

Amursky Metallist LTD

КПВ-4А

RAISE DRIVING INTEGRATED OUTFIT

CERTIFICATE

Blagoveshchensk, Russia

1. APPLICATION

The КПВ-4А raise driving integrated outfit is designed, as its name implies, for raise driving in stable rocks (needing no support) in non-gassy and non-dusty mines.

2. SPECIFICATIONS

Raise length (height), m	120
Raise cross sectional area, m ²	3—8
Raise inclination with respect to horizon, deg.	60—90
Rated (working) air pressure, MPa, minimum	0.5
Rated air flow rate (during raising platform motion), m ³ ·s ⁻¹ , maximum	0.43
Raising platform load capacity, kg	600
Raising platform motion speed (average), m·s ⁻¹	0.3
Mass, kg	11250

Note. The outfit design provides for changing inclination of the raise in the course of its driving from 60 to 90 deg.

3. STANDARD EQUIPMENT

Ref. No. in Fig. 1	Description of basic components	Designation	Qty	Note
1	Hose winch	31.200.005.000	1	
2	Supply unit	31.209.005.000	1	
3	Air piping	ПК 44.13.00.000	1	Delivered in disassembled state
4	Monorail	31.205.010.000	1	Delivered in disassembled state
5	Communication and lighting apparatus	31.203.001.000	1	Ditto
6	Raising platform	ПК 44.11.00.000	1	Ditto
	Set of spare parts, tools and accessories		1	Refer to Appendix 1
	Set of operation documentation		1	Refer to Appendix 2

4. DESIGN AND PRINCIPLE OF OPERATION

Compressed air system (Fig. 2). Compressed air is supplied to the outfit from the mine compressed air pipeline through filter 8 and hose 11. Pipeline filter valve 8.2 may be used in case of necessity for full removal of pressure from the outfit air system.

The raising platform is moved along the monorail with the aid of piston-type reversible air motor 6.5. Compressed air is fed to the air motor through T-piece 1.1 of the supply unit, hose 27, inlet 7.1 of hose winch 7, hose 31 wound on the winch drum, valve 6.1, header 6.3, hose 33 and air distributor 6.4 of the raising platform.

With the control valve of the air distributor being in the neutral position, the ducts of the latter communicate with the atmosphere through silencer 6.6. When the handle of the air distributor is turned, the control valve moves to establish communication of one of its ducts with the air supply ducts of the air motor, while the other duct communicates with the exhaust. To reverse the air motor, the air distributor handle should be turned back.

Air motor 7.7 of the hose winch is supplied with air through inlet 7.1, hose 28 and cock 7.2, oil splasher 7.4, hose 29, control cock 7.5, hose 30 and air flow restrictor 7.6. The latter are mounted on each air supply duct of the air motor and serve to control smooth rotation of the winch drum.

The raising platform is furnished with an air blowing appliance including special hose 32 with cock 6.2 and a tip for cleaning the monorail clogged rack.

Header 6.3 is provided with a tap (closed with cap 6.8) for connecting air-driven tools.

Air cylinders 6.10 are intended for changing over of the protective canopy from the transport to the operating position, and vice versa. When cock 6.9 is open the compressed air, through hoses 34 and 35, is admitted to the head end of the air cylinders, and the canopy rises to assume the operating position. To place the canopy to the transport position, it suffices to close cock 6.9. In this case, the head ends of the air cylinders communicate with the atmosphere through the hole in the cock body and the canopy lowers down under gravity.

Water and compressed air for powering air drifters and performing ventilation of faces are supplied by the mine water and compressed air systems through supply unit (1) pipelines provided with cocks and hoses connecting the supply unit with monorail buffer 2, pipelines of monorail section 3 to the changeable distributing or mixing heads installed on the monorail top in the raise face. Distributing head 4 is installed before drilling. It is provided with unions 4.2, 4.3 and 4.4 for connecting water and air supplying hoses of the air drifters, and valve 4.1 for control of water and air supply

through the monorail. Mixing head 5 is mounted just before firing and serves to produce air-water mixture and to sample air of the raise face.

Depending on the position of the supply unit cocks and on a head installed on the monorail, monorail pipe 25 is used, either, for remote control of water and air switching on and off, or for ventilation, or remote air sampling from the face.

In the initial position the supply unit cocks are closed. Compressed air passes via pipeline 17, hose 18, ejector 1.3, hose 16, supply unit pipeline 15, hose 21 and monorail pipe 25 to freely discharge to the atmosphere from the hole in the mixing head, or through valve 4.1 if the distributing head is mounted on the monorail.

