wing rear spar and is nearby the rib 6 of the outer wing. One end of the bellcrank is connected with the push-pull rod 5 and the other end with the push-pull rod 16. When the differential bellcrank 15 is swinging, it drives the push-pull rod 16 to move and thus, the push-pull rod 16 drives the aileron through the aileron rocking arm 17 and makes it deflect up and down.

The installation of the double-lug rocking arm 1 and the differential bellcrank 15 is shown in Fig. 4.7.

The rocking arms 2, 4, 6 in Fig. 4.6 and Fig. 4.7 are made of wrought alluminium. In each rocking arm are inserted two double-row radial ball bearings to ensure that the control rocking arm can rotate freely. The pedestal 1 on the midwing rear spar is made of CrMnSi alloy steel, the support 3 of the cast aluminium and the pedestal 5 of wrought aluminium.

These pedestals and supports are all fixed on the wing structure by bolts made of steel.

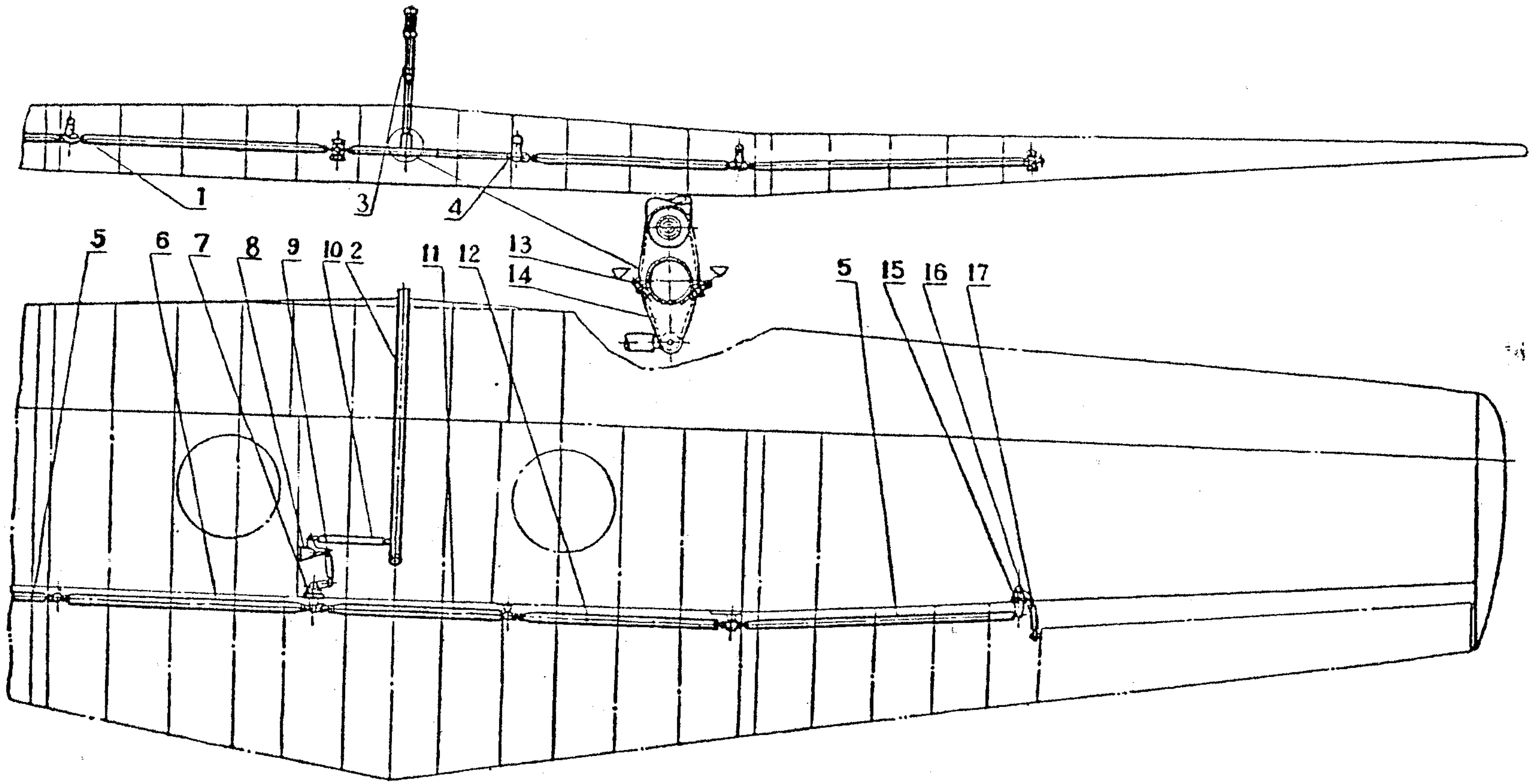


Fig. 4.5 Schematic of the aileron control system

1. Double-lug rocking arm 2. Torque tube 3. Control stick 4. Follow-up rocking arm 5. 6. 9. 10. 11. 12. 16. Push-pull rods 7. 8. bellcranks 13. Limiter 14. Rocking arm 15. Differential bellcrank 17. Aileron rocking arm

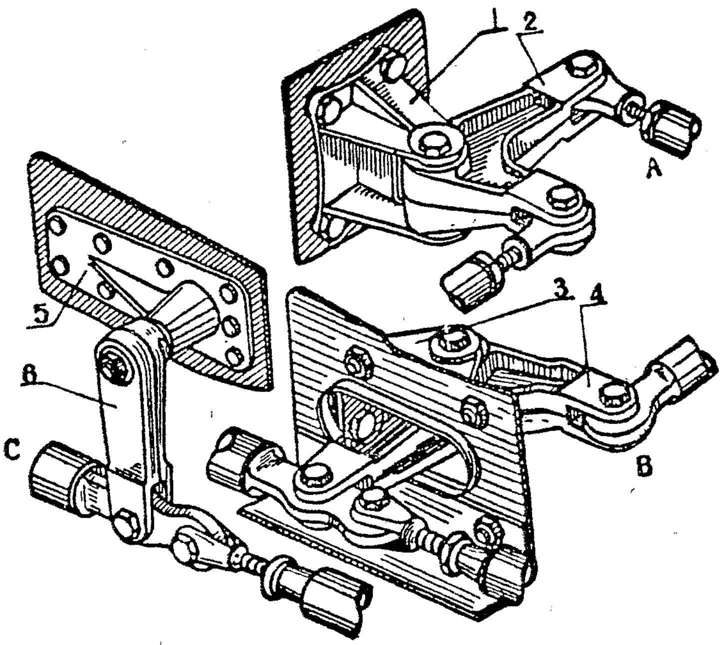


Fig. 4.6 Installation of the control bellcranks in the midwing

A. B. Bellcrank installation C. Follow-up rocking arm installation
1. 3. Supports 2. 4. Bellcranks 5. Pedestal 6. Follow-up rocking arm

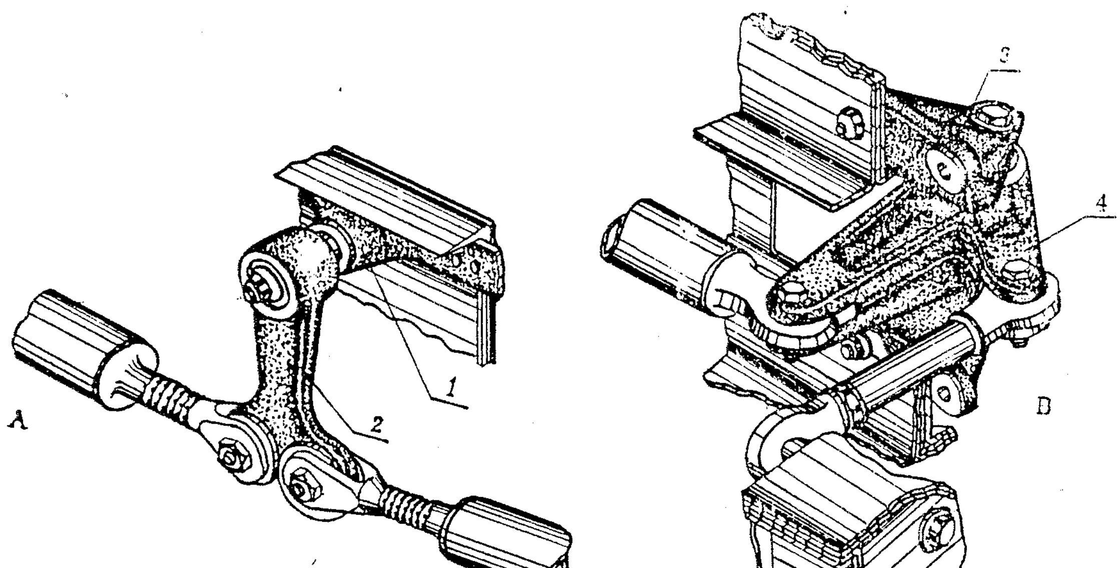


Fig. 4.7 Installation of bellcrank

A. Double-lug rocking arm installation B. Differential bellcrank installation
1. Up-pedestal of the midwing rear spar 2. Double-lug rocking arm 3. Support
4. Differential bellcrank

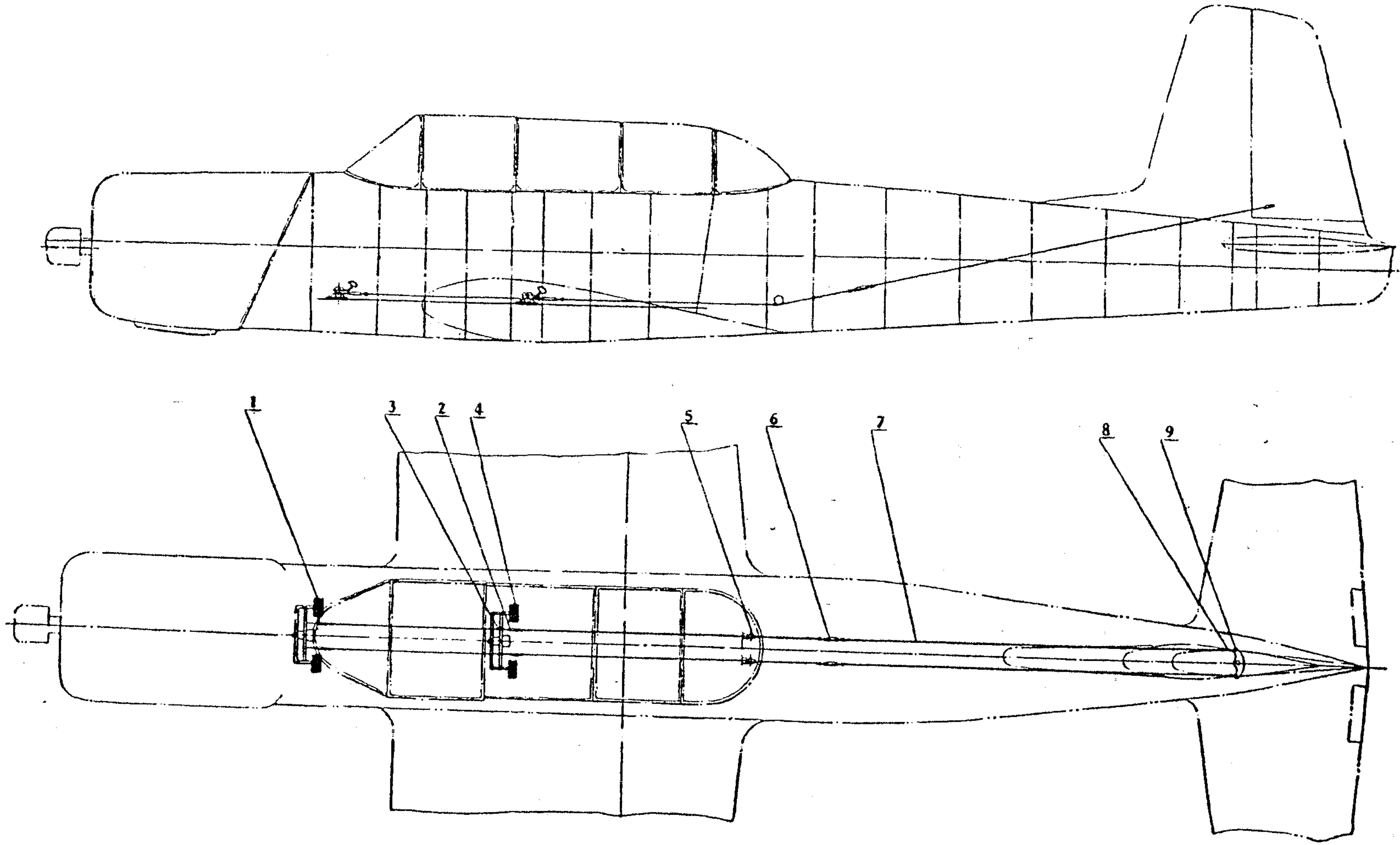


Fig. 4.8 Schematic of the rudder control system

1. Pedal mechanism in the front cockpit 2. 6. Turn-buckles 3. 8. Eye-yokes for connecting cable 4. Pedal mechanism in the rear cockpit 5. Guiding pulley 7. Cable 9. Rudder bellcrank

The aileron being controlled, the inclination angle to either right or left limit position for the control stick is 17°. Through the transmision of the bellcrank, the aileron on one side will deflect up 22° and that on the other side down 16° correspondingly. The differential is fulfilled with the help of the differential bellcrank 15.

The 17° angle as the inclination angle to the right or left limit for the control stick is controlled by the limiter 13. On the welded rocking arm 14 is mounted the limiter, in which the rubber pad is inserted.

III. RUDDER CONTROL

The rudder control system (Fig. 4.8) consists of:

1. the pedal mechanisms in the front and rear cockpits;
2. two cables and their guiding pulleys.

The pedal mechanisms in the front and rear cockpits are connected each other by the HB7×7-3-Z-YB261-64 cables to ensure that the pedal mechanisms in the both cockpits can move coincidently. The pedal mechanism 4 in the rear cockpit is connected with the rudder bellcrank 9 through the HB7×7-3.6-Z-YB261-64 steel cables thus causing their coincidence. The tightness for the control cable can be adjusted by the turn-buckles 2 and 6, and the turn-buckles should be tightened and secured with the soft steel wire after adjusting.

The rudder bellcrank is fastened with the rudder tube beam with the help of the flange (Fig. 4.9), and the cable is connected with the rudder bellcrank with the help of the eye-yoke for connecting cable.

The textolite pulley is mounted at the frame 10 of the fuselage to make the cable move along the designed direction.

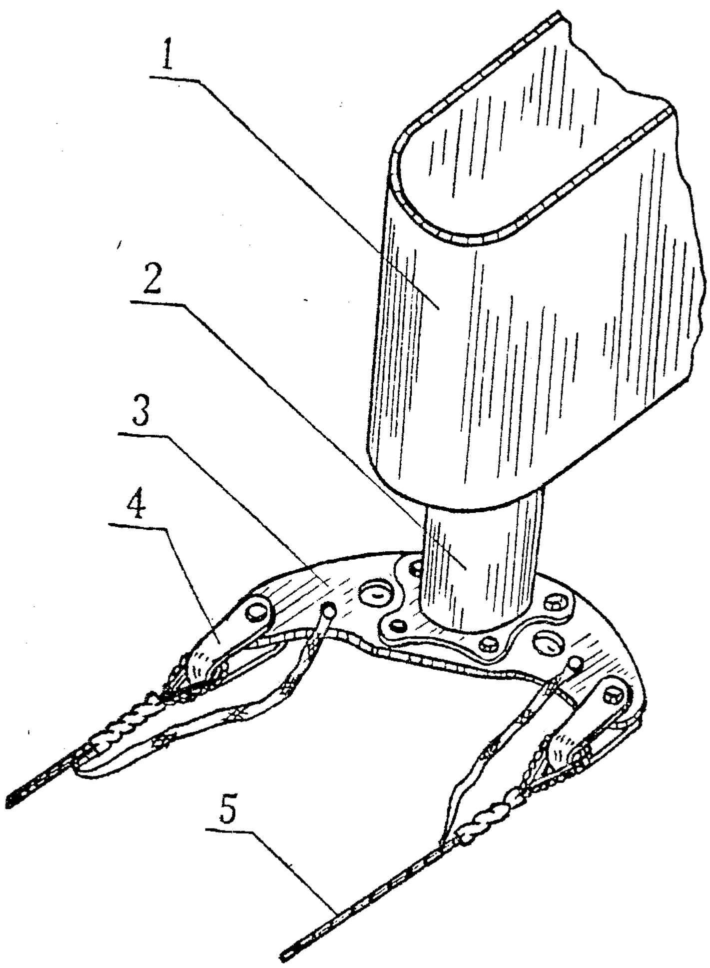


Fig. 4.9 Operating bellcrank for the rudder

1. Rudder 2. Rudder tube beam 3. Rudder bellcrank
4. Eye-yoke for connecting cable 5. Cable

The pedal mechanism in the cockpit employs the parallelogram mechanism as its components (Fig. 4.10).

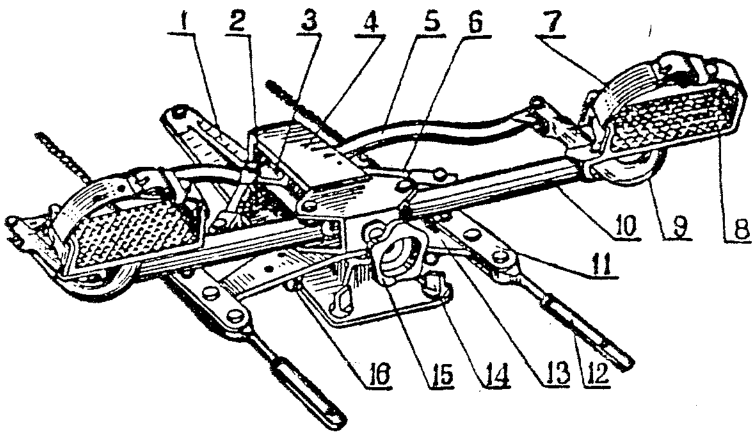


Fig. 4.10 Pedal mechanism in the rear cockpit

1. Base plate 2. Screw rod 3. Wing nut 4. Case 5. Bent link 6. Link-rod 7. Belt 8. Treadle 9. Treadle pipe 10. Rocking lever 11. Connecting plate 12. Turn-buckle 13. Rocking arm 14. Stop bolt 15. Screw rod handle 16. Limiter

The pedal mechanism is the parallelogram one which consists of the bent link 5, rocking lever 10 and treadle pipe 9. One end of the bent link 5 is jointed to the end of the treadle pipe 9 and the other end connected to the bolt for base plate 1. One end of the rocking lever 10 is connected to the treadle pipe and the other end to the case 4. The rocking arm 13 is fixed on the lower part of the case 4 and can rotate freely together with the case in the bearing housing for the base plate 1. Two double-row ball bearings with different specifications are inserted in the bearing housing. On the pivot located at the lower part of the pedal in the rear cockpit is installed a foot brake control rocking arm. When being moved, the pedal mechanism can drive the rocking arm and make it move, thus causing the foot brake to be controlled.

The treadle 8 is connected to the treadle pipe 9. On the shaft of the foot pedal is installed a torsional spring to make the treadle and vertical shaft form an angle by 30°.

By rotating the handle 15, the treadle can be adjusted forward or backward to accommodate the pilot's stature. The handle 15 is connected with the screw rod. The rotating of the handle, which in fact is the rotating of the screw rod 2 makes the wing nut 3 move forward and backward along the straight line. As the link rod 6 can drive the rocking lever 10 forward and backward, therefore, the treadle will move along with that. The range for adjusting it forward and backward is 136 mm.

As the pedal linkage rotates by an angle 25° either counterclockwise or clockwise from its neutral position, correspondingly, the rudder will deflect by an angle 25° right or left too. The limiting angle for rotating the pedal from its neutral position is limited by the stop bolt 14 and limiter 16 in the rear cockpit. In the limiter is inserted a rubber block.

IV. ELEVATOR TRIM TAB CONTROL

The elevator trim tab control system is of mechanical control (Fig. 4.11). The control dials 1 and 3 are mounted on the left sidewalls of the front and rear cockpits respectively and connected to the drum mechanism 13 on the elevator tube beam through the cables.

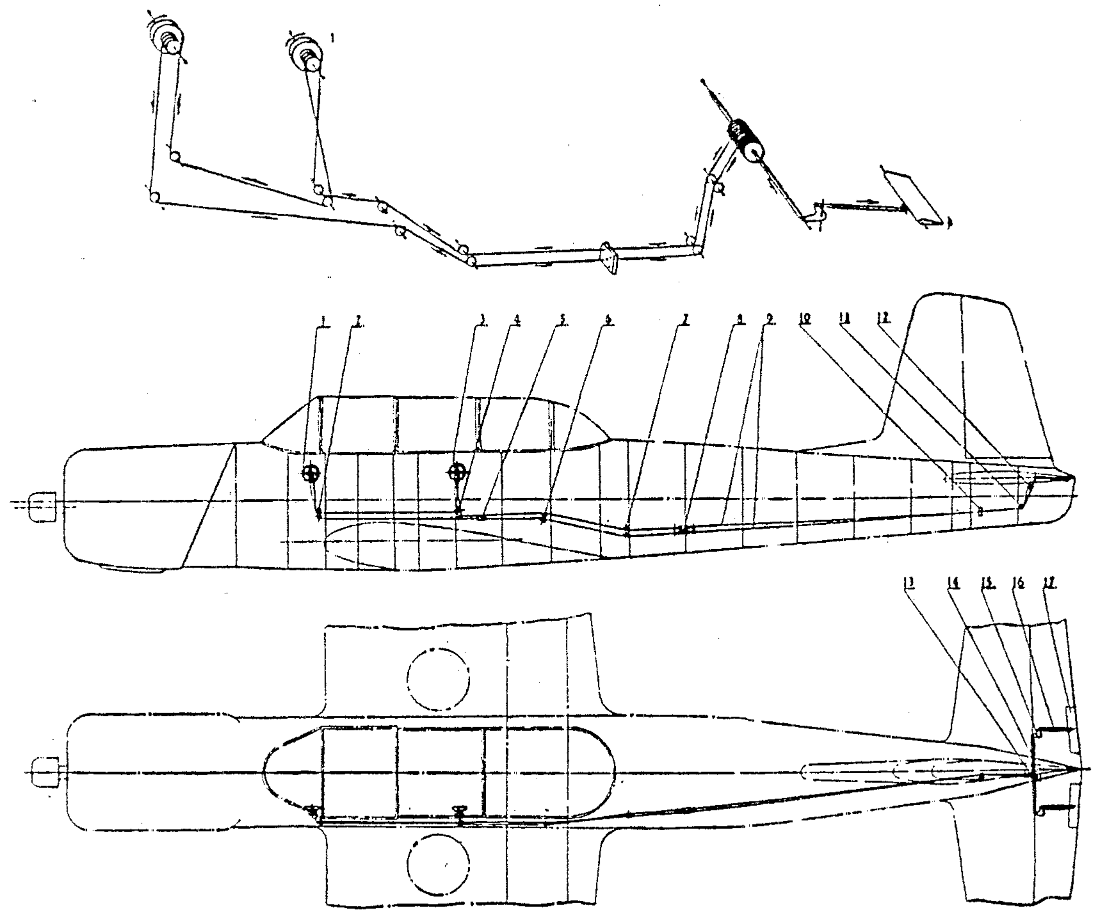


Fig. 4.11 Schematic of the elevator trim tab control system

1. Control dial in the front cockpit 2. 4. 6. 7. 11. 12. Guide pulleys 3. Control dial in the rear cockpit 5. Signal device contact switch for trim tab in the neutral position 8. Turn-buckle 9. Cable 10. Guide plate 13. Drum mechanism 15. Bellcrank 14. 16. Push-pull rods 17. Elevator trim tab

The control dials with roller 1 and 3 are made of nylon 1010 bonded graphite (the dials to the batch 26 are made of cast aluminium) and mounted on the welded brackets, which are riveted on the left sidewalls at the frame 3 in the front cockpit and frame 7 in the rear cockpit respectively.

The control cable to the batch 28 is made of HB7×19-3.6-Z-YB261-64 single-core flexible cable. (From the batch 29, it employs the HB7×19-1.2-SYB261-64 cable.) The turn-buckle 8 can adjust the tightness of the control cable and should be tightened and secured with the flexible steel wire after adjustment.

The six pairs of guiding pulleys 2, 4, 6, 7, 11 and 12 made of nylon 1010 bonded graphite (they are made of duralumin to the batch 25) and the guiding plate 10 made of nylon 1010 bonded graphite (to the batch 21, they are made of textolite) ensure that the control cable move along the designed direction.

The installation of each pair of pulleys is as follows:

Pulleys 2 are installed on the left sidewall at the frams 3;

Pulleys 4 are installed on the left sidewall at the frame 7;

Pulleys 6 are installed on the fuselage frame 9;

Pulleys 7 are installed on the fuselage frame 11;

Pulleys 11 and 12 are installed on the fuselage frame 18;

The guiding plate 10 is installed on the frame 17.

The pulleys 7 and 11 mounted on the self-aligning bracket can locate themselves automatically to cause the pulley groove and the control cable to be in the same direction.

The guiding pulley 12 can move along the axis direction in parallel with the drum mechanism 13, thus making the control cable be perpendicular to the roller 3 in the drum mechanism. The shifting range of the pulley is 7 mm.

The drum control mechanism is mounted on the elevator tube beam (Fig. 4.12).

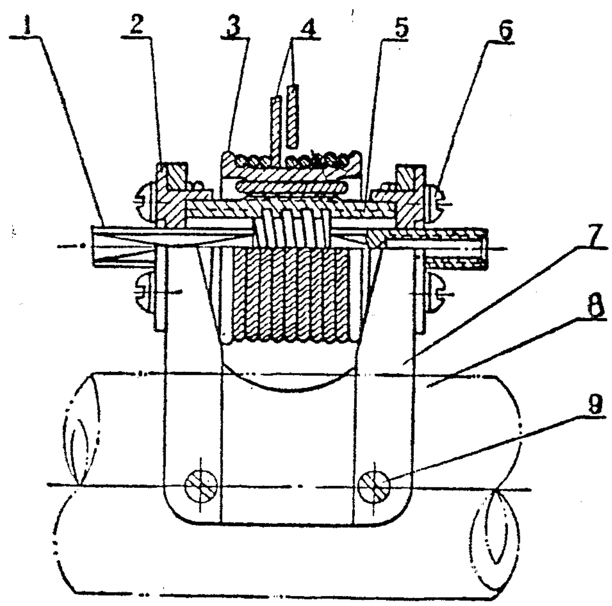


Fig. 4.12 Drum mechanism of the trim tab control system

1. Square threaded screw rod 2. Bushing with square hole 3. Roller 4. Cable
5. Bronze bushing 6. Screw 7. Bracket 8. Elevator tube beam 9. Screw

The rotating axis of the drum mechanism coincides with that of the elevator, which ensures that the trim tab control will be free from the effect of the elevator control.

The control cable 4 drives the roller 3 for rotating. Limited by the square hole in bushing 2, the square threaded screw rod has its motion transformed into the rectilinear motion.

As moving along the straight line (Fig. 4.11), the drum mechanism 13 can drive the elevator trim tab 17 through the push-pull rods 14, 16 and the bellcrank 15 and make it deflect up and down.

The signal device contact switch 5 for the trim tab in the neutral position is installed on the left sidewall between the fuselage frames 7 and 8. With the elevator trim tab 17 being in the neutral position, the green signal lights on the middle instrument panels in the front and rear cockpits light up by closing the signal circuit through contact switch 5.

When the control dials 1 and 3 in the cockpits rotate clockwise, the elevator trim tab 17 deflects upward, and vice versa. The maximum angle for deflecting up or down is 15°.

V. FLAP CONTROL

The landing flap is controlled by compressed air actuating cylinder (Fig. 4.13).

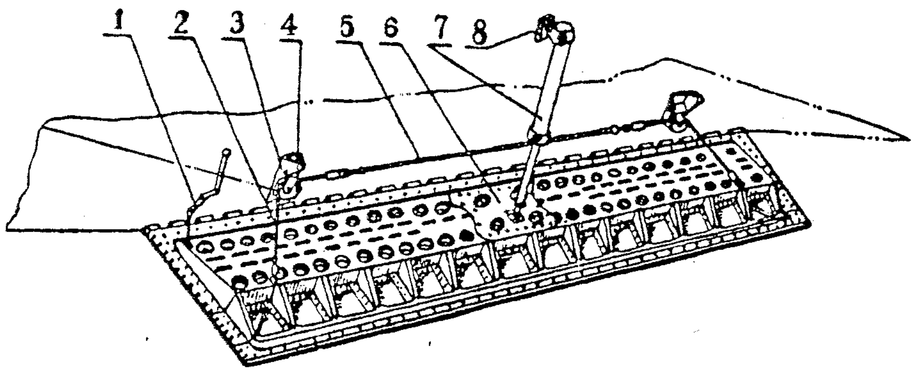


Fig. 4.13 Schematic of the flap control

1. Mechanical position indicator for the flap in down position 2. Cable 3. Bracket for pulley 4. Guiding pulley 5. Rubber rope 6. Flap 7. Flap actuating cylinder 8. Support

The flap control valves are mounted on the left consoles in the front and rear cockpits respectively for retracting and lowering the flap independently. The air intake pipe of the control valve is connected with the air supply pipe of the air bottle. The two air outlet pipes of the control valve are connected with the flap up and flap down nipples of the actuating cylinder respectively through the pipe of anticorrosive aluminium alloy and the hose.

The piston rod end of the flap actuating cylinder 7 is attached to the flap, and the case end is installed on the support 8, which is fixed on the fuselage frame 9 by bolts. The ball and socket bearing is inserted in the housing on the support 8 to accommodate the little shimmy of the actuating cylinder in retracting and extending.

The structure of the flap actuating cylinder is shown in Fig. 4.14.

With the flap control valve handle being in "down" position, the compressed air enters the inner chamber of the flap actuating cylinder through the flap valve and nipple 15 to push the piston rod and make it move until the piston 13 contacts with joint sleeve 6. The restrictors with the orifice diameter 0.5 mm. are fitted on the flap up and flap

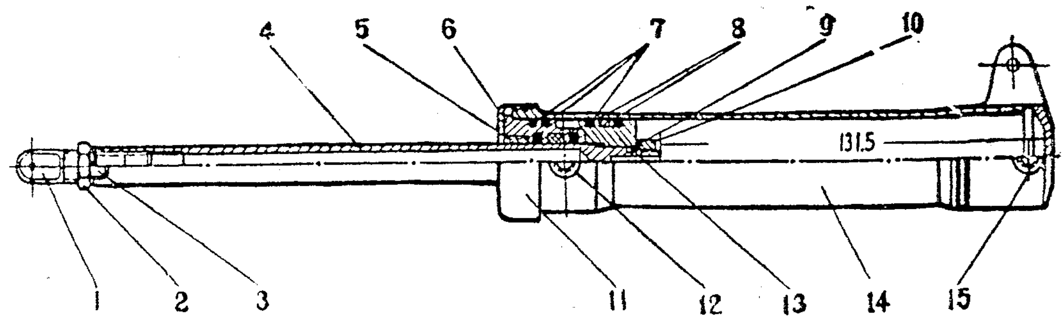


Fig. 4.14 Flap actuating cylinder

1. Forked end 2. Nut 3. Stop washer 4. Piston rod 5. Ring 6. Joint sleeve 7. Rubber ring 8. Sealing felt ring 9. Washer 10. Nut 11. Nut 12. Nipple 13. Piston 14. Actuating cylinder 15. Nipple

down nipples of the actuating cylinder respectively to ensure the steady retracting and lowering of the flap.

With the flap control valve handle being in "up" position, the compressed air enters the inner chamber of the flap actuating cylinder through the flap valve and nipple 12 to push the piston rod and make it move until the end of the piston rod 4 contacts with the top end of the actuating cylinder 14.

The travel of the flap actuating cylinder is 131.5 mm. and the corresponding opening of the flap is 40°.

The actuating cylinder 14 and piston rod 4 are made of CrMnSi alloy steel and the working surface of the piston rod is chromium plated.

The bracket 3 for pulley (Fig. 4.13) is fixed on the rear rib 4 of the midwing, and the pulley 4 is mounted on the bracket. The pulley 4 can swing freely along with the different position of the flap in retracting and lowering to ensure that the pulley groove and the cable will move along the same direction.

The both ends of the rubber rope 5 are connected with the cable 2. The rubber rope stretches when the flap is lowered and it shortens when the flap is retracted.

With the flap being in "up" position, the flap can overlap with the midwing closely due to the tensile force of the rubber rope.

The flap "down" mechanical position indicating rod 1 is installed on the rear rib 5 on the left side of the midwing. With the flap being in "down" position, the indicating rod protrudes out from the upper surface of the midwing to report the condition of the flap lowering.

VI. CONTROL OF THE WHEEL BRAKE DEVICE

The wheel brake is controlled by the compressed air from the airplane pneumatic system.

The brake handle on the control stick in the front or rear cockpit being gripped, the compressed air enters the wheel brake device immediately (Fig. 4.15).

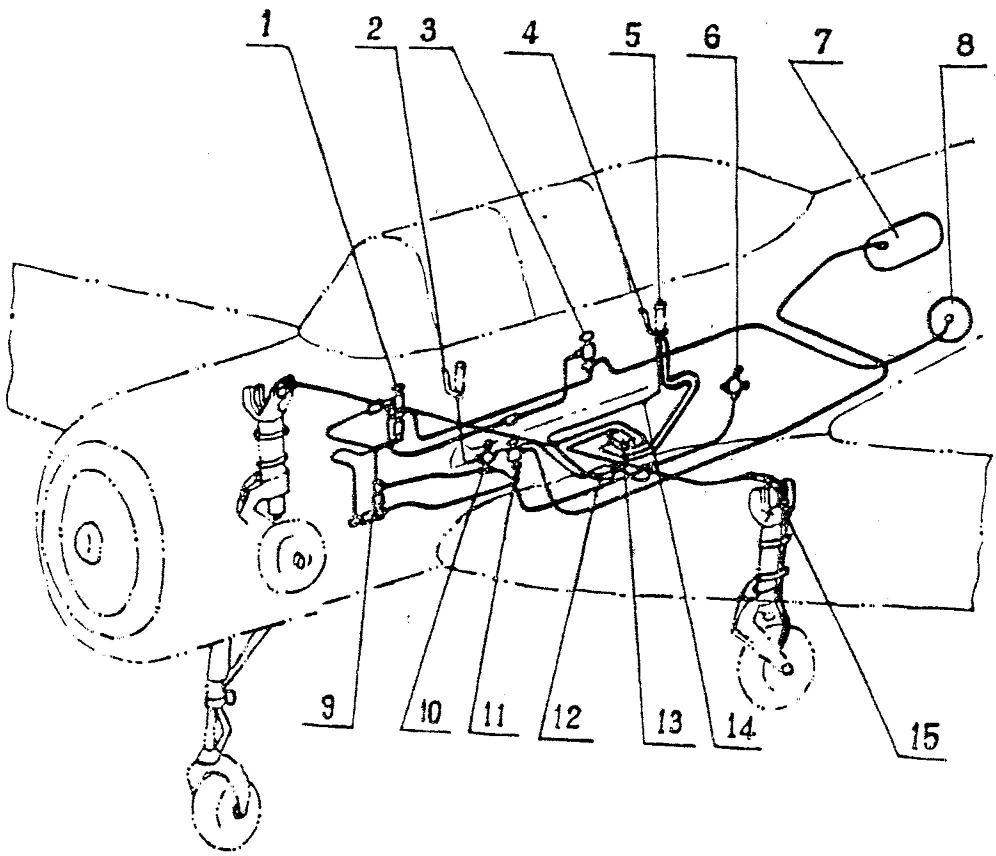


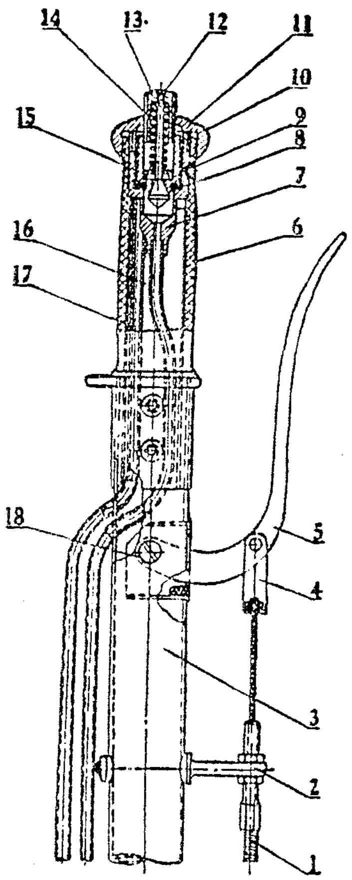
Fig. 4.15 Schematic of the brake system

1. Gear emergency lowering valve in the front cockpit 2. Brake handle in the front cockpit 3. Gear emergency lowering valve in the rear cockpit 4. Brake handle in the rear cockpit 5. Brake release valve 6. Flap control valve in the rear cockpit 7. Main air bottle 8. Emergency air bottle 9. Check valve (it is shifted to the frame 0 from the batch 23.) 10. Flap control valve in the front cockpit 11. Main compressed air valve 12. QS-1 pressure reducing valve 13. QS-2 brake differential 14. Brake cable 15. Brake hose

The brake handle is connected to the brake rocking arm mounted on the QS-1 pressure reducing valve through the cable in the anti-abrasive thimble, and the anti-abrasive thimble is tied on the torque tube by thin cord.

The QS-1 pressure reducing valve is located under the floor between the front and rear cockpits. When the brake handle is gripped, the brake rocking arm acts on the push rod of the QS-1 pressure reducing valve and makes it move, so that the compressed air is reduced to the required pressure and enters the brake pipeline.

The magnitude of the pressure drop depends on the rotating angle of the brake rocking arm and the limit position of the brake rocking arm is controlled by the stop screw fixed on the wheel braking device. The stop screw should be adjusted till the brake pressure reaches 8-9 atm. The air intake pipe for the wheel brake device is communicated with the brake release valve on the control stick in the rear cockpit (Fig. 4.16).



1. Anti-abrasive thimble
2. Bolt for fixing the anti-abrasive thimble
3. Control stick tube
4. Eye-yoke
5. Brake handle
6. Control stick ebonite handle
7. Valve case
8. Washer
9. Fixing screw
10. Valve seat
11. Cover
12. Push-rod
13. Push-button
14. Spring
15. Guiding bushing
16. 17. Copper ducts
18. Bolt

Fig. 4.16 Brake release valve

Being not depressed, the push-button 13 is protruded out from the control stick handle under the action of the spring. As the conical air vent to atmosphere is covered by the rubber cone connected with the push-button with the help of the push rod 12, the compressed air coming from the QS-1 valve and duct 17 passes through the duct 16 and then enters the QS-2 brake differential.

The push-button being depressed, the conical air vent is opened and the compressed air escapes from the braking pipe to atmosphere.

The compressed air passes through the QS-2 brake differential and enters the wheel brake device. With the pedal linkage being in the neutral position or the pedal linkage being rotated from its neutral position within the range of 15°, the two wheels of the landing gear can be braked simultaneously.

With the pedal linkage being rotated from the neutral position above 16°, the screw on the QS-2 brake differential pushes the valve, at that time, the compressed air supply for one wheel is shut-off, i.e., the single wheel is braked.

No matter where the pedal is, only if the very brake handle is released, the brake rocking arm on the QS-1 pressure reducing valve can be returned to its original position under the action of the spring, and the brake pressure is fully removed.

If something has gone wrong with the wheel brake in the front cockpit, press the pressure releasing push-button on the control stick in the rear cockpit, the brake pressure is removed.

CHAPTER V

PNEUMATIC SYSTEM

The pneumatic system of the airplane contains the main pneumatic system and the emergency pneumatic system. The main pneumatic system is used to start the engine, to retract and extend the landing gears, to retract and extend the flap and to brake the main wheels. The emergency pneumatic system is used to extend the landing gears, to retract and extend the flap and to brake the main wheel when the main pneumatic system is damaged.

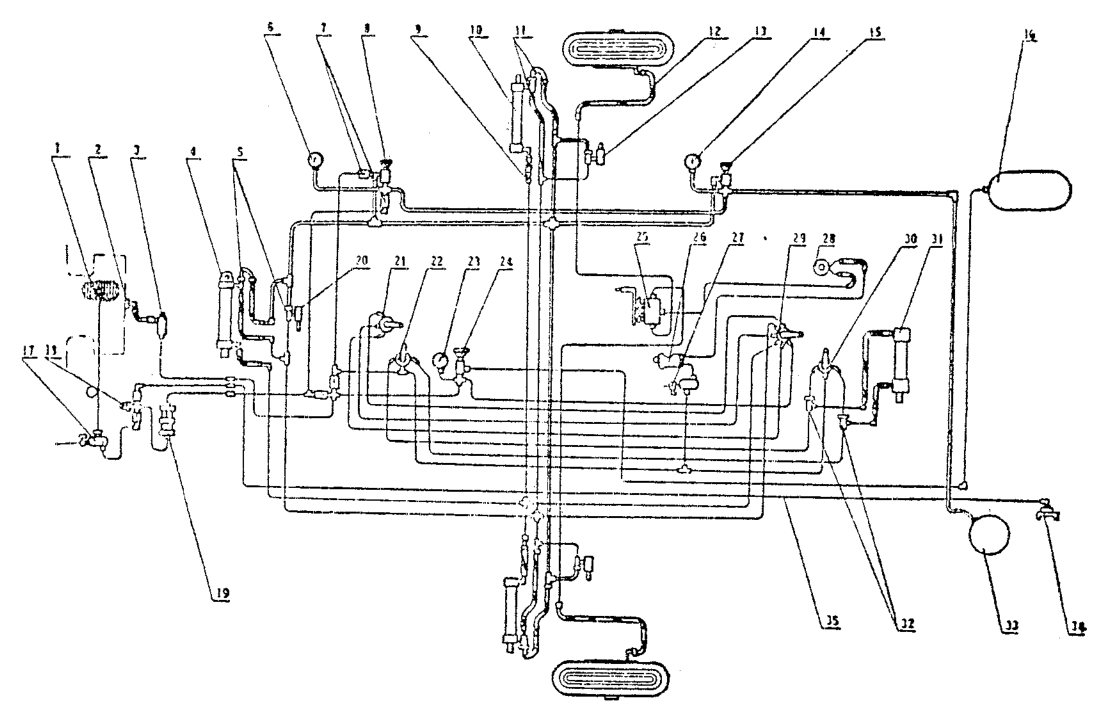


Fig. 5.1 Principle schematic of the pneumatic system (from the beginning of the batch 0 to the end of the batch 22)

1. KY-2 Air compressor 2. Engine starting air distributor 3. QDF-1 compressed air solenoid valve 4. Actuating cylinder for the nose landing gear 5. Emergency valve 6. 14. 23. BYQ-80-1A air pressure gauges 7. Check valve 8. Valve in the front cockpit for emergency extension of the landing gears 9. 11. 12. Hoses 10. Actuating cylinder for the main landing gear 13. Lock hook actuating cylinder for the main landing gear 15. Valve in the rear cockpit for emergency extension of the landing gears 16. Main air bottle 17. 27. Deposit filters 18. Pressure regulating valve 19. Water filter 20. Lock hook actuating cylinder of the nose landing gear 21. Landing gear control valve in the front cockpit 22. Flap control valve in the front cockpit 24. Compressed air main valve 25. QS-2 brake differential 26. QS-1 pressure reducing valve 28. Brake relief valve 29. Landing gear control valve in the rear cockpit 30. Flap control valve in the rear cockpit 31. Actuating cylinder for the flap 32. Flap diverter valve 33. Emergency air bottle 34. Field air charging nipple 35. Pipeline

The pneumatic system (Fig. 5.1) consists of KY-2 compressor 1, deposit filters 17 and 27, water filter 19, pressure regulating valve 18, (QS-1) pressure reducing valve 26, (QS-2) brake differential 25, check valve 7, compressed air solenoid valve 3, emergency valve 5, flap diverter valve 32, compressed air main valve 24, landing gear control valves 21 and 29, flap control valves 22 and 30, field air charging nipple 34, main compressed air bottle 16, emergency compressed air bottle 33, pipelines, hoses and fittings, etc.

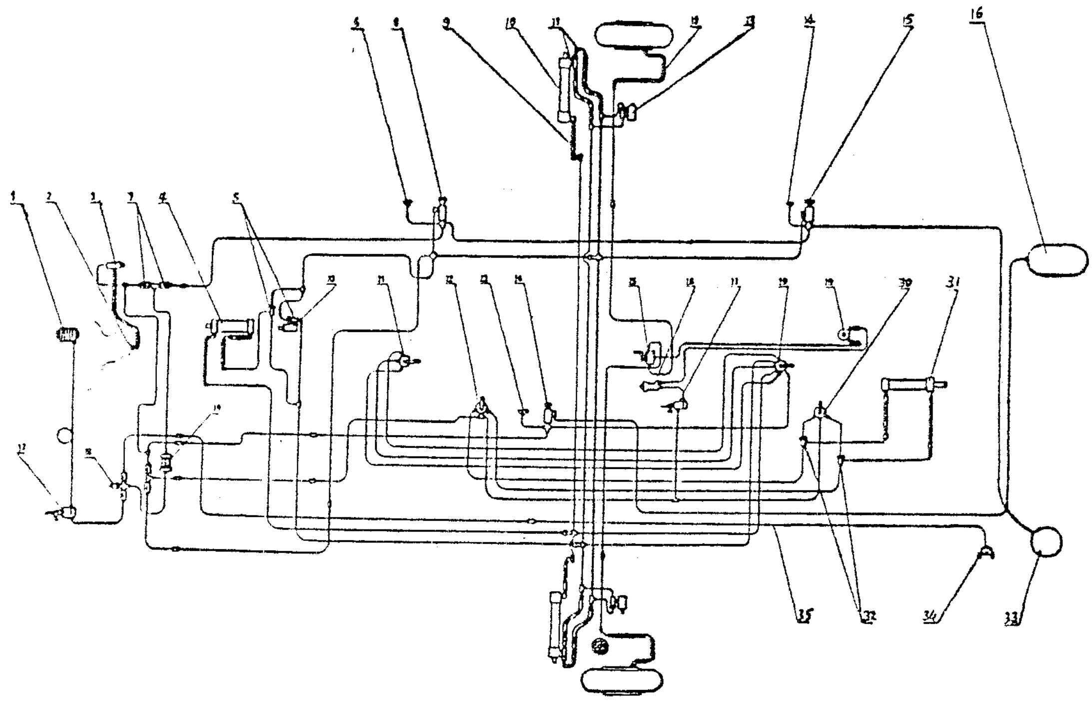


Fig. 5.1 Principle schematic of the pneumatic system
(from the 1st plane of the batch 23)

1 KY-2 air compressor 2. Engine starting air distributor 3. QDF-1 compressed air solenoid valve 4. Actuating cylinder for the nose landing gear 5. Emergency valve 6. 14. 23. BYQ-80-1A air pressure gauges 7. Check valve 8. Valve in the front cockpit for emergency extension of the landing gears 9. 11. 12. Hoses 10. Actuating cylinder for the main landing gear 13. Lock hook actuating cylinder for the main landing gear 15. Valve in the rear cockpit for emergency extension of the landing gears 16. Main air bottle 17. 27. Deposit filters 18. Pressure regulating valve 19. Water filter 20. Lock hook actuating cylinder of the nose landing gear 21. Landing gear control valve in the front cockpit 22. Flap control valve in the front cockpit 24. Compressed air main valve 25. QS-2 brake differential 26. QS-1 pressure reducing valve 28. Brake relief valve 29. Landing gear control in the rear cockpit 30. Flap control valve in the rear cockpit 31. Actuating cylinder for the flap 32. Flap diveter valves 33. Emergency air bottle 34. Field air changing nipple 35. Pipeline

The main compressed air bottle and the emergency compressed air bottle are the pressure accumulators of the compressed air. Air pressure gauge 23 indicates the pressure of the main pneumatic system. Air pressure gauges 6 and 14 indicate the pressure of the emergency pneumatic system. The operation pressure of the pneumatic system is of 50 atmospheric pressure.

I. CHARGING OF THE PNEUMATIC SYSTEM

When the airplane is in parking, the air bottle on the airplane may be charged by the field compressed air bottle through the field air charging nipple 34, which is installed under the left side skin between fuselage frames 11 and 12. The compressed air from the field air charging nipple enters the main air bottle via pressure regulating valve 18, water filter 19 and compressed air main valve 24. The compressed air enters the emergency air bottle not through the compressed air main valve, but through the pressure regulating valve and water filter only.

When the engine is operating, the air is supplied by the KY-2 air compressor mounted on the engine.

The air supplied by the air compressor enters the air bottle through the deposit filter 17 and the pressure regulating valve 18.

Two check valves are mounted on the cross fitting of the pressure regulating valve to prevent the air back flow.

II. STARTING OF THE ENGINE

When the engine starting button is switched on, the compressed air solenoid valve 3 is opened, from which the air of the main pneumatic system enters the starting air distributor 2 through pipelines and hoses to start the engine.