To supply water and air to the air drifters, in the course of drilling, valve 4.1 of the distributing head is to be closed. Compressed air flowing via pipeline 17, hose 18, ejector 1.3 and supply unit hoses 16 and 14 collects in the head end of air cylinder 1.7, and, with the pressure values in the head end and rod end equal, moves the piston, due to a difference in piston areas, in the direction of the rod end. In this case, the piston opens cocks 1.8 and 1.9 of the supply unit, and compressed air and water is fed from the mine systems via pipelines 12 and 10, hoses 19, 20 and 22, and monorail pipes 23, 24 and 26 to the unions of the distributing head.

To cut off water and air supply to the air drifters, it suffices to open valve 4.1 of the distributing head (water and air supply may be cut off, if need be, by opening supply unit cock 1.4.). In this case, the head end of air cylinder 1.7 communicates with the atmosphere, the pressure in the air cylinder head end drops, and the piston moving in the direction of the head end closes cocks 1.8 and 1.9 of the supply unit.

The face is ventilated by opening supply unit cock 1.2. Compressed air, which has no time to be discharged through cock 1.2 and pipeline 15 of the supply unit, hose 21, monorail pipe 25 and the mixing head, collects in the head end of air cylinder 1.7 and displaces the piston in the direction of the rod end. In so doing, supply unit cocks 1.8 and 1.9 open, and compressed air, via supply unit pipelines 12, 17 and 15, hoses 20, 21 and 22, and monorail pipes 24, 25 and 26, and water, through supply unit pipeline 10, hose 19 and monorail pipe 23, are fed to the mixing head. The resultant mixture is discharged through a hole in the mixing head.

Sampling air from the raise face after ventilation is accomplished by closing cock 1.2 (this results in closing supply unit cocks 1.8 and 1.9 and interruption of water and air supply to the mixing head) and opening supply unit cock 1.4 which actuates ejector 1.3. Due to ejection the face air is sucked into the supply unit through a hole in the mixing head via monorail pipe 25 and hose 21. The air is sampled through nipple 1.5 with supply unit valve 1.6 open. Take samples in two minutes after ejector actuation, with a raise length (height) amounting maximum to 80 m, and in four minutes, with a raise length (height) up to 120 m.

Upon completion of air sampling, close supply unit cock 1.4.

Mechanical diagram (Fig. 3). Rotary motion from the shaft of raising platform air motor 1, via spli-

ned shaft II and the pair of spur gears 2 and 3, is transmitted to a vertical shaft of the reducer comprising two worms III connected with splined coupling 1.

The worms transmit rotary motion to respective horizontal shafts IV via wheels 4. Rigidly fitted on the taper ends of the horizontal shafts are sprockets 5 meshed with cogged rack 6 of the monorail. The reducer is centered with respect to the monorail by means of two guide rollers 7 to ensure constant mesh of the cogged rack.

Attached to the hub of gear 2 is a pulley of the normally closed brake, connected with gear wheel 12.

Flywheels 13 and 14 and the pair of bevel gears VIII and 12 are used for emergency lowering of the raising platform in the absence of compressed air in the system.

Sprocket 8, being in constant mesh with the monorail cogged rack, brings into action (via shaft V) an automatic eccentric arrester, whose principle of operation is based on the use of centrifugal forces of rotating weights.

When the platform motion speed exceeds the rated value, the weights compress the spring to move apart as far as to catch bosses of drum 9 and turn the drum together with eccentric VI and gear 10, which transmits rotary motion to gear 11 fitted on the hub of other eccentric VII. The eccentrics, upon touching the monorail clamp the latter due to friction, and the raising platform comes to rest. To disengage from the arrester, the platform should be lifted along the monorail. In so doing, the eccentrics turn in the opposite direction and disengage the monorail. Then, the drum is to be turned by the handle to its initial position (until the slot bears up against the retainer).

Rotation from the rotor of hose winch air motor 15 is transmitted via shaft IX and sprocket 16 fitted thereon by a chain to sprocket 17 mounted on winch drum shaft X. At the same time, the rotary motion from the drum shaft via sprockets 18 and 19 with the help of a chain is imparted to screw shaft XI of the hose reeling device.

Electric circuit diagram is illustrated in Fig. 4.

5. DESIGN AND OPERATION OF COMPONENTS

Raising platform (Fig. 5). The self-propelled raising platform is designed for drilling, and charging shot-holes in raises, extending the monorail, trimming raise walls, lifting men, equipment and materials, including explosives to the raise face. It is also helpful in making insets from the raises, bracing and driving manways after completion of raises.

The raising platform consists of frame 20, upper carriage 23, suspension 13, reducer 21, air motor 22, lower carriage 8, braces 49, cab 45 and deck 35.