When the starting button is switched off, the compressed air solenoid valve is closed, and thus the air supply is cut off.

III. RETRACTION AND EXTENSION OF THE LANDING GEARS

When the landing gear control valve 21 or 29 is moved to "retraction" position, the compressed air from the main air bottle 16 enters the actuating cylinders 4 and 10 for the landing gears via the compressed air main valve 24 and the landing gear control valves, thus the landing gears are retracted.

When the landing gear control valve 21 or 29 is moved to "extension" position, the compressed air enters the lock hook actuating cylinders 13 and 20 and the retraction and extension actuating cylinders of the landing gears via the landing gear control valves and emergency valve 5, thus the landing gears are extended.

Starting from the landing gear control valves, the pipeline extends along the left side of the fuselage to the front spar of the midwing, where it branches spanwise to the left and right to give the pipelines for retracting and extensing the main landing gears respectively, while the pipeline stem which extends further becomes the pipeline for retracting and extensing the front landing gear. The pneumatic system and the actuating cylinders are connected by hoses.

In order to ensure the gentle extention and retraction of the landing gear, restrictors with orifice of 1 mm. diameter are mounted in the elbow fitting and three way fittings connected to the "Down" nipples of the actuating cylinders at the frame 1 and right and left ribs 3 of the midwing respectively by means of hoses; and restrictor with orifice of 2 mm. diameter is mounted in the cross fitting of the pipelines, which is located at the front spar and connected to the "Up" nipple of the gear control valve. In adjusting the coordination of the extending process of the landing gears, the orifice diameter of the restrictor is allowed to enlarge to 1.2 mm.

IV. EMERGENCY EXTENDING OF THE LANDING GEARS

When the main pneumatic system is out of function, the emergency pneumatic system may be used to extend the landing gears. For this purpose, the handle of the landing gear control valve should be set to the neutral position first, then turn on the emergency extending valve of the landing gears. At the moment, the compressed air from the emergency air bottle 33 enters the up-lock actuating cylinders and the landing gear actuating cylinders through the emergency extending valve 8 or 15 of the landing gears, emergency pipeline and then the emergency valve 5 to extend the landing gears.

In order to avoid the violent impact caused by the compressed air, the ground inspection for the emergency extension of the landing gears must be proceeded with back pressure according to the following sequence:

1. Set the handle of the landing gear control valve to the "Up" position.
2. Turn on the emergency extending valve of the landing gears.
3. Return the handle of the landing gear control valve to the "Neutral" position gently.

The emergency extending valves of the landing gears are mounted on the right consoles in the front and rear cockpits, and the pipelines for emergency extending are mounted on the right side of the fuselage.

The emergency extending pipeline connected to the actuating cylinders of the main landing gear and the pipeline for extending landing gears of the main pneumatic system are mounted on the front spar of the midwing in parallel. The emergency extending pipeline connected to the actuating cylinder of the nose landing gear stretches to the nose wheel bay along the right side of the fuselage.

V. RETRACTION AND EXTENSION OF THE FLAP

The flap control valves 22 and 30 are mounted respectively on the left consoles in the front and rear cockpits. When any handle of them is moved, the compressed air from the main air bottle 16 enters the flap actuating cylinder 31 through the compressed air main valve 24, flap control valve and flap diverter valve 32 along pipeline to actuate the flap.

The flap control valves and the flap diverter valves are connected by pipelines. The flap diverter valves and the flap actuating cylinder are connected by pipelines and hoses. On the inlet and outlet nipples of the flap actuating cylinder, the restrictors with orifice diameter of 0.5 mm. are mounted to ensure that the flap retracts and extends gently.

VI. WHEEL BRAKE OF THE LANDING GEARS

When the brake handle on the control stick of the front or rear cockpit is pressed, the compressed air bottle enters the brake devices of the left and right wheels through the compressed air main valve, deposit filter (mounted on the inner side of the left rib 1 of the midwing), (QS-1) reducing valve 26, brake relief valve 28 on the control stick of the rear cockpit, and the (QS-2) brake differential 25 to brake the wheels.

The pressure of the compressed air is reduced to the operating pressure required for wheel braking through the QS-1 pressure reducing valve. The operating pressure for wheel braking is 8-9 atm.

The braking control is achieved by the QS-1 pressure reducing valve. The gripping of the brake handles on the control sticks pushes the rocker mounted on the support of the pressure reducing valve through the braking cable mounted in the sheath, thus making the pressure reducing valve take action and the wheels being braked.

The foot pedal should be deflected if turning is required during ground taxiing. At a small turning angle, the braking control is not affected by the foot pedal. At a great turning angle, the foot pedal drives the QS-2 braking differential through link rod. If the brake handle is gripped, the two wheels have a difference of braking pressure, which makes a single wheel braking and the airplane turns. (See next section and chapter 4.)

The QS-1 pressure reducing valve, QS-2 brake differential and brake relief valve are connected to each other with pipelines and hoses. The pipelines led out from the brake differential extend to the left and right wheels along the front spar and are connected to the brake devices with brake hoses.

WHEEL BRAKING AND FLAP ACTUATING WITH THE EMERGENCY PNEUMATIC SYSTEM

The wheel braking and the retraction and extension of the flap may also be carried out by the emergency pneumatic system if necessary.

First, the compressed air main valve must be turned off.

Second, the emergency extending valve of the landing gears must be opened, then the wheel braking or flap actuating can be carried out by the emergency pneumatic system.

VII. ACCESSORIES OF THE PNEUMATIC SYSTEM

AIR COMPRESSOR

The double stage KY-2 air compressor is installed on the rear cover of the engine case, it has the capacity to fully charge the bottle of 8 liters within 22 minutes.

DEPOSIT FILTER

The QL-17 deposit filter (Fig. 5.2) is fitted in the pressure pipeline led from the KY-2 air compressor and fixed on the web at the lower left corner of the frame 0.

As the small handle wheel of the deposit filter is unscrewed, the deposit in the filter can be removed from the fuselage through the drainpipe.

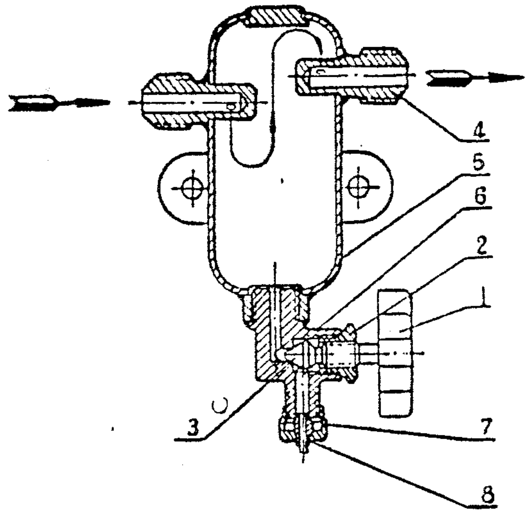


Fig. 5.2 Deposit filter

1. Small handle wheel for removing the deposit 2. Nut 3. Cone 4. Nipple 5. Case
6. Valve for removing the deposit 7. Nut 8. Drain pipe

PRESSURE REGULATING VALVE

The H2-5502-00 pressure regulating valve (Fig. 5,3) is connected with the two check valves by the tapered thread fitting and fixed on the frame 0 by clamp.

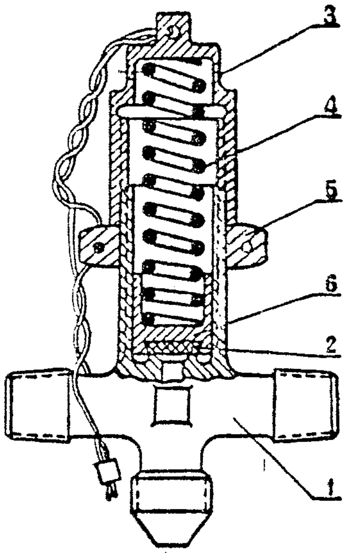


Fig. 5.3 Prsseure regulating valve

1. Case 2. Rubber pad 3. Nut cap 4. Spring 5. Locking nut 6. Valve

The pressure regulating valve keeps the operating pressure of the pneumatic system automatically not exceeding the maximum limited value. When the pressure in the system exceeds 50 atm., the compressed air escapes into the atmosphere through the small hole on the case. The operating pressure can be regulated by the adjusting spring 4.

WATER FILTER

The water filter (Fig. 5.4) is fixed on the frame 0 by the clamp. There are many wire screens, felt pads and silica gel desiccants in the water filter for filtrating the air which enters the air bottle and absorbing the air moisture.

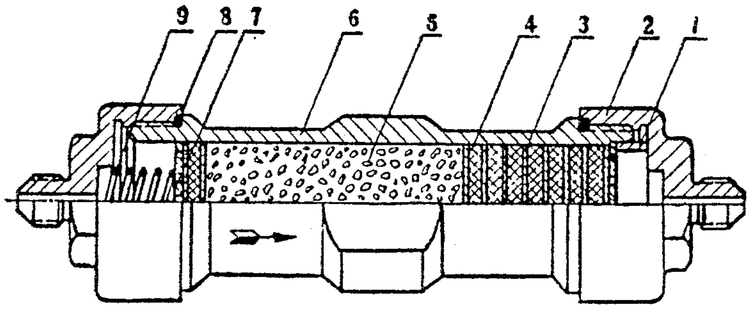


Fig. 5.4 Water filter

1. Bush pipe 2. Nut 3. Filter screens 4. Felt pad 5. Silica gel desiccant 6. Case 7. Ring 8. Washer 9. Spring

AIR CHARGING NIPPLE

The JT-7A field air charging nipple (Fig. 5.5) is installed under the skin between the frames 11 and 12 at the left side of the fuselage. The skin is provided with a cover for charging the inboard air bottle from the field air bottle easily.

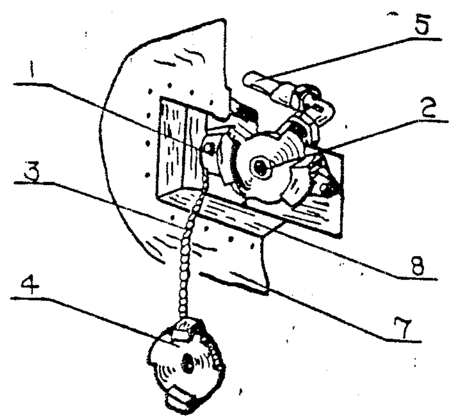


Fig. 5.5 Installation of the field air charging nipple

1. Air charging nipple 2. Rubber pad 3. Small chain 4. Cover 5. Pipe 6. Box 7. Fuselage skin

AIR BOTTLE

The main air bottle is a cylindrical weldment with two convex covers on both ends, its capacity is of 12 litres. The emergency air bottle is a spherical weldment with a capacity of 3 litres. The main air bottle is made of CrMnSi steel sheets of 2.5 mm. thickness by die forging, the emergency air bottle of 1.5 mm. thickness. On each air bottle are welded two fittings.

The upper fittings are connected with the pressure pipe, the lower fittings are used for evacuating the deposits. The operating pressure of the air bottles is 50 atm. and the pressure for the explosive test should not be less than 3 times the operating pressure.

After welding, the air bottles are undergone the heat treatment. The main air bottle is treated to a strength of $\sigma_b = 110 \pm 10$ kg./mm^2., the emergency air bottle to a strength of $\sigma_b = 80 \pm 10$ kg./mm^2

The air bottle has its outer surface painted with C04—42 black enamel and its inner surface phosphated and smeared with methyl (or ethyl) hydrogen-containing silicon oil.

The main air bottle is installed on the support between the frames 11 and 12 at the right side of the fuselage. On the support are riveted the straps with adjusting bolts and wing nuts for fixing the air bottle.

The emergency air bottle is installed on the support between the frames 10 and 11 at the left side of the fuselage. On the support is riveted the straps with turn-buckle for fixing the air bottle.

CHECK VALVE

In the pneumatic system are installed six check valves (Fig. 5.6). They restrict the flowing of the compressed air only in such a direction as indicated by the arrow marked on the case.

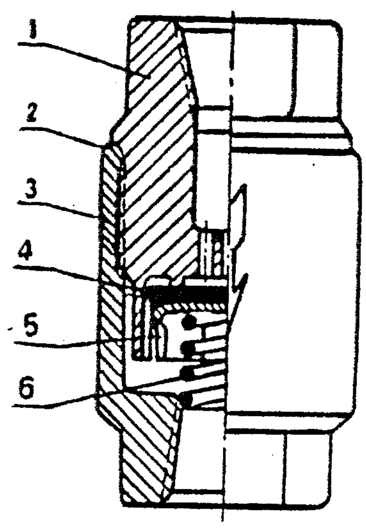


Fig. 5.6 Check valve

1. Valve seat 2. Sealing pad 3. Case 4. Rubber pad 5. Brass valve 6. Spring

Flowing through the holes of the valve seat 1, the compressed air presses the rubber sealing pad 4, valve 5 and spring 6, then enters the following pipe through the notch of the valve seat.

The inlet pressure of the check valve is higher than the outlet pressure. When the pressure difference is about one atm., the spring is compressed, the valve is opened and the compressed air flows to the following pipe of lower pressure. When the inlet pressure is lower than or equal to the outlet pressure, the valve is closed and the air stops flowing.

PRESSURE REDUCING VALVE

The QS-1 pressure reducing valve is installed on the box support made of 1 mm. thick dural sheets and fixed under the cockpit floor between the front and rear cockpits by rivets.

The QS-1 pressure reducing valve can reduce the pressure of the air entering the brake system. (The extent of pressure reducing depends on the travel of the push rod.)

The QS-1 pressure reducing valve (Fig. 5.7) consists of the push rod 1, rubber sleeve 4, piston 5, case 13, spring 6, large discharge valve 7, small discharge valve 8, large air inlet valve 10, small air inlet valve 12, etc.

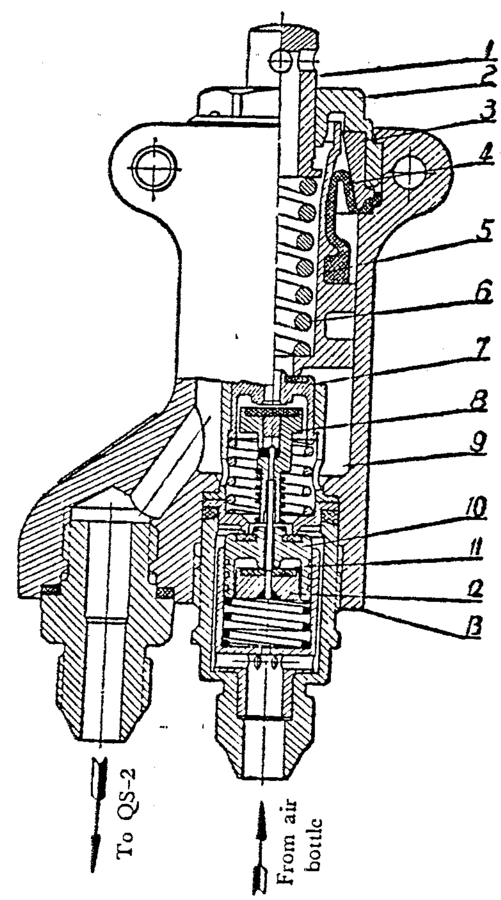


Fig. 5.7 QS-1 pressure reducing valve

1. Push rod 2. Nut 3. Pressure ring 4. Rubber sleeve 5. Piston 6. Pressure reducing spring 7. Large discharge valve 8. Small discharge valve 9. Intermediate chamber 10. Large air inlet valve 11. Lower chamber 12. Small air inlet valve 13. Body

When the push rod 1 is not pressed, the air passage from the air bottle is blocked by the large air inlet valve 10 and small air inlet valve 12, the brake system is communicated with atmosphere through the opened small discharge valve 8. When the push rod 1 has been pressed, the pressure reducing spring 6 pushes the piston 5 downwards, the piston seat presses against the large discharge valve 7, which contacts with the small discharge valve 8 in turn, and the brake system is then separated from the atmosphere. As the piston moves downwards further, the small air inlet valve 12 is opened and the air enters the brake system through the lower chamber and intermediate chamber of the QS-1 pressure reducing valve. As the small air inlet valve being opened, the air pressure under the large air inlet valve drops suddenly. Owing to the pressure difference between the air in the chambers above and below the valve, the large air inlet valve opens the large hole to offer an air passage, thus speeding up the course of braking.

When the pressure on the push rod being removed, the piston moves up and detaches from the large discharge valve, the air in the brake system is exhausted to the atmosphere through the small hole in the push rod of the QS-1 pressure reducing valve, thus releasing the brake.

BRAKE DIFFERENTIAL

The QS-2 brake differential is fixed on the boxlike support made of 2 mm. thick dural sheets and riveted under the rear cockpit floor.

The QS-2 brake differential can brake the left wheel and the right wheel of the landing gear either simultaneously or separately.

The QS-2 brake differential (Fig. 5.8) consists of the rocker 1, lever 2, piston 3, rubber sleeve 4, valve 5, pull rod 6, body 7, etc.

When the pedal control mechanism is located in the neutral position and the brake handle on the control stick is gripped, the compressed air enters the brake differential through the QS-1 pressure reducing valve and the nipple on the brake differential and pushes piston 3. The motion of the piston 3 which is limited by the lever 2 opens up the passage for leading the compressed air to the brake devices of the wheels through the outlet nipple of the brake differential.

The rocker 1 of the brake differential is connected with the pedal control mechanism by pull rod 6. When the rocker is deflected from the neutral position within 15°, it has no influence upon the braking.

When the rocker deflectes down more than 16°, the valve 5 at the right part of the brake differential moves up to the valve seat, the inlet for the compressed air into the upper chamber from the lower chamber is shut. The compressed air enclosed in the upper chamber and the brake device of the left wheel pushes the piston 3 upward and opens the outlet, then the compressed air in the left wheel brake device escapes to the atmosphere through the upper right chamber of the brake differential and the outlet hole on the piston. The pressure difference between the left and right chamber brings the brake moment difference to the left and right wheels, thus making the airplane turn along the predetermined direction.

When the rocker deflects up more than 16°, the airplane turns to the opposite direction.

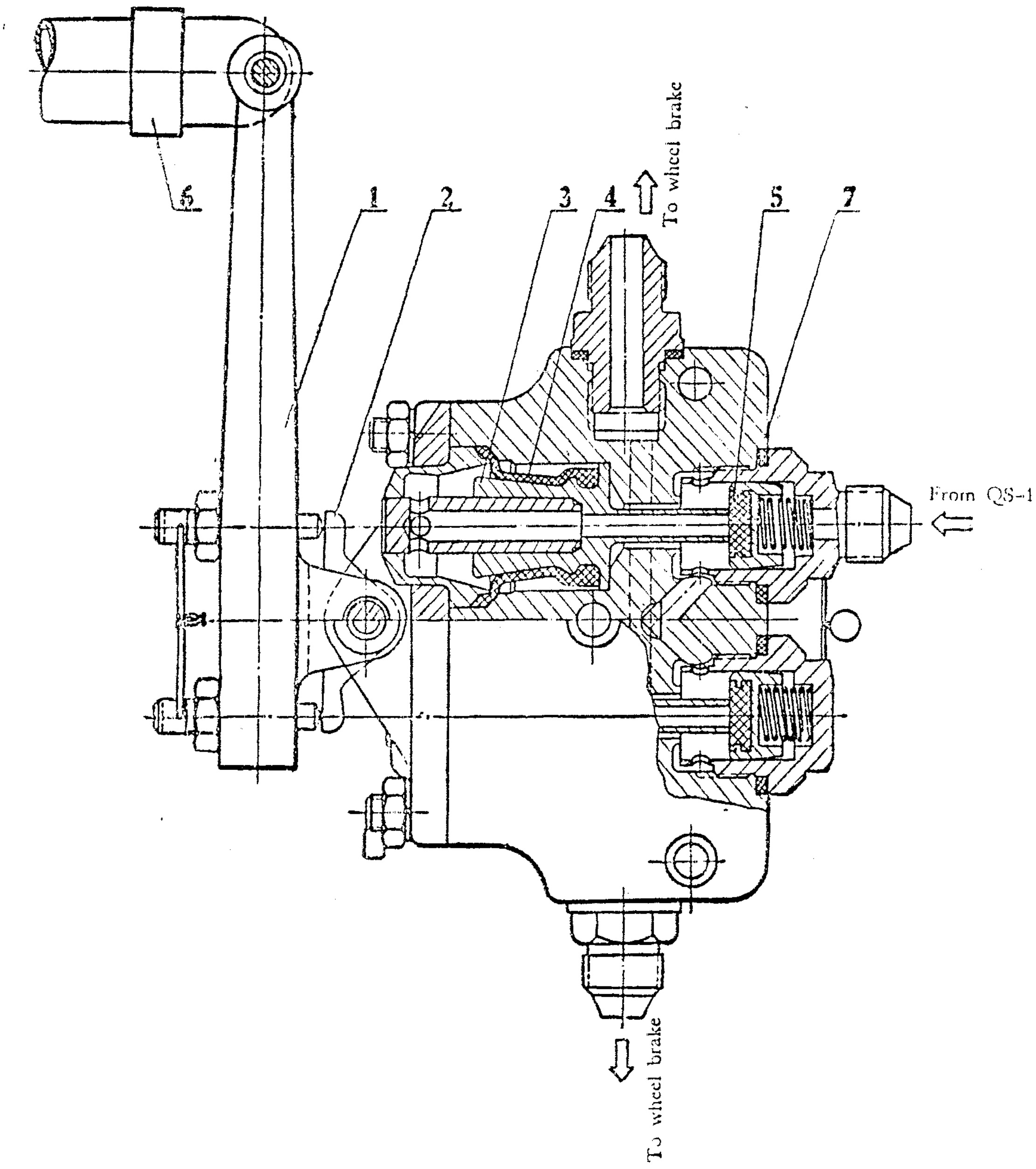


Fig. 5.8 QS-2 brake differential

1. Rocker 2. Lever 3. Piston 4. Rubber sleeve 5. Valve 6. Pull rod 7. Body

The valve 5 reaches the dead point position when the rocker deflects about 15+1°. At that time, the inlet is closed but the outlet not yet. When the compressed air leaves the pressure reducing valve, one chamber of the differential is communicated with the atmosphere, while in the other closed chamber, the piston 3 opens under the pressure of the compressed air, the compressed air escapes to the atmoshpere, too.

COMPRESSED AIR MAIN VALVE

The QSF-6A compressed air main valve (Fig. 5.9) is mounted on the left console in the front cockpit. When the handle is turned counterclockwise, the rod 6 is turned out along the threads on the nipple 9 and the cone is detached from its seat within the case, thus the compressed air from one pipeline enters the other pipeline.

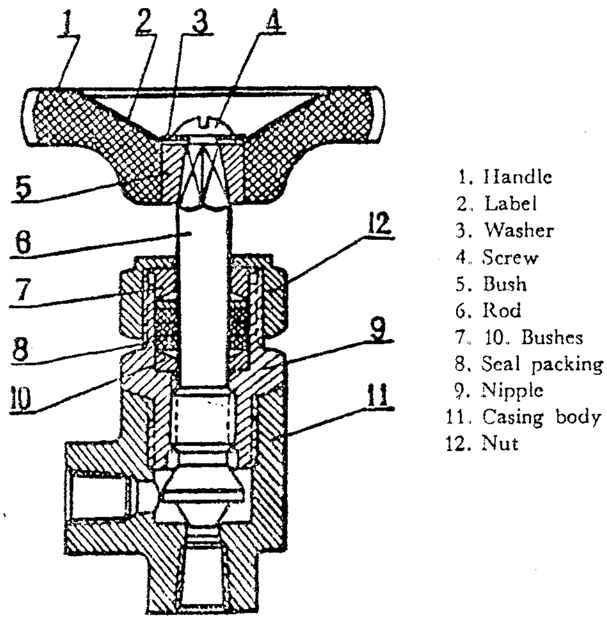


Fig. 5.9 Compressed air main valve

COMPRESSED AIR SOLENOID VALVE

The QDF-1 compressed air solenoid valve is mounted on the bracket of the frame 0. Solenoid coil is mounted inside the valve. The valve controlling the compressed air pipeline for engine starting is fixed on the iron core. When the starting button of the engine is pressed, the current flows through the solenoid coil which attracts the iron core. The valve is opend and the compressed air enters the starting distributor.

When the circuit is broken (without pressing the button), the iron core and the starting valve return to their original positions under the action of the spring, so the passage through which the compressed air enters the starting distributor is blocked.

LANDING GEAR CONTROL VALVE

Valves for controlling the landing gears are mounted on the left instrument panels of the front and rear cockpits respectively.

The compressed air enters the casing and the middle cavity of the albronze diverter valve through the middle nipple on the valve casing.

When the handle is turned to up or down position, the diverter valve rotates all along, the middle cavity and one of the outlet holes are intercommunicated. The compressed air from another cavity of the diverter valve enters the pipeline for retracting and extending the landing gear through the valve casing.

The diverter valve in the front cockpit is automatically lubricated by the oil holder mounted in the diverter valve. The lubricant is the HH-20 lubricating oil thinned with gasoline at a ratio of 1:1. Castor oil is used as the lubricant for the diverter valve in the rear cockpit. The control valves in the front and rear cockpits are connected with pipelines.

The operating principle of the landing gear control valves is shown in Fig. 5.10.

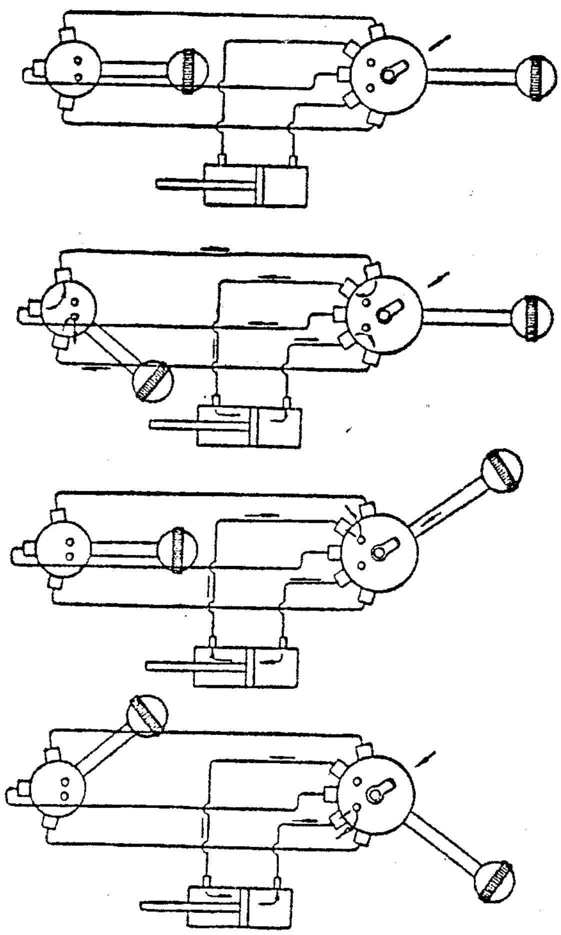


Fig. 5.10 Schematic of the operation principle of the landing gear control valves

The control valve in the rear cockpit is of the double-acting type. Only when the handle is set in the neutral position can the pilot in the front cockpit control the landing gear. Should the pilot in the front cockpit misoperate, his misoperation might be canceled by the pilot in the rear cockpit, who puts the double-acting valve handle in the desired position. At that time, the landing gear control valve in the front cockpit is cut off from the pneumatic system and the landing gears can only be controlled by the pilot in the rear cockpit.

FLAP CONTROL VALVE

The QSF-2A control valve for actuating the flap is mounted on each left console in the front or rear cockpit. The flap control valve operates in the similar way as that of the landing gear. The control valves in the front and rear cockpits are connected with the flap diverter valve and pipelines.

The compressed air enters the actuating cylinder for retracting and extending the flap via the flap control valve, flap diverter valve and side nipples when the flap control handle of the front cockpit is pushed.

When the flap control handle of the rear cockpit is pulled, the compressed air from the nut end of the flap diverter valve enters the flap diverter valve through the flap control valve of the rear cockpit and pushes the diverter valve, thus pressing the spring. The compressed air enters the actuating cylinder for retracting and extending the flap through the side nipple of the flap diverter valve. At that time, the pipeline of the flap control valve in the front cockpit is blocked by the rubber core of the diverter valve.

VALVE FOR EMERGENCY EXTENDING OF THE LANDING GEAR

The QSF-6A valve for emergency extending of the landing gear is mounted on either right console in the front or rear cockpits. Its operation and construction are similar to that of the compressed air main valve. A folding booster handle is mounted on the valve for emergency extending of the landing gear for facilitating its operation.

The two valves for emergency extending of the landing gear are connected to the pipelines in parallel, so that the landing gear can be urgently extended by controlling valve either in the front cockpit or in the rear cockpit.

EMERGENCY VALVE

In order to cut off the main pneumatic system as the landing gears are urgently extended, emergency valves are mounted on the "Down" nipples on the landing gear actuating cylinders and on the nipples of the actuating cylinders for the hook respectively.

The construction and operation principle of the emergency valve are shown in Fig. 5.11.

On one end of the valve casing is the nipple for connecting the landing gear extension pipeline of the main pneumatic system. On the other end of the valve casing is the nut with nipple which is used for connecting the compressed air pipeline for urgently extending the landing gear. At the side of the casing body is welded the nipple to be connected to the nipple of the actuating cylinder (Fig. 5.11).

A. The location of the diverter valve as the landing gear is extended through the pneumatic system.

B. The location of the diverter valve as the landing gear is extended through the emergency pneumatic system.

When the landing gear is extended through the main pneumatic system, under the action of the spring, the diverter valve presses the nipple 6 and blocks the nipple hole with

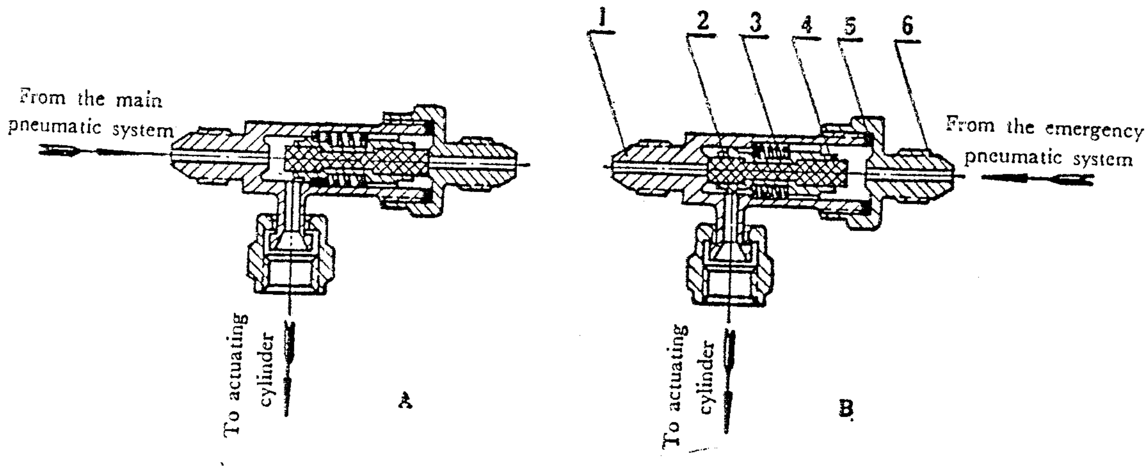


Fig. 5.11 Emergency valve

1. Casing 2. Diverter valve 3. Spring 4. Rubber core of the diverter valve 5. Sealing washer 6. Nipple

the rubber core, thus the compressed air enters the actuating cylinder through the side nipple.

When the landing gear is extended through the emergency pneumatic system, the compressed air enters the casing and pushes the diverter valve, thus pressing the spring. The rubber core blocks the hole of the casing nipple 1 and cuts off the main pneumatic system pipeline for extending the landing gear, and the compressed air in the emergency system enters the actuating cylinder along the slot of the diverter valve through the side nipple.

FLAP DIVERTER VALVE

The construction and operation principle of the flap diverter valve are similar to that of the emergency valve. The only difference is that the nipple welded on the casing of the flap diverter valve is cut with the $M12\times 1$-2a metric threads.

All the stiff pipelines of the pneumatic system are made of the $\phi 6\times 1$ anticorrosive aluminium alloy tube except that the braking pipeline are made of the $\phi 8\times 1$ anticorrosive aluminium alloy tube and that the segments of the pipeline from the air compressor to the deposit filter are made of the (20A) $\phi 6\times 1$ low carbon steel tube.

All the pipelines of the pneumatic system are sprayed with black enamel. All the pipe ends to be connected are flared with a conical angle of 74° except that the pipe end to be connected with the deposit filter is flared with a conical angle of 90°. The pipe segments are connected together with flat nipples and nuts, their joints are smeared with the ZQ10-3 seal grease. The pipeline is fixed with the clamping plates and collars.

The transitional fitting with flange is mounted on the pipeline at the sport where the pipeline passes across the fuselage frame or wall. The typical connections for such fittings are shown in Fig. 5.12.

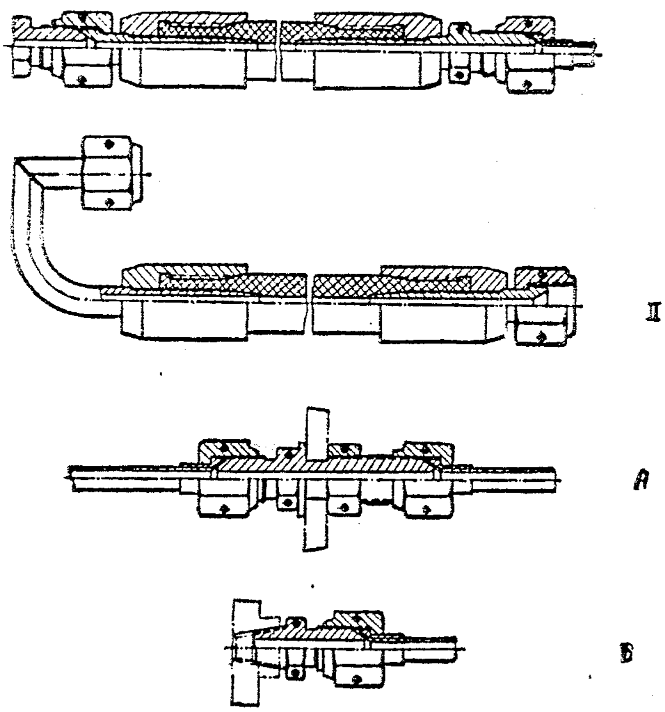


Fig. 5.12 Schematic of the typical connections

I. II. Hoses in the pneumatic system
A. B. Typical connections of the pipelines in the pneumatic system

Braided hose connections are employed for feeding the movable accessories and the engine with compressed air. The hose assembly (Fig. 5.12) consists of the 6Y4-50-HGX2-10-66 (replaced by 14Y4-120-HG6-417-66 from the beginning of the batch 27) braided hose, dural connecting sleeve and steel flat nipple, etc. On the spot of the hose where it contacts with other accessory is wrapped with black artificial leather.

In order to easily distingiush the pipelines of different functions from one another, the pipelines painted with black enamel are further painted with different identification colour collars.

The identification colour collars are conventionalized as follows:

Pipelines for extending the landing gears normally ....blue-red-blue
Pipelines for retracting the landing gears...................................blue-white-blue
Pipelines for extending the flap ....yellow-red-yellow
Pipelines for retracting the flap ....yellow-white-yellow
Pipelines for braking ....white-white-white
Pipelines for air charging ....green-green-green
Emergency pipelines ....red-red-red
Pipelines for the rest ....no colour collar

CHAPTER VI

POWER PLANT

The Airplane power plant system is composed of the following components:

1. The Model HUOSAI-6 engine equipped with an automatic pitch variation propeller type J9-G1 (modified as Model HUOSAI-6 JIA engine from the batch 18).

   Accessories installed on the engine are as follows:

   1) TS-1 speed regulator;
   2) QHQ-14 carburetor;
   3) CD-5 magneto (two);
   4) ZF-1.5 generator;
   5) KY-2 air compressor;
   6) CB-32 oil pump;
   7) XB-15A fuel pump;
   8) Starting air distributor;
   9) Tachometer driving gear;
   10) Each cylinder head is equipped with one starting valve and two DZ-5 spark plugs.

2. Engine mount;
3. Engine cowl;
4. Carburetor intake;
5. Exhaust system;
6. Fuel system;
7. Engine priming and starting system;
8. Lubricating oil system;
9. Engine control system.

I. BASIC TECHNICAL DATA OF THE MODEL HUOSAI-6 ENGINE

1. Engine code	HUOSAI-6
2. Cooling mode	air cooling
3. Number of cylinders	9
4. Arrangement of cylinders	single-row radial
5. Ordinal No. of cylinders	Numbered counterclockwise as viewed along the heading. The upper most cylinder is numbered as the cylinder 1.
6. Diameter of the cylinder	105 mm.
7. Piston stroke:	
1) Cylinder 4 (equipped with main connecting rod)	130 mm.
2) Cylinders 3 and 5	130.15 mm.

3) Cylinders 2 and 6	130.23 mm.
4) Cylinders 1 and 7	130.25 mm.
5) Cylinders 8 and 9	130.39 mm.
8. Total working capacity of all cylinders	10.161 liters
9. Compression ratio	5.9 ± 0.1
10. Direction of rotation (viewed along heading):	
1) Crankshaft	counterclockwise
2) Propeller shaft	counterclockwise
11. Type and transmission ratio of the speed reducer	planetary-type with three planet pinions, 0.787
12. Type of the propeller	J9-G1
13. Type and transmission ratio of the supercharger	incontrollable centrifugal type, 7.105
14. Engine altitude performance	not for high altitude
15. At take-off operating condition:	
1) Power	$260^{-2\%}$ hp.
2) Rotating speed	$2,350 \pm 1\%$ rpm.
3) Air-intake pressure (residual pressure in admission)	35 ± 10 mm.Hg (at full throttle)
4) Fuel consumption rate	255-280 g./hp-hr
16. At rated condition:	
1) Power	$220^{-2\%}$ hp.
2) Rotating speed	$2,050 \pm 1\%$ rpm.
3) Air-intake pressure (residual pressure in admission)	30 ± 10 mm.Hg (at full throttle)
4) Fuel consumption rate	240-255 g./hp-hr
17. At cruising condition:	
1) With 0.75 rated power:	
a. Power	165 hp.
b. Rotating speed	$1,860 \pm 1\%$ rpm.
c. Air-intake pressure	680 ± 15 mm.Hg
d. Fuel consumption rate	210-225 g./hp-hr
2) With 0.6 rated power:	
a. Power	132 hp.
b. Rotating speed	$1,730 \pm 1\%$ rpm.
c. Air-intake pressure	630 ± 15 mm.Hg.
d. Fuel consumption rate	205-225 g./hp-hr
18. Maximum permissible rotating speed at dive and other maneuver (with air-intake pressure not higher than 500 mm.Hg)	2,450 rpm.
19. Minimum rotating speed (idling speed)	500 ± 50 rpm.
20. Time for accelerating from idling rotating speed to take-off rotating speed (accelerating performance)	2-3 sec.
21. Permissible engine endurance:	
1) In take-off condition	5 min.

2) In rated condition — not limited
3) With the maximum permissible speed — 3 min.

22. Grade and mark of gasoline — RH-70
23. Octane rating of gasoline — not less than 70
24. Type and number of the carburetor — QHQ-14 diaphragm type, 1
25. Fuel pressure in front of the carburetor:
    1) In normal operating — 0.2-0.5 kg./cm².
    2) In idling — not less than 0.15 kg./cm²
26. Fuel pump:
    1) Type — XB-15A vane-type
    2) Number — 1
    3) Transmission ratio — 1.125
    4) Direction of rotation — clockwise
27. Grade of lubricating oil used in winter and summer — HH-20
28. Lubricating oil consumption rate in 0.75 rated power condition — not more than 12 g./hp-hr
29. Oil pump:
    1) Type — CB-32 gear-type with booster stage and return oil stage
    2) Number — 1
    3) Transmission ratio — 1.125
    4) Direction of rotation — counterclockwise
30. Oil pressure in the main pipe:
    1) In normal working condition — 4-7 kg./cm².
    2) In idling — not less than 1.5 kg./cm².
31. Engine inlet oil temperature:
    1) Optimal temperature — 50-65°C
    2) Permissible lowest temperature — 30°C
    3) Permissible highest temperature with engine continuous operating — not higher than 75°C
    4) Permissible highest temperature with engine endurance not more than 15 min. — not higher than 85°C
32. Permissible highest temperature of oil at engine outlet — not higher than 125°C
33. Oil flow rate in rated condition with inlet oil temperature 50-65°C — 3.9-7.5 kg./min.
34. Dissipation heat lose to oil in rated condition — not more than 160 kcal./min.
35. Cylinder head temperature (measured under rear spark plug of the cylinder 4):
    1) Proper temperature in level flight — 140-210°C
    2) Permissible lowest temperature with good acceleration — 120°C
    3) Permissible highest temperature with engine continuous operating — not higher than 230°C
    4) Permissible highest temperature with take-off and climbing endurance not more than 15 min. — not higher than 240°C

5) Permissible highest temperature with full climb endurance not more than 5 min. — not higher than 250°C

6) Temperature at shutdown:
With ambient temperature below 25°C — not higher than 150°C
With ambient temperature above 25°C — not higher than 165°C

36. Magneto:
1) Type — CD-5 four sparks shielding-type
2) Number — 2
3) Transmission ratio — 1.125
4) Direction of rotation — counterclockwise

37. Spark plug:
1) Type — DZ-5 shielding-type
2) Number for each cylinder — 2

38. Ignition sequence of cylinders — 1-3-5-7-9-2-4-6-8

39. In case of ignition with one magneto in rated and cruising condition (0.75 rated power), the permissible maximum loss of the crankshaft rpm. (propeller in low pitch) — 60 rpm.

40. Timing of engine cycle expressed in the rotating angle of the crankshaft (according to the cylinder 4):
1) Beginning of admission — 20° ±4' before top dead center
2) End of admission — 54° ±4' after bottom dead center
3) Beginning of exhaust — 65° ±4' before bottom dead center
4) End of exhaust — 25° ±4' after top dead center
5) Phase angle of admission endurance — 254° ±8'
6) Phase angle of exhaust endurance — 270° ±8'

41. Clearance adjustment of the intake valve for cool engine:
1) Clearance for inspecting the timing of engine cycle — 1.1 mm.
2) Installation clearance for engine operation — 0.3-0.4 mm.

42. For both the left and right magnetos, the maximum advance angle of ignition expressed in the rotating angle of the crankshaft — 31° ±1' before top dead center of compression stroke

43. Starting mode of the engine — start with compressed air

44. Speed regulator of the propeller:
1) Type — TS-1 centrifugal-type
2) Transmission ratio — 1.045
3) Direction of rotation — clockwise

45. Air compressor:
1) Type — KY-2 piston-type
2) Transmission ratio — 0.9
3) Direction of rotation — clockwise

46. Generator:
1) Type — ZF-1.5 D.C. shunt-type
2) Transmission ratio — 2.5
3) Direction of rotation — counterclockwise

47. Tachometer driving gear:
   1) Transmission ratio — 0.5
   2) Direction of rotation — counterclockwise
48. Net weight of the engine — $199^{+2}\%$ kg. (under allowance not limited)
   Note: The net weight of the engine does not include the weight of the following items:
   1) Generator with regulating box and filter
   2) KY-2 air compressor
   3) Residual oil inside the engine
   4) Engine mount ring with fixing parts
49. Residual oil weight inside the engine after acceptance and trial run — 2.5 kg.
50. Engine overall dimension:
   1) Diameter — 980 ± 5 mm.
   2) Length — 965 ± 3 mm.
51. Adjustment of the engine starting air distributor:
   When the piston of the cylinder 4 is situated at 12° after the top dead center of the compression stroke (according to the rotating angle of the crankshaft), the slide valve hole should be slid on the air pipe hole of the cylinder 4 with a passage gap not more than 0.1 mm.

II. GENERAL DESCRIPTION OF THE METALLIC PROPELLER TYPE J9-GI

The J9-G1 propeller is of the automatic adjusting type. Its automatic adjustment is based on the principle of positive variation through the hydraulic centrifugal force effect.

The propeller cooperated with the speed regulator type TS-1 keeps its rotating speed at a designated value automatically under various flying modes of the airplane. The blades are shifted into a lower pitch position with the help of the torque produced by the pressure of the lubricating oil which is pumped into the propeller cylinder by the adjusting pump, and into a higher pitch position with the help of another torque produced by the centrifugal force of the balance weights.

When the propeller operates, the torque produced by the balance weights tends to increase the pitch angle in any case.

If any failure happens to the lubricating system, the lubricating oil pressure in the propeller system drops, nevertheless the flight still goes on, as the blades have their pitch angle become higher.

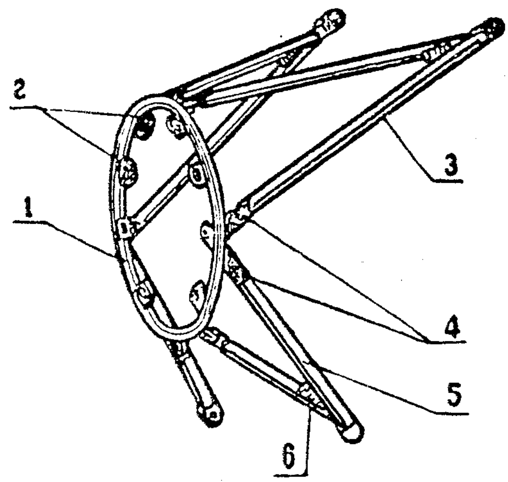
The basic data of the J9-G1 propeller are:

1. Type of the propeller — puller type with automatic pitch variation in flight
2. Method of pitch control — positive pitch
3. Principle of operation — hydraulic centrifugal
4. Direction of rotation — counterclockwise (along heading direction)
5. Propeller diameter — 2.4 m.

6. Number of blades — 2
7. Blade profile — RAF-6
8. Max. width of the blade — 167.5 mm.
9. Min. setting angle at the section of R=1,000 mm. — 16°
10. Max. setting angle at the section of R=1,000 mm. — 31°30′
11. Range of pitch control — 15°30′
12. Type of the regulator — TS-1
13. Setting angle of balance weights — 25°
14. Weight of the propeller and its accessories — 42.5 kg.

III. ENGINE MOUNT

The engine mount (Fig. 6.1) is a welded stereoscopic structure composed of eight tubular struts and a ring with boxes and eye plates.



1. Ring
2. Boxes
3. Upper jackstay
4. Connecting bolt
5. Lower jackstay
6. Gusset

Fig. 6.1 Engine mount

The eight jackstays are grouped into the two upper (right and left) pairs and the two lower (right and left) pairs. The upper pair is made of two CrMnSi alloy steel tubes of 25×1 and 29×1 size. Its intersecting end is welded with a gusset made of 1.5 mm. thick CrMnSi alloy steel sheet and a die pressed fork made of CrMnSi alloy steel and connected with the fuselage. At the other end of each strut is welded a forked end fitting made of CrMnSi alloy steel and connected with the eye plate of the ring.

The lower pairs of the jackstay are made of 25×1 steel tubes. They have the structural form like that of the upper ones but are shorter. On both the lower right pair and the left pair are welded a ground strip made of 2 mm. thick low carbon steel sheets.

The ring is made of 27×1.5 CrMnSi alloy steel tube by bending and will be connected directly with the engine. Along the ring are eight boxes and eight eye plates. The boxes are made of 2 mm. thick CrMnSi alloy steel sheets. The eye plates welded on the ring are made of the same steel by die pressing and are connected with the jackstays.

The ring, the upper and lower pairs are all heat-treated to a strength $\sigma_b = 80 \pm 10$ kg./mm². after their being welded.

The ring is connected with the upper and lower jackstays with eight CrMnSi alloy steel bolts of 8 mm. diameter.

The engine mount and the engine are connected together with eight studs of 10 mm. diameter heat-treated to a strength $6_b=80\pm10$ kg./mm². Each box for holding the engine is filled with two rubber bushes to absorb shock.

The engine mount is fixed to the fuselage fittings with four CrMnSi alloy steel bolts of 10 mm. diameter.

All the nuts for the support studs are secured with split cotter pins.

IV. ENGINE COWL

The cowl of the Model HUOSAI-6 engine is detachable (Fig. 6.2).

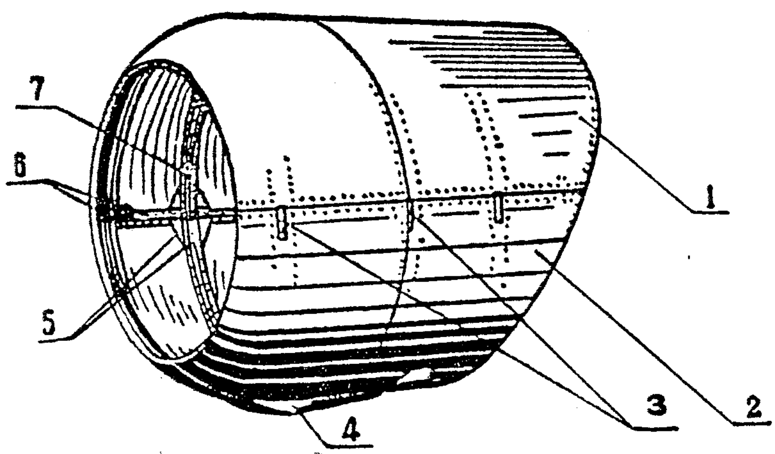


Fig. 6.2 Engine cowl

1. Upper cover 2. Lower cover 3. Fastener 4. Cap of the carburoter intake
5. Wear plate 6. Longitudinal section material 7. Transversal section material

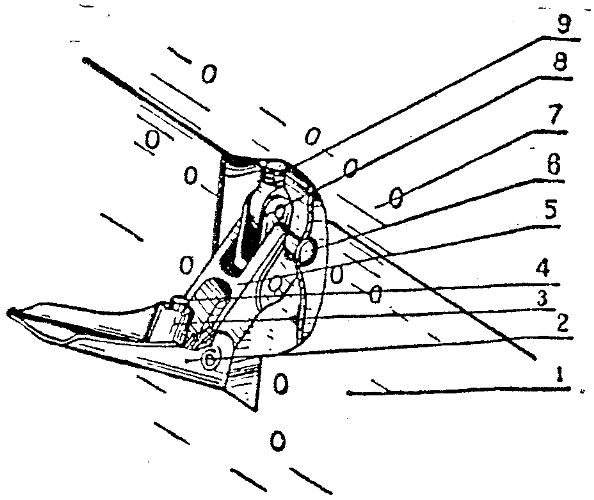
The controllable gill is installed nearby the air intake of the cowl.

The upper part of the cowl has its shape conformable with the contour of the fuselage. The lateral parts and the lower part of the cowl stretch beyond the contour of the fuselage, therefore between the cowl (along its rear edge) and the fuselage skin exists the gap through which escapes the air flow having cooled the engine cylinders.

The cowl is composed of the upper cover and the lower cover. They are connected into a whole with six fasteners of rocker structure type (Fig. 6.3), which are fixed at the ends of the transversal section material of the cowl.

The upper and lower covers are mounted on the fittings of the fuselage frame 0 with tubular shaft and fixing pins respectively.

When the cowl is in the shut position, its front rim laps uniformly over the outer ring of the gill and the baffles of the engine, and the upper rear part of the upper cover laps over the rubber sealing strap located on the fuselage frame 0 and wrapped up in varnished fabric.



1. Lower cover of the cowl
2. Cover
3. Guiding sleeve for the catch pin
4. Catch pin
5. Rocker
6. Pin
7. Upper cover of the cowl
8. Ring
9. Eyebolt

Fig. 6.3 Fastener of the engine cowl

When the upper cover is opened, it is supported with a folding tubular strut. One end of the strut is fixed on the seat of the clamping hoop of the left main exhaust pipe, while the other end on the eye plate of the upper cover. When the lower cover is opened, it is pulled by a cable stopper. The stopper has its one end fixed on the section material of the lower cover with an eyebolt, and its other end connected with the eye plate of the gill link by means of a hook.

The cowl is made of 0.8 mm. thick dural sheets reinforced with longitudinal and transversal section materials. The rear skin of the upper cover is composed of two pieces longitudinally lap riveted.

The transversal section materials of the cowl and the two longitudinal section materials on the top of the upper cover are all made of 1 mm. thick dural sheets. The longitudinal section materials fixed along the dividing line of the cowl are (XC111-18) dural ones.

On the front skin of the cowl are riveted two half-rings made of 20×1 dural tubes.

The rear edge of the cowl is reinforced with (XC611-3) dural flanged section material. The rings of the side fasteners on the upper cover are made of 1 mm. thick low carbon steel sheets and riveted together with the skin and the longitudinal section material. The fastener seats on the lower cover made of CrMnSi alloy steel sheets are served as the parts for locating and supporting the upper cover. The places where the rings and the fastener seats are mounted are reinforced with 1 mm. thick dural backing plates.

On the top longitudinal section materials of the upper cover are mounted two steel supports for installing the suspending frame of the upper cover.

The suspending frame is made of 18×1 dural tubular shaft, on each end of which is revited a steel rod (Fig. 6.4). On the extended end of the steel rod is welded a transverse steel tube. An inside threaded metallic sleeve filled with the shock absorbing fitting is welded on the end of the transverse steel tube.

The longitudinal section materials along the dividing line of the upper cover have their rear ends riveted with fixing pins. When the cowl is shut, the fixing pins coopera-

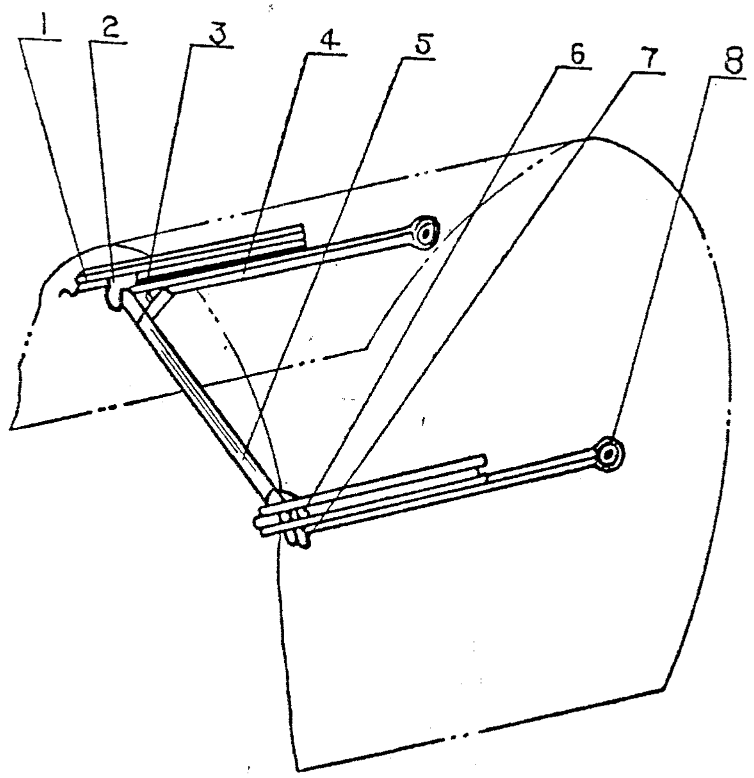


Fig. 6.4 Suspending frame of the enigne cowl

1. Section material 2. Support 3. Box 4. Tube 5. Tubular shaft 6. Wooden filler 7. Steel rod 8. Shock absorbing fitting

ted with the fasteners are inseited into the holes of the longitudinal section materials of the lower cover to unite the twin covers into a whole.

On the top of the upper cover is installed the door for the lubricating oil filler.

The cap of the air intake is cut with an opening and riveted along the bottom symmetric axis of the lower cover below the carburetor intake. The opening makes the dust filter stand in the unobstructed air flow. Two layers of screens are riveted on the cap to improve the cleaning effect.

A reinforcing padding steel sheet conformable to the periphery of the seal packing of the dust filter fairing is riveted on the lower cover to prevent its skin from being worn away.

On the rear transverse section material of the lower cover are riveted two supporting brackets to be connected with the fuselage. The brackets are made of low carbon steel and provided with rubber shock absorbers. The lower cover has its rear left side provided with an inspection door and its bottom cut with an opening for passing through the main exhaust pipe.

When the two front half-rings of the cowl are in the closed position, the taper pins of the lower cover are inserted into the ends of the half-ring on the upper cover to combine the twin half-rings into a whole. The front half-rings and the front transverse section materials of the cowl are coated with a 1.5 mm. thick layer of 320M-3 rubber to reduce the abrasion caused by the friction between the front half-rings and the gill outer ring and between the front half-ring and the baffles.

PROPELLER DOME

The propeller dome is fixed on the top of the propeller oil cylinder with dural nuts and acts as a heat insulator for it.

The dome is made of 1.2 mm. thick dural sheet by spinning. Its front part is riveted with a flange. Its rear part is reinforced with a 0.8 mm. thick dural ring. Its inside is stuck with woolen cloth lining to improve the heat insulation effect.

GILL

The gill situated at the inlet of the engine cowl is used to control the engine cylinder head temperature. It is of the shutter type and composed of the movable ring, fixed ring, twenty-eight pieces of shutters, outer ring etc.

The outer ring is made of the (XC-114-27) dural section material by bending. Acting as the support for the engine cowl and the sealer, a packing ring made of spongy rubber cord wrapped in artificial leather is glued around the periphery of the outer ring with the XY-401 glue.

In order to improve the cooling of the upper shielded cylinders, on the upper part of the outer ring is riveted the baffle made of 0.8 mm. thick dural sheet. The fixing ring and movable ring are made of cast aluminium.

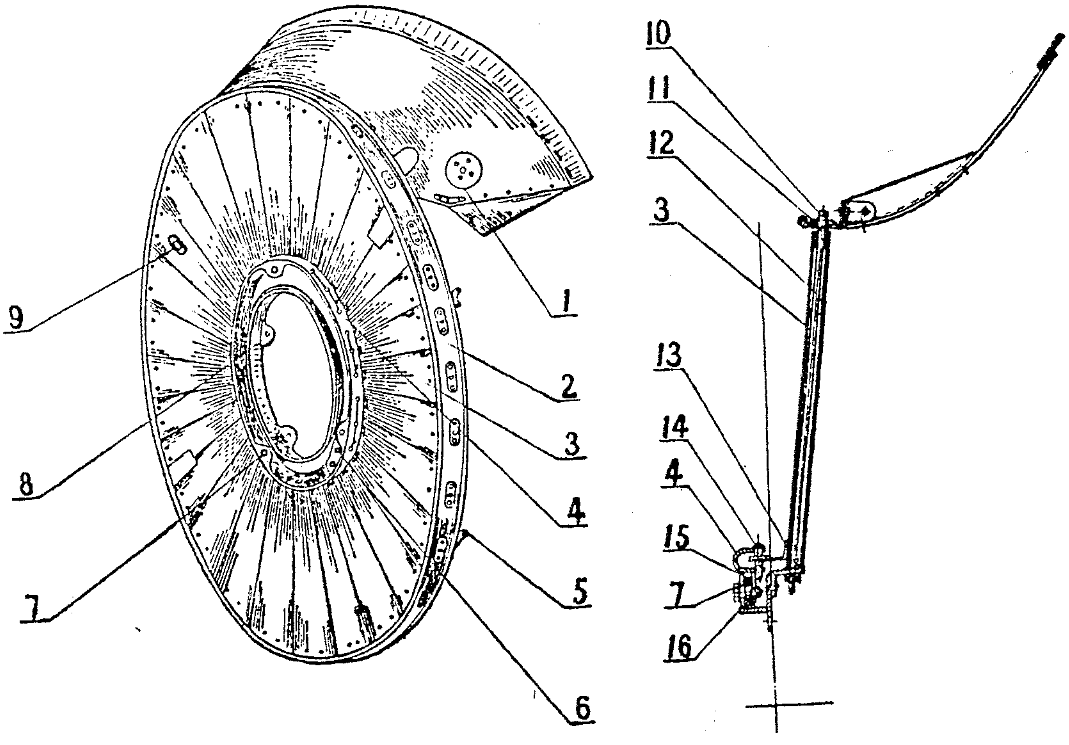


Fig. 6.5 Gill

1. Baffle 2. Outer ring 3. Shutter 4. Movable ring 5. Section material for fixing the link 6. Bolt for fixing the control support 7. Eccentric bolt 8. Fixed ring 9. Removable shutter 10. Sleeve 11. Shim 12. Rotating axle of the shutter 13. Wobbler 14. Bolt 15. Ball bearing 16. Track

The shutter has its skin made of 0.6 mm. thick dural sheet. A stiffening wooden block is inserted in each end of the shutter and glued to the skin with epoxy resin. The inlaid steel block with steel sleeve is riveted nearby the end of the rotating axle. The steel sleeve at the root of the shutter is riveted with a steel plate.

The rotating axle cf the shutter is made of medium carbon steel and installed between the outer ring and steel ring which is riveted on the fixed ring.

On the outer ring are riveted the flanged steel sleeves to guide the rotating axles. The rotating axle has two side teeth on its upper end to be matched with the milled notches of the steel sleeve on the outer wing, so that the rotating axle itself is restrained from rotation.

On the root of the shutter is riveted the steel wobbler whose end is situated within the peripheral channel of the movable ring. The bolt installed along the periphery of the movable ring passes through the longitudinal slot of the wobbler. As the movable ring is turned, the wobbler is wobbled through the bolt, thus making the shutter rotate about its rotating axle.

The movable ring has three lugs. A ball bearing is inserted in the slot of each lug and fixed with eccentric bolt. The eccentric bolts are used to eliminate the loosening and keep the concentricity between the movable ring and the fixed ring.

When the movable ring is turned, the ball bearings slide along the tracks made of 4 mm. thick CrMnSi alloy steel strips, isothermally quenched to a strength $\sigma_b = 140$--160 kg./mm^2 and fixed on the fixed ring with countersunk rivets.

The steel support for the gill control link is fixed on the bulge of the movable ring with two bolts.

The very piece of the shutter opposite to the propeller (TS-1) regulator is made detachable so that the propeller pitch variation adjusting screw is easy of access and to be adjusted.

The detachable shutter has its outer end riveted with the spring acted fixing pin, and its root riveted with the steel axle with eye plate.

The two pieces of the shutters on the right and left sides of the gill are provided with rectangular openings, through which admit streams of air for cooling the generator and the air compressor.

The gill is fixed on the engine gearbox with four studs of 7 mm. diameter. Its outer ring and baffle are fixed on the stud seats of the engine cylinders with thirteen links.

The necessary clearance between the propeller and the contour of the fully opened shutters is assured by the steel ring riveted on the fixed ring. The conical angle of the steel ring makes the outer ring out of the plane of the fixed ring so that the rotating axles of the shutters will tilt backwards by an angle of 3°.

The shutter can turn an angle up to 60°—65°.

COOLING OF ENGINE ACCESSORIES

The air streams cooling the generator and the air compressor are brought in through their own pipelines respectively.

The cooling air pipeline of the generator is composed of the air inlet funnel, connecting tubes and hoses. The funnel is made of 1 mm. thick anticorrosive aluminium alloy sheet. Passing through the opening of the gill, the front end of the funnel is fixed on the gill outer ring with four bolts. The other end of the funnel passes through the hole of the engine baffle and is connected to the tube made of 1 mm. thick anticorrosive aluminium alloy sheet. The tube has its front end fixed on the engine baffle with its welded flange and its rear end fixed on the pipe branch with the hose, two sleeves and two clamping hoops. The pipe branch is riveted on the clamping hoops of the generator.

The cooling air pipeline of the air compressor is composed of the front pipe branch and another pipe branches which lead the air to the cooling fins of the air compressor.

The front end of the front pipe branch passes the right opening of the gill and is fixed on the baffle between the engine cylinders 7 and 8 with the flange. The other end of the front pipe branch is connected with another pipe branch which is fixed on the oblique jackstay of the engine mount with clamping hoop made of 0.8 mm. thick stainless steel sheet.

V. AIR INTAKE OF THE CARBURETOR

The air intake located between the cylinders 5 and 6 is mounted on the carburetor with the flange and four studs. Between the flange seat and the fixing flange of the air intake are fitted the metallic dust screens and rubber bonded asbestos gasket.

The air intake (Fig. 6.6) consists of the dust filter of the screen type, filter fairing, warming box and warming funnel.

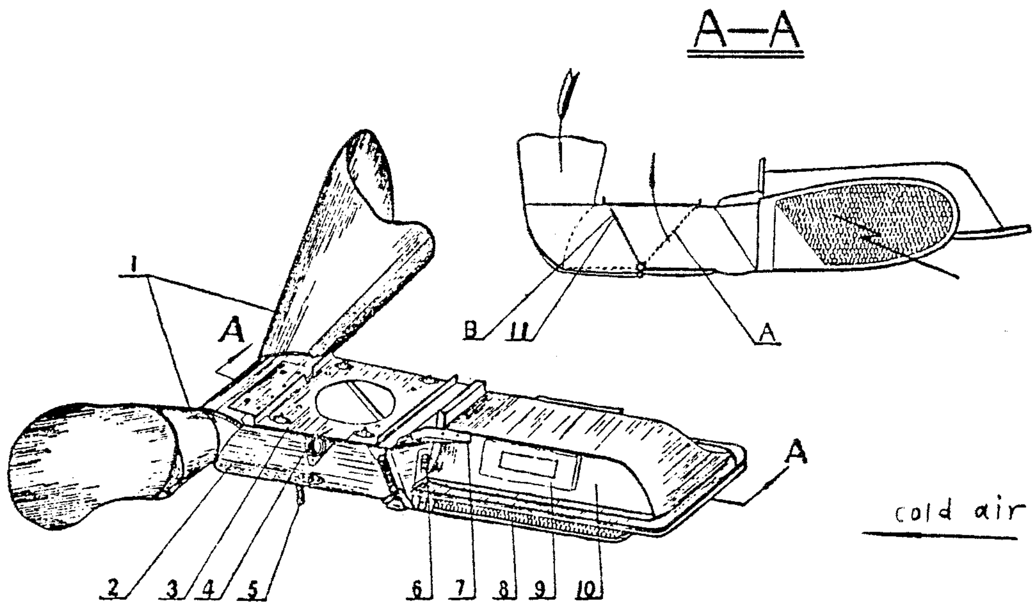


Fig. 6.6 Air intake of the carburetor

1. Warming funnel 2. Warming box 3. Flange for fixing the air intake on the carburetor 4. Adapter for fitting the air temperature transmitter 5. Drain 6. Screw 7. Bracket 8. Dust filter 9. Packing 10. Filter fairing 11. Throttle

The filter is composed of the screens brazed on the lateral plates with HISnPb58-2 solder. The installing edge of the lateral plate is connected with the connected part and the shim (made of 0.5 mm. thick tin plate).

The dust filter above which a fairing is covered is mounted on the warming box with four special screws. The fairing is made of 1.2 mm. thick anticorrosive aluminium alloy sheets and is installed on the warming box with two dural brackets. The fairing is sewn with felt along its bottom perimeter, lateral walls and rear part.

The warming funnel is made of 1 mm. thick anticorrosive aluminium alloy sheets and fastened on the warming box with hinge wing and two fixing screws. Three layers of screen are installed within the warming funnel to improve the dust cleaning effect.

The other hinge wing is riveted on the warming box. On the right wall of the warming box is riveted the adapter for the temperature transmitter. On the tubular axle within the box is fixed the throttle for controlling the quantity of warmed air fed to the carburetor. The throttle is turned by the pull rod welded on the left (refering to flight direction) extended end of the throttle axle.

The throttle is controlled with the control handle mounted on the left console of the front cockpit. The control handle and the pull rod are connected with the semi-rigid link.

When the throttle is turned to the position "A", the warmed air enters the warming box chamber and the carburetor through the trumpetlike pipe branch.

When the throttle is turned to the position "B", the inlet passage of the warmed air is blocked. The cool air enters the warming box chamber and carburetor through the dust filter.

On the bottom of the warming box is riveted the plastic drain through which the deposit such as the dirty water in the box is evacuated.

VI. MAIN EXHAUST PIPE

The two separated pipes, the right main exhaust pipe and the left main exhaust pipe, constitute the engine exhaust pipe system, through which the exhaust gas bleeds under the airplane.

Both the right and left main exhaust pipes are composed of serveral pipe branches. The right one has four pipe branches connected with five corresponding cylinders, the left one four pipe branches connected with other four corresponding cylinders.

All the pipe branches are made of 0.8 mm. thick low carbon steel sheets and are jointed together with clamping hoops and shims, which are composed of 0.3 mm. thick (1 Cr 18 Ni 9 Ti) heat resisting steel strips and the asbestos fiber.

The abutting end of each pipe branch is welded with a flanged sleeve for its reinforcement (Fig. 6.7).

The main exhaust pipe is connected to the engine through the flared pipe ends welded on each pipe branch, sleeve nuts and elastic rings.

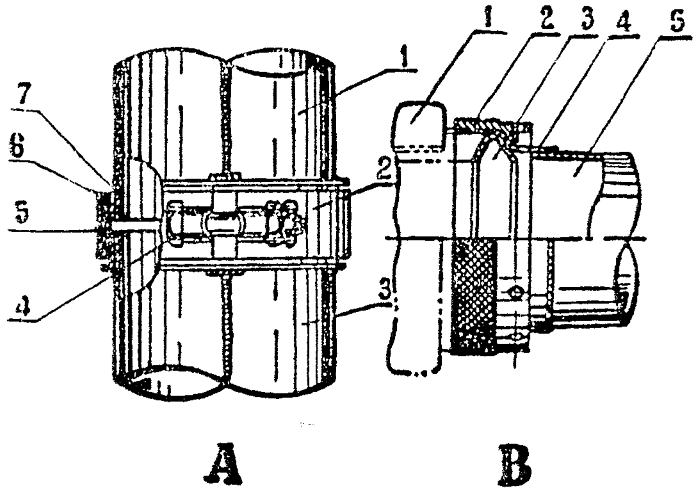


Fig. 6.7 The exhaust branch to be connected with another pipe branch or with the engine

A. The butt joint of exhaust pipe branches:
1. 3. Exhaust pipe branches 2. Clamping hoop 4. Bolts 5. Metal-asbestos shim 6. Heat resisting steel gasket 7. Flanged sleeve

B. The connection of the exhaust pipe branch with the engine:
1. Engine cylinder head 2. Nut 3. Elastic ring 4. Flared pipe end 5. Exhaust pipe branch

VII. ENGINE CONTROL SYSTEM

The engine control system includes the mechanisms controlling the air and fuel mixture throttle, altitude regulator, fire-proof valve, propeller rotating speed regulator, warmed air throttle, gill shutters and oil radiator cooling air throttle.

The air and fuel mixture throttle, altitude regulator, (TS-1) rotating speed regulator and fire-proof valve are controlled with the corresponding handles installed in the left consoles in both the front and rear cockpits (Fig. 6.6). The handles and the controlled accessories are connected with semi-rigid links.

The air warming box throttle is controlled with such handle and link as those of the accessories mentioned above, but the control is solo operated, as the handle and the link are installed in the left console in the front cockpit only.

All the handles are made of 3 or 4 mm. thick dural sheets and equipped with plastic handholds. Each handhold is fitted with a plexiglass name plate with character signifying its function such as "Air and fuel mixture throttle", "Altitude regulator", "Warmed air", "Fire-proof", "Propeller pitch vairation", etc. Moreover, the consoles are provided with index plates nearby the handle to signify the function of the corresponding handles and its direction of motion.

All the characters on the name plates are painted with luminous powder.

The handles controlling the altitude regulator, air and fuel mixture throttle, propeller rotating speed regulator, fire-proof valve and air warming box throttle are installed

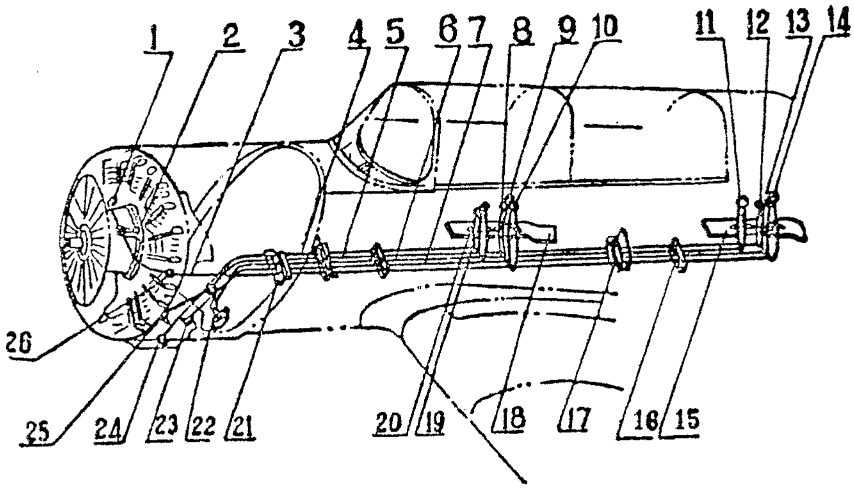


Fig. 6.8 Engine control system

1. Rocker of the TS-1 speed regulator 2. Link seat of the TS-1 speed regulator 3. Control link of the TS-1 speed regulator 4. Control link of the air warming box throttle 5. Control link of the altitude regulator 6. Control link of the fire-proof valve 7. Control link of the air and fuel mixture throttle 8. 12. Handles for controlling the altitude regulator 9. 13. Handles for controlling the air and fuel mixture throttle 15. Left console in the rear cockpit 16. 17. Tubular clamps for the links between cockpits 18. Left console in the front cockpit 20. Handle for controlling the air warming box throttle 21. Rubber seal packing 22. Rocker of the fire-proof valve 23. Rocker of the altitude regulator 24. Rocker of the air warming box throttle 25. Rocker of the air and fuel mixture throttle 26. Seal packing between the link and engine baffle opening

on the rotating shafts with textolite fillers and tightened with nuts. The aptness of moving of the handles is adjusted with the locking hand wheels or the nuts on the shaft;

The control of the gill shutters and the oil radiator cooling air throttle (Fig. 6.9) are performed with the mechanisms (Fig. 6.10) mounted on the left instrument panel and right console in the front cockpit respectively. The mechanism is composed of the dural casing, nylon handhold, triple rectangular threaded screw made of medium carbon steel nuts, indicators, etc.,

The handwheel has a squarish hole, in which is inserted the extended square end of the screw. They are fastened each other with the screw and the spring within the handwheel. On the junction plane of both the casing and the handwheel are cut smooth teeth to prevent the screw from spontaneous turning.

On the bottom of the nut is installed the stop screw to restrict the travel of the nut. On the top of the nut is installed the guiding stud.

The indicator looks like a twisted axle, on one end of which is installed the pointer painted with luminous powder.

The nut is integrated with the fitting for the control link. When the handwheel and the screw are turned, the moving nut brings the fitting on an axial motion, thus controlling the opening of the gill shutters or the oil radiator cooling air throttle.

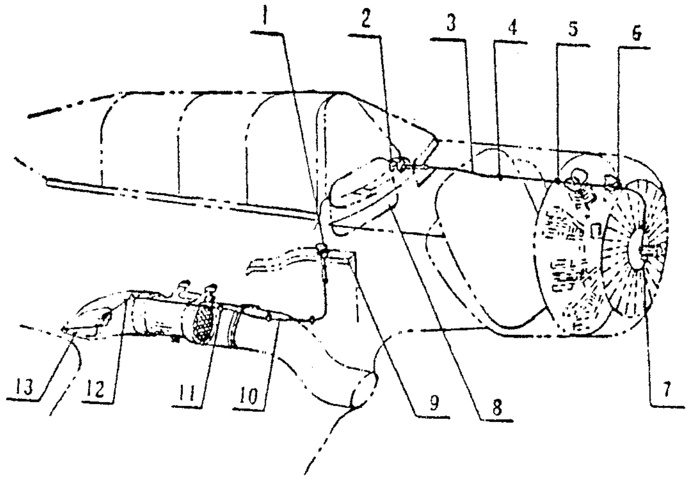


Fig. 6.9 Gill shutters control and oil radiator cooling air throttle control

1. Handle for controlling the oil radiator cooling air throttle 2. Handle for controlling the gill shutters 3. Control link of the gill shutters 4. Rubber ring 5. Clamping hoop 6. Sleeve and collar 7. Control rocker for gill shutters control 8. Instrument panel in the front cockpit 9. Right console in the front cockpit 10. Control link of the oil radiator cooling air throttle 11. Clamping hoop 12. Rubber ring 13. Oil radiator cooling air throttle

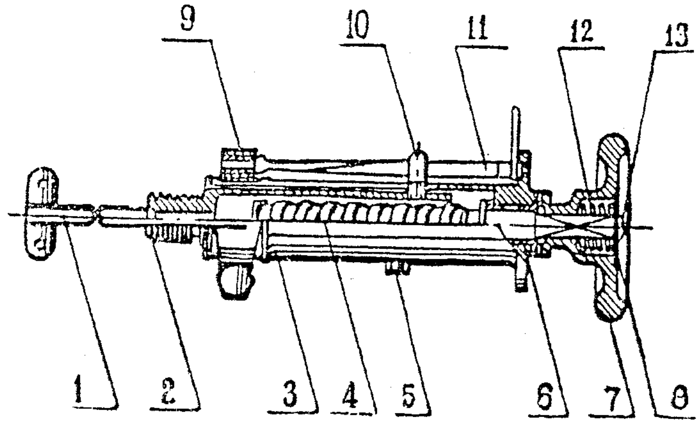


Fig. 6.10 Control mechanism

1. Holder 2. Nut 3. Casing 4. Screw 5. Stop screw 6. Sleeve 7. Handwheel 8. Washer 9. Sleeve 10. Guiding screw of the indicator 11. Indicator 12. Spring 13. Screw

All the links of the engine control system are of the semi-rigid type. The link is made of (HB7×7-4.5-Z-YB261-64) steel cable enveloped in the $\phi 8\times 1$ copper alloy guiding tube. Both terminals of the cable are ended with a fitting by pressing.

In order to reduce the friction between the steel cable and the guiding tube, the cable is smeared with the lubricant ZL7-2.

The link joints of the control handles and the accessories are of the ball and socket joint type or the fork joint type.

The engine control links are installed in the clamping holders of the special bracket fixed to the fuselage frame with bolts.

The link of the air and fuel mixture throttle is fixed on the lower left engine mount jackstay with the welded holders. The link of the propeller pitch variation control is fixed on the front gear box of the engine. The welded holder for fixing the propeller pitch adjusting screw (stopper) is made of CrMnSi alloy steel sheets and installed on the engine nearby the propeller rotating speed regulator.

The control link of the gill shutters passes through the frame 1, fire wall and engine baffle from the left side of the front cockpit and is connected to the rocker of the gill shutters.

The control link of the oil radiator cooling air throttle is at first installed on the cockpit floor, passes across the fuselage frame 3 and its successors including frame 6, pierces through the floor between frames 7 and 7A and is finally connected to the rocker of the air warming box throttle. The link is mounted with the holders and clamping hoops installed on the frames 3 and 4 and the section materials of the front spar and floor.

The guiding tubes for the control links of the gill shutters and air warming box throttle are connected to the casing of the control mechanisms through tubular clamps and special brackets.

The places where the links pass across the fire wall and the engine baffles are all fitted with rubber rings and rubber sleeves as sealing packing.

VIII. FUEL SYSTEM

The fuel system (Fig. 6.11 and Fig. 6.12) is constituted of two fuel tanks of 77 liters capacity, the feed tank, SB-1 hand pump, ZSQ-6 primer, (GUR-7I, GUR-7II) transmitters of the fuel level gauge, (GY-1) fuel pressure transmitter, (RDF-3) oil thinning valve, fire-proof valve with fuel filter, check valve, pipelines and such engine accessories as the (XB-15A) fuel pump, (QHQ-14A) carburetor, etc.

Fuel flows into the feed tank installed before the rear spar of the midwing through the $\phi 14\times 1$ pipes from two main tanks simultaneously. The feed tank is installed at the lowest position of the whole system. This arrangement ensures that the fuel can bleed completely through the bleeder of the feed tank. The fuel flows through the check valve and fire-proof valve into the fuel filter for its final filtration along the $\phi 12\times 1$ pipes, then enters the fuel pump mounted on the engine and at last enters the carburetor.

The check valve is installed between fuselage frames 3 and 4 to prevent the fuel in the system from flowing back into the tank and to prevent the fuel that has been pumped out by the hand pump from being re-sucked while the hand pump is operated. On the check valve are mounted two cross fittings which are connected with compensating pipes made of $\phi 6\times 1$ anticorrosive aluminium alloy tubes.

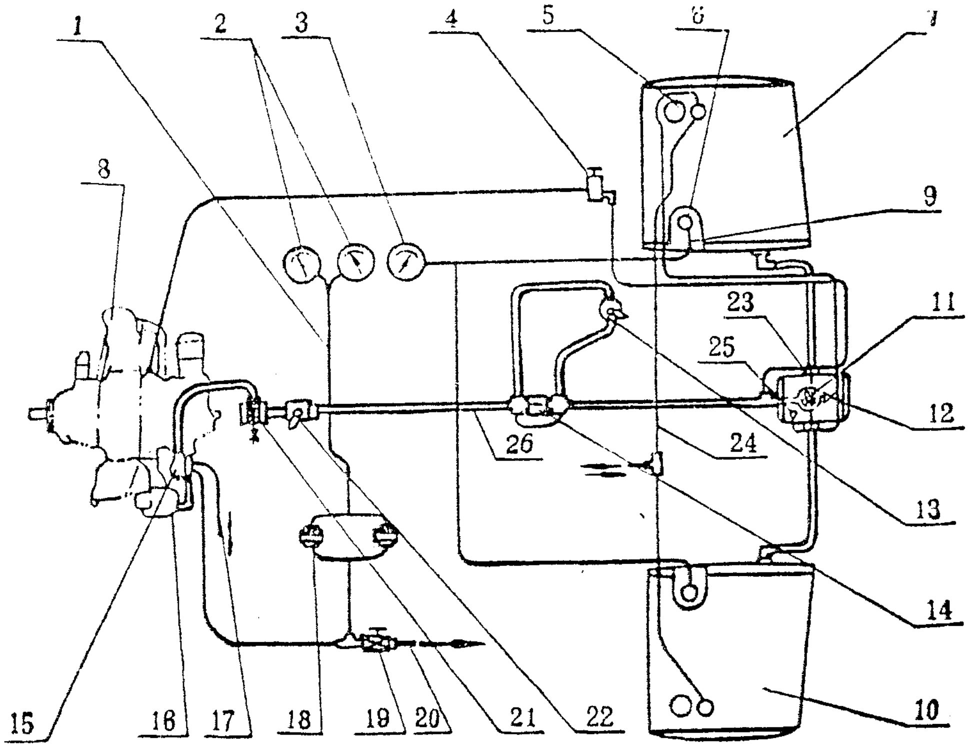


Fig. 6.11 Diagrammatic sketch of the fuel system

1. Cable 2. Fuel pressure gauge 3. Fuel level gauge 4. Primer 5. Fuel tank filler 6. Transmitter of the fuel level gauge 7. Right fuel tank 8. Engine 9. Cable 10. Left fuel tank 11. Feed tank 12. Bleeder 13. Hand pump 14. Check valve 15. Fuel pump 16. Carburetor 17. Return pipe for the fuel pump 18. Fuel pressure transmitter 19. Oil thinning valve 20. Oil thinning duct 21. Fuel filter 22. Fire-proof valve 23. Check valve on the feed tank 24. Vent of the main tank 25. Vent of the feed tank 26. Fuel supply pipe

By means of four bolts, the SB-1 hand pump in parallel connection with the check valve is fixed on the section material of the fuselage floor located in the right console of the front cockpit.

The hand pump is used to pump the fuel into the carburetor through the supply pipe before starting the engine, it may also be used as an emergency pump in case of any failure having happened to the fuel pump.

The fire-proof valve with fuel filter is fixed on the frame 0 with two bolts through the lugs on the case.

The drainage of the tanks and pipelines may be carried out with the bleeder of the feed tank. The fuel in the main tanks may also be bled through their own bleeders. The general outlet for the vents of the tanks gets in touch with atmosphere through the lower skin of the fuselage.

The fuel pressure is indicated by the (GWY-1) electric triplex gauge. The electric triplex gauge is a guage unit used for measuring fuel pressure, oil pressure and oil tem-

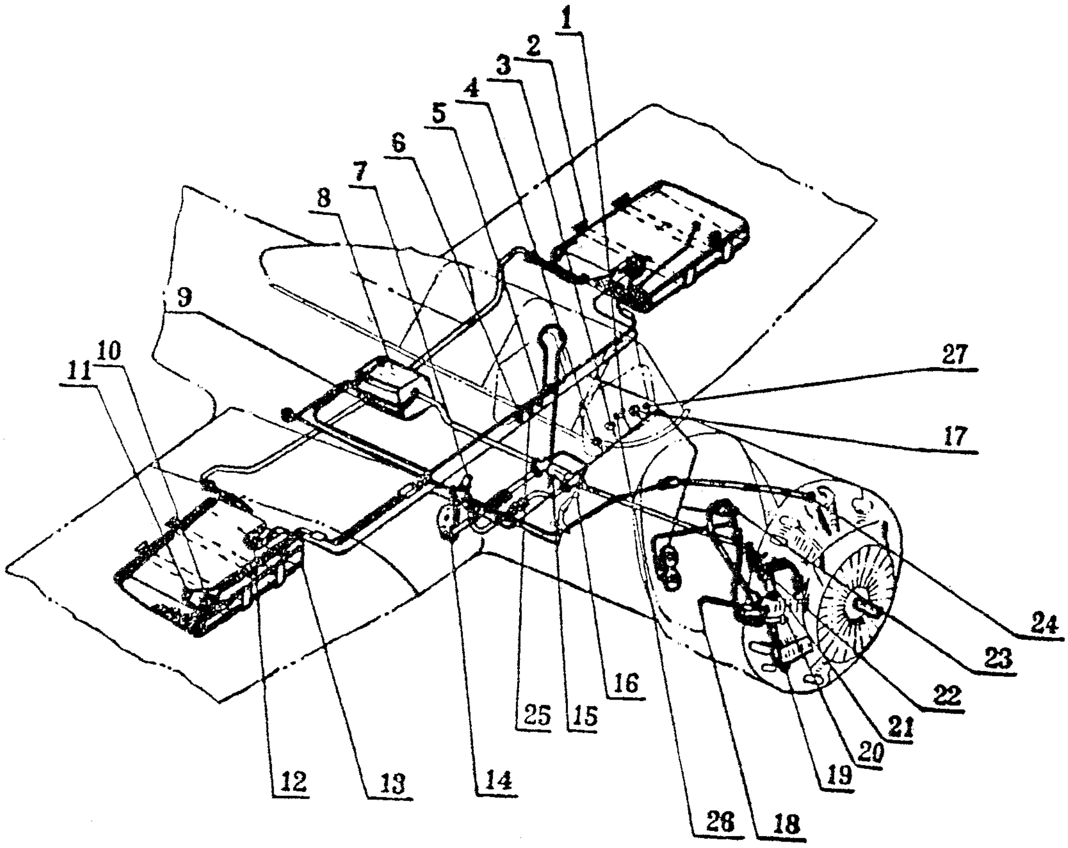


Fig. 6.12 Arrangement sketch of the fuel system accessories

1. Signal light in the front cockpit showing the fuel remaining quantity for return flight in the left tank 2. Mooring belt for tank 3. Fuel pressure gauge in the front cockpit 4. Oil thinning switch 5. Signal light in the rear cockpit showing the fuel remaining quantity for return flight in the left tank 6. Fuel pressure gauge in the rear cockpit 7. Primer 8. Feed tank 9. Bleeder 10. Fuel tank filler 11. Pipe fitting for the tank vent 12. Transmitter of the fuel level gauge 13. Fuel tank 14. Hand pump 15. Check valve 16. Hand pump handle 17. Fuel level gauge 18. Return pipe for the fuel pump 19. Carburetor 20. Fuel pump 21. Fuel filter 22. Fire-proof valve 23. Oil thinning valve 24. Adapter for primer 25. Signal light in the rear cockpit showing the fuel remaining quantity for return flight in the right tank 26. Signal light in the front cockpit showing the fuel remaining quantity for return flight in the right tank 27. Fuel level gauge switch

perature, and is composed of the (ZWY-1) indicator, (GY-1) fuel pressure transmitter, (GY-15) oil pressure transmitter and (GWR-1) resistive temperature probe. Indicators are mounted on the instrument panels of both the front cockpit and the rear cockpit. The fuel pressure transmitter is fixed on the frame 0. In order to overcome the trembling phenomenon of the pointer of the fuel pressure gauge, an additional buffer nipple is mounted on the pipe fitting led to the fuel pressure transmitter. The oil pressure transmitter is mounted on the frame 1.

The fuel pipe for the pressure transmitter made of $\phi 6 \times 1$ anticorrosive aluminium alloy tubes is connected to the T-fitting of the oil thinning valve.

The pressure transmitters are connected to the indicators with bundles of wires, or so called cables.

The fuel quantity in the tanks is reflected by the electrically driven indicator of the fuel level gauge mounted on the instrument panel of the front cockpit.

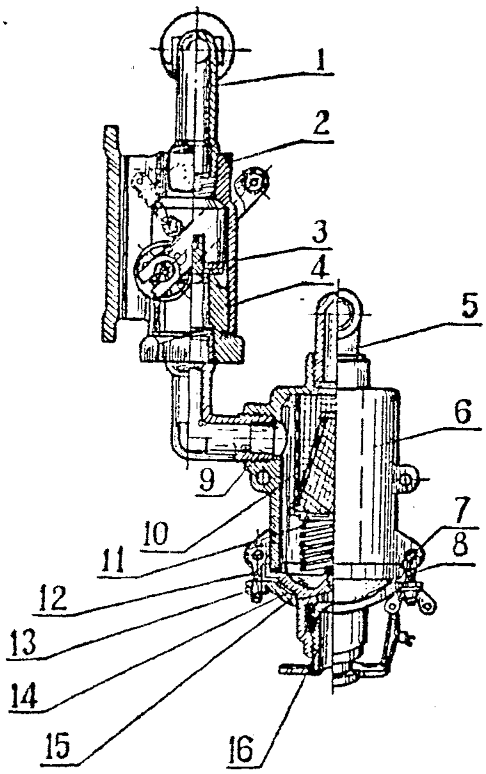
The pipelines of the fuel system are stiff pipes made of $\phi 14\times 1$, $\phi 12\times 1$, $\phi 8\times 1$, $\phi 6\times 1$ anticorrosive aluminium alloy tubes, except that the braided hoses with fittings made according to the technical specification (Q/5A4-87) are used in the engine bay and nearby the junction planes of the midwing and outer wing.

All the fuel pipelines are coated with (CO4-42) yellow enamel.

The pipelines are fixed on structural parts or special supports of the airplane with clamping hoops.

The pipelines which are vibrated violently by the operated engine are constituted of two segments connected with intermediate fabric reinforced rubber hoses.

The fire-proof valve with fuel filter (Fig. 6.13) is constituted of cast aluminium case and cover. A copper screen acted by the spring is installed in the case. The spring fixed on the cover with a screw presses the end surface of the screen against the case. By means of the bent beam, the cover of the fuel filter is fixed on the case with a wing nut, a slotted nut and two eyebolts for dismantling easily. A rubber gasket is filled in between the case and the cover. A threaded drain plug is screwed into the cover. The fire-proof valve is mounted at the fuel inlet of the fuel filter and connected to the filter case by a elbow fitting with tapered screw threads.



1. Elbow fitting
2. Case
3. Poppet
4. Joint
5. Nipple
6. Case
7. Axle pin
8. Eyebolt
9. Elbow fitting
10. Screen
11. Spring
12. Eyebolt
13. Slotted nut and cotter pin
14. Cover of the filter
15. Bent beam
16. Drain plug

Fig. 6.13 Fire-proof valve with fuel filter

The fire-proof valve is of the poppet type. Inside the case is installed a poppet with spring mechanism, which may cut off the fuel passage, if necessary, thus stopping feeding the engine carburetor with fuel. The fuel flows in such a direction as pointed by the arrow casted on the case.

HAND PUMP

The hand pump can be operated in the front cockpit only. The handle made of 4 mm. thick dural sheet is installed on the right console and connected to the rocker ram of the hand pump with the link. At the end of the handle is fixed a plastic ball handhold, on which the characters "Hand Pump" are lettered.

The handle is installed on the dural support of the console with a bolt. An index plate with characters "Hand Pump" is stuck on the support. The characters either on the index plate or on the handhold are coated with luminous powder.

The stroke limit of the handle is restricted by the rubber stoppers mounted on the support of the console. In setting the stoppers, the rocker arm of the hand pump should be positioned 6°-8° apart from its extreme positions so as to avoid the stagnation of the impeller and to reduce the torque for starting the handle from the extreme positions.

The hand pump is constituted of a cast iron case and a cover. Inside the cylindrical working chamber of the case are installed the cast iron rotary impeller, fuel inlet valves and fuel outlet valves.

The hand pump is of the impeller and double acting type, it works as shown in Fig. 6.14.

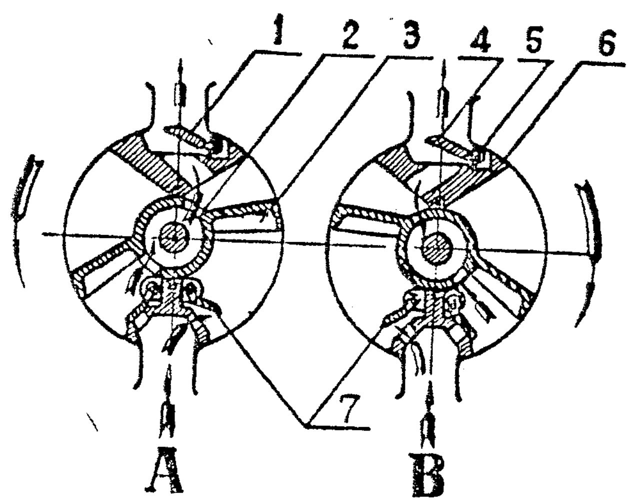


Fig. 6.14 Diagrammatic sketch of the hand pump working

1. Fuel outlet valve 2. Shaft 3. Impeller 4. Fuel outlet valve 5. Axle pin 6. Seat of the fuel outlet valve 7. Fuel inlet valves

When the impeller rotates counterclockwise (Fig. 6.14A), the lower right cavity is filled up with fuel and meanwhile the fuel in the lower left cavity and upper right cavity is pressed into the outlet pipe. When the impeller rotates clockwise (Fig. 6.14B), the lower left cavity is filled up with fuel and meanwhile the fuel in the lower right cavity and upper left cavity is pressed into the outlet pipe. Valves 4 and 7 have ensured that the processes mentioned above go on alternatively.

FUEL FEED TANK

For improving the bad effects caused by the unequel fuel consumption in the fuel system, there is a fuel feed tank installed in the fuel system.

The fuel feed tank (Fig. 6.15) is constituted of an outer shell, two end covers and two antislosh baffles. They are all made of anticorrosive aluminium alloy sheets. The antislosh baffles are riveted to the outer shell, then the rivet heads are surface welded. The outer shell and the end covers have their rims rolled up and welded together.

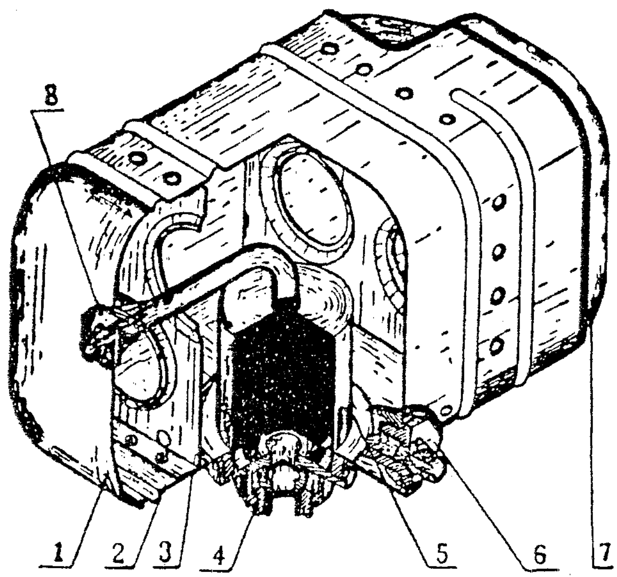


Fig. 6.15 Diagrammatic sketch of the fuel feed tank

1. Front cover 2. Shell 3. Antislosh baffle 4. Bleeder 5. Deposit filter 6. Check valve 7. Rear cover 8. Flange for fixing the fuel supply pipe

A deposit filter is installed inside the fuel feed tank. A bleeder is mounted at the bottom of the tank to ensure that the deposit and all the fuel in the main tanks and pipelines can be bled.

To prevent the fuel from flowing back to the main tanks, the check valves are respectively installed in between the joints of the pipes, by which the feed tank communicates with the right and left main tanks.

In addition, a vent fitting, a flange for fixing the fuel supply pipe and a lug for fixing the ground cable are welded on the feed tank.

The fuel feed tank with a capacity of 8 liters is welded by gas welding. It is fixed on the saddle seat under the rear cockpit floor with two dural restraining bands tightened by adjustable bolts. Rubber strips are wrapped around the fuel feed tank under the restraining bands to diminish the vibration and prevent its surface from being abraded.

CHECK VALVE

The function of the check valve (Fig. 6.16) is to prevent the fuel flowing toward the carburetor from being resucked while the hand pump is operating.