The raising platform is furnished with auxiliary appliances: guard 30 to prevent drivers from falling from the deck, canopy 32 to protect the drivers from falling rock lumps, screw clamp 29 for transportation and mechanization of monorail extension, a box found under cab for stowing tools, grapplers and explosives, case 24 for drilling tools, and a

chain for suspending the raising platform from the monorail during drilling.

Frame 20 is a base mounting other platform components, and serves as a noise silencer during the platform motion.

The internal spaces of the frame transverse and vertical beams are communicated through holes provided at their joints. Welded to the vertical beams are nipples through which the return air from exhaust holes of the air motor and platform air distributor is discharged into the frame via hoses. The air passes through the frame to the atmosphere via a hole in the lower transverse beam.

Fastened to the lower transverse beam is a branch pipe of the air hose of the hose winch and air hose casing 15. Wall 5 protecting the platform cab on the side of the monorail is attached to the platform as well.

Articulated joint of the frame with the reducer and carriages allows the platform to be moved along the curvilinear part of the monorail with a curvature radius of 3 m.

Upper carriage (Fig. 6) comprises a body provided with guide rollers and an eccentric (anchor) brake. Rollers 25 are interchangeable with those of the reducer and the lower carriage, and are mounted on bearings 17 and pins 18 supported as cantilever in holes of carriage body 3. Roller friction surfaces are protected against contamination and lubricant leakage. The roller cases are filled with lubricant in the amount sufficing for normal operation within the period between repairs.

Eccentric 24 is mounted in body 22 bolted to cover plate 4. The eccentric body together with the cover plate is free to move in the slot of carriage body 3. Keyed to the eccentric axle and secured with a nut and washer is handle 6. Spring 5 with its one end is secured in one of the cover plate holes, and with its other end, to the handle.

The eccentric brake is normally in the applied position. With the handle lowered down, the eccentric under the action of the spring rotates, and the monorail proves to be clamped between the eccentric and a boss body 22. The spring pressure is adjusted by rearrangement of its unbent end in the cover plate holes. The eccentric brake is released manually. If the brake is tightened too strongly, its release may be effected by raising the platform upward the monorail using its drive. In this instant, the brake eccentric turns and, compressing the spring, gets out of contact with the monorail.

The brake is lubricated through an oiler found in the hub of eccentric 24.

Reducer (Figs 7, 8, 9) consists of a pair of spur gears, two worms, a pair of bevel gears, and a shoe brake, accommodated in bodies 17 and 53 interconnected with bolts, the joint being sealed with the aid of rubber ring 52.

Body 17 has an eye for hinging to the frame through a suspension; two brackets opposite the drive sprockets, to install drive rollers 34; a port, closed with cover 2 and a gasket, for inspection of meshed elements; a hole for oil filling closed with a plug having oil gauge 16; and a used oil draining hole closed with plug 1.

Body 53 is provided with a flange having threaded holes for connecting the air motor, a bracket mounting pins 54 of brake shoes 61, ports with covers 82 for adjusting the shoe pressing to pulley 72, a bracket for attachment of the air distributor, illustrated in Fig. 8, and a hole for fastening guide cover 77 to bevel pinion 80.

The reducer is connected to the air motor shaft by means of splined shaft 50 through pinion 83. The design permits disconnection of the air motor by screwing sleeve 46 out of the reducer body and removing the splined shaft.

Pinion 83 is installed in the sleeve of body 53 on two bearings 57 with sealing collar 59, and is in mesh with toothed gear 18 fitted on splines of the reducer vertical shaft. The vertical shaft has two worms 25 and 29, each of which is supported in two bearings 22 and 26 installed in sleeves 21, 27 and 31. The worms are connected to each other with splined coupling 28, and serve to transmit rotary motion to respective horizontal shafts 37 via worm wheels comprising worm rings 42 and hubs 35. The worm rings and hubs are interconnected by means of compensating springs 39 and bushings 40 with pins 41, that allows the air motor torque to be equally distributed between two shafts and prevents possible overloading of gearing elements.

The horizontal shafts are installed in a body and supported in two bearings 15 and are prevented from axial displacement by covers 11 and 45 provided with gaskets 12 and 44, respectively, which facilitate adjustment of bearings-to-covers clearance.

Keyed to the output ends of the horizontal shafts are sprockets 9 secured with nuts. The meshing depth of the sprockets with coggs is fixed by guide rollers 34 and rings 10 fitted on the sprocket hubs.

A common oil bath is provided for lubrication of reducer gearings and bearing units. To prevent oil leakage from the reducer body on the sprockets side, collars 14 are installed in the covers, and the other sleeves and covers are sealed with rubber rings.