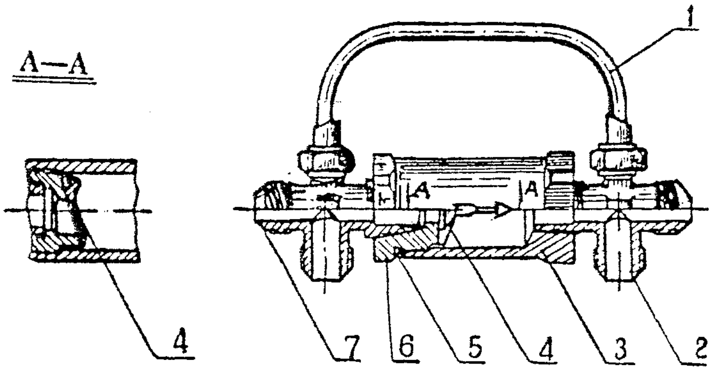


Fig. 6.16 Check valve

1. Compensating pipe joint 2. Cross fitting 3. Case 4. Clack 5. Gasket 6. Valve joint 7. Cross fitting

The check valve is composed of the dural case and pipe fittings, which are screwed on the valve joint and the case with gasket. A clack made of copper alloy is hung over the valve joint.

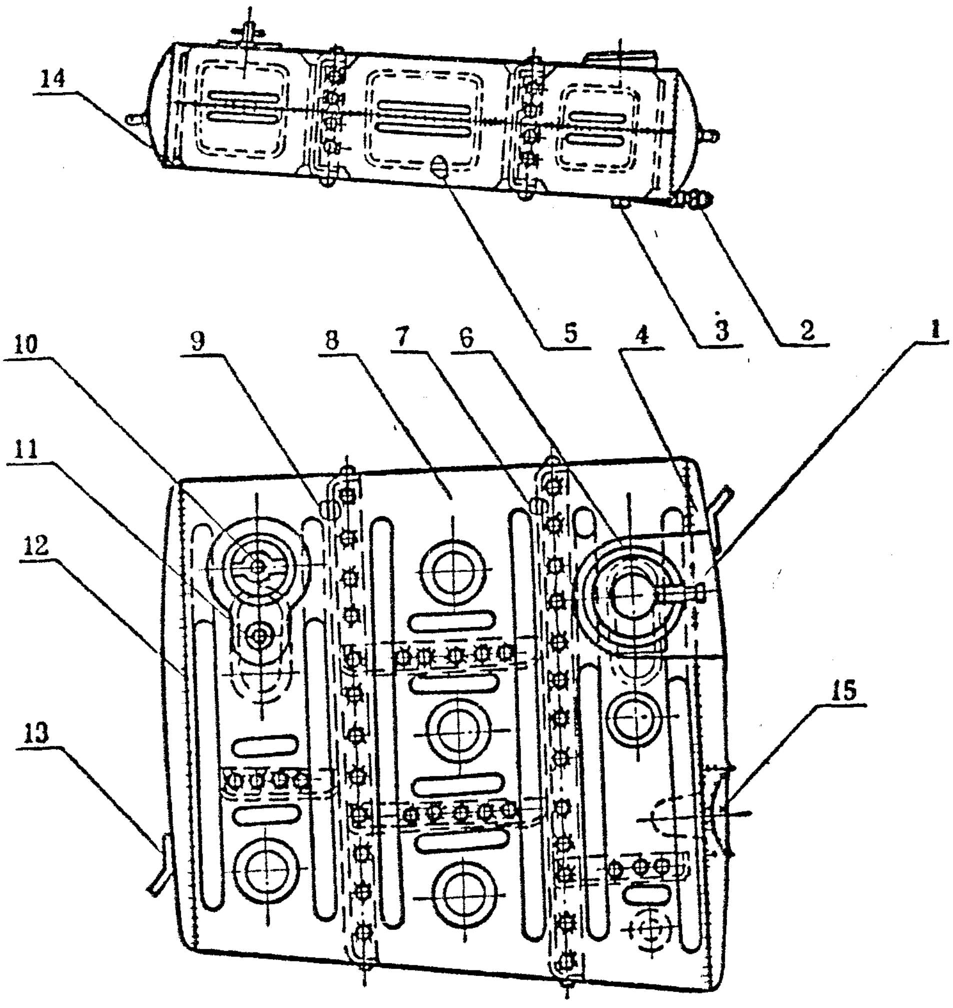
For installing the check valve in a correct position, the characters "Upper End" are marked and an arrow is casted on the case to show the flow direction of the fuel.

MAIN FUEL TANK

The main fuel tank (Fig. 6.17) is composed of upper and lower shells, front and rear covers, two longitudinal antislosh baffles and four transverse antislosh baffles. The upper shell, rear cover and the antislosh baffles are made of anticorrosive aluminium alloy sheets of 1 mm. thickness, the lower shell of 1.2 mm. thickness, the front cover of 1.5 mm thickness. Stiffening grooves and stiffening dents are pressed on the shell to improve its stiffness. Light holes and through holes are cut on the baffles. The baffles are riveted to the shell, then the rivet heads are surface welded. The upper and lower shells, and the front and rear covers have their rims rolled up and welded together.

The filler flange, the nipple of the vent and the flange for fixing the electrically driven transmitter of the fuel level gauge are welded on the upper part of the fuel tank. A nipple to be connected to the bleeder is welded on the lower part. A supply nipple is welded on the lower part of the front cover. In addition, lugs are welded on both the front cover and the rear cover for connecting the ground cables.

The supply nipple is installed at the lower part of the front cover to ensure that the fuel can flow out completely and that the engine can be fed under verious flying modes.



Figl 6.17 Diagrammatic sketch of the main fuel tank

1. Pan 2. Nipple 3. Screw plug 4. Front cover 5. Baffle 6. Transmitter of the fuel level gauge 7. Baffle 8. Upper sheel 9. Baffle 10. Filler 11. Nipple of the vent 12. Rear cover 13. Lug 14. Lower shell 15. Adoptor of the nipple

The main fuel tanks are welded by gas welding. Each tank with a capacity of 77 liters is fixed on the saddle seats at the ribs 2 and 3 of the outer wing by means of two dural restraining bands tightened by adjustable bolts. Rubber shims are wrapped around the main fuel tank under the restraining bands to diminish the vibration and prevent its outer surface from being abraded. As the outer wings have a dihedral of 7°, supporting seats for the fuel tanks are riveted on the ribs 1 of the outer wings to prevent the tanks from slipping to the lower places.

FUEL LEVEL GAUGE

The fuel quantity in the main tanks is checked with the (GUR-7) electrically driven fuel level gauge. The fuel level gauge is constituted of two transmitters, one fuel level indicator and four signal lights showing the fuel quantity for return flight. The transmitter is fixed on the flange of the fuel tank with seven bolts and is cushioned by sealing packing. The fuel level indicator is mounted on the instrument panel of the front cockpit only, but the signal lights showing the fuel quantity for return flight are mounted on the instrument panels in both the front cockpit and the rear cockpit.

The fuel quantity for return flight in each tank shall be 10 liters. As soon as the fuel remaining quantity for return flight is reached, the red signal lights light up.

LUBRICANT THINNING SYSTEM

For starting and accelerating the engine with ease under low temperature and for exempting the oil in the lubricating system from being changed in the cold winter, a lubricant thinning system is installed on the airplane. The petrol for thinning the oil comes from the fuel system of the engine. The lubricant thinning system is constituted of an (RDF-3) oil thinning valve, a push button switch and pipelines. The oil thinning valve is fixed on the dural support of the fuselage frame 0 with clamping hoops.

One end of the hose through which the petrol is supplied to the valve is connected to the T-fitting installed at the outlet of the fuel pump of the engine, while the other end is connected to the nipple of the transferring pipe of the lubricating system. At the inlet of the transferring pipe is installed a nozzle with calibration orifice of 1.6 mm. diameter to ensure that the pressure of the fuel system will not drop when the valve is working and that the petrol concentration for the thinned oil will be 8-13%.

The opening time of the valve depends on the oil quantity in the oil tank and the sustained operating time of the engine after the last thinning. For this reason, an oil thinning table is riveted on the right side skin of the front cockpit. The oil thinning valve is controlled by the switch mounted on the instrument panel of the front cockpit.

IX. ENGINE START AND PRIMING SYSTEM

The priming system is constituted of a fuel primer and pipelines.

The fuel primer is fixed on the right console of the front cockpit with three screws. A name plate marked with characters "Primer" is stuck onto the control panel. The characters are coated with luminous power.

The (ZSQ-6) fuel primer is of the plunger type. When the plunger of the primer moves upwards, the gasoline in the system enters the cylindrical chamber of the primer through the fuel passage. When the plunger moves downwards, it drives the gasoline into the engine through the valve and pipelines.

The engine is started by pushing the button switch, thus making the (QDF-1) compressed air solenoid valve and the (DH-2) starting coil in action.

Before starting the engine, the main fuel pipelines filled with gasoline by the hand pump and gasoline is primed into the air and fuel mixture collector of the engine by the fuel primer.

After pressing the starting button, the circuit of the compressed air solenoid valve and the starting coil are switched on simultaneously. The compressed air from the air bottle in the airplane enters the corresponding cylinder through the air distributor installed on the engine to push the piston for moving, and at that time, a high tension voltage induced in the starting coil is applied to the spark plugs to give ignition sparks, thus making the engine establish a normal run.

The starting button is installed on the instrument panel of the front cockpit.

The starting coil is fixed on the support with two screws, while the support itself is mounted on the upper left jackstay of the engine mount.

The compressed air solenoid valve is mounted on two supports in front of the fuselage frame 0.

X. LUBRICATING SYSTEM

The lubricating system (Fig. 6.18) of the airplane is constituted of the oil pump (installed on the cover of the accessory drive casing of the engine), oil tank, oil filter, oil funnel pipe, oil radiator, oil pipelines, oil pressure transmitter, oil temperature probe and indicators, etc.

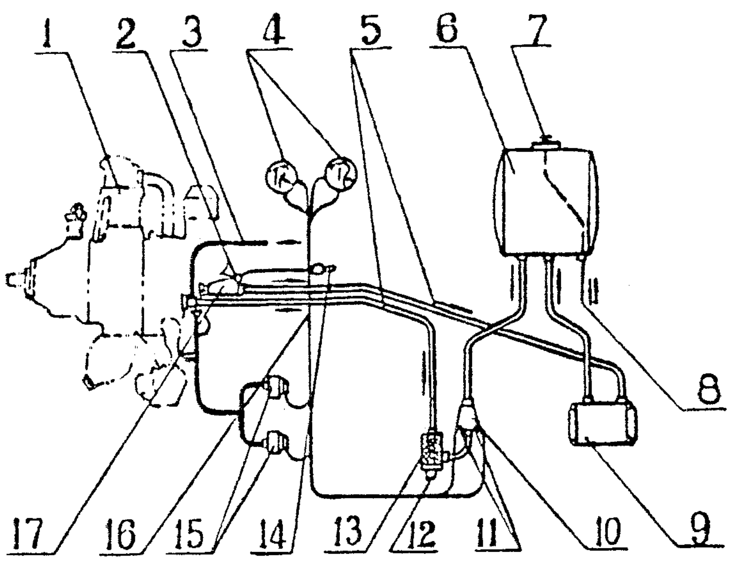


Fig. 6.18 Functional diagram of the lubricating system

1. Engine 2. Temperature probe of oil at outlet of the engine 3. Oil thinning pipeline 4. Oil pressure and temperature indicators in the front and rear cockpits 5. Braided hoses 6. Oil tank 7. Oil filler 8. Vent of the oil tank 9. Oil radiator 10. Oil funnel pipe 11. Temperature probe of oil at inlet of the engine 12. Drain plug 13. Filter 14. Inlet and outlet oil temperature probe switch 15. Oil pressure transmitter 16. Cable 17. Oil funnel pipe.

The circulation of lubricating oil in the system relies upon the action of the oil pump. The braided hoses used in the lubricating system are made according to the technical specification HG6-417-71, and assembled according to the technical specification Q/5A4-87.

When the engine is operating, the oil from the tank flows into the oil funnel pipe

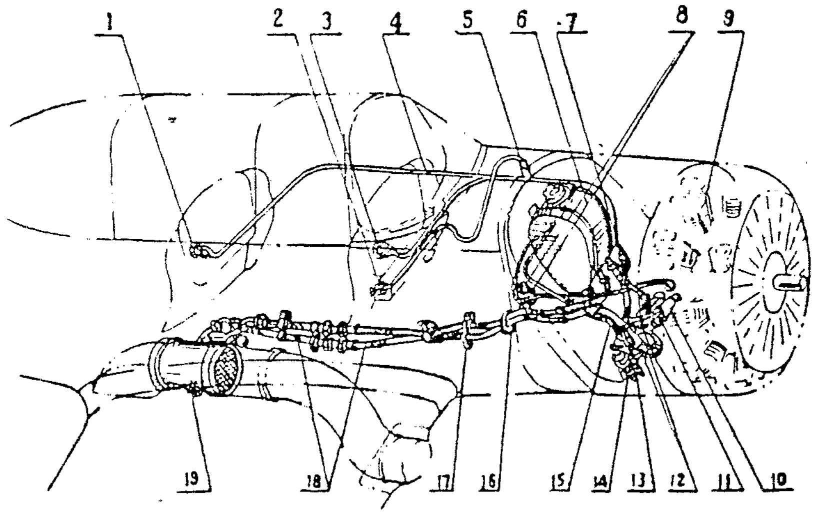


Fig. 6.19 Installation diagram of accessories of the lubricating system

1 3. Oil temperature and pressure indicators in the front and rear cockpits 2. Inlet and outlet oil temperature transfer switch 4. Cable 5. Adapter of the plug 6. Oil tank 7. Oil thinning valve 8. Oil pressure transmitter 9. Engine 10. Oil funnel pipe 11. Temperature probe of oil at outlet of the engine 12. Temperature probe of oil at inlet of the engine 13. Oil funnel pipe 14. Oil filter 15. Vent of the oil tank 16. Rubber ring 17. Clamping hoop 18. Braided hose 19. Oil radiator

and the oil filter in succession through the hoses and then enters the oil pump, which squeezes the oil into the engine.

The oil dripping from the parts inside the engine is collected in the oil sump (or the lowest part of the lubricating system of the engine), from which the oil is backed into the oil tank through the oil funnel pipe and oil radiator by the oil pump.

The vent of the oil tank is constituted of two pipe segments, the upper and lower segments of $\phi 12\times 1$ and $\phi 16\times 1$ sizes respectively. They are connected with the intermediate fabric reinforced rubber hose. The lower segment is fixed on the fuselage frame 0 with two clamping hoops, and the upper segment installed in the oil tank.

The oil pressure and the oil temperatures at the engine inlet and outlet are checked with the (BWY-1) electric triplex gauge. Indicators are installed on the instrument panels both i n the front cockpit and in the rear cockpit. The outlet oil temperature of the engine is checked with (BWY-1) triplex gauge in the front cockpit only.

The oil pressure transmitter is installed on the fuselage frame 1. The adapter of the transmitter is connected with ordinary transfer pipe. A braided hose is employed as the pipeline from the adapter of the oil pump installed on the engine to the transmitter.

The inlet oil temperature probe of the engine is installed within the oil funnel pipe on the oil filter, the outlet oil temperature probe within the oil funnel pipe on the oil pump (or on the outlet of the oil pump of the engine). The probes are fixed on the oil funnel pipe with screw threads.

The (ZWY-1) indicator of the pressure and temperature gauge unit in the front cockpit is switched on with the transfer switch there when either the inlet or the outlet oil temperature of the engine is measured.

OIL TANK

The oil tank is fixed on the brackets with dural restraining bands cushioned with rubber shims. The brackets are riveted on the fuselage frame 0.

The oil tank is welded from the shell, covers, tilted pan and trumpetlike pipe (Fig. 6.20).

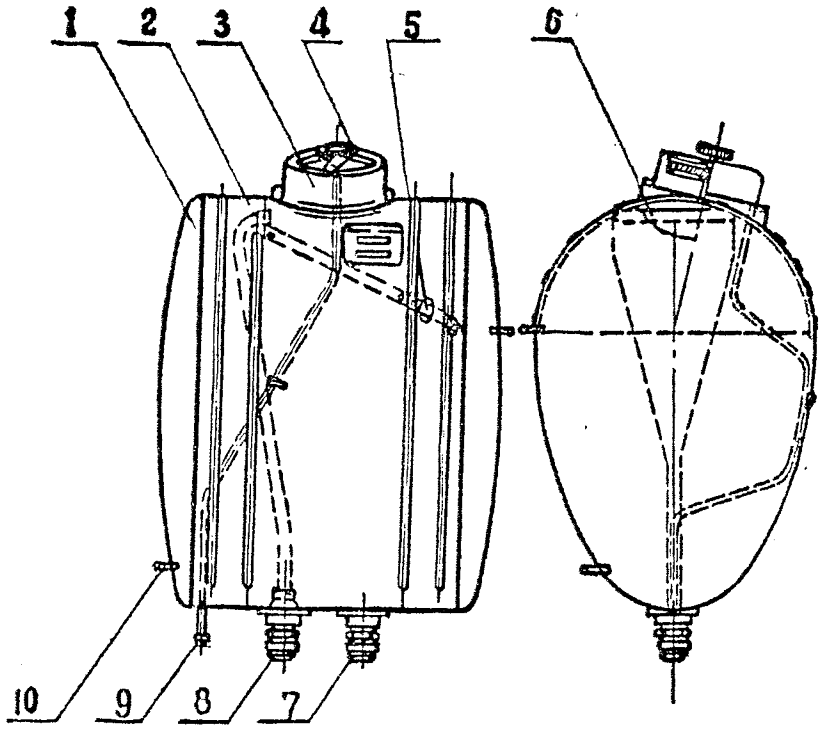


Fig. 6.20 Oil tank

1. Cover 2. Shell 3. Filler 4. Filler cap with dip stick 5. Tilted pan 6. Trumpetlike pipe 7. 8. Adapters 9. Vent 10. Lug for fixing the ground wire

The covers and the shell of the oil tank are made of 1 mm. thick anticorrosive aluminium alloy sheets, the tilted pan and the trumpetlike pipe of 1 and 0.8 mm. thick anticorrosive aluminium alloy sheets respectively.

The tilted pan and the trumpetlike pipe are welded together and then riveted on the shell of the oil tank. The rivet heads are surface welded.

The vent inside the oil tank is made of $\phi 12\times 1$ anticorrosive aluminium alloy tube. It is fixed inside the tank with the clamping hoop and then welded with the shell at the place where it is extended. The shell has its upper part welded with a filler and its lower part welded with adapters for connecting the hoses.

The quantity of oil remaining in the tank is checked with the dip stick riveted on the filler cap of the oil tank. A row of holes of 2 mm. diameter is drilled on the dip stick. The hole pitch is equivalent to one liter's tank capacity. The hole of 4 mm. diameter on the upper part of the stick represents the 17 liters' capacity, the maximum useful filling quantity (or working capacity) of the tank.

The tank and the pipelines of the lubricating system are coated with brown enamel.

OIL FUNNEL PIPE

The oil funnel pipe for installing the inlet oil temperature probe is fixed on the oil filter by means of elbow fittings with tapered screw threads, which are smeared with ZA10-5 sealing grease. The oil funnel pipe is of welded construction, its shell and bottom are made of low carbon steels sheets of 0.8 and 1 mm. thickness respectively.

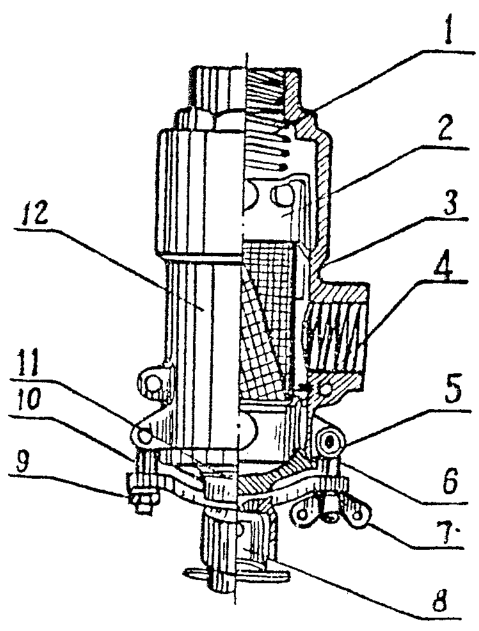
On the upper part of the oil funnel pipe is welded a elbow fitting for connecting the outlet hose of the oil tank. Adapter for fixing oil temperature probe and elbow fitting for fixing the oil funnel pipe on the oil filter are welded on the bottom.

The shell of the oil funnel pipe for mounting the outlet temperature probe is also made of low carbon steel sheets by welding. It is fixed onto the casing of the oil pump with two studs passing through the sealing packing and its flange. Besides the flange on the shell of the oil funnel pipe are welded adapters for fixing outlet temperature probes and for connecting the hoses from the oil pump to the oil radiator.

OIL FILTER

The lubricating oil filter is fixed on the fuselage frame 0 with two bolts through the lugs of its case.

The oil filter is composed of the case and the cover made of cast aluminium (Fig. 6.21).



1. Spring
2. Cup
3. Filter screen
4. Supporting ring
5. Sealing ring
6. 10. Eyebolts
7. Wing nut
8. Drain plug
9. Nut
11. Cover
12. Case

Fig. 6.21. Oil filter

Inside the oil filter are installed the spring, sleeve and filter screen, which is fixed on the cylindrical part of the cover with cotter pins.

The cover of the oil filter is easily dismantled so that the periodic inspection, the drainage of the oil from the oil tank and lubricating system and the cleaning of the filter screen can be carried out conveniently.

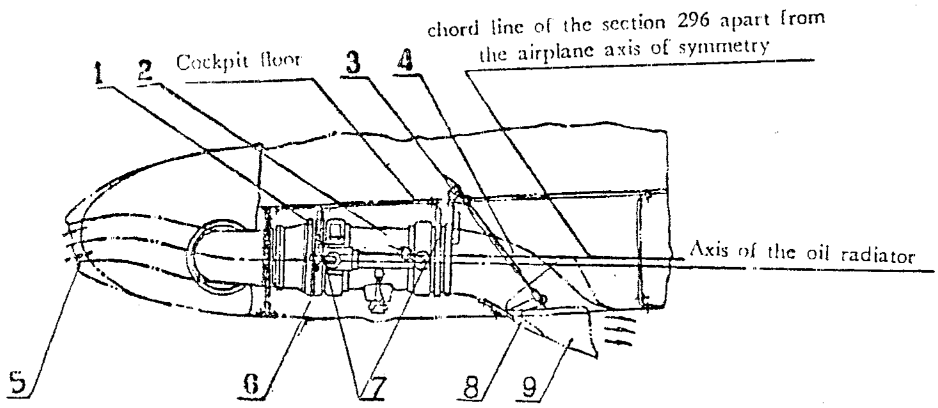
After the cover with the filter screen has been dismantled, the cup supported by the bottom of the filter screen falls onto the supporting ring under the spring force, thus blocking the inlet of the case automatically.

By means of the bent beam, the cover of the oil filter is fixed on the outer case with two bolts so as to be dismantled easily. A rubber gasket is filled in between the case and the cover. A drain plug is screwed on the cover of the oil filter. A oil funnel pipe is installed on the outer case of the oil filter.

AIR COOLED OIL RADIATOR

The airplane is equipped with an (SRQ-14) air cooled oil radiator for cooling the lubricating oil.

The oil radiator is installed between the front and rear spars on the right side of the midwing and suspended under two saddle seats of the midwing with two steel clamping hoops (Figl 6.22).



Figl 6.22 Installation diagram of the (SRQ-14) oil radiator

1. Rubber ring 2. Oil radiator 3. Control link of the throttle in the exhaust pipe
4. Exhaust pipe 5. Intake 6. Clamping hoop 7. Saddle seats 8. Rocker
9. Exhaust pipe throttle

The rubber rings are fitted between the clamping hoops and the oil radiator to prevent the radiator skin from being abraded. They are also served as the packings at the connections between the air intake and the exhaust pipe of the radiator.

Having flowed out from the engine, the lubricating oil through the braided hose enters the radiator and fills up the space of the honeycomb. The honeycomb is divided into several sections inside by transversal baffles. Flow gaps on the baffles are cut alternatively to ensure that the oil has a zigzag circulation. The oil flows through the inner holes of the outer shell, fills up the cavity between the outer shell and the cylindrical sleeve and then flows toward the outlet of the oil radiator.

A safety valve is installed in the sleeve of the radiator to prevent the disruption of the radiator caused by the excessive pressure of the oil inside the radiator. (In general, the higher viscosity of the oil brings about an excessive oil pressure in starting the engine in cold weather.) When the oil pressure in the radiator is higher than 4 atm., the safety valve is relieved so that the oil bypasses the honeycomb tubes and flows directly to the outlet of the radiator, and then to the tank, thus ensuring that the radiator shall not be disrupted by the excessive pressure. The safety valve is closed when the pressure drops down, and the radiator then turns to the normal function.

The air enters the honeycomb through the air intake and flows out through the exhaust pipe, thus cooling the oil in the radiator. The cooling effect is controlled with the throttle valve installed in the exhaust pipe.

CHAPTER VII

AUXILIARY EQUIPMENT

The airplane auxiliary equipment consists of the ordinary equipment in cockpits, instrumentation, electrical devices and radio equipment.

I. DISPOSAL OF THE EQUIPMENT IN THE COCKPIT

The cockpit is equipped with the necessary instruments, various control handles, control boxes, switch panels, pyrotechnic pistol, error correction cards, cockpit illuminators, etc. For facilitating the pilot's observation, operation and the ground crew's service-maintenance and adapting to the serving speciality of the front cockpit (trainee's cockpit) and rear cockpit (trainer's cockpit), the devices mentioned above are disposed in proper positions in the front cockpit and the rear cockpit respectively.

DISPOSAL OF THE EQUIPMENT IN THE FRONT COCKPIT

The front cockpit is the trainee's cockpit (Fig. 7.1). The auxiliary equipment is disposed on the instrument panel, right and left consoles and other positions on both sides of the cockpit respectively.

INSTRUMENT PANEL

The instrument panel in the front cockpit (Fig. 7.1) consists of three dural panels: the middle one has a thickness of 2 mm., the right or left one a thickness of 1.5 mm.

The right and left instrument panels are the fixed parts screwed on the upper and side segments of the fusclage frame 2 and on the cover plates of the right and left consoles respectively.

The middle instrument panel is a damping part fixed on four (HB6-12-2/8) rubber dampers with four brackets. Two dampers are fixed on the special beam transversely connected with the frame 2 behind the instrument panel, while other two dampers on the upper brackets of the right and left instrument panels respectively.

In order to give the best view, the lower parts of all the three instrument panels are tilted by 22° towards the pilot.

The middle instrument panel is equipped with the 301-1, 302-1 airplane clock, BK450 airspeed indicator, BDP-2 gyro-horizon, BC10 rate-of-climb indicator, BTJ-1 manifold pressure gauge, BG12-1A altimeter, BZW-2A turn-and-bank indicator, ZH-4 heading indicator, ZWY-1 triplex gauge indicator, ZAV-2 voltammeter, ZWH-1 carburetor temperature indicator, BWG-2 cylinder head temperature indicator, ZZ35 tachometer indicator, signal light for trim tab "In neutral position", "Generator power-off" signal

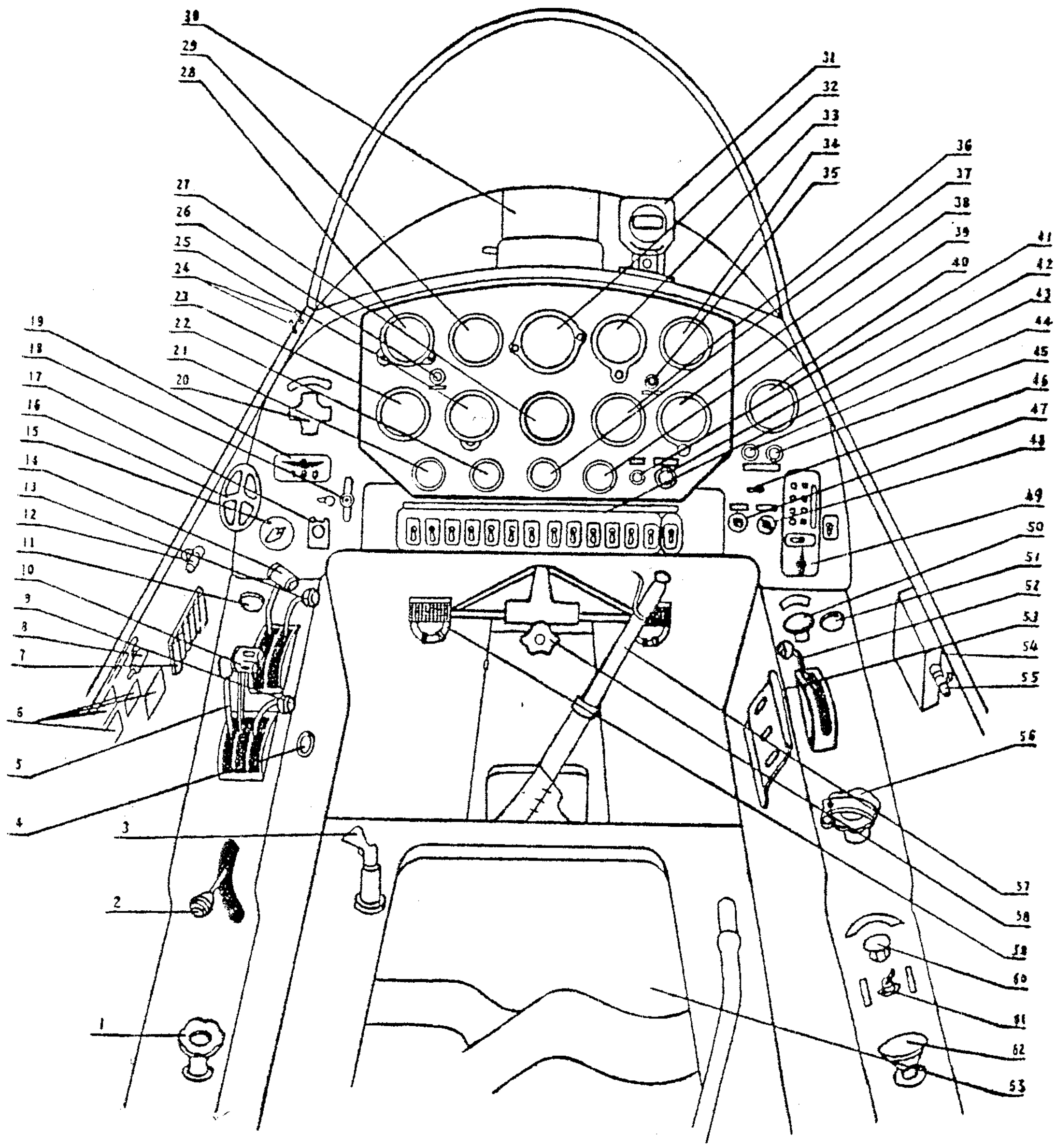


Fig. 7.1 Disposal of the equipment in the front cockpit (trainee's cockpit)

1 Compressed air main valve 2. Flap control handle 3. Pyrotechnic pistol 4. Throttle lock 5. Propeller pitch variation control handle 6. Instrument-error correction cards 7. Pyrotechnic cartridges 8. Cockpit lamp 9. Altitude regulator handle 10. Air and fuel mixture throttle handle 11. Main compressed air pressure gauge 12. Left fluorescent lamp 13. Handle of air warming box throttle 14. Fire-proof valve handle 15. Magneto change-over switch 16. Trim tab control handle 17. Engine starting button 18. Landing gear control knob 19 Signal box for landing gears 20. Gill shutter control knob 21. ZZ 35 tachometer indicator 22. BWG-1 cylinder head temperature indicator 23. BYJ-1 manifold pressure gauge 24. Navigation lights and landing light switches 25. BG12-1A altimeter 26. Signal light for trimmer "In neutral position" 27. BZW-2A turn-and-bank indicator 28. 301 Clock 29. BK450 airspeed indicator 30. Ventilator 31. LC-2 magnetic compass 32. BDP-2 gyro-horizon 33. BC10 rate-of-climb indicator 34. ZHW-1A radio compass indicator 35. Synchronizing button 36. ZWY-1 triplex gauge indicator 37. ZWH-1 carburetor temperature indicator 38. ZH-4 heading indicator 39. ZAV-2 voltammeter 40. ZUR-7 indicator of the fuel level gauge 41. Signal light indicating generator trouble 42. Rheostat of the magnetic compass illumination 43. Central switch panel 44. Signal light showing the fuel remaining quantity in the left tank 45. Signal light showing the fuel remaining quantity in the right tank 46. Change-over switch for the fuel level gauge 47. Rheostat of the left fluorescent lamp 48. Rheostat of the right fluorescent lamp 49. Wave band control box for the radio station 50. Knob for controlling the oil radiator throttle 51. Emergency compressed air pressure gauge 52. Hand pump 53. Chart holder 54. Control box for the radio compass receiver 55. Right fluorescent lamp 56. Landing gear emergency extending valve 57. Control stick 58. Knob for the pedal adjustment 59. Treadle 60. Volume control knob of the radio station 61. Change-over switch for the receiver-radio compass 62. Primer 63. Seat

light, AN-1A synchronizing button for LTC-1 gyro compass, R-6 rheostat for "magnetic compass illumination" light and ZHW-1A radio compass indicator.

The left instrument panel is equipped with the engine gill shutter control knob, XH-7 signal box for landing gear, DHK-1 magneto change-over switch, AN-2 engine starting button, landing gear up and down control valve and JXZ-5 terminal plate (fastened on the back of the instrument panel by screws).

The right instrument panel is equipped with the ZUR-7 indicator of fuel level gauge, R-11 rheostats for the right and left fluorescent lamps, CT-1 wave band control box of the radio station, signal lights showing "10 liters' fuel remaining quantity" in the right and left tanks and change-over switch.

The central switch panel is transversely installed on the lower part of the middle instrument panel between the right and left instrument panels by four screws.

The switch panel is provided with the battery and the (JK-1) generator switches, ten ZKC automatic cut-off switches for the feed circuit, ZK2-1 change-over switch for measuring the engine oil inlet and return temperature, and AJK-1 oil thinning switch.

The LC-2 magnetic compass is installed on the special support located on the upper right side of the arched apron above the instrument panel. The axis of the compass is parallel to the axis of symmetry of the airplane.

The ZKC-5 and ZKC-10 automatic cut-off switches of the navigation lights and landing light are mounted on the upper left longeron between the fuselage frames 2 and 3.

CONSOLE

The right and left consoles (Fig. 7.1) are installed along both sides of the cockpit. Each console consists of a horizontal removable dural cover plate of 1.5 mm. thickness and a vertical removable dural sidewall of 0.8 mm. thickness.

The cover plate is fixed on the four supports riveted on the fuselage frame with seven or eight screws. The upper hem of the sidewall is fastened to the lower hem of the cover plate by Dzus fasteners, while the anchor pin on the floor section material is engaged with the notch on the lower hem of the sidewall, thus ensuring the quick installing and dismantling of the sidewall.

The section of the cover plate located between the frames 2 and 4 is inclined by 6° to the pilot to offer him the facilitation in his observation and controlling the auxiliary devices on the console.

On the cover plate of the left console are mounted the fire-proof valve handle, air warming handle, air and fuel mixture throttle control handle, altitude regulator handle, propeller pitch variation control handle, flap up and down valve, QSF-6A compressed air main valve and BYQ-80A main compressed air pressrue gauge.

On the sidewall of the left console is installed a hand wheel to lock the air and fuel mixture throttle handle in any position as required.

The cover plate of the right console is equipped with the hand fuel pump control handle, QSF-6A landing gear emergency extending valve (with a folding handle for increasing the rotative moment), BYQ-80A emergency compressed air pressure gauge, knob for controlling the oil radiator throttle, primer for the fuel system, and JT-2A interpnone user's box.

On the sidewall of the right console is the chart holder for setting the satchel.

The arrangement of devices on both sides of the cockpit (except the console) is as follows:

On the left side of the cockpit are installed the pyrotechnic pistol and it's socket (riveted on the floor between the seat and the sidewall of the left console in front of the frame 4), the magazine containing six pyrotechnic cartridges (the magazine is riveted on the fuselage skin above the stringer 6 between the frames 3 and 4.), WL-5, LC-2, LTC-1 compass error correction cards and BK-450 air speed indicator error correction card (the card holders HB7-1 are riveted on the fuselage skin bordered by the frames 2, 3, 4 and 5 and stringers 3, 4, 5 and 6 respectively), YD-1 fluorescent lamp (on the special support between stringer 4 and the cockpit port frame behind frame 3) and ZCD-2 cockpit lamp (on the rotatable push-pull rod below the cockpit port frame behind the frame 4).

On the right side of the cockpit are installed the WL-5 control box (mounted vertically on the special support under the cockpit port frame from frame 3 to frame 4) and the YD-1 fluorescent lamp (on the special support between the stringer 4 and the cockpit port frame behind the frame 4).

DISPOSAL OF THE EQUIPMENT IN THE REAR COCKPIT

The disposal of the auxiliary equipment in the rear cockpit is basically like that in the front cockpit, the slight difference results from the facilitation for the trainer's instruction and preventing the trainee from mis-operation.

The rear cockpit instrument panel (Fig. 7.2) consists of three dural panels too. Its material, structure type and fastening method are basically like that of the front cockpit.

The middle instrument panel is equipped with the BK-450 airspeed indicator, BDP-2 gyro-horizon, BC-10 rate-of-climb indicator, AN-1A "synchronizing button" for LTC-1 gyro compass, 302 clock, BZW-2A turn-and-bank indicator, ZH-4 heading indicator, ZWY-1 triplex gauge indicator, signal lights showing " 10 liters' fuel remaining quantity", signal light for the trim tab "In neutral position", "Generator power off" signal light, BWG-1 cylinder head temperature indicator, BYJ-1 manifold pressure gauge, ZHW-1A radio compass indicator, ZZ35 tachometer indicator and BG12-1A altimeter.

The left instrument panel is equipped with the JXZ-4 terminal plate (fastened on the back of the instrument panel by screws), DHK-1 magneto change-over switch, XH-7 signal box for the landing gear, compressed air double-acting valve for the landing gear up and down (the retracting and extending valve for the landing gear, which may be used to correct the trainee's mis-operation) and JK2-1 engine ignition change-over switch.

The right instrument panel is equipped with the R-11 rheostats of the right and left fluorescent lamps, switches of ZKC-5 and ZKC-2 types for the gyro-horizon, turn-and-bank indicator and interphone and JT-2A user's box.

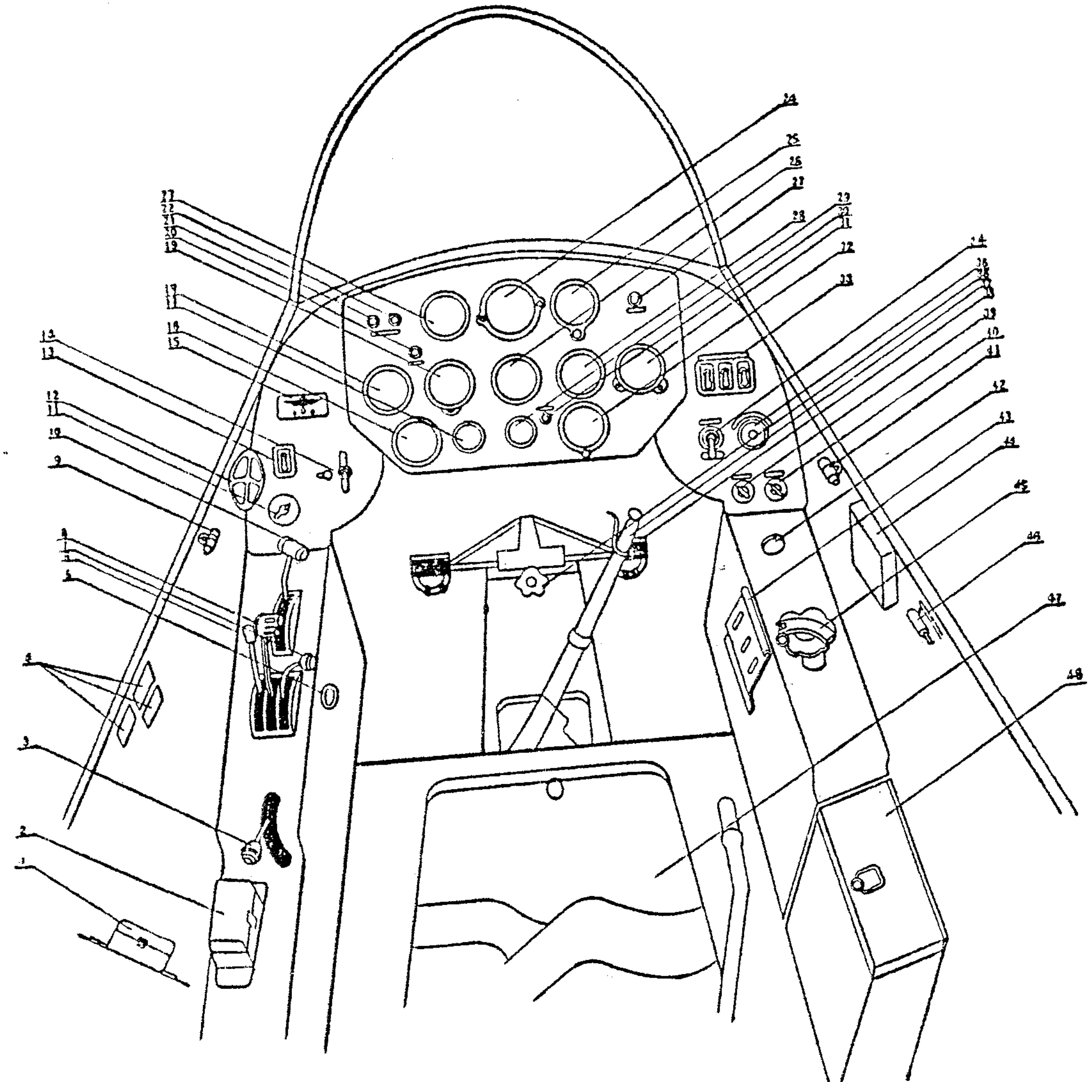


Fig. 7.2 Disposal of the equipment in the rear cockpit (trainer's cockpit)

1. Radio crystal box for the front cockpit 2 Radio crystal box for the rear cockpit 3. Flap control handle
4. Instrument-error correction cards 5. Air and fuel mixture throttle lock 6. Propeller pitch variation con-
trol handle 7. Altitude regulator handle 8 Air and fuel mixture throttle handle 9. Left fluorescent lamp
10 Fire-proof valve handle 11. Magneto change-over switch 12. Trim tab control hand wheel 13. Ignition
change-over switch for the front and rear cockpits 14. Landing gear control knob 15. Signal box for the
landing gears 16. ZWY-1 triplex gauge indicator 17. ZZ-35 tachometer indicator 18. BYJ-1 manifold
pressure gauge 19. BG12-1A altimeter 20. Signal light for trim tab "In neutral position" 21. Signal light
showing the fuel remaining quantity in the left tank 22. Signal light showing the fuel remaining quantity in
the right tank 23. BK-450 airspeed indicator 24. BDP-2 gyro-horizon 25. BC-10 rate-of-climb indicator
26. BZW-2A turn-and-bank indicator 27. Signal light indicating generator trouble 28. ZHW-1A radio com-
pass indicator 29. BWG-1 cylinder head temperature indicator 30. Synchronizing button 31. 302 Clock
32. ZH-4 heading indicator 33. Control switches for the gyro-horizon, turn-and-bank indicator and interphone
34. Change-over switch for the receiver-radio compass 35. Volume control knob of the radio station
36. Knob for the pedal adjustment 37. Control stick 38. Treadle 39. Rheostat of the left fluorescent
lamp 40. Rheostat of the right fluorescent lamp 41. Right fluorescent lamp 42. BYQ-80A Emergency
compressed air pressure gauge 43. Chart holder 44. Control box for the radio compass receiver
45. Landing gear emergency extending valve 46. Cockpit lamp 47. Seat 48. Ration box

CONSOLE

The components, structure type and fastening method of the console in the rear cockpit (Fig. 7.2) are the same as that in the front cockpit. As compared with the disposal of the auxiliary equipment in the front cockpit, the difference lies in:

For the left console, the air warming box throttle handle, compressed air main valve and main compressed air pressure gauge are abolished, but the CT-1 radio receiver crystal box is added. (The box is fastened on the cover plate between the frames 8 and 9 with four screws.)

The right console is rid of the hand fuel pump control handle, JT-2A interphone user's box, oil radiator throttle control handle and the primer of the fuel system, and thus has less equipment. The right console has its length somewhat shorter than that of the right console in the front cockpit and a space is left for setting the ration box.

The tool box composed of the box body and cover is located between the fuselage frame 9 and the right console of the rear cockpit and fastened to the special supports on the frame 9 and stringer 7 with screws.

The disposal of the equipment on both sides of the cockpit (except the console and tool box) is as follows:

On the left side of the cockpit are installed the WL-5, LTC-1 gyro compass error correction cards and BK-450 airspeed indicator error correction cards (HB7-1 card holders are riveted on the fuselage skin bordered by the stringers 4, 5 and 6 and the frames 8 and 9 respectively), YD-1 fluorescent lamp (mounted on the special holder between the stringer 4 and cockpit port frame behind the frame 7).

On the right side of the cockpit are installed the WL-5 control box (installed vertcially on the special bracket under the cockpit port frame between the fuselage frames 7 and 8), YD-1 fluorescent lamp (on the upper longeron in front of the fuselage frame 7) and ZCD-2 cockpit lamp (on the rotatable push-pull rod below the rear cockpit port frame behind the fuselage frame 8).

II. INSTRUMENTATION

The airplane instrumentation consists of the pilot-navigational instruments and the instruments for checking the powerplant and airplane accessories.

NAVIGATIONAL INSTRUMENTS

The navigational instruments are used to measure the flight parameters concerned by which the pilot can properly drive the airplane according to its flight performance.

The navigational instruments include the GKY-5 pitot tube and its pitot-static pressure system, BK-450 airspeed indicator, BG12-1A altimeter, BC-10 rate-of-climb indicator, BZW-2A turn-and-bank indicator, BDP-2 gyro-horizon, LTC-1 gyro compass and LC-2 magnetic compass.

GKY-5 PITOT TUBE AND ITS PITOT STATIC PRESSURE SYSTEM

The GKY-5 pitot tube, a pitot-static air pressure sensor of the aneroid flight instrument, is secured within the special thimble in the right outer wing by three screws. The thimble is made of LY11CZ-30×1 dural tube. The pitot tube is extruded into the region of undisturbed airstream at 530 mm. ahead of the wing leading edge to perceive the steady air pressure in flying. An electric heating device is installed in the GKY-5 pitot tube as the de-icer.

The pitot-static pressure system (Fig. 7.3) is the channel for transmitting the static pressure and pitot pressure perceived by the GKY-5 pitot tube. (In fact, the pitot pressure is the total pressure consisting of the dynamic pressure and static pressure.) It consists of LF2M-6×1 anticorrosive aluminium alloy tubes and 5T4-10HG6-447-66 canvas reinforced rubber hoses. The pitot pressure pipes are painted with black enamel and the static pressure pipes with grey enamel for their identification.

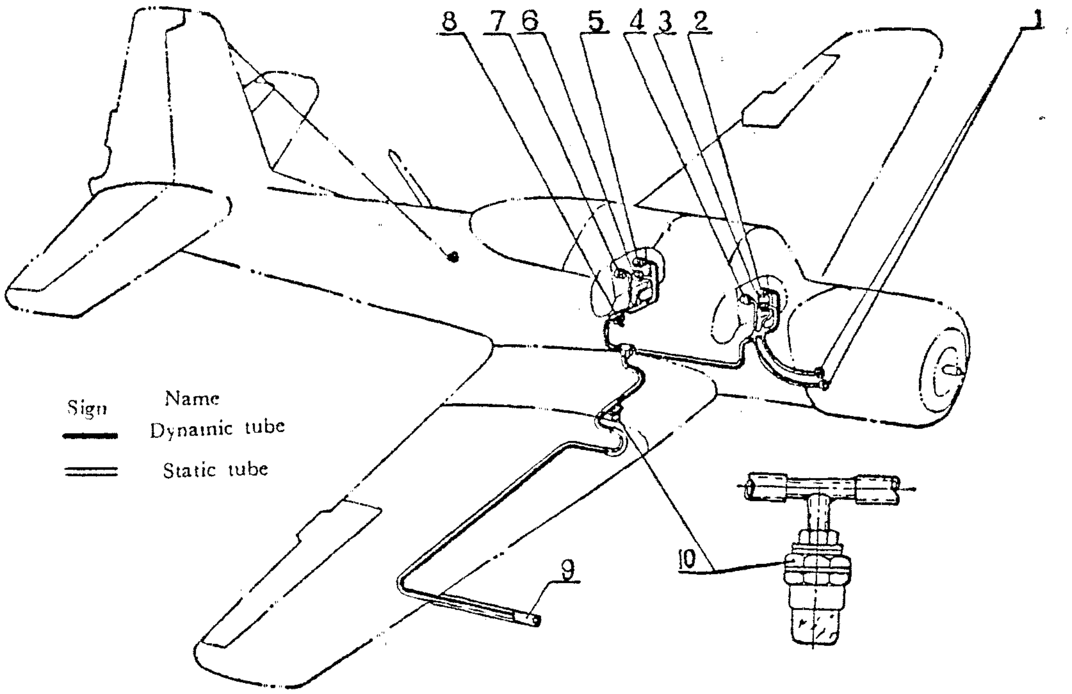


Fig. 7.3 GKY-5 Pitot tube and pitot-static pressure system

1. Fuel pressure transmitter for the ZWY-1 triplex gauge indicator 2. BK-450 airspeed indicator in the front cockpit 3. BG12-1A altimeter in the front cockpit 4. BC-10 rate-of-climb indicator in the front cockpit 5. BK-450 airspeed indicatoı in the rear cockpit 6. BG12-1A altimeter in the rear cockpit 7. BC-10 rate-of-climp indicator in the rear cockpit 8. Standby branch (for automatic recorder) 9. GKY-5 Pitot tube 10. Moisture sump

The pitot pressure pipe is connected to the BK-450 airspeed indicator.

To the static pressure pipe are connected the BK-450 airspeed indicator, BG12-1A altimeter, BC-10 rate-of-climb indicator and the GY-1 fuel pressure transmitter for the ZWY-1 triplex gauge indicator.

In order to prevent the moisture in the pipelines from entering the instrument, two water sumps are set at the proper position of the pipeline system, i.e., set in front of the front spar between the right ribs 4 and 5 of the midwing. On the wing skin under the sump is provided an inspection cover for draining the water deposited during flight.

On the segment of the pitot-static pressure pipe situated behind the right instrument panel in the rear cockpit are preset standby branches which are assumed to be connected with the automatic recorder. If the airplane is rid of the automatic recorder, the standby branches should be chocked with two plugs.

III. ELECTRICAL EQUIPMENT

Most of the circuits in the airplane electrical system belong to the single-wire system with rated voltage $27 \pm 10\%$ V.

The main airborne power supply is the ZF-1.5 generator, the standby one is the 12-HK-30 storage battery. As an auxiliary device, the field power supply plug ensures that the airplane is connected to the field power supply when the airplane is parking. All these three electric power supplies mentioned above are connected in parallel with the airborne circuit.

The ZKC automatic cut-off switches are adopted to protect and control the circuits, they are all centralized on the central switch panel at the lower part of the middle instrument panel in the front cockpit. The circuits for the generator and storage battery are provided with the GB inertia fuses, while the A.C. circuits of the WL-5 radio compass and the CT-1 radio station with the TB heating fuses.

The electrical equipment consists of:

The power supply;
The engine starting device;
The signal device;
The illuminating device;
The electrical instrument;
The radio equipment power supply;
The heating device.
The location of the electrical equipment is shown in Fig. 7.4.

CIRCUIT

The rated voltage for the airplane circuit is of $27 \pm 10\%$ volt. The negative leads of the electrical equipment employing the single-wire system are grounded with the airplane body through special negative connector. The circuits belonging to the double wire system are such as:

The circuit from the generator to the regulating box;
The circuit from the regulating box to the wave filter;
The power supply circuit for the WL-5 radio compass;
The power supply circuit for the CT-1 radio station;

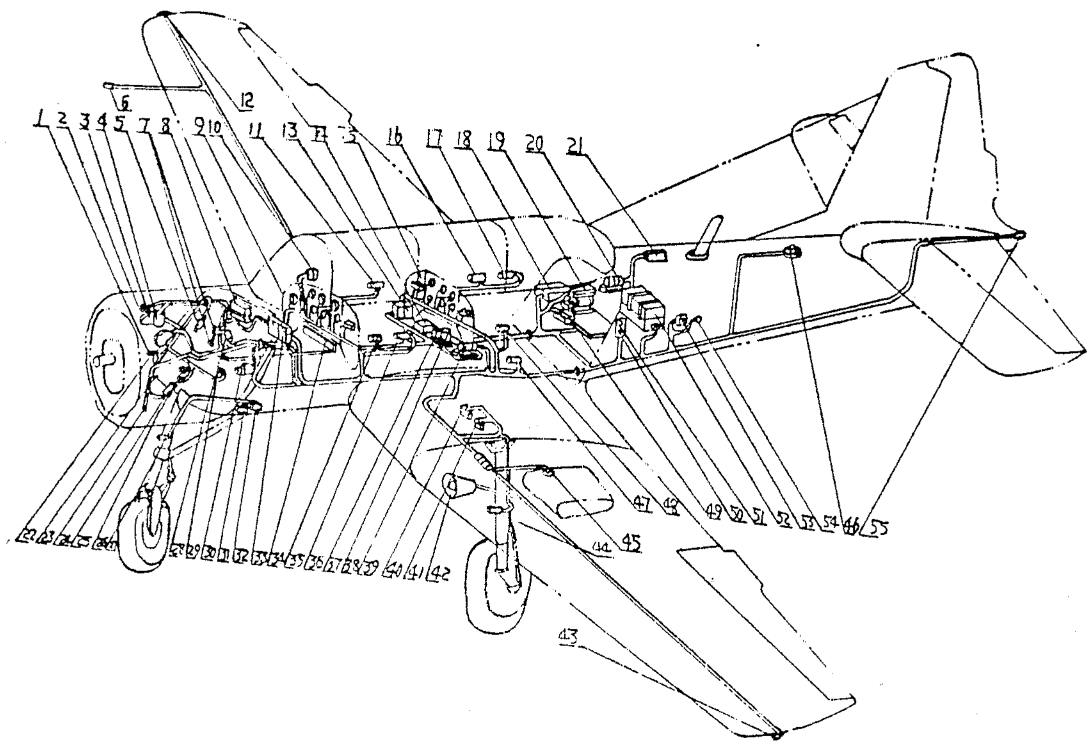


Fig. 7.4 Schematic for the electrical eqiupment arrangement

1. GWR-1 resistive oil outlet temperature probe (6Y) 2. BWG-1 cylinder head temperature transmitter for the rear cockpit (44Y) 3. CD-5 right magneto (7Q) 4. ZF-1.5 generator (1D) 5. QDF-1 compressed air solenoid valve (3Q) 6. GKY-5 pitot tube resistance heater (1JW) 7. GY-15 oil pressure transmitter (4Y, 10Y) 8. ZY-1,500 regulating box (2D) 9. Instrument panel in the front cockpit 10. LC-2 magnetic compass illuminator (17Z) 11. YD-1 right fluorescent lamp in the front cockpit (8Z) 12. HD-3 right tip navigation light (3Z) 13. Power supply relay box 14. EX junction box (33Y) 15. Instrument panel in the rear cockpit 16. YD-1 right fluorescent lamp in the rear cockpit (9Z) 17. ZCD-2 rear cockpit lamp (19Z) 18. CT-1 rectifier 19. GBL-250 inverter (1W) 20. SBL-40 inverter (34Y) 21. DR equivalent loading resistance box 22. CD-5 left magneto (6Q) 23. BWG-1 resistive cylinder head temperature probe for the front cockpit (42Y) 24. ZWH-1 carburetor temperature probe (2Y) 25. GWR-1 resistive oil inlet temperature probe (7Y, 12Y) 26. GY-1 fuel pressure transmitter (5Y, 11Y) 27. WD-1 nose landing gear outboard signal light (9X) 28. DH-2 starting ignition coil (2Q) 29. RDF-3 solenoid oil thinning valve (1C) 30. GZ-9A tachometer transmitter (18Y) 31. AXP2-1 nose landing gear "down" terminal switch (1X) 32. AXP2-1 nose landing gear "up" terminal switch (2X) 33. LBQ-3 wave filter (3D) 34. Central switch panel 35. YD-1 left fluorescent lamp in the front cockpit (10Z) 36. ZCD-2 front cockpit lamp (18Z) 37. FL-3 amplifier (31Y) 38. TH-3 gyro mechanism (27Y) 39. SBL-53 inverter (22Y) 40. AKP2-1 main landing gear "up" terminal switch (4X, 6X) 41. AKP2-1 main landing gear "down" terminal switch (3X, 5X) 42. ZLD-4 landing light (6Z) 43. HD-3 left tip navigation light (2Z) 44. WD-1 main landing gear outboard signal light (10X, 11X) 45. GUR-7 fuel level gauge transmitter (14Y, 15Y) 46. GHC-2 magnetic heading sensor (25Y) 47. WK3-1 trim tab "In neutral position" microswitch (25X) 48. YD-1 left fluorescent lamp in the rear cockpit (11Z) 49. JR resistance relay box 50. CX-5 interphone power supply socket (14W) 51. CX-4 portable lamp socket (21Z) 52. 12-HK-30 battery (4D) 53. PJ250A plug for field power supply (5D) 54. ZSD-1 field power supply signal light (9D) 55. WD-1 tail light (4Z)

The electrical instrument circuits such as the circuits of the ZWY-1 triplex gauge indicator, BWH-1 carburetor temperature indicator, BWG-1 cylinder head temperature indicator and BUR-7 fuel level indicator.

The negative grounding terminals of the circuits are concentrated on the six negative lead terminal plates mounted on the webs and right and left stringers in the front and rear cockpits and avionic compartment respectively. The negative leads on the fuselage tail and the wings are grounded with the airplane body nearby their corresponding current consuming equipment respectively.

According to the current intensity of various current consuming apparatuses, the leads with cross sectional areas of 0.5 mm^2., 0.75 mm^2., 1 mm^2., 2.5 mm^2., 3 mm^2., 4 mm^2., 8.8 mm^2. of designated grades FVN, FFBL and FVNP are adopted respectively.

In order to give facilities for connecting leads and checking the circuits, the end of each lead is marked with code. The polyvinyl-chloride sheath with the code are also served as the insulator insulating the lead from its surrounding conductor. The code of the lead is signified by the corresponding first letter of the spelled Chinese nomenclature naming the equipment, operation and function, for example:

D — Power supply;
Q — Engine starting;
X — Signal devices;
Z — Illuminating devices;
Y — Electrical instruments;
W — Power supply for radio equipment;
JW — Warming;
C — Thinning.

In order to give facility for laying and disconnecting the leads and to prevent the leads from being damaged, the circuit wires are bound to bundle and wrapped in the B106 black bifacial-rubberized-fabric sheath to form the so called cable. For minimizing the interference with the radio equipment, such cables as laid between the radio power supply, starting ignition coil, electrical instruments or generator and the wave filter unit should be shielded with the metallic sheathes.

The connections between the cables and the current consuming apparatuses and between cables themselves are, in general, accomplished with the PD plugs, but some other current consuming apparatuses equipped with their own special connectors are the exceptions to the rule. On the sheath of the lead is marked the code number identical to that of the corresponding plug pin. The connections of the separate leads behind the instrument panel are fulfilled with the JXZ-4 or JXZ-5 terminal plates.

The cables on either side of the cockpit and midwing are laid in the special metal channels respectively and fixed with the polyvinyl-chloride strips. The cables within the wing are laid with the help of the metallic ducts. The segments of the cable which lie over the sharp edges of the webs are clothed in the HB2-6 rubber sheath or wound with the artificial leather to prevent the cable from being scrapped.

The electrical system has its current distribution of the concentrated type, which is realized through the power supply relay box and the positive pole bus-bar in the central switch panel. On the singly made central switch panel are mounted two JK-1 switches, ten ZKC automatic cut-off switches, one ZK2-1 change-over switch and one AJK-1 switch. Within the panel-box is given the wiring diagram. The arrangement for these switches is shown in Fig. 7.5.

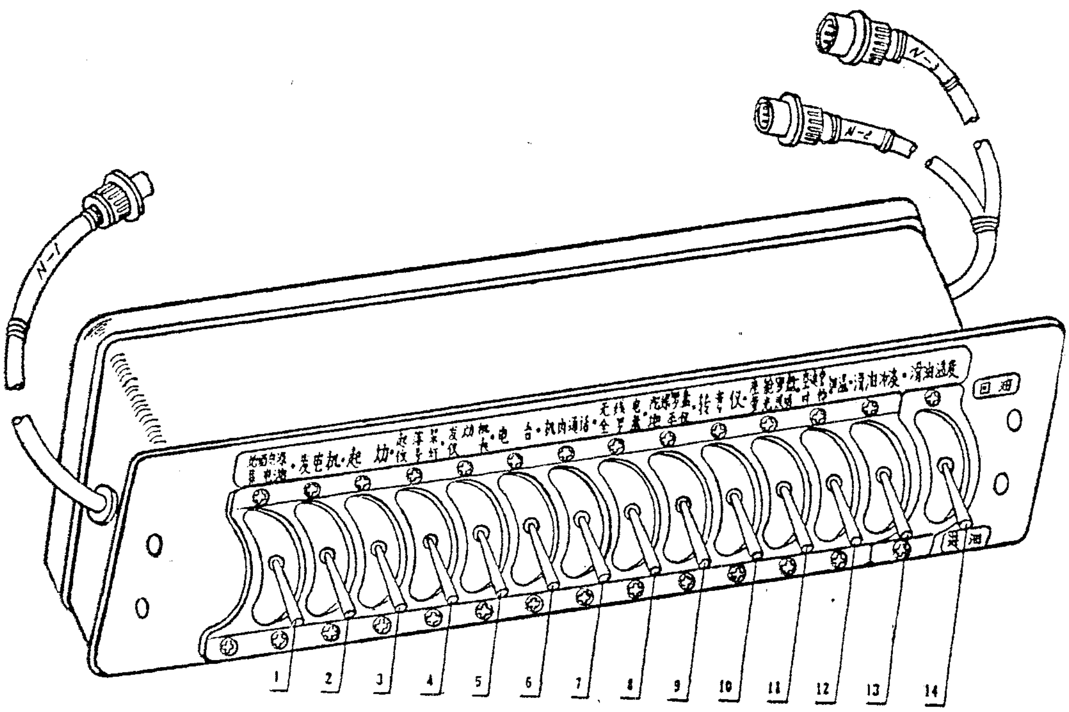


Fig. 7.5 Central switch panel

1. JK-1 switch for field power supply and storage battery 2. JK-1 switch for generator 3. ZKC-5 starting ignition switch 4. ZKC-5 landing gear signal light switch 5. ZKC-2 engine instrument switch 6. ZKC-5 radio station switch 7. ZKC-5 interphone switch 8. ZKC-5 radio compass switch 9. ZKC-5 gyro compass and horizon switch 10. ZKC-2 turn-and-bank indicator switch 11. ZKC-2 cockpit compass fluorescent illuminating switch 12. ZKC-5 pitot tube and clock heater switch 13. AJK-1 oil thinning switch 14. ZK2-1 oil temperature change-over switch

POWER SUPPLY

The airplane takes the ZF-1.5 generator as its main power supply and the 12-HK-30 storage battery as its standby power supply. Both the power sources are connected in parallel with the airborne circuit.

The airplane circuit is fed through the ZY-1,500 regulating box and the LBQ-3 wave filter when the ZF-1.5 generator is taken as the power supply, or through the special power supply relay box when the field power supply or the airborne battery as the power supply. When the field power supply is adopted, the very power supply relay box will automatically disconnect the airplane circuit from the airborne battery.

The switching on of the generator and the airborne storage battery is controlled by the JK-1 switch located on the central switch panel.

ZF-1.5 GENERATOR

The ZF-1.5 generator is a quadrupole shunt D.C. generator, which is capable of not only feeding all electrical equipment, but also charging the storage battery.

The generator is cooled with the wind blowing through the air inlet on the gill shutter and the vent duct.

The main technical data of the ZF-1.5 generator are as follows:

Rated power .... 1,500 W.
Rated voltage .... 27.5 V.
Rated current .... 54 A.
Rated rotating speed.. 3,800 to 5,400 rpm.
Allowable over-load current within 5 min. .... 81 A.
Weight .... 12.6 kg.

The generator is perpendicularly fixed on the studs of the rear cover of the engine case with its flange.

ZY-1,500 REGULATING BOX

The function of the regulating box is as follows:

When the loading and the rotating speed of the generator vary, the output voltage of the generator is maintained within the prescribed range.

The minimum relay in the regulating box can guarantee that the generator operates in parallel with the storage battery.

The radio interference caused by the regulating box itself and the generator circuits can be minimized.

The maximum relay in the regulating box can prevent the generator from being overloaded.

The main technical data of the ZY-1,500 regulating box are as follows:

Voltage regulating range .... 26.5 to 28.5 V.
Rated current .... 54 A.
Switching-on voltage for the minimum relay .... 24.5 to 26.5 V.
Initial operating current for the maximum relay.............................. 80 to 95 A.
Back current for disconnecting the generator from the airborne circuit by
the minimum relay.. 4 to 15 A.

By turning the contact slider of the rheostat from its original position, the voltage of the generator can be increased by 1.7 volts or reduced by 0.4 volt steadily.

Weight .... 2.1 kg.

The ZY-1,500 regulating box with its four rubber pads is bolted on the right web of the fuselage frame 1.

LBQ-3 WAVE FILTER

The function of the LBQ-3 wave filter is to minimize the H.F. current interference with the radio equipment induced by the power supply circuits of the generator and the regulating box.

The LBQ-3 wave filter consists of a chock coil connected in series and a capacitor connected in parallel. The high inductive reactance of the chock coil prevents the H.P. current from entering the airplane circuit; the low condensance of the capacitor makes the H.P. current bypass to ground.

The main technical data of the LBQ-3 wave filter are as follows:

Rated voltage .... 28 V.
Rated current .... 100 A.
Voltage drop in the wave filter .... 0.1 V.
Weight .... 1.9 kg.

The LBQ-3 wave filter is fixed on the left web of the fuselage frame 1 with four bolts.

12-HK-30 STORAGE BATTERY

The 12-HK-30 storage battery is used to feed the airplane circuit when the airplane is starting or in preflight preparation and the generator is not feeding or overloaded.

The main technical data of the storage battery are as follows:

Rated voltage .... 24 V.
Discharge current for ten hours .... 3 A.
Rated capacity .... 26 a./h.
Weight of the storage battery with electrolyte .... 27.5 kg.

The storage battery is held in a dural battery box, whose inner surface is stuck with heat insulating felt of 6 mm. thickness. A gas eduction pipe is led out from the battery box, so that the gas educed from the battery in operation may leak into the atmosphere.

The battery box is mounted in the special bay located between frames 10 and 11 on the left side of the fuselage and locked on the bracket with two pins. Wheels installed on the bottom of the box facilitate its mounting and removing. With the help of the P40K1A/Q plug connector, the battery is connected to the airborne circuit. Its installation is shown in Fig. 7.6.

GROUND POWER SUPPLY ON AIRFIELD

The PJ250A ground power supply plug located at the left fuselage skin between frames 11 and 12 ensure that the airplane circuit can be fed by the ground power supply when the airplane is parked on the airfield.

The ground power supply connector plug has three pins, two pins with larger diameter for the power supply, the third pin with smaller diameter for the circuit control. The pins for the power supply have their length longer than that of the third pin, the switching on of the airplane circuit by the pins of the power supply takes place earlier than that of the contactor in the power supply relay box, thus avoiding the arc discharge.

A cover for the connector plug is used to keep the pins free from dirt and accidental shorting.

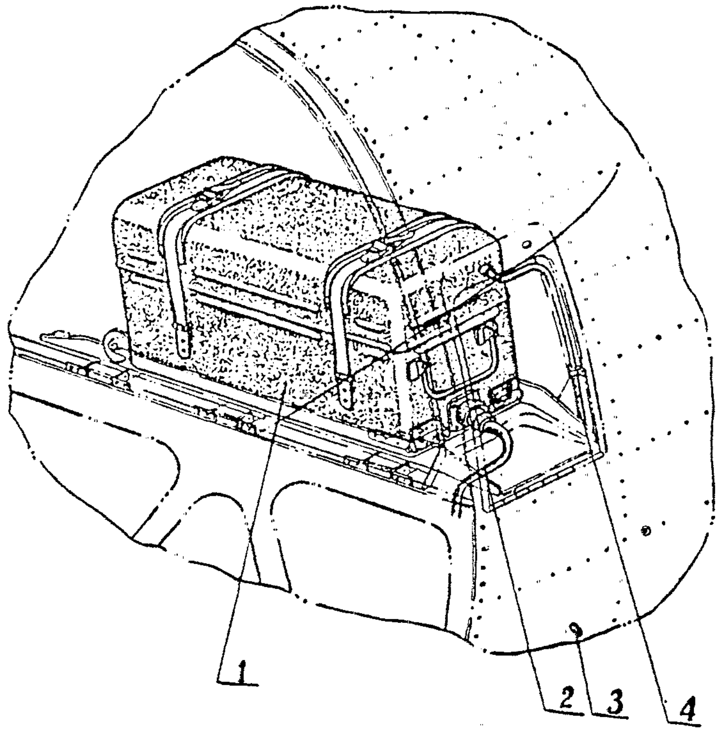


Fig. 7.6 Installation for the battery box

1. Battery box 2. Storage battery 3. Vent 4. Gas eduction pipe

The cable with plug receptacle is included in the complete set of the airplane ground equipment.

POWER SUPPLY RELAY BOX

The function of the power supply relay box is:

To switch on the storage battery or the ground power supply with distant control;

To disconnect the inboard storage battery from the airplane circuit automatically when the ground power supply is employed;

To guarantee that the power supply is cut-off from the airplane circuit automatically if the reverse polarity connection of the storage battery or the ground power supply is happened;

To switch on the generator trouble signal light if the generator is in faulty or inoperative.

The power supply relay box is also furnished with other relays to ensure that the GBL-250 inverter feeds the radio compass and radio station as they are operating and that the outboard landing gear lights light up during night flight.

The power supply relay is installed in a dural flat box, in which a wiring diagram is provided. The box is mounted on the special bracket on the right side of the pilot's seat in the front cockpit.

INVERTERS

The GBL-250 inverter is used to convert the D.C. voltage of 27 V. into the single-phase A.C. voltage of 115 V., 400 c.p.s. for feeding the WL-5 radio compass and the CT-1 radio station.

The main technical data of the GBL-250 inverter are as follows:

Power supply voltage …… $27 \pm 10\%$ V.
Rotating speed …… $8{,}000^{+800}_{-400}$ r.p.m.
A.C. Voltage …… 115 ± 3.5 V.
A.C. frequency …… 400^{+10}_{-20} c.p.s.
Output current …… 2.17 A.
Current consumption under the rated load …… 20 A.
Operating condition …… continuous
Weight …… not more than 10 kg.

The GBL-250 inverter with four HB6-21-2/8 shock absorbers mounted on its base is installed on the movable bracket in the avionic compartment between the fuselage frames 9 and 10.

The SBL-53 and SBL-40 inverters are used to convert the D.C. of 27 V. into the three-phase A.C. of 36 V., 400 c.p.s. The SBL-40 inverter feeds the gyro-horizon in the rear cockpit, while the SBL-53 inverter the LTC-1 gyro-magnetic compass and the gyro-horizon in the front cockpit.

The main technical data of the SBL-53 and SBL-40 inverters are as follows:

Power supply voltage …… $27 \pm 10\%$ V.
Output A.C. voltage:
For SBL-40 …… 36 ± 4 V.
For SBL-53 …… $36 \pm 10\%$ V.
Frequency …… $400 \pm 10\%$ c.p.s.

D.C. comsumption under the rated load:

For SBL-40: For one load not more than 3 A.
For two loads not more than 3.5 A.
For SBL-53 …… not more than 4.5 A.

Rated output A.C.:

For SBL-40: For one load …… 0.32 A.
For two loads …… 0.65 A.
For SBL-53 …… 0.85 A.
Operating condition …… continuous
Weight …… not more than 3.5 kg.

The SBL-40 inverter is mounted on the bracket on the right side of the fuselage between the frames 10 and 11. On the fuselage skin a hatch with folding door is opened. The SBL-53 inverter is mounted on the special bracket on the left side of the fuselage between the frames 5 and 6.

CURRENT CONSUMING EQUIPMENT

ENGINE STARTER

The engine starter consists of the following components:

DH-2 starting ignition coil;
QDF-1 compressed air solenoid valve;
AN-2 starting button;
DHK-1 Magneto change-over switch;
JK2-1 ignition control switch.

The DH-2 starting ignition coil and the QDF-1 compressed air solenoid valve are controlled by the ZKC-5 automatic cut-off switch mounted on the central switch panel and marked with the word "Starting" and by the engine starting button mounted on the left instrument panel in the front cockpit.

The operation of the magnetos can be controlled by the two DHK-1 magneto change-over switches mounted on the left instrument panels in both cockpits respectively. The left instrument panel of the rear cockpit is also equipped with a JK2-1 ignition change-over switch, which can make the operation of the magnetos out of the pilot's control in the front cockpit.

The DH-2 starting ignition coil is installed on the engine mount and the QDF-1 compressed air solenoid valve on the fuselage frame 0.

SIGNAL DEVICES

The airplane is equipped with the following signal devices, namely the landing gear "Up and down" signal, the elevator trim tab "In neutral position" signal and the generator trouble and ground power supply signal.

Landing gear signal devices:

The landing gear signal is classified into the inboard signals and the outboard signals.

The inboard signals indicate the landing gear retraction or extension by the red and green signal lights of the special XH-7 signal box respectively. When the landing gear is at the "Full-up" and "Full-down" positions, the signal light circuits are controlled by six AKP2-1 terminal switches respectively.

The AKP2-1 terminal switches for the nose gear retraction and extension are mounted on the lower part of the fuselage frame 0, while those for the main gear retraction and extension in the wheel bay of the midwing.

The outboard signal indicates the landing gear extension by three WD-1 signal lights fastened on the three landing gear struts respectively. The power supply feeds the WD-1 signal light through the "Navigation light" switch located on the left instrument panel of the front cockpit.

Elevator trim tab "In neutral position" signal device:

The elevator trim tab "In neutral position" signal device is composed of one WK3-1 microswitch and two ZSD-1 green signal lights.

The WK3-1 microswitch is switched on with the help of the contacting bulge on the cable controlling the elevator trim tab. Only when the trim tab is in the neutral position, the contacting bulge can just press the button head of the WK3-1 microswitch and the neutral position signal lights light up instantly.

The WK3-1 microswitch is mounted on the left fuselage skin between frames 6 and 7, and the two "In neutral position" signal lights are mounted on the middle instrument panels in the front and rear cockpits respectively.

Signal device for generator trouble and ground power supply:

When the voltage of the generator is too low or the generator is incapable of feeding, the orange-yellow signal lights installed on the middle instrument panels in both cockpits will light immediately. The circuit of the signal lights is switched on through the ZY-1,500 regulating box and the JKB-21A relay in the power supply relay box.

When the ground power supply is used, the green signal light mounted on the left fuselage skin between frames 11 and 12 and nearby the ground power supply connector plug is lighted.

ILLUMINATING DEVICES

The illuminating devices of the airplane consists of the instrument illuminators, cockpit illuminators, navigation lights, landing light and the portable lamp receptacle.

Instrument illumination:

The YD-1 fluorescent lamps mounted on the right and left sides of the front and rear cockpits are used to irradiate the fluorescent agent on the instrument dial and make it glow distinctly. The brightness is adjusted by varying the effective resistance of the R-11 rheostat mounted on the right instrument panel.

The brightness of the LC-2 magnetic compass interior illumination is adjusted by varying the effective resistance of the R-6 rheostat mounted on the middle instrument panel.

Cockpit illumination:

The cockpit illumination employs the ZCD-2 cockpit lamps. The cockpit lamp has a metallic cylinder, its beam-width is adjusted through the movable part of the metallic cylinderical pedestal and its brightness through the R-11 rheostat mounted on the fixed part of the metallic cylinder. An additional button can light up the lamp instantaneously.

The ZCD-2 cockpit lamps are mounted on the right and left sides of the front and rear cockpits. In order to widen the illuminating scope, the cockpit lamp is equipped with a protractile holder, by means of which the lamp can be positioned at any angle and direction as desired.

Navigation lights:

The HD-3 tip lights and the WD-1 tail light on the airplane are used to show the airplane location and heading during night flight, and also served as the liaison signal between the airplanes themselves and between the airplane and the ground.

The navigation light power supply is switched on through the ZKC-5 automatic cut-off switch marked with the characters "Navigation light" and located on the upper left longeron behind the frame 2 in the front cockpit.

The two HD-3 tip lights, the red and green, are located on the tip borders of the right and left outer wings respectively, the WD-1 tail light is placed on the tail cone of the fuselage.

ZLD-4 Landing light:

The ZLD-4 landing light is used to illuminate the run way during landing.

The landing light power supply is switched on through the ZKC-10 automatic cut-off switch marked with the characters "Landing light" and located on the upper left longeron behind the frame 2 in the front cockpti.

The ZLD-4 landing light with a movable pedestal is fixed in a special cavity located at the left outer wing leading edge between the ribs 1 and 2 and covered with the organic glass cover.

The setting angle of the landing light is ascertained in accordance with the special template. The installation for the landing light is shown in Figs. 7.7 and 7.8.

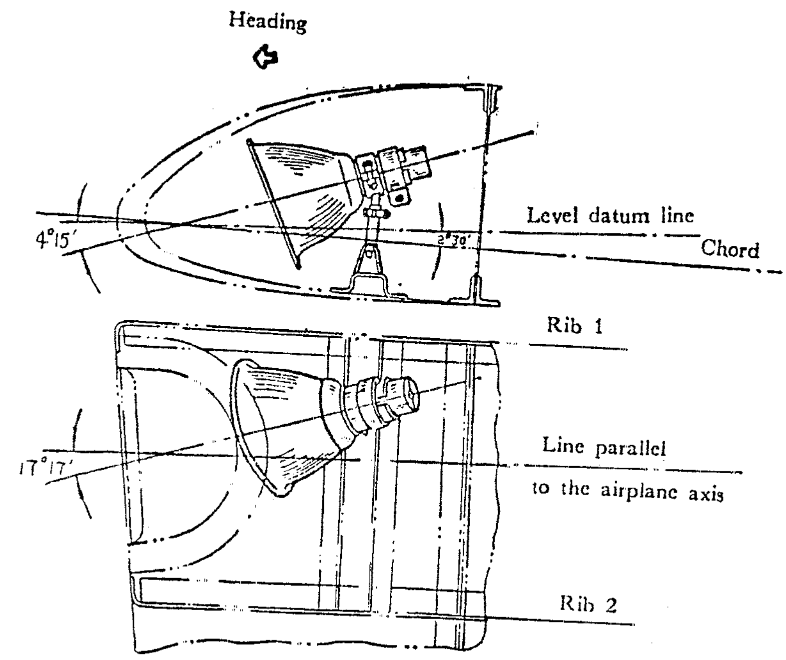


Fig. 7.7 Installation diagram for the landing light

CX-4 portable lamp receptacle:

The CX-4 portable lamp receptacle is used to switch on the GZD-2 portable lamp for local and temporary illumination during check and maintenance.

The CX-4 portable lamp receptacle is located on the left skin of the avionic compartment between the fuselage frames 9 and 10.

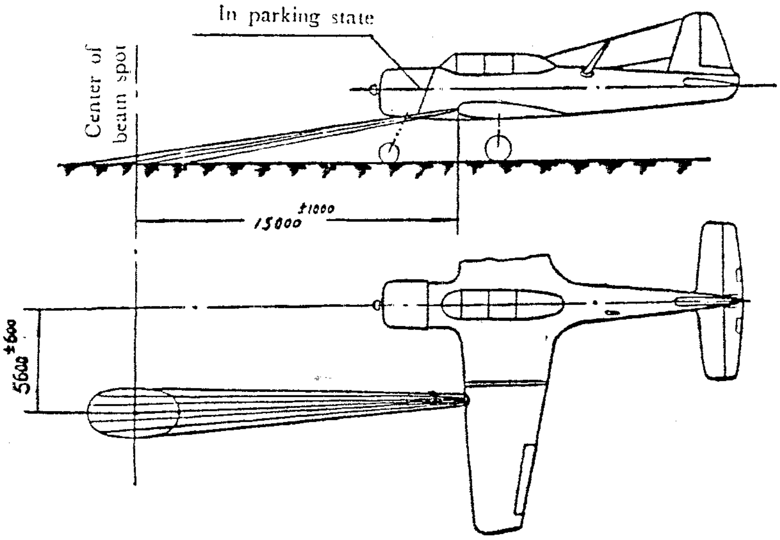


Fig. 7.8 Beam directing diagram for the landing light installation

ELECTRICAL INSTRUMENT

The power supply for the ZWH-1 carburetor temperature indicator, the ZWY-1 triplex gauge indicator and the ZUR-7 indicator of the fuel level gauge is switched on through the ZKC-2 automatic cut-off switch located on the central switch panel and marked with the characters "Engine instrument".

The switch panel in the front cockpit and the instrument panel in the rear cockpit are both equipped with the ZKC-2 automatic cut-off switches, by each of which the BZW-2A turn-and-bank indicator can be controlled independently.

The SBL-53 inverter acts as the power supply for the LTC-1 gyro-magnetic compass and BDP-2 gyro-horizon which is located in the front cockpit. The feeding with the output 36 V. three phase A.C. is controlled through the ZKC-5 automatic cut-off switch located on the central switch panel and marked with the characters "Compass and gyro-horizon".

The feeding of the gyro-horizon in the rear cockpit by the SBL-40 inverter is controlled through the ZKC-5 automatic cut-off switch located on the right instrument panel in the rear cockpit and marked with the characters "Gyro-horizon".

The reading of the BAV-2 voltammeter for normal condition indicates the charging and discharging current intensity of the storage battery. The voltage for the airplane circuit is measured only after pressing the button on the instrument case.

RADIO EQUIPMENT POWER SUPPLY

The application of the 115 V. A.C. power supply from the GBL-250 inverter to the WL-5 radio compass and the CT-1 radio station is controlled by the ZKC-5 automatic cut-off switches and the JKB-52A relay in the power supply relay box. The ZKC-5 automatic cut-off switches are installed on the central switch panel and marked with the characters "Radio compass" and "Radio station" respectively.

The resistance relay box is used for adjusting the plate voltage and negative voltage of the radio station of a value within the prescribed range by the voltage drop of the RXYC-T-20W-15Ω-1 and RXYC-T-25W-200Ω-1 resistors. As the radio station is in the receiving and transmitting state, the resistors are connected in series with the input circuit of the radio station.

The equivalent loading resistor should be cut off when the WL-5 radio compass is used.

The resistance relay box is a flat box made of dural, in which there is a wiring diagrams. The box is mounted on the movable bracket in the avionic compartment for ease of adjusting and inspecting the radio station.

The function of the equivalent loading resistor box is to connect a RXYC-75W-240Ω-1 equivalent loading resistor in parallel with the output terminals of the GBL-250 inverter to meet the requirement that the inverter load is not less than 30%, when the CT-1 radio station operates independently.

The equivalent loading resistor box is made of dural and mounted on the right fuselage skin between frames 12 and 13. The mid-part of the box cover is fitted with a copper screen to give good heat dissipation and ventilation.

The power supply for the JT-2A airplane interphone is switched on with the help of the CX-5 receptacle. The power supply circuit is connected with two ZKC-5 automatic cut-off switches, one of which is located on the central switch panel of the front cockpit, while the other on the right instrument panel of the rear cockpit.

The CX-5 power supply receptacle together with the CX-4 portable lamp receptacle is mounted on the left side of the avionic compartment between the fuselage frames 9 and 10.

HEATING DEVICE

The circuits heating the GKY-5 pitot tube, the 301-1 clock (on the middle instrument panel of the front cockpit) and the 302-1 clock (on the middle instrument panel of the rear cockpit) are switched on through the ZKC-5 automatic cut-off switches located on the central switch panel and marked with the characters "Pitot tube and clock heating".

The wiring diagram of the electrical equipment is shown in Fig. 7.9.

The connection diagram of the electrical equipment is shown in Fig. 7.10.

The detailed list for electrical equipment is shown in table 7.1.

Detailed List of the Electrical Equipment

Table 7.1

Code	Name	Designation	Qt.	Location
1D	Generator	ZF-1.5	1	Engine
2D	Regulating box	ZY-1500	1	Frame 1
3D	Wave filter	LBQ-3	1	Frame 1
4D	Storage battery	12-HK-30	1	Frames 10-11
5D	Ground power supply plug	PJ-250A	1	Frames 11-12
6D	Inertia fuse	GB-50	1	Power supply relay box
7D	Polarized relay	JN-1	1	Power supply relay box
8D	Voltammeter	BAV-2	1	Middle instrument Panel in the front cockpit
9D	Signal light for switching-on ground power supply	ZSD-1 (green)	1	Frames 11-12
10D	Signal light indicating generator trouble	ZSD-1 (orange yellow)	1	Middle instrument panel in the front cock pit
11D	Signal light indicating generator trouble	ZSD-1 (orange yellow)	1	Middle instrument panel in the rear cockpit
12D	Relay	JKB-21A	1	Power supply relay box
13D	Contactor	MZJ-50A	1	Power supply relay box
14D	Contactor	MZJ-50A	1	Power supply relay box
15D	Relay	JKB-52A	1	Power supply relay box
16D	Trouble signal light fuse for generator	TB-2	1	Power supply relay box
17D	Shunt	QFL-5	1	Power supply relay box
18D	Switch for storage battery and ground power supply	JK-1	1	Central switch panel
19D	Switch for generator	JK-1	1	Central switch panel
20D	Storage battery plug	P40K1A/P	1	Battery box
1C	Oil thinning solenoid valve	RDF-3	1	Slant frame
2C	Oil thinning switch	AJK-1	1	Central switch panel
1Q	Engine starting button in front cockpit	AN-2	1	Left instrument panel in the front cockpit
2Q	Starting coil	DH-2	1	Engine mount
3Q	Compressed air solenoid valve	QDF-1	1	Slant frame
4Q	Magneto change-over switch in the front cockpit	DHK-1	1	Left instrument panel in the front cockpit
5Q	Magneto change-over switch in the rear cockpit	DHK-1	1	Left instrument panel in the rear cockpit
6Q	Left magneto	CD-5	1	Engine
7Q	Right magneto	CD-5	1	Engine
8Q	Ignition change-over switch	JK2-1	1	Middle instrument panle in the rear cockpit
9Q	Automatic cut-off switch for starting	ZKC-5	1	Central switch panel
1X	Nose landing gear "down" limiting position switch	AKP2-1	1	Lower part of the slant frame
2X	Nose landing gear "up" limiting position switch	AKP2-1	1	Lower part of the slant frame
3X	Left main landing gear "down" limiting position switch	AKP2-1	1	Left wheel bay

Detailed List of the Electrical Equipment

SHEET 1

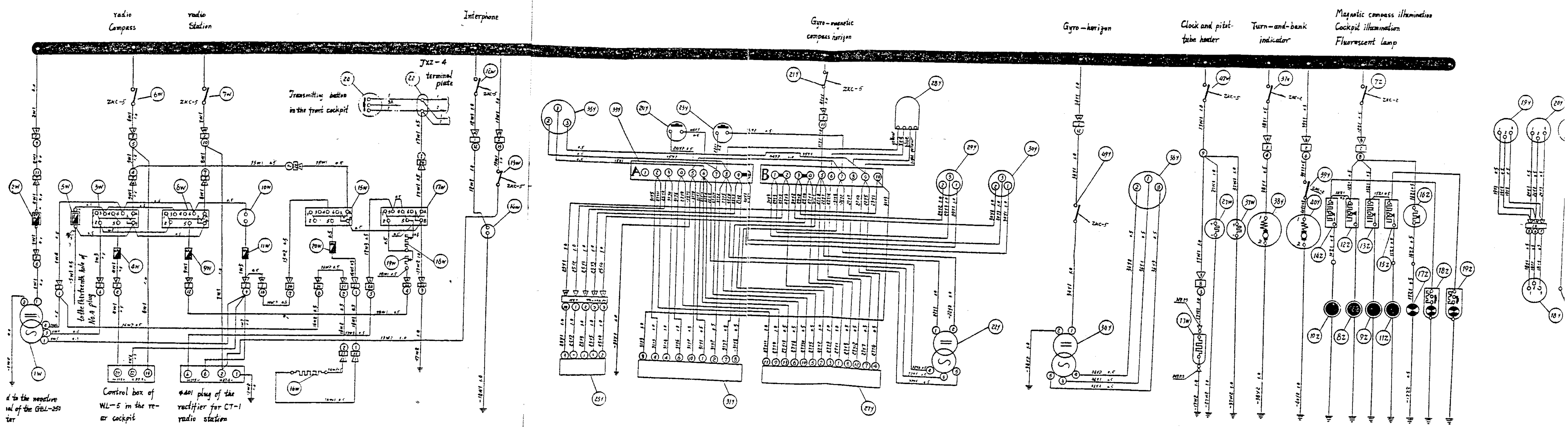


Fig. 7.9 Priciple diagram of the electric equipment

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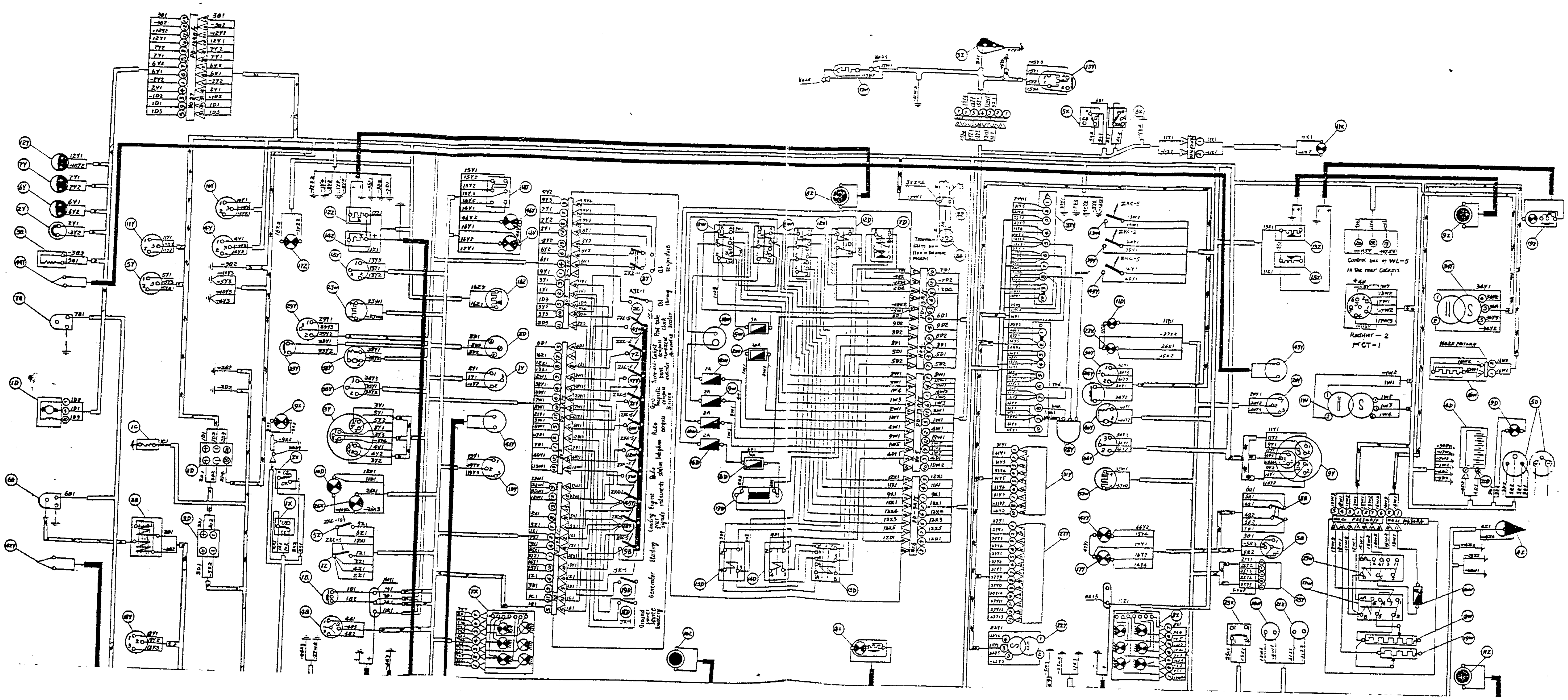
Detailed List of the Electrical Equipment

SHEET 2



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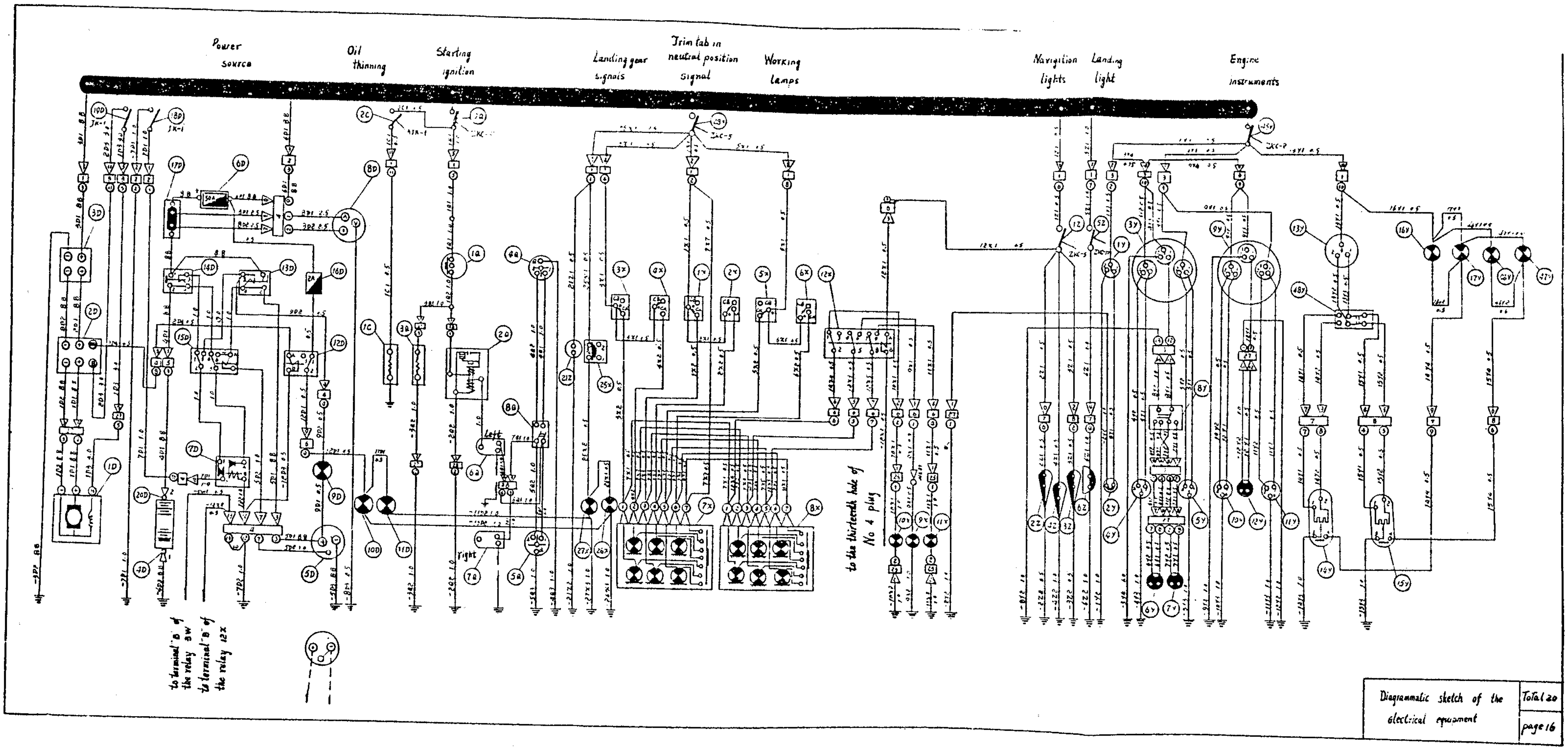