Shoes 61 embrace brake pulley 72, fitted on splines of pinion 83 and secured with nut 70, and are pressed to the pulley by spring 63. The shoes are furnished with brake bands 62 fastened with rivets. The clearance between the shoes is adjusted by bolt 64.

Keyed to the top of shaft 93 (coupled to pinion 92 of the air distributor) and secured with a nut is cam 95 accommodated between the shoes. The pinion carrying handle 89 attached to its lower end is in mesh with the middle part of control valve 108, made in the form of a toothed rack. Control valve 108 moves in sleeves 106 pressed in body 104. Located inside the control valve between two stops 109 is spring 110 which returns the control valve together with cam 95 to their neutral position. With the control valve in the neutral position, the shoes brake the pulley. When the air distributor handle is shifted to either side, the cam turns to move apart the shoes and the pulley is released.

To prevent jerks at the moment of take off of the platform lowering, the cam is provided with chamfers. Due to availability of chamfers, with the air distributor handle set to effect lowering, the cam

turns, first, to supply air to the air motor, and then, to move apart shoes and release the pulley.

The control valve stroke, with the air motor switched on for downward movement, is limited by a stop on handrail 84 of the air distributor body. The speed of lowering of the platform is limited by changing the position of the stop.

Flywheel 74 attached to the end of bevel pinion 80 is intended for taking off of the raising platform at emergency lowering in case of absence of air in the supplying pipeline. For this purpose, disconnect from the air motor, or from the air distributor a hose supplying air to the air motor when lowering the raising platform, and rotate flywheel 76 to engage the pinion with bevel gear wheel 68 bolted to brake pulley 72. In so doing, see to it that the reducer shoe brake and the upper carriage eccentric brake are released. After starting off the raising platform with the help of flywheel 74 the platform lowers down under gravity.

For the design of the raising platform air motor, and its operating instructions, refer to its service manual included in the set of the operation documentation of the raise driving integrated outfit.

Lower carriage (Fig. 10) comprises a body assembled with guide rollers and an automatic eccentric arrester.

Carriage body 11 accommodates eccentrics 2 and 4 supported in four spherical roller bearings 12. Fitted on the hub of eccentric 4 is drum 48. The eccentric houses (arranged on two bronze bushings 3) shaft 6, whose end mounts sprocket 7 and disc 45. Pressed in the disc holes are two pins carrying weights 44 interconnected by means of tie 24 with shackle 26, and axles 27. Spring 22 fitted on the tie bears up with its ends through washers 21 and 23 against the disc bracket and tie nut 25 intended for adjustment of the spring pressure. The drum is closed with cover 40 which is removed only by a special wrench included into the outfit standard equipment. The cover is prevented from turning to one side by retainer 31 pressed against the cover with stop 32 and spring 33. The retainer is fitted on the hub of eccentric 2 and locked with retaining ring 36.

The arrester is lubricated through oilers provided in openings of body 11. It is also lubricated through an oiler in the hub of eccentric 2.

To protect the arrester mechanism from ingress of dirt and avoid lubricant leakage, body 11 on the side of the monorail, and cover 50, and the hub of eccentric 4 on the sprocket side are furnished with collars 1, 20 and 5, respectively, and the covers of the body and the drum provided with rubber gaskets.

Cab (Fig. 11) consists of frame 4, casing 3 and door 5. The frame sides and the rear are covered with a metal net. The net of the rear has steps for climbing up to the deck. The frame bottom is provided with an emergency manhole for climbing down the monorail, and climbing up to the cab using grapples, and removable box 7.

The door is a frame covered with a metal net and provided with rollers 16 to roll over guides 6 and 15 bolted in the door aperture. Travel of the door

in its aperture during opening and closing is limited by stops.

The side wall is bolted to the frame. Installed on the wall are a header, terminal box and a telephone set.

Deck (Fig. 12) comprises main deck 19 (1300×1500 mm), three additional removable decks 11 (1600×300 mm) and 13 (300×1500 mm) and a cover of manhole 16.

The main deck has eyes for fastening ties and the canopy air cylinders, holes for accommodation of air drifters and the drilling tool case during transportation, as well as a manhole for walkover from the cab to the deck.

The cover of manhole 16 may be opened, both, from the cab, and from the deck. It is balanced with the help of springs 8 and 12 installed on axle 10 securing the cover to the main deck. The springs with their one end are engaged in the slots of the main deck, and with their other end, in the holes of the cover frame (the springs are installed with the cover opened). Latch 4 serves to lock the cover in the closed position.

There are pockets in the cover top accommodating vibration-absorbing plates 15 made of oil-gasoline-resistant porous rubber. To prevent the plates from damage, they are closed with cover strips 14 having pins, welded to plate bottoms, for fastening inside the pockets. It is recommended that the drivers stay on these strips during drilling, since they are a kind of "safety islands".