Fig. 7.9 Principle diagram of the electric equipment

Code	Name	Designation	Qt.	Location
4X	Left main landing gear "up" limiting position switch	AKP2-1	1	Left wheel bay
5X	Right main landing gear "down" limiting position switch	AKP2-1	1	Right wheel bay
6X	Right main landing gear "up" limiting position switch	AKP2-1	1	Right wheel bay
7X	Signal box for landing gear in the front cockpit	XH-7	1	Left instrument panel in the front cockpit
8X	Signal box for landing gear in the rear cockpit	XH-7	1	Left instrument panel in the rear cockpit
9X	Nose landing gear external indicating light	WD-1	1	Nose landing gear strut
10X	Left landing gear external indicating light	WD-1	1	Left main landing gear strut
11X	Right landing gear external indicating light	WD-1	1	Right main landing gear strut
12X	Relay	JKB-53A	1	Power supply relay box
25X	Trim tab "In netural position" microswitch	WK3-1	1	Left side of the frames 6-7
26X	Signal light for trim tab "In neutral position"	ZSD-1 (green)	1	Middle instrument panle in the front cockpit
27X	Signal light for trim tab "In neutral position"	ZSB-1 (green)	1	Middle instrument panel in the rear cockpit
28X	Automatic cut-off switch for signal device	ZKC-5	1	Central switch panel
1Z	Automatic cut-off switch for navigation light	ZKC-5	1	Left instrument panel in the front cockpit
2Z	Left wingtip light	HD-3 (red)	1	Left wingtip
3Z	Right wingtip light	HD-3 (green)	1	Right wingtip
4Z	Tail navigation light	WD-1	1	Fuselage tail cone
5Z	Automatic cut-off switch for landing light	ZKC-10	1	Upper longeron between the frames 2 and 3
6Z	Landing light	ZLD-4	1	Leading edge of the left outer wing between ribs 1 and 2
7Z	Automatic cut-off switch for fluorescent lamps and cockpit lamps	ZKC-2	1	Central switch panel
8Z	Right fluorescent lamp of the front cockpit	YD-1	1	Frames 2-3
9Z	Right fluorescent lamp of the rear cockpit	YD-1	1	Frames 7-8
10Z	Left fluorescent lamp of the front cockpit	YD-1	1	Frames 3-4
11Z	Left fluorescent lamp of the rear cockpit	YD-1	1	Frames 7-8
12Z	Rheostat of the right fluorescent lamp in the front cockpit	R-11	1	Right instrument panel in the front cockpit
13Z	Rheostat of the right fluorescent lamp in the rear cockpit	R-11	1	Right instrument panel in the rear cockpit
14Z	Rheostat of the left fluorescent lamp in the front cockpit	R-11	1	Right instrument panel in the front cockpit
15Z	Rheostat of the left fluorescent lamp in the rear cockpit	R-11	1	Right instrument panel in the front cockpit
16Z	Rheostat for the magnetic compass illuminating light	R-6	1	Middle instrument panel in the front cockpit
17Z	Magnetic compass illuminating light	LC-2 (accessory)	1	Front windshield
18Z	Front cockpit lamp	ZCD-2	1	Frames 4-5
19Z	Rear cockpit lamp	ZCD-2	1	Frames 8-9
21Z	Portable lamp socket	CX-4	1	Frames 9-10

Code	Name	Designation	Qt.	Location
1W	Inverter	GBL-250	1	Frames 9-10
2W	Inertia fuse	GB-30	1	Power supply relay box
3W	Relay	JKB-52A	1	Power supply relay box
4W	Fuse	TB-2	1	Power supply relay box
5W	Inertia fuse	GB-5	1	Power supply relay box
6W	Automatic cut-off switch for radio compass	ZKC-5	1	Central switch panel
7W	Automatic cut-off switch for radio station	ZKC-5	1	Middle instrument panel
8W	Relay	JKB-52A	1	Power supply relay box
9W	Fuse	TB-2	1	Power supply relay box
10W	Voltage checking socket	CX-4	1	Power supply relay box
11W	Fuse	TB-2	1	Power supply relay box
12W	Automatic cut-off switch for interphone in the front cockpit	ZKC-5	1	Central switch panel
13W	Automatic cut-off switch for radio station in the rear cockpit	ZKC-5	1	Middle instrument panel in the rear cockpit
14W	Power source socket for the interphone	CX-5	1	Frames 9-10
15W	Relay	JKB-52A	1	Resistance relay box
16W	Resistor	RXYC-75W-240Ω-1	1	Equivalent loading resistance box
17W	Relay	JKB-52A	1	Resistance relay box
18W	Rheostat	RXYC-T-20W-15Ω-1	1	Resistance relay box
19W	Rheostat	RXYC-T-25W-200Ω-1	1	Resistance relay box
20W	Fuse	TB-2	1	Resistance relay box
1Y	Carburetor temperature indicator	BWH-1	1	Middle instrument panel in the front cockpit
2Y	Carburetor temperature probe	BWH-1 (attachment)	1	Engine
3Y	Triplex gauge indicator of the front cockpit	ZWY-1 (ZWY-1)	1	Middle instrument panel in the front cockpit
4Y	Oil pressure transmitter in the front cockpit	GY15	1	Frame 1
5Y	Fuel pressure transmitter in the front cockpit	GY1	1	Slant frame
6Y	Oil outlet temperature probe in the front cockpit	GWR-1	1	Engine
7Y	Oil inlet temperature probe in the front cockpit	GWR-1	1	Slant frame
8Y	Oil temperature change-over switch	ZKZ-1	1	Central switch panel
9Y	Triplex gauge indicator of the rear cockpit	ZWY-1 (ZWY-1)	1	Middle instrument panel in the rear cockpit
10Y	Rear cockpit oil pressure transmitter	GY15	1	Frame 1
11Y	Rear cockpit fuel and oil pressure transmitter	GY1	1	Slant frame
12Y	Rear cockpit oil temperature probe	GWR-1	1	Slant frame
13Y	Fuel level gauge	ZUR-7	1	Middle instrument panel in the front cockpit
14Y	Left fuel tank transmitter	GUR-7I (left)	1	Left outer wing fuel tank
15Y	Right fuel tank tramsitter	GUR-7II (right)	1	Right outer wing fuel tank
16Y	Signal light for fuel remaining quantity in the left tank	ZSD-1 (red)	1	Middle instrument panel in the front cockpit
17Y	Signal light for fuel remaining quantity in the left tank	ZSD-1 (red)	1	Middle instrument panel in the rear cockpit

Code	Name	Designation	Qt.	Location
18Y	Tachometer transmitter	GZ-9A	1	Slant frame- frame 1
19Y	Tachometer indicator of the front cockpit	ZZ-35	1	Middle instrument panel in the front cockpit
20Y	Tachometer indicator of the rear cockpit	ZZ-35	1	Middle instrument panel in the rear cockpit
21Y	Automatic cut-off switch for gyrocompass and horizon	ZKC-5	1	Central switch panel
22Y	Inverter	SBL-53	1	Frames 5-6
23Y	Synchronizing button of the front cockpit	AN-1A	1	Middle instrument panel in the front cockpit
24Y	Synchronizing button of the rear cockpit	AN-1A	1	Middle instrument panel in the rear cockpit
25Y	Magnetic heading sensor	GHC-2	1	Left outer wing
27Y	Gyro mechanism	TH-3	1	Frames 5-6
28Y	Rectifier	EX-2	1	Inside the EX-terminal box
29Y	Gyro-magnetic compass indicator of the front cockpit	LTC-1 (ZH-4)	1	Middle instrument panel in the front cockpit
30Y	Gyro-magnetic compass indicator of the rear cockpit	LTC-1 (ZH-4)	1	Middle instrument panel in the rear cockpit
31Y	Amplifier	FL-3	1	Frames 5-6
33Y	Terminal box	LTC-1 (EX-2)	1	Frames 5-6
34Y	Inverter	SBL-40	1	Frames 10-11
35Y	Gyro-horizon	BDP-2	1	Middle instrument panel in the front cockpit
36Y	Gyro-horizon	BDP-2	1	Middle instrument panel in the rear cockpit
37Y	Automtic cut-off switch for the front cockpit turn-and-bank indicator	ZKC-2	1	Central switch panel
38Y	Front cockpit turn-and-bank indicator	BZW-2A	1	Middle instrument panel in the front cockpit
39Y	Automatic cut-off switch for rear cockpit turn-and-bank indicator	ZKC-2	1	Right instrument panel in the rear cockpit
40Y	Rear cocpkit turn-and-bank indicator	BZW-2A	1	Middle instrument panel in the rear cockpit
41Y	Cylinder head temperature indicator of the front cockpit	ZWG-2	1	Middle insturment panel in the front cockpit
42Y	Cylinder head temperature transmitter of the front cockpit	BWG-1 (accessory)	1	Cylinder 4 of the engine
43Y	Cylinder head temperature indicator of the rear cockpit	ZWG-2	1	Middle instrument panel in the rear cockpit
44Y	Cylinder head temperature transmitter of the rear cockpit	BWG-1 (accessory)	1	Cylinder 1 of the engine
45Y	Automatic cut-off switch for the engine instrument	ZKC-2	1	Central switch panel
46Y	Signal light for fuel remaining quantity in the right tank	ZSD-1 (red)	1	Right instrument panel in the front cockpit
47Y	Signal light for fuel remaining quantity in the right tank	ZSD-1 (red)	1	Middle instrument panel in the rear cockpit
48Y	Left and right tank fuel level change-over switch	ZKZ-1	1	Right instrument panel in the front cockpit
49Y	Gyro-horizon switch	ZKC-5	1	Right instrument panel in the rear cockpit

Code	Name	Designation	Qt.	Location
1 J W	Pitot tube heater	GKY-5 (accesories)	1	Pitot tube of the right outer wing
2 J W	Clock heater	301-1	1	Middle instrument panel in the front cockpit
3 J W	Clock heater	302-1	1	Middle instrument panel in the rear cockpit
4 J W	Autoamtic cut-off switch for heater	ZKC-5	1	Central switch panel
No. 1	Plug	PD-13A/T	1	Central switch panel
No. 2	Plug	PD-13A/T	1	Central switch panel
No. 3	Plug	PD-13A/T	1	Central switch panel
No. 4	Plug	PD-13A/T	1	Power supply relay box
No. 5	Plug	PD-13A/T	1	Power supply relay box
No. 6	Plug	PD-9A/T	1	Power supply relay box
No. 7	Plug	PD-13A/T	1	Leading edge of the left midwing at rib 5
No. 8	Plug	PD-7A/T	1	Leading edge of the right midwing at rib 5
No. 11	Terminal plate	JXZ-5	1	Left instrument panel in the front cockpit
No. 15	Terminal plate	JXZ-4	1	Left instrument panel in the rear cockpit
No. 20	Plug	P28J4A/P	1	Resistance relay box
No. 21	Plug	P16J4A/P	1	Resistance relay box
No. 22	Plug	P16J4A/P	1	Equivalent load resistance box
No. 23	Plug	CX-1	1	Leading edge of the right outer wing
No. 24	Plug	CX-1	1	Leading edge of the right outer wing
No. 25	Plug	PD-2A/T	1	Landing edge of the right outer wing
No. 26	Plug	PD-2A/T	1	Landing gear bay of the right wing
No. 27	Plug	PD-13AB/T	1	Right side of the frame 0
No. 28	Plug	PD-7AB/T	1	Left side of the frame 0
No. 29	Plug	CX-1	1	Left side of the nose gear bay

IV. RADIO EQUIPMENT

The radio equipment (Fig. 7.11) on the airplane ensures that the communication between the airplane and ground and between airplanes themselves and the interphone communication can be successfully carried out and that the airplane flies along the correct course. The airplane is equipped with the following wireless equipment:

1. CT-1 ultrashort wave commanding radio station system;
2. WL-5 radio compass system;
3. JT-2A interphone communicator.

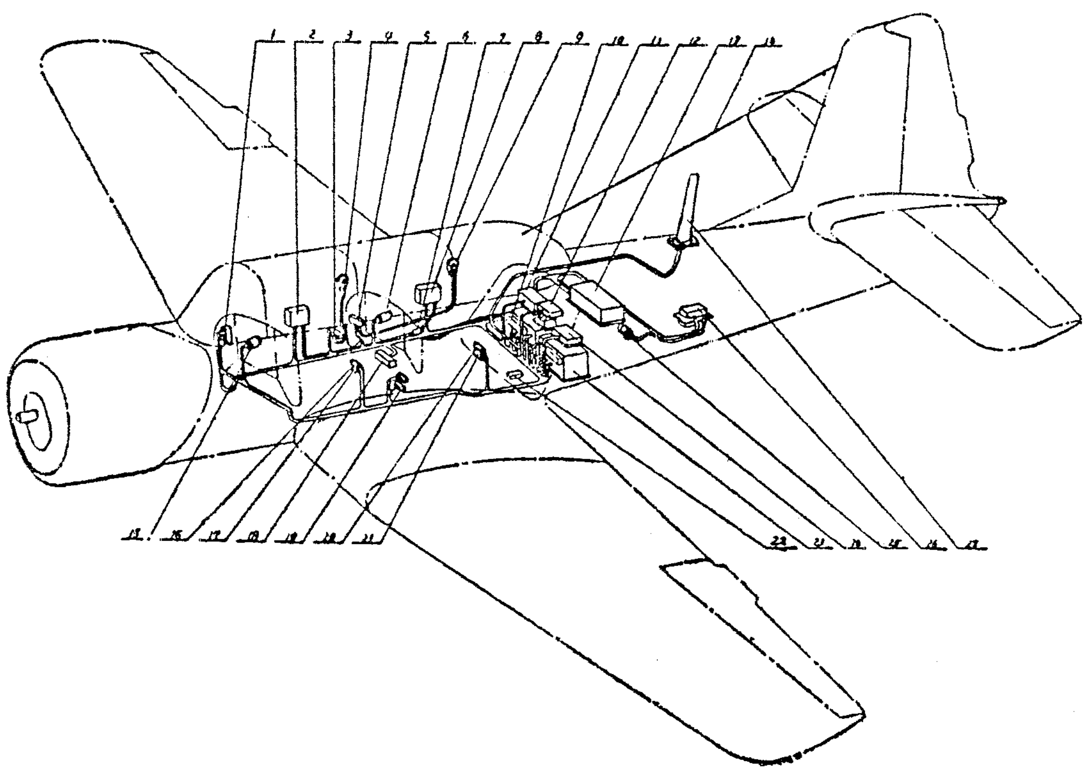


Fig. 7.11 Arrangement sketch for the radio equipment

1. Wave band control box of the CT-1 radio station 2. WL-5 radio compass control box in the front cockpit 3. Interphone user's box in the front cockpit 4. Aviation helmet in the front cockpit 5. Interphone user's box in the rear cockpit 6. ZHW-1A radio compass indicator in the rear cockpit 7. T-joint of the flexible shaft for WL-5 radio compass 8. WL-5 radio compass control box in the rear cockpit 9. Aviation helmet in the rear cockpit 10. Transmitter of the CT-1 radio station 11. CT-1 rectifier 12. GBL-250 inverter 13. Receiver of the WL-5 radio compass 14. Non-directive antenna of the WL-5 radio compass 15. ZHW-1A radio compass indicator in the front cockpit 16. AN-3A transmitting button in the front cockpit 17. AN-3A interphone button in the front cockpit 18. Change-over relay box of the WL-5 radio compass 19. JXZ-4 cable terminal plate of the air and fuel mixture throttle lever 20. AN-3A transmitting button in the rear cockpit 21. AN-3A interphone button in the rear cockpit 22. CT-1 radio crystal box 23. Receiver of the CT-1 radio station 24. JT-2A interphone amplifier 25. Desiccator tube for the loop antenna of the WL-5 radio compass 26. Loop antenna of the WL-5 radio compass 27. Fin antenna

CT-1 ULTRASHORT WAVE COMMANDING RADIO STATION

The CT-1 radio station is an ultrashort wave radio transmitter-receiver for the communication between the airplane and ground and between airplanes themeslves. Its connection diagram is shown in Fig. 7.12.

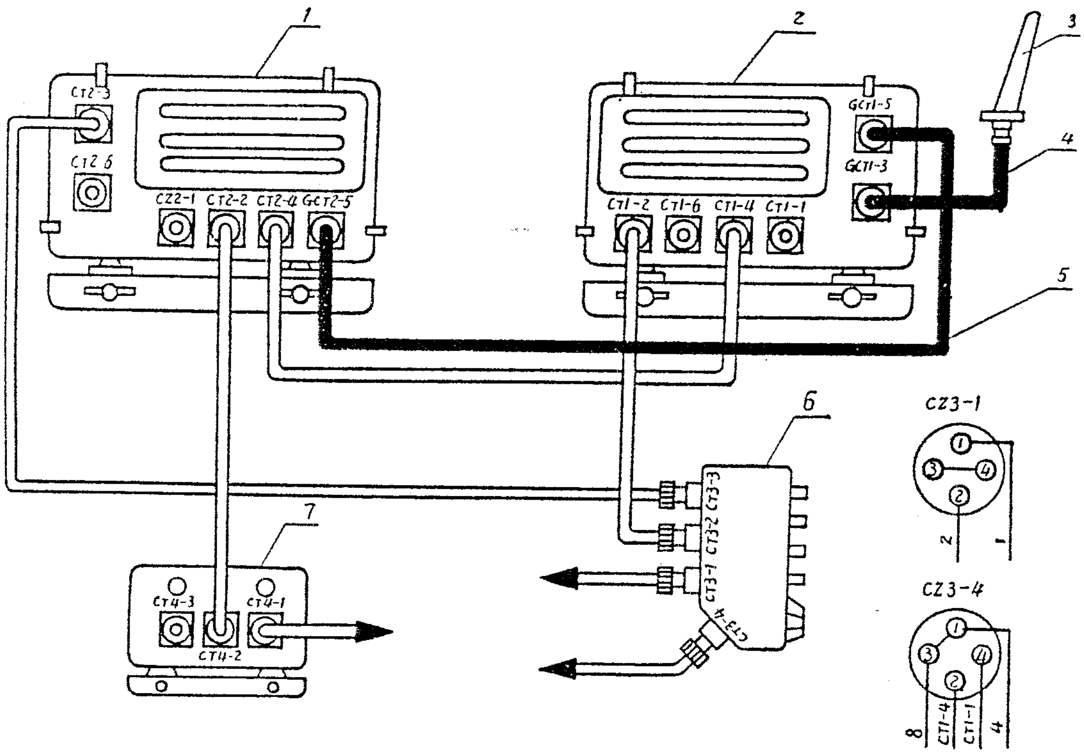


Fig. 7.12 Connection diagram of the CT-1 radio station

1. Receiver 2. Transmitter 3. Fin antenna 4. High frequency feeder 5. High frequency feeder 6. Control box 7. Rectifier

TRANSMITTER

The transmitter has its transmitting frequency crystal-controlled. The transmission can be carried out through any four channels previously adjusted. Each of the preset channel can be adopted without any complementary adjustment in flight. The transmitter endures a cyclic operation (two minutes for transmitting, other two minutes in succession for receiving) for a long time or endures a continuous operatoin for fifteen minutes at most. The transmitting power is 6 W. While the transmitter being communicated with the ground radio station type A-522T, its communication distance is assured as given in the following table.

Flight altitude (m.)	1,000	2,000	5,000
Communication distance (km.)	120	160	230

When the airplane is flying at an altitude of 500 m. or above, the communication with the far way airplane at a distance more than 120 km. is ensured.

There is a self-hearing system in the transmitter, which may be used to check the working condition of the transmitter.

RECEIVER

The receiver has its receiving frequency crystal-controlled. The receiving can be realized through any four channels previously adjusted. Each of the preset channel can be adopted without any complementary adjustment in flight, but the tuning frequency of the receiver may be different from that of the transmitter. The sensitivity of the receiver is not lower than 12 microvolts.

The receiver is provided with an autocontrol system for keeping the sound a constant volume. The special noise suppressor installed in the receiver frees the air crew from the fatigue which might be caused by the noise from the earphone. The noise suppressor is controlled by the switch located either on the meter board or on the control box. When there is no incoming signal, the noise suppressor will be disconnected from the receiver automatically.

The receiver can operate continuously for a long time.

The four channels for the transmitter and receiver should be tuned till the CT-1 instrument for tuning the radio station gives the maximun deflection. At the moment, the power supply voltage should not be less than 24.3 V.

SELENIUM RECTIFIER

The A.C. power of the GBL-250 inverter is transformed and rectified by the selenium rectifier to supply the plate and grid circuits of the radio station. The transformer ratio may be changed automatically and the D.C. output voltages are as follows:

In transmitting condition, the voltage applied to the tube plate is 310 V.

In receiving condition, the voltage applied to the tube plate is 275 V.

In transmitting condition, the voltage applied to the tube grid is–120 V.

In receiving condition, the voltage applied to the tube grid is–105 V.

REGULATING BOX

The regulating box is used to control the sound volume and to change over the channel without tuning.

CT-1 INSTRUMENT FOR TUNING THE RADIO STATION

The CT-1 instrument is used to tune the radio station and check the current and voltage of its main circuits. This instrument has change-over switches for eleven positions to check the operation of the radio station. The transmitter and receiver are tuned according to the reading of this instrument.

INSTALLATION OF THE UNIT

The receiver and transmitter are fixed on the support between the fuselage frames 9 and 10 through their bottom boards with screws.

A detachable support is situated above the transmitter and receiver between the fuselage frames 9 and 10. On its right side is installed the selenium rectifier, on its left side the amplifier of the interphone communicator and in the middle the GBL-250 inverter. All these apparatuses are screwed on the detachable support through their bottom boards.

The regulating box of the radio station installed on the right instrument panel in the front cockpit is at first fastened to the two angle sections by four screws, the angle section themselves are then fastened to the right instrument panel through screws and self-locking nuts.

The radio crystal box in the front cockpit is installed on the left front side of the web of the frame 9, the radio crystal box in the rear cockpit on the left console of the rear cockpit.

Two transmitting buttons are installed on the air and fuel mixture throttle control handles in the front cockpit and rear cockpit respectively.

The CT-1 instrument is not installed on the airplane, but used in the field inspection for the radio station only.

WL-5 RADIO COMPASS

The WL-5 radio compass used to navigate and locate the airplane in accordance with the signal transmitted by the beam radio station, aeronautical broadcast station or beacon station, and also used for blind landing. The radio compass can fulfil the following tasks:

1. To lead the airplane to fly toward the radio station by visual direction-finding.
2. To lead the airplane to fly toward the radio station by auditory direction-finding.
3. To lead the airplane to fly with the radio station in the rearward direction (the radio compass served as an auxiliary device).
4. To determine the wind angle and the drift angle.
5. To determine the azimuthal angle of the radio station automatically in accordance with the WL-5 radio compass indicator and by auditory direction-finding.
6. To lead the airplane to fly in accordance with the signal transmitted by the local station or the amplitude-modulated beacon radio station.

When the WL-5 radio compass is operated together with the 500 W. beam radio station, its operating distance is 180-200 km. The sensibility of the receiver is 10-12 microvolts, its maximum sensitivity for navigation 50 microvolts per meter. The remote tuning and remote control for the WL-5 radio compass can be carried out by means of the regulating boxes in the front and rear cockpits respectively. The connecting diagram of the WL-5 radio compass is shown in Fig. 7.13.

The change-over device of the regulating boxes for the WL-5 radio compass in both cockpits is the terminal box not conventionalized as the ready-made complement but designed and made in the very airplane factory in accordance with the special requirement for the airplane. Its wiring is shown in Fig. 7.14.

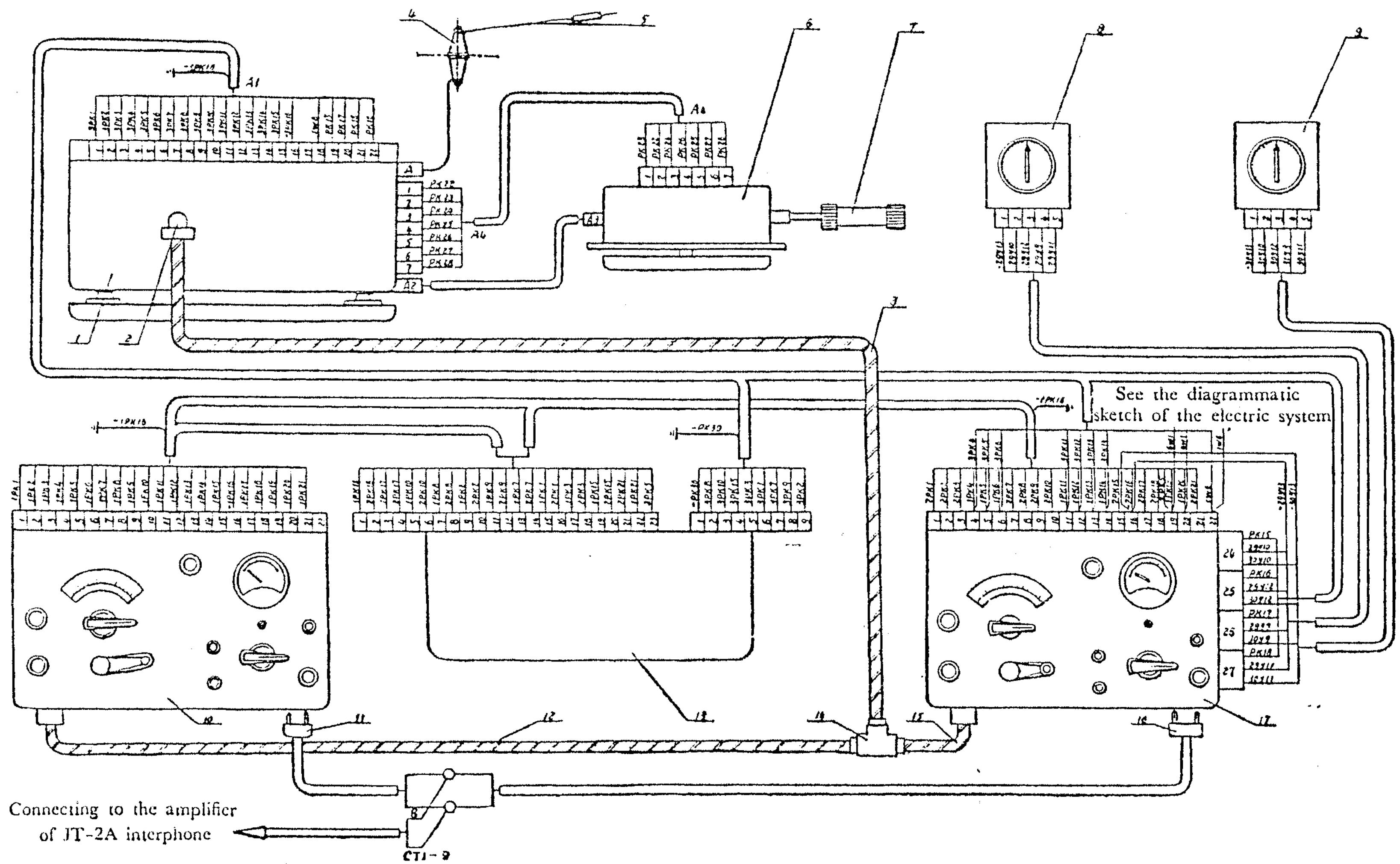


Fig. 7.13 Connection diagram of the Radio Compass WL-5

1. WL-5 Receiver 2. Elbow joint of the flexible shaft 3. Flexible shaft from T-joint to the receiver 4. Insulator 5. Non-directional antenna 6. Loop antenna of the WL-5 radio compass 7. Desiccator tube for the WL-5 radio compass 8. ZHW-1A radio compass indicator in the front cockpit 9. ZHW-1A radio compass indicator in rear cockpit 10. Regulating box for WL-5 radio compass in the front cockpit 11. Earphone socket in the front cockpit 12. Flexible shaft from the front cockpit regulating box to the T-joint 13. Change-over relay box 14. T-joint of the flexible shaft for WL-5 radio compass 15. Flexible shaft from the rear cockpit regulating box to the T-joint 16. Earphone socket in the rear cockpit 17. Rear cockpit regulating box for WL-5 radio compass

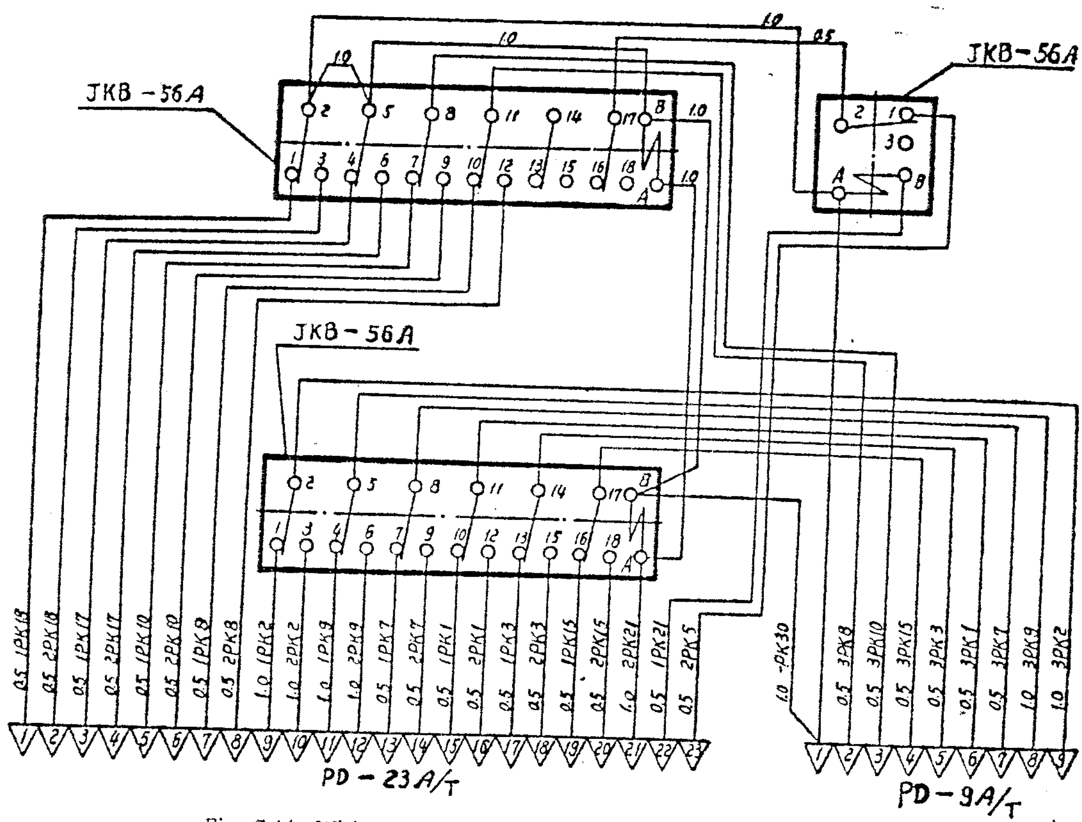


Fig. 7 14 Wiring diagram of the change-over terminal box of the WL-5 radio compass

INSTALLATION OF THE UNITS OF THE WL-5 RADIO COMPASS

The receiver of the WL-5 radio compass is fixed on the support between the fuselage frames 11 and 12. The bottom board of the receiver has its rear end jammed by the reed, its front end fixed by the spring lock through a support and two angular plates. As being installed in such a way, the receiver can be conveniently mounted and dismantled.

The loop antenna shielded with an organic glass cover is mounted on its low positioned support between the fuselage frames 12 and 13.

The regulating box of the front cockpit is installed on the right support between the fuselage frames 3 and 4, and that of the rear cockpit on the right support between the fuselage frames 7 and 8. The non-directional antenna made of steel cable has its one end connected to the special damper on the vertical stabilizer through the finger insulator and the "8" shaped eyes, and its other end fastened to the insulator on the right side of the fuselage by means of nut.

The change-over relay box is installed on the support between the fuselage frames 5 and 6. On this very support is also installed the LTC-1 gyro compass accessory.

The desiccator tube is fixed on the lower part behind the fuselage frame 12 with two spring locks.

INTERPHONE COMMUNICATOR

The JT-2A interphone communicator in the airplane is used for the intercommunication between the pilots in the front and rear cockpits. It is also used to change-over the circuits when the commanding radio station communicates with the ground radio station and when the pilots listen in to the signals from the beam radio station and aeronautical broadcast station through the radio compass. The connection diagram of the interphone communicator is shown in Fig. 7.15.

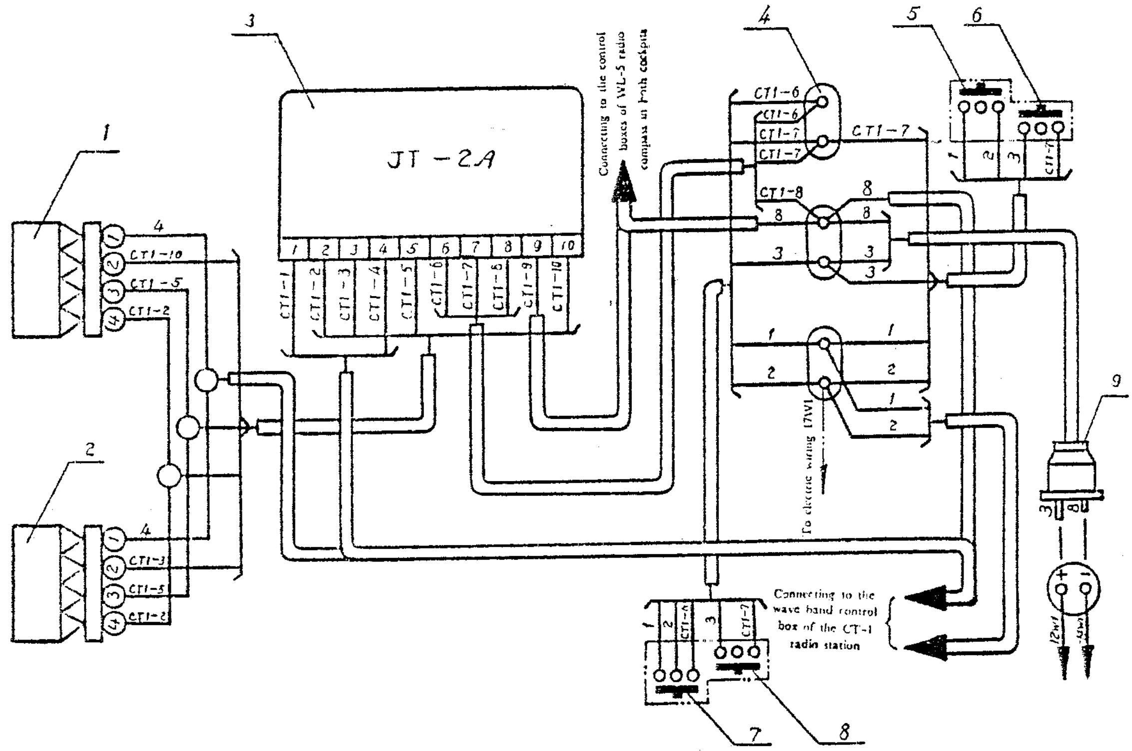


Fig. 7.15 Connection diagram of the JT-2A interphone communicator

1. User's box in the front cockpit 2. User's box in the rear cockpit 3. Amplifier of the JT-2A interphone 4. JX7-4 terminal plate 5. Transmitting button in the rear cockpit 6. Talking button in the rear cockpit 7. Transmitting button in the front cockpit 8. Talking button in the front cockpit 9. CX-5 power supply socket

INSTALLATION OF THE UNITS OF THE JT-2A INTERPHONE COMMUNICATOR

The amplifier is fixed on the left side of the detachable support situated between the fuselage frames 9 and 10 with screws and anchor nuts.

The user's box for the front cokpit is installed on the right consloe of the front cockpit, while that for the rear cockpit on the right instrument panel of the rear cockpit. The talking buttons are installed on the air and fuel mixture throttle control handles of the tandem cockpits.

AIRPLANE GROUNDING SYSTEM:

The airplane grounding system is the electric connection between the airplane metallic components themselves and between the airborne equipment and airplane metallic components. It makes all the connected members being at the same potential. The purpose of grounding is for:

1. To eliminate the possible fire caused by static discharge between airplane components and the interference with the operation of the radio equipment during flight;
2. To take the airplane body as a common negative terminal, thus giving the reliable single-wire system circuits:
3. To form a ground network with a definite capacitance.

Any metallic part (such as strip, pipe, shielding sleeve, etc.) with its face area greater than 0.2 m^2. or its length longer than 0.5 m. and all auxiliary equipment should be grounded with the airplane body.

There are two grounding methods for the airplane: One method is to ground the airborne equipment and metallic components directly to the airplane body. In such a case, the contact surfaces must be cleaned to give a good electric contact, e.g., the connected spots should be cleaned by grinding, the connector such as rivets should have their surfaces chemically treated to remove the layer of oxides and oil. The other method takes the soft braided copper wires as the grounding jumper, by which the equipment and metallic components to be grounded are connected with each other and to the ground.

The airplane grounding system is shown in Fig. 7.16, 7.17.

1. Engine——engine mount
2. Engine——engine mount
3. Engine mount——slant frame
4. Movable instrument panel——fixed instrument panel
5. Movable instrument panel——fixed instrument panel
6. Front control stick——frame 3——push-pull rod
7. Rear control stick——bellcrank——push-pull rod——support
8. Bellcrank——push-pull rod——steel cable
9. Emergency air bottle——frame 10
10. Main air bottle——frame 12
11. Elevator bellcrank——steel cable——airplane body
12. Front pedal bellcrank——steel cable——support
13. Rear pedal bellcrank——steel cable——support
14. Steel cable——steel cable
15. Flap——rear spar
16. Rudder bellcrank——steel cable——support
17. Aileron bellcrank——steel cable——support
18. Tank——airplane body
19. Tank——airplane body
20. Bellcrank——push-pull rod——support
21. Bellcrank——push-pull rod——support
22. Bellcrank——push-pull rod——support

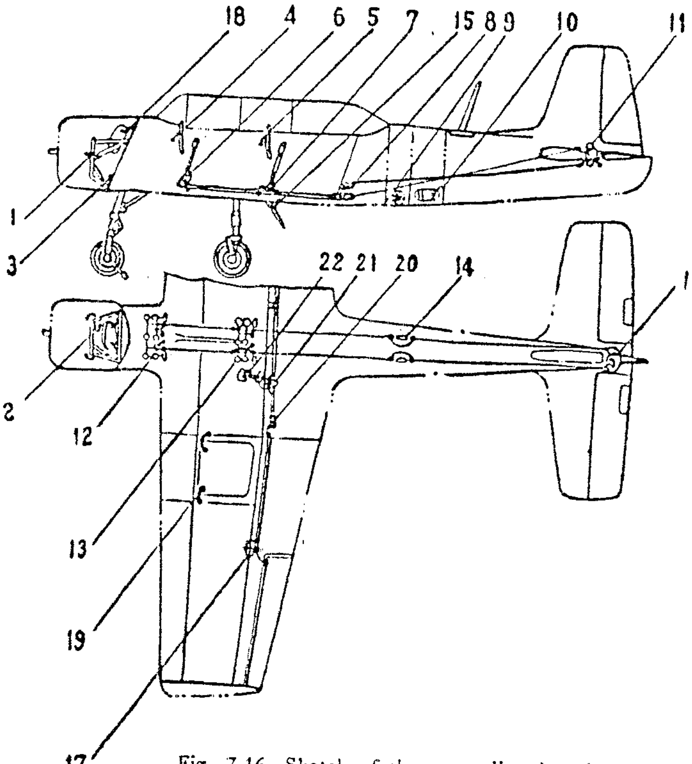


Fig. 7.16 Sketch of the grounding location

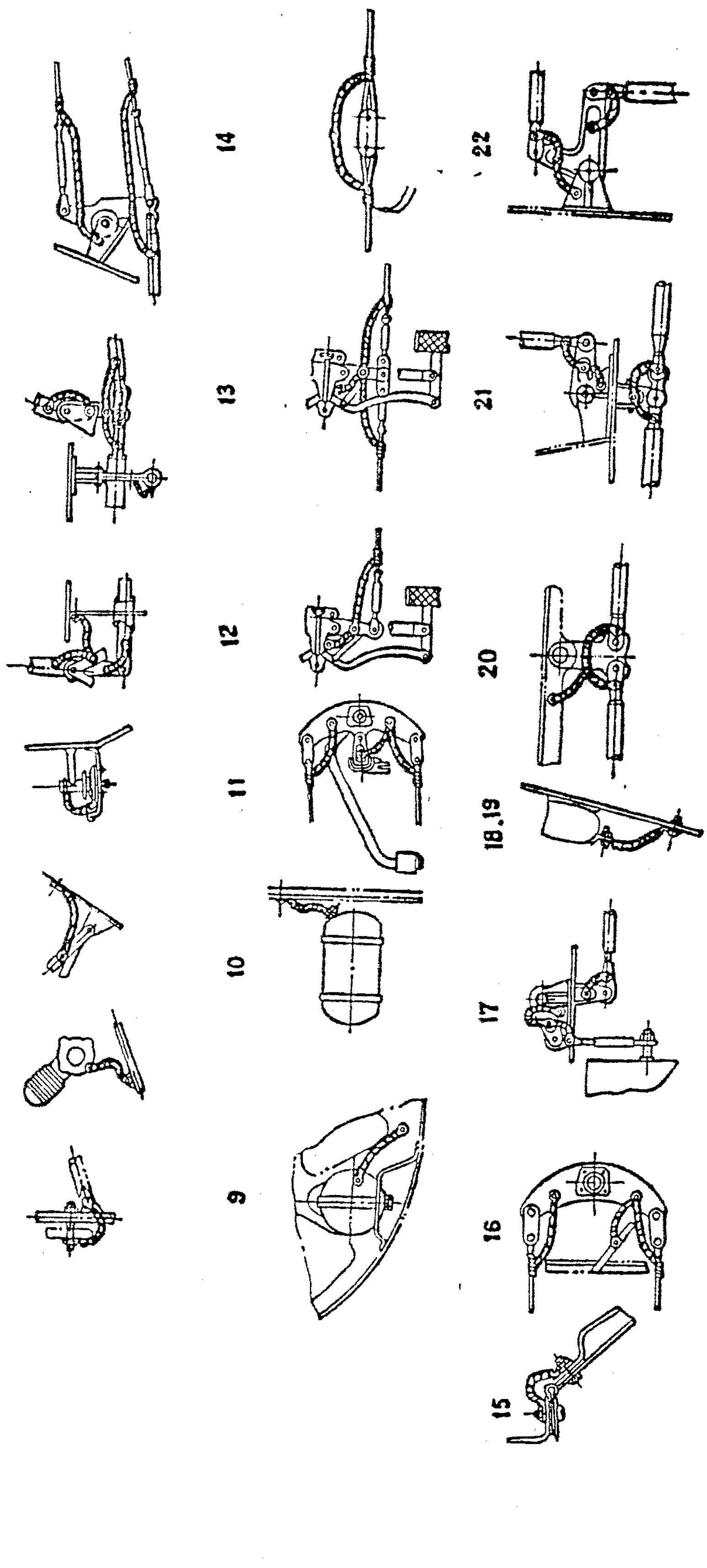


Fig. 7.17

List of the normal rated resistance value for grounding points

Item / Ser. No.	Drawing Number	Name of the Grounded Pairs	Normal Rated Valve (micro-ohm)	Remark
1	H2-7,140-00	Engine — engine mount	600	
2	H2-7,140-00	Engine mount — slant frame	600	
3	H2-7,140-00	Front movable instrument panel — fixed instrument panel	2,000	
4	H2-7,140-00	Rocking arm — push-pull rod	2,000	
5	H2-7,140-00	Front control stick — front support	2,000	
6	H2-7,140-00	Front support — frame 3	2,000	
7	H2-7,140-00	Rocking arm — link-rod	2,000	
8	H2-7,140-00	Rear movable instrument panel — fixed instrument panel	2,000	
9	H2-7,140-00	Rear control stick — rear support	2,000	
10	H2-7,140-00	Rocking arm — push-pull rod	2,000	
11	H2-7,140-00	Push-pull rod — push-pull rod	2,000	
12	H2-7,140-00	Push-pull rod — rocking arm	2,000	
13	H2-7,140-00	Rocking arm — support	2,000	
14	H2-7,140-00	Rocking arm — cable	2,000	
15	H2-7,140-00	Rocking arm — cable	2,000	
16	H2-7,140-00	Emergency air bottle — frame 10	2,000	
17	H2-7,140-00	Main air bottle — frame 12	2,000	
18	H2-7,140-00	Cable — rocking arm	2,000	
19	H2-7,140-00	Cable — rocking arm	2,000	
20	H2-7,140-00	Rocking arm — airplane body	2,000	
21	H2-7,140-00	Rocking arm — support	2,000	
22	H2-7,140-00	Rocking arm — cable	2,000	
23	H2-7,140-00	Rocking arm — support	2,000	
24	H2-7,140-00	Rocking arm — cable	2,000	
25	H2-7,140-00	Cable — rocking arm	2,000	
26	H2-7,140-00	Rocking arm — support	2,000	
27	H2-7,140-00	Rocking arm — support	2,000	
28	H2-7,140-00	Cable — rocking arm	2,000	
29	H2-7,140-00	Rocking arm — cable	2,000	
30	H2-7,140-00	Rocking arm — cable	2,000	
31	H2-7,140-00	Cable — cable	2,000	
32	H2-7,140-00	Cable — cable	2,000	
33	H2-7,140-00	Cable — rocking arm	2,000	
34	H2-7,140-00	Support — rocking arm	2,000	
35	H2-7,140-00	Cable — rocking arm	2,000	
36	H2-7,140-00	Push-pull rod — aileron	2,000	
37	H2-7,140-00	Push-pull rod — rocking arm	2,000	
38	H2-7,140-00	Rocking arm — support	2,000	
39	H2-7,140-00	Rocking arm — push-pull rod	2,000	
40	H2-7,140-00	Tank — rib	600	
41	H2-7,140-00	Tank — rib	600	
42	H2-7,140-00	Push-pull rod — support	2,000	
43	H2-7,140-00	Support — rocking arm	2,000	

Item / Ser. No.	Drawing Number	Name of the Grounded Pairs	Normal Rated Valve (micro-ohm)	Remark
44	H2-7,140-00	Rocking arm — push-pull rod	2,000	
45	H2-7,140-00	Flap — rear spar	2,000	
46	H2-7,140-00	Support — rocking arm	2,000	
47	H2-7,140-00	Rocking arm — push-pull rod	2,000	
48	H2-7,140-00	Support — rocking arm	2,000	
49	H2-7,140-00	Rocking arm — push-pull rod	2,000	
50	H2-7,140-00	Rocking arm — push-pull rod	2,000	
51	H2-7,140-00	Push-pull rod — rocking arm	2,000	
52	H2-7,140-00	Rocking arm — push-pull rod	2,000	
53	H2-7,140-00	Push-pull rod — rocking arm	2,000	
54	H2-7,140-00	Rocking arm — support	2,000	
55	H2-7,140-00	Rocking arm — push-pull rod	2,000	
56	H2-7,140-00	Support — rocking arm	2,000	
57	H2-7,140-00	Push-pull rod — rocking arm	2,000	
58	H2-7,140-00	Rocking arm — push-pull rod	2,000	
59	H2-7,140-00	Tank — rib	600	
60	H2-7,140-00	Tank — rib	600	
61	H2-7,140-00	Rocking arm — support	2,000	
62	H2-7,140-00	Push-pull rod — rocking arm	2,000	
63	H2-7,140-00	Support — push-pull rod	2,000	
64	H2-7,140-00	Push-pull rod — aileron	2,000	
65	H2-7,140-00	Oil tank — slant frame	600	
66	H2-7,001-00C	Left console of the front cockpit—airplane body	2,000	
67	H2-7,002-00C	Right console of the front cockpit — airplane body	2,000	
68	H2-7,003-00	Left console of the rear cockpit — airplane body	2,000	
69	H2-7,004-00C	Right console of the rear cockpit — airplane body	2,000	
70	H2-7,200-00	Starting ignition coil, SBL-40, SBL-53, ZY-1500, LBQ-3 — cable	600	
71	H2-7,202-00	Negative terminal plate — airplane body	not more than 400	
72	H2-7,210-00	ZY-1500 regulating box — airplane body	600	
73	H2-7,213-00	Relay box — airplane body	600	
74	H2-7,214-00	LBQ-3 wave filter — airplane body	600	
75	H2-7,220-00	Starting ignition coil — engine mount	600	
76	H2-7,230-00A	SBL-40 inverter — airplane body	600	
77	H2-7,232-00A	SBL-53 inverter, EX-2 junction box — airplane body	600	
78	H2-7,240-00	Tachometer transmitter — airplane body	600	
79	H2-7,261-00A	GHC-2 transmitter — airplane body	600	
80		Lead shielded cable — airplane body	600	
81	H2-7,110-00	CT-1 radio station (transmitter, receiver, rectifier and control box) — shielded cable	600	measured for two to three times
82	H2-7,110-00	GBL-250 inverter — movable support	600	
83	H2-7,110-00	CT-1 radio station rectifier bottom board — detachable support	600	

Item / Ser. No.	Drawing Number	Name of the Grounded Pairs	Normal Rated Valve (micro-ohm)	Remark
84	H2-7,110-00	JT-2A — detachable support	600	
85	H2-7,110-00	Detachable support — airplane body	600	
86	H2-7,111-00	CT-1 radio station transmitter bottom board — support	600	
87	H2-7,111-00	CT-1 radio station receiver bottom board — support	600	
88	H2-7,111-00	Support — frames 9 and 10	600	
89	H2-7,120-00	WL-5 radio compass bottom board — support	600	
90	H2-7,120-00	Support — airplane body	600	
91	H2-7,121-00	WL-5 control box of the front cockpit — airplane body	600	
92	H2-7,122-00	WL-5 control box of the rear cockpit — airplane body	600	
93	H2-7,123-00	WL-5 loop antenna — airplane body	600	
94	H2-7,124-00	Antenna rod — H2-7,124-07	600	
95	H2-7,124-00	H2-7,124-08 — frame 12	600	
96	H2-7,125-00A	WL-5 change-over terminal box — airplane body	600	
97	H2-7,710-00C	CD-5 megneto change-over switch of the front cockpit — instrument panel	600	
98	H2-7,720-00C	CD-5 magneto change-over switch of the rear cockpit — instrument panel	600	
99	H2-7,710-00C	Instrument panel of the front cockpit — airplane body	600	
100	H2-7,720-00C	Instrument panel of the rear cockpit — airplane body	600	
101	H2-2,000-00	Left and right outer wings — midwing	600	
102	H2-3,100-00	Horizontal stabilizer — airplane body	2,000	
103	H2-3,400-00	Vertical fin — airplane body	2,000	
104	H2-4,200-00	Nose landing gear strut — airplane body	2,000	
105	H2-6,900-00	Engine cowl joint — slant frame	2,000	
106	H2-6,500-00	Engine control push-pull rod — airplane body	2,000	
107	H2-6,205-00	Oil radiator — airplane body	2,000	
108	H2- 0109-00	Compartment door — airplane body	2,000	
109	H2-7,520-00	Seat of the rear cockpit — airplane body	2,000	

CHAPTER VIII

SUPPLEMENTARY DESCRIPTION OF THE CHUJIAO-6 JIA AIRPLANE

The CHUJIAO-6 JIA airplane is an advanced version of the CHUJIAO-6 airplane. Both the constructions and the aerodynamic configurations of their main components are identical. What the modification reveals itself on the CHUJIAO-6 JIA airplane lies in:

1. The airplane having been replaced with the Model HUOSAI-6 JIA engine of high power;
2. The area of the filter screens of the carburetor air intake having been enlarged;
3. The maximum setting angle of the propeller having been increased (J9-G1) up to 31°30′.

Owing to the modifications mentioned above, the performance of the CHUJIAO-6 JIA airplane is improved, and the data of the power plant performance vary too as compared with the CHUJIAO-6 airplane.

For ease of service and maintenance of the CHUJIAO-6 JIA airplane, the differences between the two different airplanes are described as follows.

I. POWER PLANT

ENGINE

The CHUJIAO-6 JIA airplane is equipped with the Model HUOSAI-6 JIA engine of high power. All the overall dimensions, types of accessories (except that the carburetor type QHQ-14 is replaced with that of type QHQ-14A and the diameter of Venturi is changed to $\phi 59$ mm.), installation arrangement and control devices of the Model HUOSAI-6 JIA engine are the same as that of the Model HUOSAI-6 engine. The difference lies in the main performance data only.

1. Performance data

Model of Engine	Conditions	Rotating Speed (rpm.)	Air-intake Pressure (mm. Hg)	Power (hp.)	Fuel Consumption Rate (g./hp.-hr.)
HUOSAI-6	Take-off	$2{,}350 \pm 1\%$	$B_0 + 35 \pm 10$	$260^{-2\%}$	255-280
	Rated	$2{,}050 \pm 1\%$	$B_0 + 30 \pm 10$	$220^{-2\%}$	240-255
	0.75 rated	$1{,}860 \pm 1\%$	680 ± 15	165	210-225
	0.6 rated	$1{,}730 \pm 1\%$	630 ± 15	132	205-225
HUOSAI-6 JIA	Take-off	$2{,}350 \pm 1\%$	$B_0 + 85 \pm 10$	$285^{-2\%}$	260-285
	Rated	$2{,}250 \pm 1\%$	$B_0 + 80 \pm 10$	$270^{-2\%}$	255-270
	0.65 rated	$1{,}950 \pm 1\%$	660 ± 15	160	220-240
	0.5 rated	$1{,}790 \pm 1\%$	600 ± 15	130	210-230

OTES:

1) B_0 means the surrounding atmospheric pressure.

2) The air and fuel mixture throttle should be fully opened in take-off and rated conditions.

3) The auxiliary throttle of the Model HUOSAI-6 JIA engine is shut during the ground test run and taxying. The permissible air-intake pressure is as follows:

A) $B_0 + 70 \pm 10$ mm. Hg in take-off condition;

B) $B_0 + 65 \pm 10$ mm. Hg in rated condition.

4) In case of sandy wind, flight with the shut auxiliary throttle (by dismantling the control cable) is permissible.

2. Main technical data

1) The compression ratio of the engine cylinder is 6.2 ± 0.1.

2) The transmission ratio of the suppercharger is 8.77.

3) The maximum ignition advance angle of the right and left magnetos (according to the rotating angle of the crankshaft) is $27° \pm 1°$.

4) The oil pressure in operating condition is 4-7 kg./cm.^{2}

5) The oil flow rate through the engine at oil inlet temperature $50° \sim 65°$C is $3.9 \sim 7.5$ kg./min. in rated condition.

6) The engine endurance in take-off condition should not exceed 5 minutes and in rated conditions 1 hour. (After 3 minutes' operation under low power, the engine can be continuously operated in rated condition for 1 hour further.)

7) The shutdown temperature depends on the ambient atmospheric temperature:

Atmospheric Temperature (°C)	Shutdown Temperature (°C) (Not higher than)
below 25	150
above 25	165

8) The net weight of the engine is $200^{+2\%}$ kg.

AIR INTAKE INSTALLATION

In the HUOSAI-6 JIA engine, the area of the filter screens in the carburetor intake is enlarged in accord with the intake air pressure, so that the advantages of the engine may be fully developed.

The dust entering the engine from the air intake and warming funnels will worsen its operation. In order to prevent this bad effect, layers of filter screens on the skin of the lower engine cowl and three additional layers of filter screens inside the warming funnels are installed, so as to reduce the dust. As the additional screens enlarge the intake opening of the warming funnels, therefore the warming funnels should be installed at the rear of the left and right main exhaust pipes instead of between cylinders, thus improving the air warming effect as well.

II. PERFORMANCE OE THE AIRPLANE

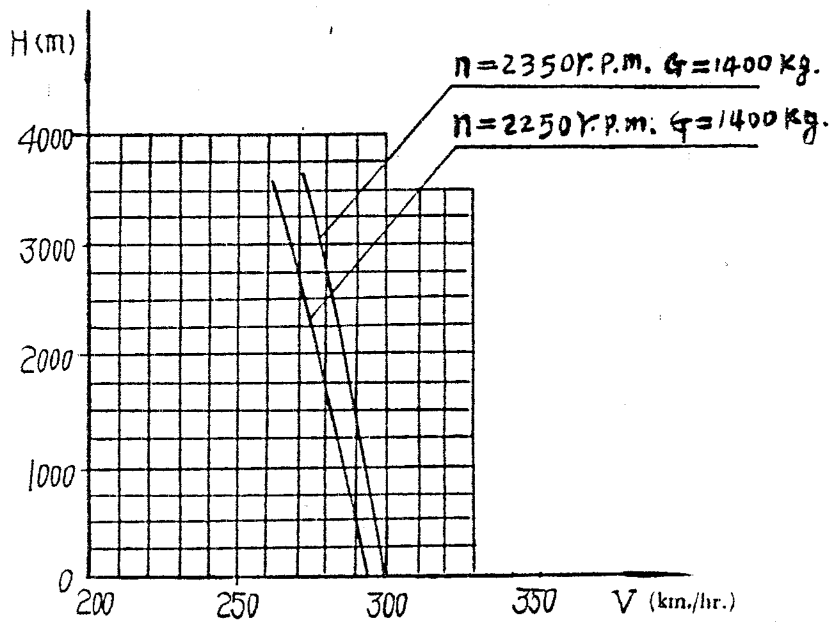
Compared with the CHUJIAO-6 airplane, the CHUJIAO-6 JIA airplane keeps its weight data basically unchanged but has its engine power remarkably increased (increase by about 23% of the rated power), therefore, the CHUJIAO-6 JIA airplane distinguishes itself by its performance remardably improved.

1. Maximum level-flight speed

When the engine is operated in the maximum power with n = 2,350 rpm., the maximum level-flight speeds at the following altitude are as follows:

		KTS
Sealevel	297 km./hr.	160
Altitude H = 1,000 m.	292 km./hr.	157
Altitude H = 2,000 m.	286 km./hr.	154
Altitude H = 3,000 m.	279 km./hr.	150

The curves of the maximum level-flight speed vs. the altitudes are shown as Fig. 8.1.



Fg. 8.1 Curves of the maximum level-flight speed vs. the altitudes

2. Climb performance

When the engine is operated in rated power with n = 2,250 rpm., the time of climbing (time for take-off run not included) up to the different altitudes are as follows:

Altitude H = 1,000 m.	2.8 min.
Altitude H = 2,000 m.	6.2 min.
Altitude H = 3,000 m.	10.4 min.
Altitude H = 4,000 m.	16.1 min.

The curves of the maximum climbing speed and time vs. the altitudes are shown as Fig. 8.2.

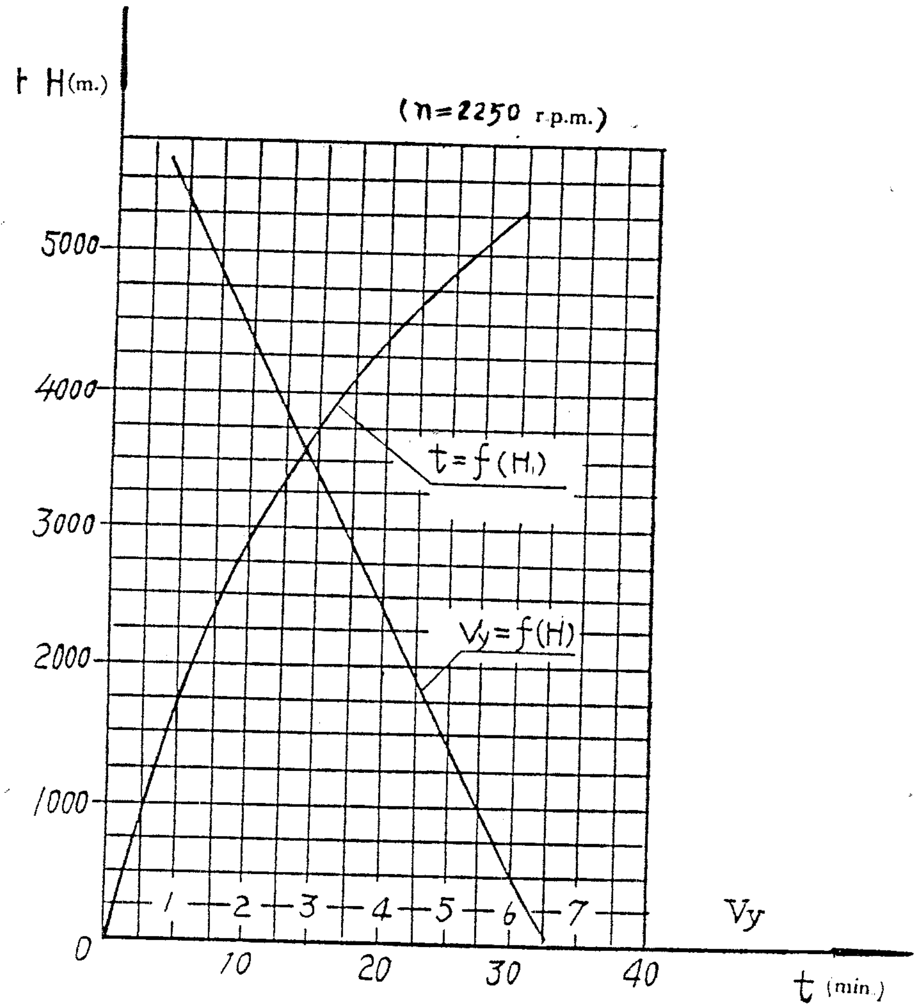


Fig. 8.2 Curves of the maximum climbing speed and time vs. the altitudes

3. Operating ceiling:
   At n = 2,250 rpm. 5,800 m.
   At n = 2,350 rpm. 6,250 m.
4. The time of climbing up to the operating ceiling 39.1 min.
5. Landing speed (with the fuel remaining quantity 30%, landing weight G = 1,323 kg.) 115 km./hr. (62 KTS)
6. Landing run (when the airplane is decelerated with the flap and the wheel brakes and landed on the cement runway) 350 m.
7. Take-off run (on the cement runway) 280 m. 920 FT
8. Technical air range (H = 1,000 m., n = 1,790 rpm. V indicator = 170 km./hr. with fuel remaining quantity 10%) 690 km. (370 NM)
9. Duration (H = 1,000 m., n = 1,790 rpm. V indicator = 170 km./hr. (92 KTS) with fuel remaining quantity 10%) 3.9 hr.
10. Permissible maximum diving speed 370 km./hr. (200 KTS)

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PART TWO

SERVICE AND MAINTENANCE
OF THE AIRPLANE

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CHAPTER IX

FLIGHT PREPARATION

I. MATTER TO BE NOTED

1. Take off all the canvas covers outside the airplane, and put the foot step in good order.
2. Take off the retaining clips of the ailerons, elevator and rudder.
3. Prepare necessary ground equipments and tools.
4. Loose the mooring device of the airplane.
5. The following inspection should be done on the purpose of safety.
   1) All switches should be in off-positions.
   2) The landing gear control knob in the front cockpit should be in down position, and that in the rear cockpit in neutral position.
   3) The flap control handles in the front and rear cockpits should be in neutral position.
   4) The magneto change-over switches should be in "0" position.
   5) The normal gas pressure in the damper cylinder and tyres should be kept.
6. Draw the airplane to the take-off line with the towing tractor at a speed of not more than 3 kilometers per hour. Put the trigs under the wheels steadily. (Pushing the airplane forward on the elevator or ailerons and pulling the airplane backward are prohibited.)
7. Mount the fully charged battery on the airplane.
8. Bring the field compressed air bottle and fire extinguishers near the airplane.

   NOTES:

   1) If there is any deposit in the fuel tank to be drained off, it should be done before the airplane being moved. The airplane in moving will slosh the deposit in the tank, thus making the full drainage with difficulty.
   2) The retraction and extending motions are prohibited in checking the landing gears and the flap.
   3) The number of crews working on the airplane at the same time should not exceed five.
   4) All switches should be in off-positions before mounting the battery.
   5) The inspection and maintenance doors of the airplane are shown in Fig. 2.41.

II. PREFLIGHT INSPECTION

Preflight inspection is carried out only for those airplanes which have beens pinected carefully and ascertained to be faultless. Its purpose lies in:

1. See whether the preflight preparations have been performed well or not. Check to see if there is any surplus article left in the airplane.

2. See whether any trouble has happened to the airplane in its parking and transport.

The inspection should be initiated from the propeller and carried on one by one according to the inspecting line (Fig. 9.1).

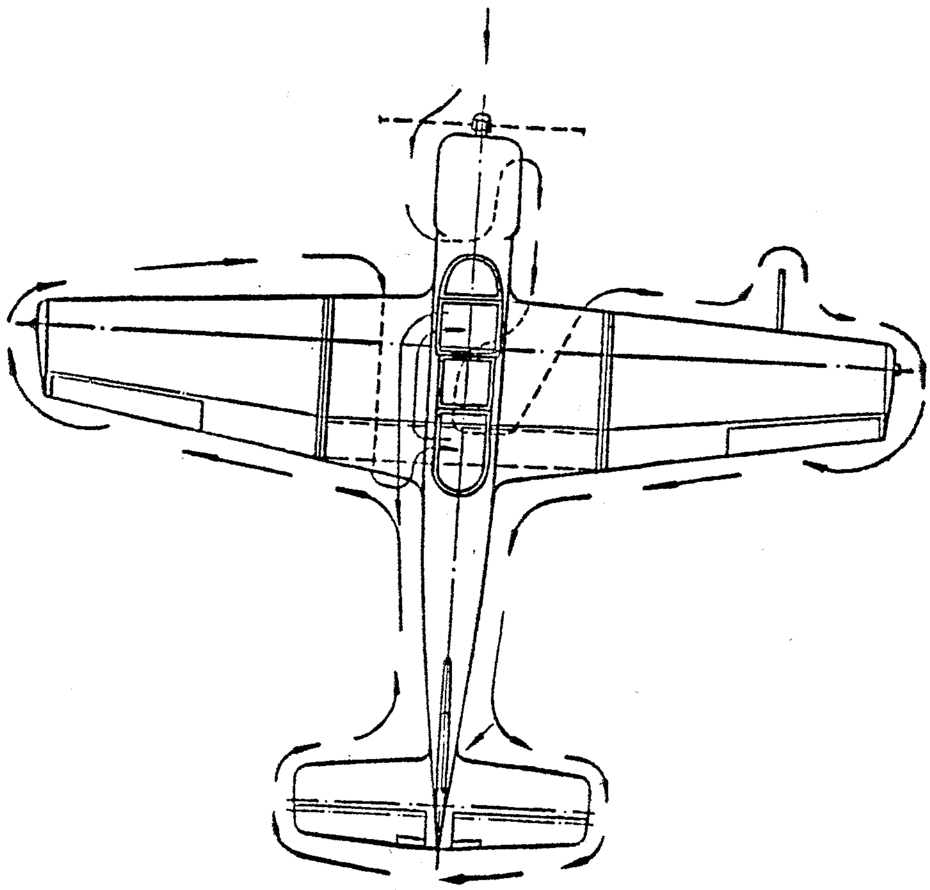

Fig. 9.1 Diagram of the preflight inspection line

THE AIRPLANE AND ITS POWER PLANT

1. Inspection for the propeller and the gill:

   1) See if the propeller dome is fixed and fastened reliably.

   2) Turn the propeller blade ends by hand to see if there is any play in the mounting.

   3) See if the gill shutters are fixed reliably and every piece of shutter can be moved freely.

2. Inspect the fixing condition of the engine cowl. Looseness is not allowed. The fasteners should be fastened well.

3. Inspect the connecting and fixing conditions of the engine control links through the inspection door on left engine cowl and the rear exhaust port, and see if there is any leakage of fuel and oil within the sight.

4. Inspect the fixing condition of the exhaust pipes. All the joints should be in good condition without crack or mechanical damage.

5. Inspection for the nose landing gear and the inside of the nose gear bay:

1) Check the damper cylinder and the shimmy damper of the nose landing gear for oil leakage.

2) Judge the gas pressure in the damper cylinder by the amount of depression of the damper cylinder. In normal parking state, the damping piston skirt of the nose gear should be extended to 185 mm.

3) Inspect the torque link, which should be in good fixing condition and without any mechnical damage.

4) Check the axle nut and its security, inspect the tyre visually and judge the air pressure within it by its amount of depression. In parking state with normal load, the tyre depression of the nose wheel is 15.5 mm.

5) Inspect the wheel fork and other welded parts, they should not have any crack or deformation and the ground wiring should be in good condition.

6) Check the landing gear up lock to see whether it is in the open position.

7) Check the position indicator to see if its protrusion is enough and if its activity is normal.

8) Inspect the security of all the accessories and pipelines in the landing gear bays. They should be in good condition.

6. Check the air cooling ducts of the oil radiator to see if there is any deformation and surplus article in it.

7. Open all the doors closed with Dzus fasteners on the lower skin of the midwing and perform the following inspections:

1) Fuel ducts and check valve should not have leakage and mechanical damage, and should be reliable and secure.

2) Torque tubes of the front and rear control sticks should not have any mechanical damage and collision with other mechanical parts.

3) Any surplus article should not be left in the airplane.

4) Inspect the security of the fuel feed tank. Fuel leakage is not allowed.

8. Check the throttle of the oil radiator for its fixing and connecting condition.

9. Inspection for the right landing gear and the right landing gear bay:

1) Inspect the tyre visually, judge the air pressure within it by its amount of depression. (Tyre depression should be 30 mm. in parking state with normal load.)

2) Inspect the gas pressure of the damper cylinder. In parking state with normal load, the piston skirt should be extended to 113 ± 2 mm. Inspect the damping performance by pulling the wing tip.

3) Inspect the damper cylinder, it should not have any leakage of oil.

4) Check the locking ring for its fixing condition, it should not have any deformation or crack.

5) Inspect all the active joints of the landing gear strut, the half-wheel fork, the damper and the actuating cylinder. They should be secure and reliable.

6) Inspect the fixing and safe condition of all the compressed air pipes in the landing gear bays and on the landing gears. There should have no rub between pipes themselves or between pipes and other parts.
7) Check all the welded parts for crack.
8) Check the gear up lock to see if it is in open position.
9) Inspect the wheels, their fixations should be reliable, and their surfaces should have no damage.
10) Inspect all the landing gear fairing doors, their fixations should be reliable, they should not have any damage and deformation, and the upper doors can be moved freely.

10. Inspection for the right skin of the midwing:

1) The skin should not have any mechanical damage and dint.
2) Check the landing gear mechanical position indicators to see if it can be fully extended. It should not have any deformation and its flexibility must be kept.
3) The fairings around the joints of the midwing and outer wings should be fixed reliably and fitted with the wing skin tightly.

11. Open the filler caps of the fuel tanks to inspect the fuel quantity. Carefully inspect the filler cap sealing gaskets, they must be intact.

12. Inspection for the right outer wing:

1) Inspect the skin, there should not have any damage or dint.
2) Check all the doors to see if they are closed steadily and all the fasteners are fastened well.
3) Inspect the pitot tube, its surface should not be scratched and its fixation should be reliable.
4) Inspect the glasses of the navigation lamps, they should be in good exterior, their fixation should be reliable.
5) Inspect the ailerons, the fabrics on which should be intact.
6) Inspect the suspending fittings and the link joints of the ailerons, they should be secure.
7) Pull the ailerons by hand, their swings should be enough and stagnation or looseness should not be allowed.
8) Check the aileron trim tabs for deformation.
9) Check the fuel tank compartment door and see if there is any leakage on the fuel tank.

13. Check the right fuselage skin for damage, all the doors should be closed well.

14. Check the fin skin for damage and wear.

15. Check all the wrappage screws on the tail to see if they are screwed tightly.

16. Check the horizontal stabilizer to see if there is any damage and see if there is any looseness by shaking it lightly.

17. Inspection for the elevator:

1) The doped fabric and the framework should be in good condition and without damage.
2) Check the security of all the suspending fittings and link joints.

3) Pull the elevator by hand, its swing should be enough and stagnation or looseness should not be allowed.

18. Check the elevator trim tab for its security.

19. Inspection for the rudder:

1) The doped fabric and the framework should be in good condition and without any damage.

2) Pull the rudder by hand, its swing should be enough and stagnation and looseness should not be allowed.

20. The inspections for the left fuselage skin are the same as those for the right fuselage skin.

21. Besides the same items to be inspected as those for the right midwing, the inspection of the left midwing should have the following complements:

1) The foot step should have no damage and its fixation should be reliable.

2) The tread should be in good condition, any crack or deformation should not be allowed.

3) Inspect the flap position indicator, its fixation should be reliable, it should not have any deformation and can be moved freely.

22. Inspect the left outer wing in the same way as the right outer wing (refer to item 12). In addition, inspect the GHC-2 magnetic heading sensor door and the landing light glass. Their fixation should be reliable. The organic glass should have no scratches and have good transparency.

23. The inspection of the left landing gear is the same as that of the right landing gear (refer to item 9).

24. Inspection on the airplane:

1) Inspect organic glass shield of the canopy, it should not have any crack or scratch and have good transparency. Dirt and moisture should be wiped out.

2) Move the front and rear sliding canopies of the cockpits, to see if they can be slid with ease. The canopy locks should be reliable.

25. Inspection within the rear cockpit (form left to right one by one):

1) Manoeuvre the control handles of the air and fuel mixture throttle, propeller pitch variation and altitude regulator on the left console, they should be moved freely.

2) Manoeuvre the fire-proof valve to check the correctness of the open and close positions.

3) Inspect all the instruments, switches, signal lights and other accessories on the instrument panel, their exteriors should not be damaged.

4) Inspect the safety belt to see if it is damaged. Make sure that its fasteners perform good function. (After inspection put the safety belt in order, so the pilot can sit.) The fixation of the seat should be reliable.

5) Manoeuvre the foot pedals and the control sticks to see if they rub against and collide with other structural parts.

6) When the ailerons and the elevator are in neutral positions, check the control

sticks of the front and rear cockpits to see if they are in the neutral positions, too.

7) When the rudder is in the neutral position, check the foot pedals of the front and rear cockpits to see if they are in the neutral positions, too.

8) Give a command: "Leave the flap !" After getting a clear answer, extend and retract the flap once with the flap control valve in order to check its extending and retraction motions.

9) Check the brake systems to see if they are in good condition.

10) Inspect the cockpit, make sure that there is no surplus article left in it.

26. Inspection within the front cockpit, besides the same items as those for the rear cockpit, the inspection within the front cockpit should have the following complements:

1) Manoeuvre the air warming intake installation handle, its travel should be free.

2) Inspect the compressed air pressure, when it is below 35 atm., the airborne air bottle should be charged with the field compressed air bottle.

3) Inspect the controls of the gill shutters and the air warming box throttle of the oil radiator. They should be traveled smoothly without stagnation.

27. Inspect the oil quantity in the oil tank, when the oil quantity is less than 14 liters, additional oil should be filled, but the total oil quantity must not exceed 17 liters.

ELECTRICAL EQUIPMENT

1. Check the storage battery to see if it is installed properly and if the latch pin is well inserted.

2. Inspect the navigation lights and the landing light, their fixations should be reliable. Check with switching on to see if the operations of the AKP2-1 switches are normal and complete. Make sure that their fixations are reliable.

3. Give a command: "Leave the propeller !" After ascertaining that there is no body nearby the propeller, switch on the battery, in the meantime turn on the navigation light switch. Check the output voltage of the storage battery, which should be above 24.5 V., also inspect the working condition of the landing gear signal lights.

4. In the inspection for night flight, switch on the corresponding switches, check the navigation lights, cockpit lights, fluorescent lamps and landing light to see if their work is in good condition.

5. See that all the switches, valves and rheostats are turned to the correct positions.

RADIO EQUIPMENT

1. Inspect all the antennas (including the fin antenna, the non-directive antenna and the cover of the loop antenna), the down leads in the airplane and the insulators, they should be intact and fixed firmly. Snow, frost and moisture should be cleared off.

2. Open the radio equipment bay door to check the radio station, rectifier, inverter and radio compass; their conditions of shock absorbing and fixing should be good. Make sure that they have correct wiring.

3. Inspect the interphone installation, its mounting and fixation should be in good condition.

4. Inspect the WL-5 regulating box; the fixing condition of the regulating box and the user box should be good; the volume knob and the adjusting knob should be turned to the correct position.

5. Inspect the radio equipment with switching on, their working condition should be good. The CT-1 regulating box must be transferred to the wave band and frequency used in that day, the communication with outside should be fluent and the WL-5 frequency scale should be turned to the prescribed graduation.

INSTRUMENTATION

1. Put the pointer of the altimeter to zero agreeable to the local atmospheric pressure and correct the navigator's clock. Inspect and clean all the instrument glasses in the front and rear cockpits.

2. Inspect the exteriors of all the instruments, the positional correctness of all the pointers and of the small ball in the bank indicator.

3. Check the fixing condition of the pitot tube to see if there is any looseness of the screw. Make sure that the static and dynamic pressure pipelines and the drain hole are unobstructed. There should have no water in the deposit filter. Inspect the warming condition of the pitot tube if it is below 0°C.

4. Check the fixing condition of all the inspection doors to see if there is any looseness of the screws.

5. Inspection with switching on:

1) Inspect the working conditions of the triplex gauge, fuel level gauge and the air intake temperature gauge.

2) In preparing the night flight, instrument flight and the flight under bumpy weather, inspect the working condition of the BDP-2 gyro-horizon, the LTC-1 gyro-compass and the turn-and-bank indicator.

III. PREPARATION BEFORE STARTING THE ENGINE

1. Drain off 0.5-0.8 liter of gasoline together with its deposit from the fuel feed tank.

2. Inspect the engine cowl and all the doors, make sure that they are closed well, there is no surplus article left around both the wings and the tail and that the trigs are all inserted under the wheels. Fire extinguishers should be set nearby the airplane.

3. Pump the fuel up to a pressure of 0.2-0.5 kg./cm². by hand-pump, inspect the tightness of the pipelines.

4. Switch off the magnetos, pull the propeller by 3-4 turns. If there is any choke to be felt, remove one spark plug from the cylinders 4, 5, 6 each, also remove the drain plugs of the air intakes of the cylinders 4, 5, 6. Then turn the propeller continuously to evacuate the fuel so as to prevent the hydraulic ram.

5. If the parking lasts seven days and more, before starting the engine, 1.3-1.5 liters of aviation oil in temperature 40-60°C should be filled into the vent holes of the front

and rear gear boxes and 40-50 g. of oil in temperature 40-60°C should be injected with the oil gun into the spark plug holes of the cylinders above the horizontal line. (As the pistons in the cylinders should be located at the bottom dead centers respectively.)

6. In order to prevent the hydraulic ram for the engine which could not be started for three times or has shut down for more than two days, the work described in item 4 should be performed before starting.

NOTES:

1) When the engine is tested on sandy ground, sprinkle the ground with water in front of the airplane.

2) In pulling the propeller blades, the noising due to the collision of the wobbly balancers is considered as being natural.

IV. ENGINE STARTING

1. Open the fire-proof valve and the compressed air main valve, check the brakes to see if they are in good condition.

2. Switch on all the engine instruments.

3. Adjust the position of every control handle:

1) Put the pitch variation control handle to the high pitch position, thus, that the speed regulator draws up oil from the crankcase at the movement of starting the engine will be eliminated, so that a fine lubrication in starting can be guaranteed.

2) Put the control handle of the altitude regulator of the carburetor onto the "Rated" position, thus giving a maximum rich air and fuel mixture.

3) If the ambient temperature is below 0°C, then open the air warming box throttle.

4) Put the engine air and fuel throttle control handle onto the position corresponding to 700-900 rpm. (push about 10 mm. forward from idling).

4. In order to let the air and fuel mixture be sucked into the cylinders and to enssure that all the engine frictional surfaces have a good lubrication, the following work should be done:

1) Make sure that the magnetos have been cut-off, then give a command: "Pull the propeller !" The partner to pull the propeller responds with: "Is the magneto off ?" Just after having got the positive answer, the partner may pull the propeller for turning.

2) Use the primer to prime the engine with gasoline. Prime two to three times in summer and four to five times in winter. Pull the propeller along the direction of operation by hand while priming.

NOTE:

The gasoline primed in should not exceed the quantity as prescribed above. Otherwise, the lubricating oil on the cylinder wall will be washed off, resulting in piston abrasion. The gasoline accumulated in the lower part of the cylinder may lead to a hydraulic ram.

5. Boost the fuel pressure in the carburetor to 0.2-0.5 kg./cm². with the handpump.

6. Give a command: "Leave the propeller !" After having got the positive answer, "Left already." the tester turns the switch of magneto to the position "1+2". (Magneto switch in the rear cockpit is also turned in the position "1+2"、) Open the starting button safety and press the starting button to start the engine.

7. If the engine could not be started, prime once more and repeat the above procedures.

As often as not, too much fuel primed in is the resaon of starting with difficulty. In such a case, the magnetos should be cut-off first, pull the propeller three to four turns in the opposite direction with full throttle and then six to eight turns along the direction of normal operation with no more priming. Repeat the procedures described in items 2, 3, 5 and 6 of this section to start the engine again.

8. If the engine fails to be started for three times, then stop starting, find the cause of failure and eliminate it. After the trouble having been eliminated, inject 40-50 g. of aviation oil in temperature 40-60°C into cylinders 1, 2, 3, 8 and 9 each through the spark plug holes with oil gun, then start the engine again.

In order to prevent the hydraulic ram, the propeller should be turned three to four turns along the direction in operation, so as to drain off the fuel left in the cylinders by the last starting.

9. As soon as the engine starts to operate steadly, the air and fuel throttle handle should be set in the position corresponding to 700-900 rpm., meanwhile observe the oil pressure indicated by the oil pressure gauge. If the oil pressure is less than 1.5 kg./cm². within 15-20 sec. after starting, shut down the engine at once and do not start again until the cause for lowering the oil pressure is found and the trouble eliminated.

10. Lock up the primer handle after the start-up is completed.

V. TEST RUN FOR ENGINE

1. Engine warm-up

1. After starting, set the air and fuel mixture throttle to the position corresponding to 1,200-1,400 rpm. for warming up the engine.

2. When the temperature of the cylinder head attains to 120°C and that of the oil inlet to 30°C (the temperature for thinned oil is 20°C), the warm-up will be considered as being completed. At the moment, the gill shutters and the air warming box throttle of the oil radiator should be opened gradually.

2. Inspection for the engine operation under various conditions

1. Inspection for the generator output voltage

After setting the air and fuel mixture throttle to the position corresponding to 1,600-1,700 rpm., switch on the "radio compass" switch and press the "Voltammeter" button so as to check the generator output voltage, which should be 27.5±1 V.

When the generator operates normally, the "switching off" signal lamp should not be lighted. The "Radio compass" switch should be switched off after the inspection for the generator output voltage has been accomplished.

2. Inspection for the operation under the rated condition

After setting the air and fuel mixture throttle in the position corresponding to 2,100 rpm., pull the pitch variation control handle so as to make the rotating speed drop to 2,050 rpm., then set the throttle in the full opened position, at the moment:

The rotating speed should be 2,050±1% rpm.

The manifold pressure should be 30±10 mm. Hg higher than the airport atmospheric pressure at that time.

The oil pressure should be 4-7 kg./cm².

The fuel pressure should be 0.2-0.5 kg./cm².

The oil inlet temperature should be 30-75°C.

The cylinder head temperature should not be higher than 230°C at most.

The operation of the engine should be steady and without knocking.

3. Test for constant speed

Make the air and fuel mixture throttle opening become less gradually under the rated condition, so as to make the manifold pressure drop by 100-150 mm. Hg. At the moment, the rotating speed should remain unchanged, then set it to the rated condition again.

4. Inspection for propeller pitch variation

Under the rated condition, set the pitch variation control handle to the high pitch position smoothly. At the moment, the rotating speed should drop to 1,350-1,450 rpm., then set the pitch variation control handle to the low pitch, thus shifting to "Take-off" condition.

5. Inspection for the operation under the "Take-off" condition

The rotating speed should be 2,350±1% rpm.

The manifold pressure should be 35±10 mm. Hg more than the airport atmospheric pressure at that time.

The oil pressure should be 4-7 kg./cm².

The fuel pressure should be 0.2-0.5 kg./cm².

The oil inlet temperature should not be more than 75°C.

The cylinder head temperature should not be more than 230°C.

6. Inspection for the operations of the magnetos and spark plugs

Set the air and fuel mixture throttle in the position corresponding to 1,860 rpm., operate with the left and right magneto alone for 15-20 sec. respectively. When the operation is achieved with single megneto, the drop of the rotating speed should not be more than 60 rpm. When it is achieved with the left and right magneto alternately, the two magnetos should be operated for 20-30 sec. simultaneously before shift.

7. Inspection for the accelerating performance

Push the air and fuel mixture throttle from the lower limit position to the full opened position within 2-3 sec., at the moment, the rotating speed should be increased from idling to "Takeoff" condition uniformly.

The cylinder head temperature should not be less than 120°C and the oil temperature not less than 30°C in checking the accelerating performance.

8. Inspection for the engine idling

Set the air and fuel mixture throttle in the lower limit position, at the moment, the operation of the engine should be steady.

The rotating speed should be 500±50 rpm.

The oil pressure should not be less than 1.5 kg./cm².

The fuel pressure should not be less than 0.15 kg./cm².

In order to prevent the spark plugs from being spoiled with oil, it is not suitable to idle the engine for a long time.

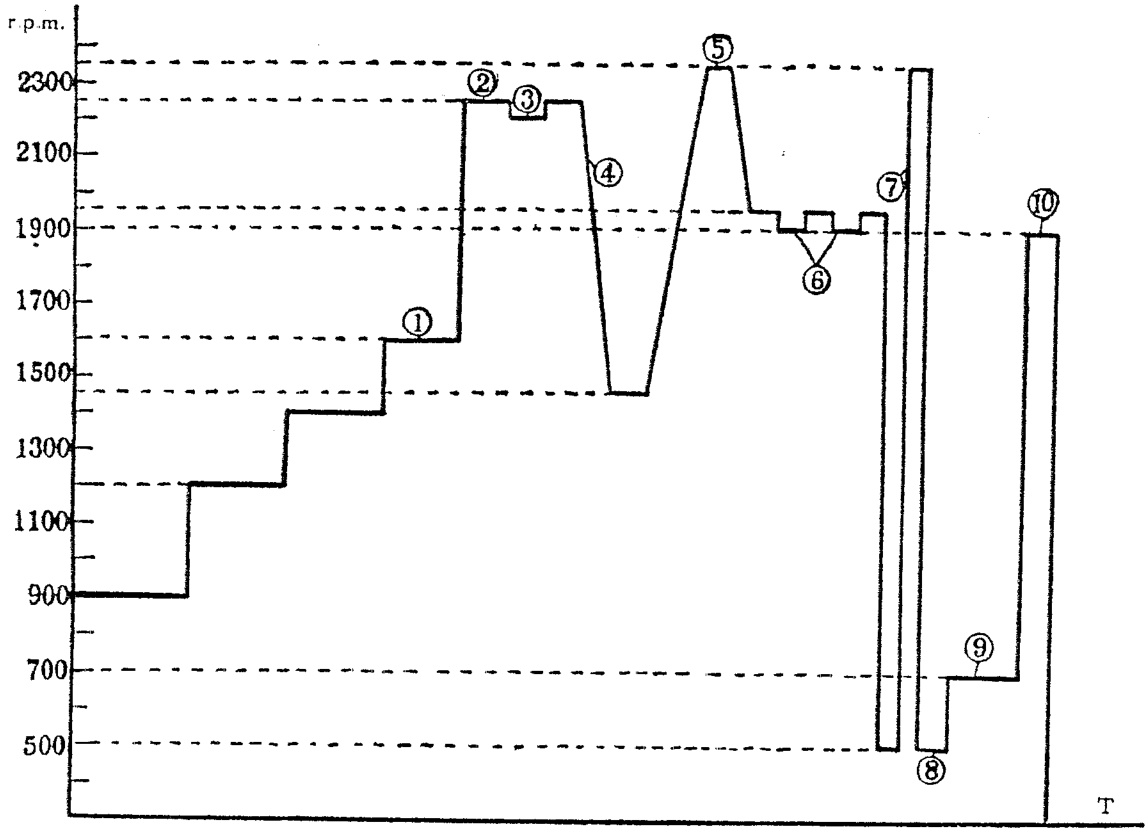

Fig. 9.2 Test run curve for Model HUOSAI-6 JIA engine

1. Inspection for generator output voltage 2. Inspection for the operation under the rated condition 3. Test for constant speed 4. Inspection for propeller pitch variation 5. Inspection for the operation under the "Take-off" condition 6. Inspection for the operation of the magneto 7. Inspection for accelerating performance 8. Inspection for engine idling 9. Engine cooling down 10. Burning spark plugs

VI. SHUTDOWN OF THE ENGINE

1. Set the air and fuel mixture throttle in the position corresponding to 700-800 rpm. to cool down the engine, and make the cylinder head temperature be in agreement with the following data:

Atmospheric Temperature (°C)	Shutdown Temperature (°C) (Not higher than)
25 below	150
25 above	165

2. Push the air and fuel mixture throttle so as to make the rotating speed attain to 1,900 rpm. for 10-15 sec., thus burning the spark plugs. Then set the throttle in the position corresponding to 600-700 rpm., cut off the magneto switch and set the throttle to fully opened position smoothly.

All the switches should be switched off and set the throttle handle in the fully shut position after shutting down the engine.

NOTES:

1) The engine should not be shut down directly at a higher rotating speed or under the operating condition.
2) In order to prevent fire caused by back fire, it is forbidden to shut down the engine by means of closing the fire-proof valve.
3) The reading of each instrument, the operating condition and the operating time of the engine should be filled in the log book of the engine after each starting.

VII. INSPECTION ON TAKE-OFF LINE

For the airplane in service, the inspection on take-off line should be carried out after each landing, so as to find out the trouble caused by flying in time.

1. The airplane should taxi to the preparation take-off line for a careful inspection after each abnormal (or rough) landing. Special care must be taken to inspect the landing device. Even the midwing spars should be inspected for its deformation caused by rough landing, if necessary.

2. If the airplane has flied for a long time or is prepared to undertake a long range flying course, the remained fuel and oil quantities should be inspected after landing. Make sure that the airplane has sufficient fuel and oil for carrying out the next flying.

3. Check the engine for leakage through the inspection door on the left and the exhaust port on the rear of the engine cowl. Drain off the deposit out of the deposit filter of compressed air and close the drain plug tightly after inspection.

4. Inspect the propeller blades, which should be intact.

5. Inspect the tire pressure of airplane wheels and outer surfaces, which should be proper. Inspect the landing device. Shake the wing to check the performance of the damper cylinders for good condition.

6. When the airplane flies, takes off on lands on a wet airport, the mud splashed on the movable joints of the landing gears and on the smooth surfaces of the damper cylinders as well as on the locking hooks for retracting landing gears should be wiped out after each

landing. When the airplane lands and taxis on the airport logged with water, care should be taken to inspect the flap, because the mud splashed by the airplane being in motion may make the flap deform.

When the airplane flies on the airport on which there is withered grass everywhere, inspection for the dust filter screen and air intake pipe should be taken to see if they are clean.

When the airplane flies on the airport on which there is more gravel, inspection for blades and the lower part of the fuselage as well as lower skin of the horizontal stabilizer and the elevator should be taken to see if there is any damage.

When there is damage or holes on the fairing or fabric of the airplane, it is forbidden for the airplane to fly.

7. When the airplane flying in winter, care should be taken to the cleaning about the vent for the fuel and oil systems. Special care must be taken to prevent the vent from being choked up caused by freezing.

8. After each landing and shut-down, inspection for the indication about each temperature and pressure gauge should be taken. Report to your superior if there is anything doubtful and abnormal.

9. After the airplane flies the first and second take-off and landing, the following work should be done at the take-off line.

1) After ascertaining that there is no body within the turning range of the propeller, switch on the navigation lights and battery switches.
Inspect the voltage of the battery, which should not be lower than 24.5 V.

2) Inspect the fixing condition of each electrical equipment in the front and rear cockpits, and the operating condition of the signal lights for landing gears.

3) Inspect the switches and the rheostat knobs, their positions should be correct.

4) Inspect the condition of the navigation lights.

5) Inspect the thimble of the pitot tube and its sensor, and make sure that they are fixed securely. Judge that there is no moisture and dust in the static pressure holes and in the drain hole.

6) Inspect the installation of the instrument panels and each instrument in the front and rear cockpits. Make sure that they are fixed securely and damping condition of the instrument panel is good.

7) Check to see if the indications of the instrument pointers are proper.
Switch on to inspect the working condition of all the electrical instruments.

10. When filling fuel and oil, inspect the sensors of all instruments, in which there should be no leakage. The fixing of the cylinder head temperature indicator and the thermo-couple for it should be in good condition.

11. Inspect the fixing and intact condition of the antenna and its down-lead.

12. Inspect the fixing condition of the radio equipment in the cockpits and make sure that all the switches and knobs are in normal positions.

VIII. POSTFLIGHT INSPECTION

After the completion of flying, the mechanist should carefully hear pilot's opinions about the auxiliary equipment, the radio and the engine as well as the trouble and faults discovered while the airplane is in service. These opinions should be written down on the preparation diary for the airplane after making these condition clear, and then the post-flight inspection can be carried out.

Postflight inspection is usually achieved at once after the completion of the flying day. As the engine has not yet cooled down, it is easy to detect the troubles about leakage and also easy to clean the engine and its parts. Before the postflight inspection, it is necessary to check the pressure of the compressed air to see if it is of 40-50 atm. Charge the air bottles if the pressure is insufficient.

It is recommended to carry out the postflight inspection according to the following sequence:

1. The propeller and the engine equipment;
2. The nose and main gears;
3. The midwing and other wings;
4. The fuselage and the empennage;
5. The control mechanism;
6. The cockpits.

In consideration of their characteristics, the auxiliary equipment and radio station may be inspected in two ways, one of which may be achieved with the mechanic inspection alternately, and another of which may be achieved alone according to a certain line on the condition that all the other items of the postflight inspection have been completed. All troubles discovered in the inspection should be written down in time and steps should be taken to eliminate them according to the nature of troubles and other conditions after the inspection.

PROPELLER AND ENGINE

1. If the operation of the engine has been found something abnormal in flight, test run should be carried out if necessary, so as to investigate the cause clearly.

2. In case of draining off the oil after flying, it should be carried out at once after shutdown, for the hot oil could be drained off and away easily.

PROPELLER

1. Check the dome for deformation, dint and crack. Clean the blades and the propeller hub. Check the fixing screws of the pitch variation cylinder and their safety for good condition.

2. Inspect the maskant of the blades and make sure that there is no strip, break and other mechanical damage.

3. Hold the blade and vibrate it forth and back so as to see if there is any movable clearance at the back taper of the propeller. Be sure that the angular play of the propeller is not more than 1°.

4. Check the parts of the propeller hub for damage and make sure that the fixing is secure.

GILL SHUTTER

1. Make sure that the fixing condition is secure and that there is not any mechanical damage. The movable clearance of each piece of shutter should be proper.

2. Operate the gill shutter control knob in the cockpit so as to see if the open-close condition of the shutters is proper.

LUBRICATING SYSTEM

1. Inspect the ducts of the lubricating system and make sure that there is not any leakage at each joint and that the safety of the coupling nuts and the hoses are proper.

2. Inspect the fixing condition of the oil tank, which should be secure and make sure that the ventilation of the oil tank is free. It should be blown through in case of its being choked up.

3. Inspect the fixing condition of the oil pump and the safety of the parts, which should be secure.

4. Check the oil quantity in the oil tank. Oil should be replenished if it is insufficient.

FUEL SYSTEM

1. Increase the fuel pressure to 0.2-0.5 kg./cm^2. by the hand pump so as to inspect the tightness of the fuel system.

2. Inspect the ducts and special care must be taken to check the segments passing through the fire wall and adjacent to the other parts for abasion. The worn ducts should not be used continuously.

3. Inspect the hoses of the fuel system, and special care must be taken to see if the metal joints for hoses is entirely intact and if there is any leakage. Replace the hoses injured by swell, dint and leakage.

4. Inspect the tightness of the fire-proof valve and its security for working. Check the connection of the control link with the fire-proof valve for security.

5. Inspect the fixing condition of the carburetor and its parts.

See if there is any leakage at each joint and the threaded plugs, and special care should be taken to make sure that the ball joint of the control link for carburetor is safe and secure and that there is very little friction at the neck of the ball joint.

6. Inspect the fixing condition of the fuel system and the priming system, which should be proper. Inspect the tightness of the system while the primer operates.

7. Check the fixing of the fuel pump and the safety of its parts for security.

8. Check the quantity of the fuel. Fuel should be replenished if it is insufficient.

PNEUMATIC SYSTEM

1. Inspect the fixing condition of the compressed air bottle. The clamping strips should not be tightened too much.

2. Within the sight, see if the joints of each duct in the pneumatic system is in good condition. Inspect the airtightness of the system while the pressure of the system being 50 atm. If the pressure drops no more than 1.5 atm. within 10 minutes, the airtightness will be considered as being satisfactory. Inspection may be achieved by the use of soapy water for the doubtful spots.

3. Check the duct segments passing through the fire wall as well as the segments contacting with or adjacent to the other parts for abrasion. Make sure that the fixing of all ducts in the airplane is in good condition.

4. Inspect the hoses for the pneumatic system and especially the metallic connecting part, which should be intact.

5. Inspect the KY-2 air compressor to see if it is in good condition. Its fixation should be secure. The air filter should be clean. Drain off the deposit in the deposit filter of the compressed air after inspection. Then close it tightly.

6. Inspect the starting compressed air valve on each cylinder and each duct of the air distributors, which should be intact and their fixing should be secure.

IGNITION SYSTEM

1. Inspect the fixing condition of the magnetos and the connecting condition of the wires, which should be good. Make sure that the connection of the cables with the magnetos and spark plugs is correct and secure, and that the fixing of the bent pipes is in good condition.

2. See if the cable shielding sleeve contacts with other parts and if there is any abrasion. Make sure that the cable would not contact with the cooling fins of the cylinder head.

3. Inspect the fixing of the spark plugs on the cylinder head, which should be secure.

4. Check the wires of the magnetos for good condition.

CONTROL SYSTEM FOR ENGINE AND ITS ACCESSORY

1. Inspect the fixing and safety condition of the air and fuel mixture throttle, altitude regulator, pitch variation and air intake warming box throttle control handles and links in the cockpits; inspect the flexibility of their stroke. The pipes should not be bent in the process of control operation. Correctness should be attained while the handle position being regulated forth and back. The contact of the rocker arm with the stop blots should be proper while the control handle is in the limit position.

2. Inspect the sleeves of the control links, in which there should not be dint and abrupt bend, and make sure that their fixing is secure.

ENGINE MOUNT

1. Inspect the fixing condition of the engine and the engine mount, that is, the fixing of the fittings should be in good condition.

2. Check the engine mount ring and jackstays for crack and deformation.

3. Inspect the fittings and blots for connecting the engine mount with the fuselage, which should be intact.

4. See if the bracket of the fixing seal pin for the engine cowl is intact.

5. Check all weldments for crack and tip-off.

AIR-INTAKE SYSTEM

1. Inspect the fixing condition of the warming funnels, which should be secure.

2. Inspect the fixing and cleaning condition of the dust screen.

The dust screen should be taken down for cleaning after the airplane has flown on the airport on which there is more dust.