Welded to the bottom of the main deck are brackets each having three holes for connection with the raising platform frame directly, and the eyes for connection to the frame through braces, that allows rearrangement of the deck with respect to the frame to maintain its horizontal position when driving the inclines.

The additional decks are bolted to the main deck.

Recommendations on applications of the additional decks are set forth in Section 7 of the present Certificate.

Guard 30 (Fig. 5) is made of removable tubular posts and ropes.

Posts 36 are secured with the help of axles 37 to risers 40, which irrespective of the deck size (number of decks) are installed with the help of bolts 41 in holes along the deck perimeter at its corners, and in the center of each side, except for the side opposite the monorail.

The guard has four horizontal ropes equally spaced over the height of the posts, and vertical ropes arranged in between the posts (two ropes per interval) at equal distance from the posts and from each other. The horizontal ropes are passed through post clamps. The rope ends are secured with clamps, blocks and nuts, that makes it possible to change the rope length depending on the deck size. The vertical rope ends are secured in the similar way. The upper and lower horizontal ropes are passed through the loops of the vertical rope ends. The other horizontal ropes are attached to the vertical ropes with the use of clamps, blocks and nuts.

The guard posts allow their deviation from the vertical position up to 45 deg. beyond the deck due to their hinge joint to the risers. In the vertical

(transport) position the posts are held by special retainers, while in the operating position, by means of horizontal ropes, or by raise walls, when the gap between the deck edges and the raise walls does not exceed 500 mm.

To install the guard into the operating position, raise and incline the posts alternately beyond the deck. When the posts are raised, retainers B go off the slots of risers 40. When placing the guard to the transport position, the posts are lowered and locked with retainers in the riser slots.

The length of the horizontal ropes is adjusted each time when the deck size is changed. In this case, the vertical ropes are also to be refastened.

Canopy (Fig. 13) consists of two single-acting air cylinders 28 and roof 17. The air cylinders are attached with their axles to the deck and can be deviated together with the roof from the vertical to the raise hanger or footwall. The air cylinders are locked in the vertical position with the help of ties and axles.

The roof is a frame arched in the vertical plane (at angle of 120 deg) covered with a metal net having 100×100-mm meshes. Such an arrangement allows the space above the manhole to be always covered at any inclination of the driven raise, thus ensuring protection of the drivers when they walk over from the cab to the deck. The sizes of the large and small roof components are 940×840 and 290×840 mm, respectively. The roof is hinged through trunnion 25 to the rods of the air cylinders and can be turned with respect to the deck. In its extreme positions, when turned, it is locked with pins A.

In the transport position and at the moment of a driver's walkover from the cab to the deck, the canopy air cylinders should be positioned vertically with respect to the deck, while the roof, depending on the angle of inclination of the driven raise should be turned and fixed in one of the two positions. When driving a vertical raise, the roof is recommended to be installed so that its large component is parallel to the deck. When raises are driven at angles of inclination of 60 to 75 deg relative to the horizon, the small roof component should be set parallel to the deck.

Raising the canopy to the operating position and its lowering to the transport position are carried out remotely from the cabin by means of the control cock. In the extended position the air cylinder rods are locked manually by shoe brakes (do not interrupt air supply to the air cylinders at this moment). The rods are locked in bodies 27 by shoes 26 with the help of handles 21. The air cylinders and the canopy roof are turned by hand. When dismantling the monorail the canopy roof is closed with metal shields 14 and 15 secured with screws 16, and fulfills the function of the dismantling roof.

Screw clamp 29 (Fig. 5) comprises a body head and a screw with a handle. The head is installed with its rod into a body sleeve secured with four bolts to the platform frame brackets, and by turning it through an angle (α) of 125 to 130°, it may be set to the transport or operating position. Its turning to the transport position is limited by body boss A, against which bears up head boss B.

Turn the screw together with the handle in the head. Hinged to the screw with the aid of a retaining ring is a heel. When the screw is rotated, the heel approaches or moves off the stops of the strip connecting the upper and lower walls of the head.

The monorail is clamped between stops and the head heel (Fig. 1). The screw clamp head is installed on the monorail section prepared for raising to the raise face in the chamber. For which purpose, the head removed from the raising platform is to be engaged with the monorail section so that its stops and heel are aligned in the plane square to the cogs and clamped with the screw. Then the head together with the section is installed into the body sleeve and turned counterclockwise to the transport position. The head is to be installed at a maximum distance of 100 mm from the section bottom shoe.

In the raise the platform is installed so that the bottom shoe of the section clamped by means of the head of the screw clamp is located at a distance of 100—150 mm from the monorail top. Then, the section together with the head is turned clockwise to the operating position. The heel is drawn off with the help of the screw, the new section is lowered on the monorail top and fastened. After the extension operation is over, the head is removed from the monorail, installed in the body sleeve and placed to the transport position.

Monorail (Fig. 14). The raising platform moves along the monorail, which is essentially an assembly including short sections 11 with a length of 750 mm, intermediate sections 19 and strengthened sections 17, each 1500 mm long.

To bring the raising platform to the chamber use is made of curved sections 32 (the angle of a curvature of one section equals 15 deg.). The horizontal portion of the monorail is assembled in the chamber of short section 11 and special section 33, whose cogged rack is provided with a cutout to facilitate repair of the running gear of the raising platform (replacement of rollers, sprockets, etc., without dismantling the platform from the monorail).

The monorail sections consists of four pipes, E-shaped guide with a cogged rack and two shoes with holes for connecting sections by bolts 10 and 22. The pipes serve to supply water and air to the raise face, and to sample air from the face after ventilation. The pipes at the section joints are sealed with rubber rings 3 and 4. The section E-shaped guides have a number of holes along the cogged rack to clean the latter.

The monorail sections are fastened to the raise walls with gripping rods 800, 1000 and 1500 mm long through the holes of tie pieces 12 secured by means of two bolts 10 to the section supporting brackets. Strengthened sections 17 have three supporting brackets, while the other ones have one supporting bracket each. Should the raise wall have a hollow at the place of the monorail attachment, wooden blocks with the size to suit local conditions are to be driven between the tie pieces and the raise wall.

When fastening the monorail sections to the raise walls the rod nuts should be tightened with a torque of 10—11 kg·m, checked by means of a torque wrench.

The length of the gripping rods should be selected with due consideration to the characteristics of drilled rocks (their strength, jointing, rigidity, etc), and the monorail tie-piece-to-raise wall clearance, which should be as small as possible. The rods 800, 1000 and 1500 mm long are recommended to be used with the clearances of 200, 300 and 500 mm, respectively.

Bolted to the monorail top are changeable heads. The distributing head is used for control of water and air supply to the air drifters during drilling. Mixer 21 (mixing head) protects the monorail from damage during blasting operations, and serves also for ventilation the raise face and remote sampling of air from the face.

Water and air are supplied to the monorail pipes by means of hoses through unions of support 7 bolted to the shoe of the monorail last section in the chamber.

The monorail set is provided with convex sections 20 and concave sections 18 (the angle of a curvature of one section amounts to 5 deg) to effect changing of the inclination angle of the raise in the course of driving.

Hose winch (Fig. 15) is intended for automatic winding on of the hose supplying compressed air to the platform air motor. It consists of a frame, drum, drive, oil splasher with a hydraulic tank, air inlet device, pendulum and current collector devices, hose wound on the drum and a hose reeling device.

Mounted on the frame (1) floors are drum 32 with bearing bodies 31, and a drive comprising shaft 111 with sprocket 108 (supported in bearings 19 of bracket 114), and air motor 68.

For the design and operating rules of the air motor, refer to its Certificate included in the outfit operation documentation set.

Rotary motion is transmitted from the drive to the drum by means of chain 42.

Through inlet 27 the compressed air is admitted to the drum hollow shaft and to the oil splasher, with cock 97 opened. Connected to the drum shaft flange is a branch pipe of hose 4 supplying compressed air to the platform air motor. The oil splasher is designed for lubricating the hose winch air motor and is comprised of body 89 and adjusting needle 92.

Hydraulic tank 50 is a 5-l metal vessel whose oil filler is closed with cover 48 provided with an oil gauge. Screwed in the tank bottom are unions for connecting the compressed air pipeline and oil splasher. Gauze filter 112 (with a mesh of 0.1 mm) is installed in the tank in front of the union on the side of the oil splasher.

Due to a positive pressure in the tank, the oil flows through hose 91 to the oil splasher, and, being entrapped by the air passing through the air splasher, is conveyed through hose 86 to the cock for switching on the air motor. The oil flow rate (minimum $0.18 \text{ kg} \cdot \text{h}^{-1}$) is controlled by means of the adjusting needle.

The pendulum device comprises two levers 8 and 82, hinged to the frame posts. The levers are connected with the help of two ties 7 to rollers 5. Lever 82 through a key is coupled with sector 80

which is in mesh with gear 74 of the cock switching on the hose winch air motor.