The way for cleaning is: immerse it into the gasoline bath and clean the outside surface with rag after it is taken out of the bath. Coat a thin layer of oil on the dust screen by way of immersion before it is remounted onto the airplane.

3. Inspect the air intake pipe of the engine and its fixing condition, which should be proper. Crack and scratch are not allowed. The clearance between the engine mount ring and the air intake pipe should be remained no less than 2.5 mm.

4. Inspect the safety of the air intake pipe drain plugs for the cylinders 4,5 and 6, which should be secure and make sure that their lead seals are intact.

EXHAUST PIPE SYSTEM

Check the exhaust pipe for burn-out and crack. There should be no abrasion at the joints of the exhaust pipe. Rub is not allowed between the exhaust pipe and the engine cowl. The fixing condition of the fixing nuts for the exhaust pipes should be secure.

INDIVIDUAL PARTS AND ACCESSORIES OF THE ENGINE

1. Inspect the fixing condition of all accessories on the engine, which should be proper. See if there is any leakage at the coupling of the accessories.

2. Inspect the coupling nuts and the studs for each component part of the engine casing and make sure that their tightness and safety are proper.

3. Inspect the fixing studs of the cylinders, which should be intact and make sure that the fixing nuts and safety are secure and that there is not any looseness.

4. See that the rocker arm protective covers and push rod sleeves are entirely intact. The fixing condition of the push rod sleeves should be secure and there should be no dint and deformation.

5. Check the joints of the cylinder heads with the cylinder barrels for tightness and leakage.

NOSE AND MAIN GEARS

1. Inspect the tires, bosses and air valves. Check the tires for normal pressure by means of pressure gauge, if necessary (3.2 atm. for the main tires and 2.3 atm. for the front tire). See if the red lines of the bosses with tires are dislocated.

2. Hold the brake handle to inspect the air tightness of the ducts in the brake system. Inspection of brakes may be achieved in the front and rear cockpits respectively. The operation of brakes should be in coordination. Check the brakes for normal pressure by means of pressure gauge, if necessary. (Which should be 8-9 atm.)

3. Inspect the fixing condition of the half-wheel fork and the landing gear strut. The fixing of the brake ducts on the strut should be secure. Inspect the fixing and safety of the brake pans mounted on the astral bush of the wheel axles and make sure that the fixing of the wheel on the wheel axles is secure. See that the tightness of the fixing nuts on the wheel is proper and that the safety of the nuts is secure.

4. Inspect the fixing condition of the damper cylinders and all the safety nuts, which should be secure, and make sure that there is no crack and other mechanical damage in the damper cylinders, front wheel shimmy damper and other parts.

5. See if the lubricating oil in the filler of the landing gear is sufficient.

6. Inspect the gear up-hook and the spring on the landing gear, which should be intact and have no deformation and crack. Make sure that the fixing condition is secure.

7. Inspect the transmission device of the mechanical position indicator for landing gear, which should be in good working condition.

8. Check the fairing door of the landing gear for damage and be sure that its fixing is proper. The operation of the upper fairing door should be flexible.

MIDWING AND OUTER WINGS

1. Check the ribs, stringers and other inner parts of the wings for deformation through each inspection doors.

2. Check the skin of the midwing for damage. Make sure that the rivets on the skin have not any looseness and that the inspection door covers as well as the fairings are fixed and secure.

3. Check the skin of the left and right wings for damage. Check the rivets and screws for looseness. Check the joints of the landing gears for damage and the front spar for damage and deformation.

4. Inspect the retraction and extension of the flap, which should be in good condition. See if the inner parts of the flap and the control rocker arms and links of the ailerons are clean and intact with the flap down.

5. Check the treads on the midwing skin for good condition.

6. Inspect the fairing strips at the junction planes between the mid and outer wings and their fixing condition, and inspect the safe condition of the bolts.

7. Inspect the control links and rocker arm for the ailerons through the inspection doors. Replacement of the lubricating oil for control links and rocker arms movable mechanism should be achieved, if necessary.

8. Check the flap for good condition and deformation, and see if its fixing hinge is in good condition and if the flap can match tightly with the midwing skin.

9. Check the inspection door cover of the fuel tank on the outer wing for leakage so as to see if there is any leakage on fuel tank.

FUSELAGE

1. See if there is any looseness at the rivets and screws on the skin and if the fairings of the empennage is secure. Make sure that there is not any crack.

2. Within the sight, check each fuselage frame and other components inside the fuselage for crack and damage.

3. Inspect the fixing condition of the cockpit canopy. See if the sliding canopies are flexible in opening and closing, their organic glass covers should be clear and intact, and there should not be any crack and deformation at the frameworks of the cockpit canopies. If the tail skid collides with the ground while the airplane lands, inspection for the tail skid and empennage should be carried out to see if there is any damage.

4. When the airplane is parked, it should be covered with cockpit canvas cover so as to protect the organic glass covers from sun shining. If it is only a short time parking, the canopies should be partly opened.

EMPENNAGE

1. Rock the horizontal stabilizer with hand to inspect the fixing joints, in which there should be no movable clearance.

2. Inspect the fixing joints of the fin with the fuselage, in which there should be no movable clearance.

3. Inspect the fabric skin of the empennage, in which there should not be anything slack or damaged. The connection of the fabric with the framework should be in good condition. Looseness of rivets and screws at the fabric is not allowed.

4. Inspect the joints of the rudder, elevator and their trim tabs, which should be firm and secure. See if the movable clearance of each bearing is proper.

5. See if the control cables for rudder, elevator and their trim tabs are in good working condition.

CONTROL MECHANISM

1. Inspect the flexibility of the control sticks and their movable links in the front and rear cockpits, and they should have no stagnation. Make sure that the forked end bolts have no looseness and that the movable clearances of the bearings are not over the allowable range and have no other troubles. Each ground-wire should be properly fixed.

2. Inspect the transmission of the elevator and aileron control, which should be in good working condition and see if there is sufficient swing. Replace the rubber caps on the stop bolts while they are worn away.

3. Inspect the control links, the link joints and the rocker arms for the aileron and elevator and see if they are intact.

4. Inspect the brake handles on the control sticks of the front and rear cockpits as well as the release valve button on the control stick of the rear cockpit, which should be in good working condition.

5. See if the action of the foot control mechanism is proper. Inspect the QS-2 brake differential, and its fixing should be secure.

6. Inspect the suspending and connecting condition of the rudder, and check the control cables for abrasion, broken wire and looseness. Make sure that the cable does not jam with the pulley. Replace the lubricating oil in the pulley, if necessary.

7. The turn buckles of the control cables and their safety should be secure. There could not be any rub between the cable and web, or and other parts.

8. Inspect the flexibility of the trim tabs for elevator and make sure that the swing is proper and that there is no broken wires and other damage on the control cable.

9. Check the trim tabs of the aileron for deformation.

COCKPITS

1. Inspect the adjusting mechanism of the seat, which should be in good working condition and its fixing should be secure.

2. See if the tying of the safety belt on the seat is proper and if the operation of the lock catch for the safety belt is flexible and secure.

3. See that the fixing condition and the operation of all equipment, accessories and parts in the cockpit are in good condition.

4. Inspect the operation of the hand pump and primer, which should be in good working condition.

5. Wipe out the dirt and moisture from the cockpit. It is not allowed to keep surplus articles in the cockpit.

RADIO EQUIPMENT

1. Inspect the non-directive antenna and its insulator, which should be proper. Wipe out the dirt on the antenna with rag, if necessary.

2. Inspect the fixing of the fin antenna, which should be secure, and its surface should be clean and intact.

3. Open the radio compass inspection door to inspect the radio compass receiver, wire bundle, flexible shaft, ground wire and antenna down lead, which should be secure and firm. The cushion should be intact.

Inspect the cable connection of the loop antenna and the fixing of the silica-gel desiccant tube, which should be secure. Check the silica-gel desiccant for discoloration. See that the feeder of the radio station and the ground wire are secure and intact.

4. Inspect the fixing of the plexiglass for the loop antenna and see if there is any damage. Dirt should be wiped out with rag.

5. Open the storage battery access doors to inspect the fixing and damping of the radio compass, radio station and telephone, which should be in good condition.

6. Inspection for the front cockpit:

1) The button and leads on the air and fuel mixture throttle control handle and their shields should be in good condition, and the button should be entirely intact.

2) The compass indicator should be fixed and secure. The glass and pointers should be clean and intact.

3) The fixing of the band regulating box, the cable connection, the band knob and the volume knob should be secure. Set the volume knob in the maximum position.

4) Inspect the radio compass regulating box, ear telephone pin, volume knob, switch, bulb, fuse and flexible shaft, which should be secure and intact. The exterior and dial of the tuning adjusting instrument should be clean and intact. The pointers should stay on the right.

5) Inspect the fixing of the user box, volume knob and switch of the JT-2A interphone, which should be in good condition. The volume knob and the switch should be set on the specified position.

6) Check the bakelite caps and sockets of the JXZ-4 and JXZ-5 terminal plates for crack. The fixing of wires should be secure.

7) Inspect the cable connection for the radio compass indicator of the rear cockpit, which should be proper.

7 Inspection for the rear cockpit:

1) Inspect according to items 1, 2, 4, 5, for the front cockpit.

2) Inspect the fixing of the switching relay box for the radio compass, which should be secure.

8. Inspection for the avionic bay:

1) Inspect the fixing of each accessory, which should be secure and see if there is anything abnormal and crack in each bracket and cushion.

2) Inspect the fixing of each cable, ground wire and feeder, which should be secure.

3) Open the dust shields of the transmitter and receiver of the radio station to inspect the link mechanism and the contact, which should be clean. And the caging knob should be locked tightly, the fixing of the crystals should be secure and the noise suppressor switch should be set in the specified position. (The radio station made in 1960 is provided with an additional parallel switch on the right panel of the front cockpit.)

Cover the dust shield after the inspection.

9. Switching on inspection

1) The operation of the interphone on the airplane should be proper. And move the air and fuel mixture throttle control handle to know if there is any interrupted sound.

2) Switch on the radio station and the radio compass, and the operation of the GBL-250 inverter should be proper. The communication of the radio station on four bands should be in good working condition. There should not be anything interrupting self-hearing while the air and fuel mixture throttle control handle being moved.

Inspect the operation of the radio compass on three bands, which should be proper. And the indicators of the front and rear cockpits shoul be synchronous.

4) Set the compass indicator on 180° and withdraw the connecting link for the radio station after the completion of switching on.

ELECTRICAL EQUIPMENT

1. Wobble the fan of the generator with hand so as to inspect the friction clutch, in which there should not be anything sliding. (Note: It is forbidden to pull the propeller at the moment.)

2. Inspect the fixing of the generator, regulating box, wave filter, starting coil, QDF-1 and RDF-3 solenoid valves, voltammeter, center switch panel and power supply relay box, which should be secure. And the cable connections should be proper.

3. Inspect the fixing of the navigation lights, landing light outboard indicating lamps for landing gears, field power supply socket and its indicating lamp, which should be secure and have no damage on the exterior.

4. Inspect the fixing of the AKP2-1 end-point switch, which should be secure and make sure that there is no crack in the bracket and that the cable is properly fixed and has no rub.

5. Inspect the illuminating devices for the front and rear cockpits and signal box for landing gear, which should be fixed, secure and clean.

6. Inspect the protectors of the power supply relay box, which should be intact and its installation should be correct.

7. See if the fixing of all the wires in the negative terminal plate is secure and if there is any friction.

8. Inspect the bracket of the battery box, in which there should be no crack, and the cables and pins should be in good condition. The duct of ventilation should be free.

9. Inspect the illuminating devices with switching on and judge that the operation of the AKP2-1 end-point switch is secure.

10. Inspection for the storage battery:
    1) The steel band, pulley and fastener for the battery box should be in good condition; clean the inside of the battery box.
    2) Open the battery caps so as to inspect the outer case, threaded plug and sealing pitch, which should be intact; and clean the outer electrolyte.
    3) Inspect the voltage of the battery and its electrolyte fluid level.
    4) Inspect the specific gravity of the electrolyte and the voltage of single cell while charging for deficiency.

INSTRUMENTATION

1. Inspect the fixing of the outer sleeve and the sensor for the pitot tube, which should be secure and make sure that there is no crack on the surface, the total static pressure holes should be unobstructed and that the fixing of the negative wire is secure. Clothe it with canvas bag after inspection.

2. Inspect the fixing of the sensor of each engine instrument, which should be secure. The joints of ducts should be sealed. (Inspection for the fuel pressure gauge may be achieved by means of operating the hand pump.)

3. Inspect the fixing condition of the wires or of the duct connection for each instrument, which should be no rub.

4. Inspect the fixing of each instrument and its accessory in the front and rear cockpits, which should be secure. Make sure that the indication of each instrument is correct and that there is no damage on the surface. And judge that the operation of each adjusting knob should be in good condition.

5. Inspect the minute and second control of the clock, which should be in good working condition.

6. Inspect the fixing and clearance of the intrument panels as well as the damping device in the front and rear cockpits, which should be proper.

7. Check the flexible shaft of the tachometer generator for abrasion and tip-off.

8. See if the fixing of the sensors of the fuel level gauge is secure and judge that there is not any leakage.

9. Open the SBL-53 inverter cover for inspecting the fixing of the inverter, which should be secure, and there should not be any crack in the bracket.

10. Inspect the error correction cards of instruments for the front and rear cockpits, which should be coincident with the provision and lettered clearly.

11. Switching on inspection:

1) The indication of each engine instrument should be proper and the value of the indicational difference in the front and rear cockpits should be coincident with the provision.

2) The indication of the fuel level gauge should be correct and the operation of the fuel remaining quantity signal lights should be proper.

3) The operation of the gyro horizon, turn-and-bank indicator and compass should be proper.

4) The operation of the SBL-53 inverter should be proper.

5) The illumination of the magnetic compass and the heating of the pitot tube should be in good condition.

CHAPTER X

PERIODICAL WORK

I. TASKS FOLLOWING THE REPLACEMENT OF THE ENGINE

1. Remove the oil sump filter and the oil pump inlet filter, then clean them up for inspection. If dirt be spotted, the firewall oil filter and the oil filter of the speed regulator should be removed for cleaning and inspection.

2. Inspect the fuel pump air vent to see if it is ventilative. Take care not to damage its membrane.

3. Check the fuel system and oil system to see if there is any leakage. A pressure of 0.2-0.5 kg./cm^2. in the fuel system should be built with the hand pump for inspection.

4. Inspect the reliability of fixation of the engine control links (controlling the air and fuel mixture throttle, altitude regulator, pitch variation, gill shutters and air intake warming). See if the control rocking arm touches the stop pin with a thin slip of paper.

5. Inspect the reliability of fixation of all the engine auxiliary equipment.

6. Inspect the fixing condition of the propeller. When the blades being turned clockwise and counterclockwise, no play should be found in the rear taper. (The torque for wrenching the propeller nuts is 50-60 kg.m.)

7. The engine can enter the flight service only after it is proved to be in accordance with the technical regulations through engine run.

II. TASKS FOLLOWING THE FIRST TEST FLIGHT

1. Drain off 0.5 liter of oil from the oil sump to see whether there is any metallic grits in it. If there is dirt in it, remove the firewall oil filter, oil pump inlet filter and the speed regulator oil inlet filter for cleaning and inspection.

2. Remove the carburetor fuel filter for cleaning and inspection.

3. Inspect the mounting fixation of the engine on the engine mount.

4. Inspect the fixing condition of the propeller, no plag should be found in the rear taper.

5. Inspect the pipe connections and the auxiliary parts of the fuel and oil systems, leakage and looseness are not allowed.

III. TASKS FOLLOWING EVERY 25±5 HOURS' FLYING

Inspect the airplane, the engine and the auxiliary equipment according to the post-flight inspections (Section 8, Chapter 9). In addition, the following tasks should be performed:

AIRPLANE

1. Control system:

See if there is any play between the joints, and any crack on the parts. Inspect the cable and the fixing condition of the bearings.

2. Make use of the control valves in the front and rear cockpits to properly retract and extend the landing gears and inspect the working condition of the emergency system. Inspect the play in the hinge points.

3. Drain off the deposit from the oil filter.

4. Blow the oiltank air vent.

5. Drain off the deposits from the main compressed air bottle, the emergency bottle and the two deposit filters.

ENGINE

1. Remove the idling air filter for cleaning and inspection, and clean up the carburetor air inlet dust filter.

2. Clean up the oil sump filter.

3. Inspect the fixation of the inlet manifold and the exhaust pipes and inspect their surface condition.

4. Inspect the reliability of fixation of all ball joints of the engine control links. Supplementary tasks for a new engine after its first 25 hours' working should be done:

1) Remove the propeller for all the inspections described in Item 5 of the next Section (for engine).

2) Inspect the valve clearance. (The gap should be within the range of 0.3-0.4 mm.) Adjust it if necessary

3) Remove the rear cover of the magneto and inspect the integrity and clearance of the outside surfaces of the breaker and distributor. The gap of the breaker points should be of 0.25-0.35 mm.

RADIO EQUIPMENT

1. Inspect the intergrity and cleaning of the radio system. Special care must be taken to see if there is a discoloration about the blue desiccator and the plexiglass cover of the loop antenna.

2. Inspect the fixation and cleaning of the wires in the JXZ-5 terminal plate of the JT-2A interphone.

3. Inspect the cable shielding sleeve and the ground wires between the metallic parts and the cable. Broken wire and abrasion of the cable is disallowed.

4. Inspect the volume knob and the flexible shaft, their turning should be uniform and soft.

5. Inspect the condition of cushioned fixation of the radio station, the interphone and the GBL-250 inverter, and see if there is any crack on the shock pad.

ELECTRICAL EQUIPMENT

1. Turn the propeller blade with hand, inspect the operating condition of the generator and the tightness of the protecting belt. Take off the protecting belt to inspect the condition of the commutator. Clean it up, if necessary.

2. Inspect the mounting condition, the wire connection and the cleaning of the ZY-1500 regulating box, LBQ-3 wave filter and ZF-1.5 generator. Tighten the nuts with a socket spanner.

3. Inspect and clean up the landing light and the wires on the back of the light focusing reflector. Make sure that the connections are not worn-out and are tight and clean.

4. Inspect the fixing and clean condition and the operating synchronization of all the switches and inspect the cleaning and fixation of all the negative terminals.

5. Inspect the cleaning of the cable leads, threaded plug and binding posts of the battery. If the electrolyte be spotted on the felt pad, wash it with soda powder and then dry it thoroughly.

INSTRUMENTATION

1. Inspect the warming resistor, warming ring and wires of the pitot tube. They should be in good condition. Make the drain hole of the pitot tube unobstructed with a copper wire.

2. Remove the flexible shaft from the tachometer. Clean up its steel core and shaft sleeve with RH-70 aviation gasoline, and inspect the wear of the cable. (Replacement should be done when its wear is beyond the half of its diameter.) Before mounting on to the airplane, the cable should be lubricated with industrial cable grease.

3. Open the inspecting door of GHC-2 magnetic heading sensor, inspect its surface condition and the accuracy of its mounting position. Its mounting should be fixed steadily without any displacement.

4. Open the EX-2 rectifier and the tachometer terminal plate, inspect the fixing condition and the correctness of the wiring.

IV. TASKS FOLLOWING EVERY 50±5 HOURS' FLYING

Besides the tasks described for the 25 hours' flying maintenance, the following tasks should be performed:

AIRPLANE

1. Control system:

Clean up the aileron, the elevator and its trim tabs, the rudder control push-pull rod, rocker arm and its active joints with clean gasoline. See if there is any play and any crack on the parts. Inspect the control cable and the mounting of the bearings. After inspection, they should be recoated with ZL7-2 grease.

2. Pneumatic system:

   1) Remove and disassemble the dual valve for cleaning up and inspection. Spring and valve should be coated with ZL7-2 grease.

2) Disassemble, clean up and inspect the compressed air deposit filter.

3) Inspect the pressure regulation of the compressed air pressure regulator. Adjust it, if necessary.

3. Inspect and clean up the firewall fuel filter.

4. Inspect the pressure and the airtightness of the wheel brakes.

5. The actuating cylinders for the landing gear, flap and landing gear up lock should be filled with transformer oil. The quantity of oil to be filled in each cylinder is 10-15 g.

6. Measure the gas pressure within the damper cylinder. It should be boosted if the pressure is insufficient.

7. Clean up the brake cable sheath with dehydrated kerosene.

8. Inspect all the handles in the front and rear cockpits, and fill lubricating oil in their movable parts.

ENGINE

1. Inspect the tightness for each cylinder with a pressure gauge. Its indication should be 3.5-6 kg./cm^2. under a cylinder head temperature of 40-60°C.

2. Take off the rocker arm chamber covers and perform the following tasks:

1) Inspect the valve springs, rocker arms and spring caps.

2) Check the gap between the rocker arm pulley and the top end of the valve push rod. It should be within 0.3-0.4 mm.

3) Fill 40-50 g. of No. 4 high-temperature grease into each rocker arm chamber of all cylinders which are above the horizontal line. (For the 6th batch engine, the filling is unnecessary.)

3. Remove, clean up and inspect the carburetor fuel inlet filter, drain out the deposit in its fuel chamber. Wash up the air nozzle, then dry it with air compressed.

4. Inspect the tightness of the cylinder fixing nuts and see if there is any crack on the engine case and any looseness of the studs.

5. Inspect the tightness of the nuts fixing the propeller hub. See if there is any play in the propeller. Dismantle the propeller to perform the following work, if necessary:

1) Tighten up the propeller hub nuts.

2) Inspect the hub quill gear and the propeller shaft quill gear.

3) Inspect the taper ferrule.

4) Tighten up the propeller fixing nuts (with the torque within 50-60 kg.m.).

5) Inspect the tightness of the balance weight clamping bolt, the tightening torque should be 8 kg.m.

RADIO EQUIPMENT

1. Inspect the radio station, compass, fuse and the relay box, which should be clean, intact and in good operating condition.

2. Clean up and inspect the transmitter and the interphone button device.

3. Inspect the wave band transferring system. The inspection should include the checking of the sensibility and the cleaning of the pulsation device, the link mechanism, the crystal transfer switch and its button, and their wiring should be complete.

4. Measure the resistance of the flying helmet wire.

ELECTRICAL EQUIPMENT

1. Generator:

   1) Take off the generator protecting belt, inspect the brush height and the full surface contact of the brush with the commutator. Wipe out the carbon deposit and dirt from the generator.

   2) Inspect the air pipe, which should be kept in a stable, clean and complete condition without any oil filth.

2. Inspect the plug connecting the battery, its wiring should be perfect.

3. Open up the starting coil outer lid, its surface should be clean, complete and reliable. Inspect the interrupter, the wire and the insulator, they should be clean and complete. Inspect the operating current of the primary coil (2-3A.) and the high tension sparking.

4. Inspect the AKP2-1 switch and the landing gear signal light bulb, its socket and the wiring, then clean them up. If the bulb is blackened, replace it with a new one.

5. Inspect the cables at the rear of the instrument panel, they should have no rub and looseness.

6. Inspect all the switches on the central switch panel and inspect the mounting and fixing condition of their wires. Shorting and tip-off should be prohibited.

7. Inspect the starting button and the plug of the compressed air solenoid valve see if there is any wear of the wire and then clean them up.

8. Inspect all the bulbs and switches with switching on. Make sure that the bulbs should work normally and the switch synchronously.

INSTRUMENTATION

1. Dismantle the BZ-35 tachometer indicator and inspect:

   1) The error of the indicator;

   2) The fluctuation value;

   3) The pointer swinging;

   4) Pointer deflection from the null position;

   5) The balance of the indicator system.

2. Pull out the dynamic and static pressure fabric reinforced rubber hoses from the nipples of the fuel pressure sensor and all the aneroid instruments, blow the dynamic and static pressure tubes with compressed air below 3 atmospheric pressures, then remount the hoses. Inspect the airtightness of the aneroid instruments with M-3 apparatus.

3. Inspect the liquid and scale of the LC-2 magnetic compass, they should be distinct and transparent. Inspect the stagnation error and time for stabilization of the compass azimuthal ring.

4. Remove BDP-2 gyro-horizon from the airplane for checking and inspection:

   1) Inspect the accuracy of the sideslip indicator.

   2) Inspect the starting button and the operating condition of the miniature airplane.

   3) Inspect the operating time of the bimetallic relay.

4) Inspect the turn-off angle and turn-on angle of the lateral correcting motor.
5) Inspect the inertial time of the instrument rotor.
6) Inspect the operating current of each phase.
7) Inspect the insulating resistance.

5. Inspect the gyro-magnetic compass:
1) Inspect the regulating position of the amplifier sensibility.
2) Inspect the compass coordinating speed.
3) Check the indicator pointer to see if it moves sensibly and smoothly. Items (1), (2) and (3) may be performed with switching on.

6. Inspect the integrity and fixation of the instrument cushioning collars on the back of the instrument panel, they should be without any crack. The wires should be without any rub.

V. TASKS FOLLOWING EVERY 100±10 HOURS' FLYING

Besides the periodical tasks described for the 50 hours' flying maintenance, the following tasks should be performed:

AIRPLANE

1. Pneumatic system:
1) Inspect the airtightness and the availability of the compressed air main valve, the emergency valve, the landing gear and the flap extending and retracting valves. Air leakage and other failures must be eliminated. Replace them with new components if necessary.
2) Disassemble the QS-1 pressure reducing valve, QS-2 brake differential, check valve and pressure regulator valve.
3) Clear the rust of the QDF-1 compressed air solenoid valve.
4) Inspect the airtightness of the pneumatic system. The drop of pressure within 10 minutes should not exceed 1.5 atmospheric pressures when the landing gear is in up or down position.

2. Inspect the hydraulic fluid quantity in the damper cylinder, and it is not necessary to remove it from the airplane.

3. Inspect the integrity and operating smoothness of all the engine control links and their joints. If their control is jammed, clean up the interior of the sheath with gasoline and grease it with ZJ53-3 grease.

4. Remove the front and rear sliding canopies, clean up the bearings and lubricate them with lubricating oil.

5. Disassemble the tires, inspect the soundness of the tubes and the tyres.

6. Remove the fuel tank compartment door. See if the cover touches the tank out wall and inspect the tightness of the fixing belts and the security of the adjustable bolts.

7. Open up all the access covers on the fuselage, see if there is any crack on the fuselage framework within the sight. Inspect all the rivets connecting the fuselage and the midwing.

8. Remove the fairing strips around the junction plane of the midwing and outer wings, and inspect their joints.

ENGINE

1. Drain out the stale oil from the engine and the oil tank, and refill fresh oil into them.

2. Clean up the firewall oil filter, oil pump filter and speed regulator filter.

3. Remove the pressure regulating valve of the oil pump, clean up and inspect it.

4. Remove the wave shield from the distributor on the magneto, thus inspecting the following sets:

   1) The breaker:
   Inspect all the screw connections on the breaker, inspect the rotating condition of the lever on its shaft and measure the breaker points gap. Clean up the points with a piece of chamois cloth or white silk soaked with alcohol and adjust the points gap within the range of 0.25-0.35 mm. After each gap-adjustment, note it down on the magneto log book.

   2) The distributor:
   See if there is a contact spring which leads the high-tension current in the hole on the distributor seat. Make sure that the spring is in good condition. Inspect the carbon brush and its holder spring, replace it if necessary.
   If there is filth on the distributor disk or on the brush, it must be wiped out with a piece of clean and dry chamois.

   3) See that the high-tension leads are in good condition.

   4) Inspect the mounting fixation of the transformer and the distributor brush.

   5) Check the brush for crack. It should be replaced if any crack is found.

5. Inspect the mounting fixation of the KY-2 compressor, remove the duct communicating the KY-2 with the deposit filter, clean it up with gasoline and blow it with compressed air.

RADIO EQUIPMENT

1. Remove the GBL-250 inverter. Measure the spring pressure, the brush height and the degree of sparking (see GBL-250 certificate). Clean up the commutator and inspect the integrity of the distributor circuit.

2. Remove the radio station, the interphone and the radio compass to inspect the performance of the electronic tubes. (The electronic tube performance of WL-5 may not be inspected.)

3. Inspect the inner connecting circuits of the radio station, the interphone and the radio compass; clean up the tube sockets and its base pins. Replace the grease in the radio station link gear.

4. Open up the radio compass transferring relay box to inspect the inner connecting circuits. Make sure that the transferring relay is in a good condition and its mounting is reliable.

5. Inspect the antenna current, the coefficient of amplitude modulation, the power consumption and the input current of the transmitter.

6. Open up the JT-2a user's box for inspecting the fixation and cleaning of the inner wires.

ELECTRICAL EQUIPMENT

1. Inspection for the generator by performing the following tasks:
   1) Inspect the tightness of the post bolts with their nuts. If the post is loose, its nut should be tightened.
   2) See if the brush is correctly mounted onto the brush holder hole, if its travel is free and if the positions of all the springs which press the brush to the commutator are correct. (The pressing ends of the springs should be always in the brush recess.)
   3) Inspect the brush heigh. Replace the worn brush with a new one if the brush height is below 15 mm. The new brush should enter the brush holder hole freely. Polish the new brush carefully with No.00 glass sand paper and make it fit with the commutator. After polishing, blow off the dregs from the generator with compressed air.
   4) Check the brush wire for damage. Special attention should be paid to the wires on the brushes and terminal plate joints.
   5) Inspect the working surface of the commutator, clean up the commutator with a piece of clean cloth soaked with gasoline if there is any dust or carbon deposit on it and then blow off the dirt on the generator with compressed air. The dirt on the commutator which can not be wiped out by cloth can be polished out with No. 00 glass sand paper only. The use of emery paper is prohibited.
   6) Inspect the tightness of all the fixing bolts of the magnetic poles.

2. Remove the regulating box, wash its interior part, clean up the control points with alcohol for inspection and inspect the wire soldering and fixing conditions.

3. Remove the starting coil, open up its outer cover and inspect the contact points. Clean up the points with alcohol and inspect it with a tester. Its normal spark distance should not be less than 5 mm.

4. Inspect the operating condition of the generator regulating box and the battery set connected in parallel.

5. Disassemble and inspect the cockpit lights and the fluorescent lamps. Their bulbs and their wires should be clean and in good working condition.

6. Inspect the contact points of the relay in the relay box, which should be clean, and the wire connecting should be in good condition.

INSTRUMENTATION

1. Inspection for the aneroid instruments:
   1) The airtightness of the instrument housing;
   2) Basic error;
   3) The fluctuation value;
   4) The non-uniformity of the pointer indication;
   5) Deflection from the null position of the rate-of-climb indicator. Remake the correction list for the altimeter, the airspeed indicator and the rate-of-climb indicator.

2. Remove the tachometer and the transmitter from the airplane and inspect the following items:

1) The set indication error;

2) The phase voltages of the transmitter.

3. Inspection of the BWG-2 cylinder head temperature indicator:

1) The basic error of the pointer indication:

2) The fluctuation value;

3) The stagnation of the indicator movable system;

4) Inspect the thermocouple temperature probe ring, which should be integral and clean.

4. Inspection of the gyro-magnetic compass:

1) The insulating resistance between the sensor housing and pin joint 1, 2 and 3 of the GHC-2 magnetic heading sensor.

2) Disconnect the pin joints of the gyro mechanism and then inspect the resistance between the pins:

a. The resistance between pins 8 and 10 should be within the range of 100-130 ohm.

b. The resistance between pins 7 and 12 should be 300-450 ohm.

c. The resistance between pins 1 and 2, 2 and 3, 1 and 3 should be within the range of 267-400 ohm (in accordance with the airplane operation instruction).

3) Inspect the insulating resistances between the pin hole ends 1 and 7, 1 and 12, 1 and 4, and between the hole end 1 and the fuselage body with a 500 V. megohmmeter, they should not be less than 2 megohm.

5. Remove the turn-and-bank indicator for checking and inspecting:

1) Inspect the commutator and the brush. Clean the cavity by way of blowing a stream of air not greater than 0.5 atmospheric pressure.

2) Inspect the sensitivity of 6°/sec. of the turn-and-bank indicator.

3) The time of inertia of the turn-and-bank indicator.

4) The balancing of the gyro-mechanism.

6. Disassemble the inlet resistive temperature probe plug and inspect the interior wire, which should be intact.

7. Remove the FL-3 compass amplifier to inspect the performance of the electronic tubes.

VI. TASKS FOLLOWING EVERY 200±10 HOURS' FLYING

Besides the periodical tasks described for the 25, 50 and 100 hours' flying, the following tasks should be performed:

AIRPLANE

1. Remove the flap actuating cylinder for disassembly and inspection.

2. Remove the landing gear actuating cylinder and the gear up-lock cylinder for disassembly and inspection.

3. Remove the landing gear for disassembly and inspection. Inspect the tightness of the nuts and its safe condition. Check all the weldments for crack. Inspect the safe condition of the piston rod, replace all the worn parts.

4. Check the landing gear movable joints for damage. Inspect the tightness and safety of the nuts and see if there is any crack in the welded seams.

5. Disassemble the landing gear up-lock for cleaning and inspection and then lubricate with ZL7-2 grease.

6. Disassemble and inspect the shimmy damper and refill hydraulic fluid to it.

7. Clean up and inspect the paddles, the abnormal gaps should be eliminated.

8. Inspect the control stick support and the pull rod bearings, and see if there is any play in the movable joints. Grease all the joints with ZL7-2 grease.

9. Remove the main compressed air bottle and the emergency compressed air bottle, and flush their inner walls. Inspect the integrity of the compressed air bottle mount and its fixing belts.

NOTE:

The inner walls of the compressed air bottle and the emergency compressed air bottle should be flushed at least twice per year no matter how long the airplane has flown.

10. Blow through the ducts of the landing gear retracting and extracting system, the flap retracting and extracting system and the brake and starting systems with the compressed air of 50 atmospheric pressures.

11. Inspect the fixing condition of the flap and its actuating cylinder.

12. Enter the rear fuselage to inspect the rivet condition of the stringers on each frame.

13. Clean up the oil tank, oil ducts and the oil radiator.

ENGINE

Perform the periodical work for the spark plugs according to the following steps:

1. Remove the spark plugs from the engine according to the removing regulations, perform the exterior check to see if there is any damage on it.

2. Clean up the spark plugs with clean gasoline and dry it in the air.

3. Remove the carbon deposit in the spark plugs cavity with dry sand on a special sand blaster. The dry sand used must first be sifted with a sieve of 1,600 holes per cm^2. The air pressure for the sand-blasting should be of 6-8 atmospheric pressures. After being cleaned up by sand, the spark plug cavity should be cleaned with dry compressed air of 4-5 atmospheric pressures, and then be cleaned up again by gasoline.

4. Adjust the gap between the poles to a range of 0.4-0.5 mm. on a special jig. In adjusting the gap, insertion of a feeler gauge into the gap and applying a pressure to the central pole are not allowed, for these will cause a break down of the central pole or a break down of the porcelain insulating cone.

5. Inspect the pole sparking performance on a special spark-over testing device. When the test is performed with 9 atmospheric pressures, the spark formed between the holes should be sustained without interruption within 30 seconds.

6. When the spark plug shielding chamber is wet, it must be cleaned up with a piece of clean, dry rag. Then dry it in a 120-130°C temperature for 1.5 hours. After drying, a sparking-test should be performed.

RADIO EQUIPMENT

1. Inspect the WL-5 radio compass and the performance of the electronic tubes.

2. Inspect the sensitivity of the receiver for both the maximum directional sensitivity and the maximum positioning sensitivity with the WL-5 radio compass installed either in the airplane or on the test bed. Inspect the autorotation speed of the loop antenna at any frequency in the wave band when the electric field strength is 1,000 μV./m.

3. Inspect the frequency stability and the graduation accuracy of the WL-5 radio compass.

4. Remove the loop antenna to see if the internal synchronous system and the compass compensator are in good condition and renew the lubricating oil for the shaft and the gear.

5. Inspect the insulating resistance of the inverter. It should not be less than 2 megohms in a warm state.

6. Disassemble and inspect the cable, the pins and the pinholes. Test the button wires on the air and fuel mixture throttle control handle to see if there is any shorting or breakage. Disassemble and inspect it, if necessary.

7. Inspect the regulating box and its inner circuit.

8. Remove the radio station from the airplane for switching on inspection, then tune the radio station.

ELECTRICAL EQUIPMENT

1. Inspection for the operation performance of the regulating box:
   1) The cut-in voltage of the minimum relay;
   2) The back current when the back current circuit breaker is cut off;
   3) The regulating range of the voltage regulator;
   4) The maximum operating current of the maximum relay (the current-limiting range).

2. Cut off the capacitor to measure the insulating resistance of the wave filter with a megohm-meter sustaining not greater than 500V., the insulating resistance should not be less than 2 megohms. After mounting, the capacitor is charged with a 200V.D.C. In discharging with the current supply off, the capacitor should give sparks.

3. Inspect the starting coil.

4. Remove the landing gear limiting position switches and care must be taken to inspect its contact points and see if there is breakage in the leads.

5. Remove the navigation lights to inspect the insulating, connecting and soldering conditions of the wires, and see if the bulb blackening or its filament is deformed. Replace it if necessary.

6. When the airplane porforms night training flight, inspect the landing light illuminating angle. Adjust it if necessary.

7. Measure the insulating resistance of the positive pole of the airplane circuit network with an electrical bridge or with a megohm-meter.

INSTRUMENTATION

1. Inspection for the BYQ80-1A compressed air pressure gauge:
   1) Inspect the external condition of the indicator, the fuse should be in good working condition.
   2) Inspect the basic error and the lag error of the instrument, and inspect the uniformity of its pointer travel.
2. Inspection of the following items for the BWY-1 triplex gauge:
   1) Inspect the exterior and fixing condition of the instrument indicator and the temperature and pressure transmitter. Judge that the connection of the plug with socket is reliable, and the fuse is in good condition.
   2) Inspect the connecting condition of the fabric reinforced rubber vent hoses on the cases of the fuel and oil pressure transmitter.
   3) Inspect the insulating resistance of the instrument circuit network and inspect the external condition of its wires.
   4) Inspect the instrument basic error, the airtightness of the cases of the pressure gauge transmitter and the resistance of the temperature gauge probe.

3. Disassemble the electrical plugs of the triplex gauge, the fuel and oil pressure transmitter, the fuel level gauge, the turn-and-bank indicator and the tachometer. Clean up the adapters and nipples with alcohol.

4. Inspection for the SBL invertor:
   1) Inspect the a.c. voltage;
   2) Inspect the d.c. voltage needed;
   3) Inspect the conditions of the carbon brush and the commutator, and then clean them up;
   4) Replace the bearing lubricating grease;
   5) Inspect the fixing and soldering conditions and the circuit connecting condition of the parts of commutator units.

5. Inspect the performance of the LTC-1 gyro-magnetic compass. (Inspect according to the LTC-1 gyro-magnetic compass certificate.)

6. Arrange the airplane circuit and new signs should be painted.

VII. TASKS FOLLOWING EVERY 200^{+20}_{-30} TIMES OF TAKE-OFF AND LANDING

1. Remove the airplane wheels to carry out the following tasks:
   1) Clean up and inspect the bearings, and replace ZN6-4 Grease.
   2) Inspect the axle surface and the fixation of the wheel drum.
   3) Inspect the brake blocks. When they are worn and their thickness is less than 8 mm., they should be replaced. It is not allowed to use the brake blocks of different thickness simultaneously.
   4) Inspect the airtightness of the brake rubber bag.
   Means for inspections: Hold the brake rubber bag lightly to make it being locally swelled.

2. After the wheel is mounted onto the airplane, inspect it and make sure that there is no axial play and that the tighteness of the two main wheels is the same. Inspect the brakes and the individual braking conditions.

3. Fill ZL7-2 Grease to all the movable parts and grease nipples.

4. Check the protrusive length of the piston skirts. They should be:
For main wheels 113±3 mm.;
For front wheel 185±2 mm.

5. The joint clearance between the upper and lower jackstays should be within 0.05-0.15 mm.

Means for inspection:

Jack up the airplane, extend the landing gears with the control valve down. (The compressed air pressure should not be less than 25 atmospheric pressures.)

6. Remove the brake cable to see if there is any broken wire on it within the sight.

7. Care must be taken to inspect all the joints and weldments on the landing gears with an amplifying lens of not less than five times. Crack is not allowed.

VIII. TASKS FOLLOWING EVERY 400^{+20}_{-30} TIMES OF TAKE-OFF AND LANDING

Besides the periodical work described for the 200 take-offs and landings, the following tasks should be performed:

Disassemble and inspect the brake disk.

NOTE: The maintenance for the engine in this chapter refers mainly to the "HUO-SAI-6 Piston Aero-Engine Service and Maintanance Manual" (1966, 5 Edition). If there is any doubt about the contents of this chapter, only the manual should be trusted.

CHAPTER XI

SEASONAL MAINTENANCE CHARACTERISTICS

I. IN WINTER

Before the airplane enters winter service, the following works should be performed:

1. Care should be taken to inspect the airplane, the engine system and all the accessories.

2. Clean up the airplane and repaint the spots where the paint has flaked.

3. Put the heat retaining covers on the power plant set (the engine, the oil tank etc.). The heating equipment is prepared and tested for its availability.

4. Clean up the lubricating system with kerosene and the fuel system with gasoline. Blow through the pneumatic system with compressed air, clear the air bottles of their interior deposits and rust and keep the pneumatic system dry constantly.

From the 20th batch on, the fire wall is equipped with an additional water filter. In winter, the desiccator in the water filter is dried in the daily preflight maintenance so that the desiccator may keep its moisture absorptivity. Besides, the unit should take precaution in accord with its environment to avoid the water condensation.

5. Inspect all the control cables to see if there is any broken wire or any deformation in the cable diameter. Clean up all the control cables and their pulleys and put the winter grease on them.

PREPARATIVE WORK FOR ENGINE

1. Prior to the arrival of winter, heat-retaining covers must be prepared.
2. The rubber hoses and the electric cables must be sheltered with protecting plates or asbestos coverings to prevent them from any damage during heating.
3. The cloth-bonded rubber hoses for lubricating oil can be without heat-retaining.
4. The oil tank should be heat-retained with a special cloth coat.

OIL THINNING

The high viscosity of the lubricating oil at low temperature brings about difficulty in engine starting or the damage of the engine parts when the crankshaft rotates. Therefore the oil must be thinned with the gasoline fed by the airplane itself. The thinning of the oil is carried out before the engine is shut down at the end of the flight day when the ambient temperature is below 5°C.

1. The thinning of the oil is done as follows:

1) Keep the inlet oil temperature at 30-50°C, regulate the engine rotating speed to 1,600 rpm. with a low propeller pitch angle and the oil pressure not lower than 1.5 kg./cm².

2) The duration of setting the oil thinning switch at "On" position depends upon how much oil the oil tank contains and how long the engine has run after the last thinning. It may be determined as referred to the following table.

Operation Time of the Engine after Last Oil Thinning (hr.-min.)	Oil Quantity in the Oil-tank (kg.)		
	15	12	9
	Valve Opening Time Needed for the Thinning the Lube Oil with 8-13% Gasoline (min.-sec.)		
0-15	1-43	1-28	1-14
0-30	2-44	2-21	1-57
0-45	3-27	2-58	2-29
1-00	3-41	3-17	2-46
Lube Oil without Thinning	4-36	3-47	3-10

3) After the thinning switch has turned back to "Off" position, keep the engine running as before for three minutes. At that moment, the propeller pitch variation control handle should be operated twice or thrice to mix the lubricating oil with gasoline well. Then, the engine is shut down according to the regulation.

4) During thinning, the cylinder head temperature higher than 160°C and the inlet lubricating oil temperature higher than 50°C are disallowed.

NOTE:

Thinning by filling the gesoline into the oil tank is prohibited.

2. The characteristics of the engine being operated with the thinned lubricating oil:

1) After being started, the engine must be warmed up by running at a speed of 900-1,000 rpm. for 5-6 minutes and then by running at a gradually increased speed up to 1,500 rpm. with the lubricating oil pressure of 4-7 kg./cm². When the cylinder hand is attained the temperature not lower than 120°C and the inlet oil temperature not lower than 20°C, the engine is considered as being properly warmed up.

2) At the beginning of the engine operation, the oil pressure lower than the normal oil pressure by 1 kg./cm². is allowed, but should attain its normal value 20-30 minutes later.

3) When the engine is idling, if the oil pressure drops below 1.5 kg/cm²., the engine should be shut down immediately. If it is caused by over-thinning of the oil, then all the lubricating oil in the system should be replaced.

PREPARATION FOR ENGINE STARTING

1. When the ambient temperature is below 0°C, the engine should be warmed up before starting. The temperature of the warming air should not be higher than 180°C.

2. When the ambient temperature is below—20°C, the oil radiator air warming installation should be warmed up as well. The temperature of the warming air used should not be above 100°C.

3. After warming up, turn off the ignition system, rotate the propeller in its operating direction 3—4 rounds manually. It should be easy to rotate.

4. The oil filled should be warmed to 40-60°C, but filling the engine with boiling oil is prohibited.

ENGINE STARTING AND WARMING UP RUN

1. The engine starting and test run should be performed according to the engine run regulation.

2. In order to save the fuel and to guarantee the stability of the engine operation, the temperature of air entering the carburetor should not be below 15°C.

ENGINE SHUTDOWN

The engine shutdown in winter is carried out much the same as that in summer, the difference lies in:

1. The lubricating oil should be thinned with gasoline before engine shutdown if necessary.

2. When the ambient temperature is below—20°C, lubricating oil not thinned should be bled from the airplane (oil-tank, oil sump and oil radiator).

II. IN SUMMER

When the airplane is served in summer and in damp weather, caution should be taken to the following points:

1. Special attention should be paid to the removal of moisture from the pneumatic system and to the elimination of the trouble caused by moisture. If the check valve, dual valve and the parts inside the air intake of the QS-1 pressure reducing valve are spoiled with rust, they should be cleaned in time or replaced if seriously damaged.

2. At the end of every engine operation and in the inspection on the take off line, all the deposit in the deposit filters of the pneumatic system should be evacuated.

3. To protect the organic glass from deterioration caused by over-exposure of the sunlight, the cockpit canopies should be covered with shields.

4. Take a constant notice of the inflation pressure of the landing gear tyres to prevent them from explosion caused by thermal expansion.

5. Take a constant notice of the rubber parts on the engine to prevent them from damage caused by over heat.

6. At filling fuel, the effect of thermal expansion of the fuel should be taken into account, therefore, a free margin of 30—40 mm. between the fuel surface and the filler should be kept.

CHAPTER XII

AIRPLANE RESERVATION

To reserve airplane in a rational way is an important link of prolonging the airplane service life.

The airplane in reservation must be constantly kept clean and ventilated and be coated with dry and clean canvas covers; the propeller blades should be always kept in the horizontal position.

The following requirments should be checked and met before the airplane being coated with the canvas covers:

1. Make sure that the magneto is switched off.

2. Make sure that the starting button is safeguarded.

3. Make sure that the control valves of the landing gears and flaps are in the neutral positions.

4. The landing gears are fully extended.

5. All the landing gear damper cylinders are smeared with industrial vaseline.

6. The gas pressure in the damper cylinder and tyres are normal and there is no gas leakage.

7. Make sure that no surplus articles has been left on the airplane.

8. All the access doors should be fully closed.

I. RESERVATION IN HANGAR

1. In hangar, airplanes must be ranked with a certain distance from one another to prevent any collision caused by the gas leakage at the damper cylinders or tyres.

2. Care must be taken to prevent the airplane from the damage caused by collision while being pushed out from the hangar.

3. The reservation in hangar should be performed according to the relevant regulation.

II. RESERVATION IN THE OPEN AIR

1. Select dry, hard and flat area as the parking lot for the airplane reserved in the open air.

2. For long-time parking, underlay the tyres with wooden panels.

3. In parking, place the airplane nose against the wind and moor the airplane.

4. In summer, open the sliding canopies under the canvas covers to the intermediate positions till they touch the locking holes and lock them.

5. The airplanes should be coated with canvas covers.

CHAPTER XIII

CHARACTERISTICS IN SERVICE AND MAINTENANCE OF THE CHUJIAO-6 JIA AIRPLANE

The service and maintenance of the CHUJIAO-6 JIA airplane is much the same as that of the CHUJAIO-6 airplane, except that the modification of the carburetor air intake installation must be taken into consideration. The service and maintenance for the HOUSAI-6 aero-engine are described in its manual, while those for the CHUJIAO-6 JIA is supplemented with the following provisions:

I. CARBURETOR AIR INTAKE INSTALLATION

1. Check carefully and make sure that the auxiliary throttle should be opened to 30 mm. When the nose landing gear is retracted.

2. Check carefully and make sure that the auxiliary throttle is shut during the ground test run and taxiing

3. In case of sandy wind, flight with the shut auxiliary throttle by dismantling its control cable is permissible.

4. Clean up the filter screens of the air intake installation on the engine cowl, so that the air can flow in freely.

5. The gaps between the air warming funnels and the exhaust pipes are of 10-15 mm.

II. PERIODICAL WORK

After every 100+10 hours' flying:

1. See if the terminals of the control cable are well braided.
2. See if the control cables and their thimbles have been abraded.

END