Passed through the pendulum device is hose 4. When the platform rises, the hose is forced to un-reel off the winch drum. With the platform lowering, the pendulum device together with the hose lowers too under gravity and turns control valve 76 of the cock, and admits air to the air motor which drives the winch drum to wind on the hose.

The current collector ensures continuity of the power supply circuit of the platform electrical apparatus, and consists of current collector itself 54 and three brush holders 52 enclosed in casing 62 closed with a cover.

The current collectors is bolted to the drum shaft and presents a bushing made of insulating material carrying six current collecting brass rings and terminals. Each current collecting ring is connected to a respective terminal by means of a lead.

The brush holders are mounted on a pin of cover 51 and have two casings each for copper-graphite brushes 53, springs for pressing the brushes to current collecting rings and terminals. Connected to the current collector terminals are cores of cable 36 (laid in hose 4) which supplies the platform electrical apparatus. The brush holder terminals are connected to the mine lighting and telephone lines through the chamber terminal box.

To prevent ingress of moisture into the current collector the cable leads are provided with rubber seals, and the cover-to-casing joints, with gaskets.

The hose reeling device ensures uniform winding of hose 4 on the winch drum, and consists of screw 101, body 17, retainer 100 installed between two slides 16 and 103 connected to each other and to a guide frame through which hose 4 is passed. The frame includes rods 15 with pipes 14, and slide 13 with rollers 10 moving along guide 3. During motion of the platform, rotation from the drum shaft is transmitted by means of chain 44 to the shaft of the hose reeling device whose slides with the frame executing reciprocating motion along the shaft arrange the hose on the drum in layers.

The driving chain of the hose reeling device is tensioned by displacement of the shaft together with radial bearings in the longitudinal attachment holes on the post plates of the winch frame, and the tension of the drum shaft chain, by rearranging the drive in attachment holes of the platform on the frame runner.

Supply unit (Fig. 16) is designed for remote sampling of the air from the raise face (without lifting the raising platform), as well as for switching on and off water and air supply through the monorail, from the face, to actuate the air drifters and for ventilation of the face, from the chamber. It consists of an air cylinder, water pipeline and three air pipelines mounted on side members 13 and 58, secured to frame 2 and closed with casing 28.

The air and water pipelines comprise pipes each of which is provided with a cock (10, 25, 33 and 62, respectively). The pipe furnished with cock 10 has an ejector including body 7, mixer 9 and nozzle 4, while the pipe with cock 25 has rod (valve) 18 with nipple 17 for sampling the air from the raise face, and for connection of a gas analyzer. The pipes of

the air pipelines are connected with rubber hoses 3, 6, 22 and 27.

Cocks 33 and 62 of the air and water pipelines are connected through shackle 36 and axle 37 to piston 46 of the air cylinder which is hinged with the help of axle 53 to bracket 59 attached to side member 58. With the rod moved, this pair of cocks either opens or closes.

The supply unit casing carries instruction plates indicating positions of the handles of cocks 10 and 25 in the course of drilling, ventilation and air sampling.

Bear in mind that the ejector operates reliably and steadily provided the clearance between its nozzle 4 and mixer 9 is equal to 3—4 mm (adjusted by turning the nozzle in ejector body 7).

Communication and lighting apparatus (Fig. 4) are used, as the name implies, to afford telephone communication, lighting and light signalling for the outfit. The apparatus include a current collector of the hose winch, two terminal boxes with signalling buttons, two mine lights, two telephone sets and cables.

The hose winch and the first terminal box with light J11 and telephone set Tφ1 are installed in the chamber. The second terminal box with light J12 and telephone Tφ2 are mounted on the raising platform.

The telephone set and the light installed in the chamber are connected via a terminal box to the mine telephone (24 or 60 V) and lighting (36 V) systems.

The telephone and the light of the raising platform are supplied through the terminal box and cable 10 (passing inside the hose wound on the winch drum) whose cores through the winch current collector ПК and the terminal box in the chamber are also connected to the mine telephone and lighting systems.

The cable leads in the telephone sets, lights and terminal boxes are provided with rubber seals protecting the apparatus from ingress of moisture and dust.

Two-way telephone communication between the chamber and the raising platform is effected through the mine telephone switchboard.

The lights on the platform and in the chamber are cut in parallel through normally closed buttons Kφ1 and Kφ2, arranged in terminal boxes, and used to provide light signalling between the platform and the chamber.

Cable 10 has a wire rope 3.5 mm in diameter. To prevent the cable from damage in case of breakage of the hose accommodating the cable, one end of the wire rope is attached to the terminal box of the platform, while the other end, to the drum shaft and to the hose winch current collector.

Air piping (Fig. 17) includes: pipeline filter 5 with hose 2 connecting the supply unit; hose 3 supplying water from the mine pipeline to the supply unit; hose 1 for connecting the hose winch; hose 4 for supplying water and hoses 6 supplying compressed air from the supply unit to the monorail support (buffer); header 8; hose 10 with cock 12 and a tip for blowing the monorail cogs, hose 9 for connecting to the header of the platform air distribu-

tor; hose 20 for air supply from the air distributor to the platform air motor; hoses 19 and 23 for discharge of the used air from the air motor and the air distributor into the frame-silencer; hose 7 connecting canopy control cock 16 to the header, and hoses 14 and 21 to pass the air from the control valve to the canopy air cylinders; as well as fittings for connecting hoses.

Pipeline filter 5 is designed for cleaning the compressed air of moisture and mechanical impurities. It comprises an upper and a lower housings and a valve.

Compressed air is fed to filter pipe A, passes through an impeller welded to output pipe B, and acquires downward rotary motion under the action of the impeller. Suspended moisture and solid particles are thrown to the walls due to the centrifugal forces, and move downward into a reservoir while the clean air rises upward and passes through the output pipeline. The filter valve is used for periodic cleaning of the filter. With side displacement of the handle the valve moves off its seat, and the accumulated condensate and dirt are discharged outside. The valve and the handle are returned to their initial position under the force of the spring.

The filter is secured to the mine pipeline with the aid of turnable flange B in the vertical position.

Since efforts are continually made to improve the reliability and performance of the product, minor changes may be introduced in its design without special notice.

6. SAFETY PRECAUTIONS

Safeguards

To ensure safety in driving raises the outfit design provides for the following safeguards:

(1) an automatic eccentric arrester which stops the platform when its speed exceeds the rated value;

(2) a normally-applied shoe brake interlocked with the handle of the air distributor of the raising platform air motor;

(2) a manual anchor-type eccentric normally-applied brake (released before starting moving by hand);

(4) a hose winch automatically winding on the air hose (housing the cable) during motion of the platform;

(5) a supply unit allowing remote control of water and compressed air supply to the raise face, and remote sampling of air from the face (without lifting the platform);

(6) guards along the deck perimeter to prevent falling of drivers;

(7) a canopy (dismountable roof) to protect the men from falling rock lumps during face trimming, extension and removal of the monorail, and during walkover of the men from the cab through the manhole to the deck;

(8) a mixing head for protection of the monorail during blasting operations, production of air-moisture mixture for ventilation and sampling air from the face;

(9) a distributing head for connection of the air drifters and control of their water and air supply;

(10) emergency lowering of the platform in case of absence of compressed air in the system;

(11) a cab for protection of men during motion of the platform;

(12) a safety chain for suspending the platform from the monorail during drilling;

(13) two-way telephone communication and light signalling between the chamber and the platform;

(14) a lighting system;

(15) a noise protection device (discharge of the air motor and air distributor exhaust into the platform hollow frame which serves as a silencer);

(16) a vibration protection device (vibration-dampening cover of the platform deck);

(17) dust protection devices (shothole flushing and dust suppression with air-water mixture after blasting operations);

(18) sets of individual means for climbing up and down the monorail in emergency situations (a set comprises a pair of grapplers, clamp and a safety belt);

(19) a special section used for repair of the platform running gear;

(20) a screw clamp for transportation and extension of the monorail sections;

(21) safety belts to provide safety for the drivers working on the deck, or walking over from the cab to climb down the monorail using grapplers;

(22) guards of drive chains and the hose reeling device shaft of the hose winch.

Safety regulations to be observed when driving raises

(1) only the persons who have driver's licenses and have been specially trained and issued a qualification certificate for operation on the outfit are authorized for work on the outfit;

(2) the drivers are allowed to lift to the raise face only after its ventilation and decreasing the harmful gas concentration down to the safe values;

(3) attachment of the monorail sections to each other and to the raise wall is subject to check by the drivers after blasting, and, once a week, by a mine technical inspectorate official;

(4) trimming the raise walls and the face is allowed only under protection of the canopy, in this case, only one driver is permitted to stay on the deck;

(5) prior to drilling, sprinkle the raise face with water;

(6) during operation, two sets of individual means for climbing the monorail must be located on the platform and the third set, in the chamber (the grapplers and clamps, should be coated with lubricant PIBK);

(7) walking over from the cab to climb the monorail in emergency cases is carried out in the following way: tightly fasten the grapplers with straps to your footwear, put on a safety belt; pass the chain of the safety belt through the clamp and use the snap hook to fasten yourself to the cab; open the cover of the emergency manhole; grapple the monorail with grapplers; hold on to the cab or to the platform frame and climb down the monorail with the aid of grapplers to leave the cab down-

ward; secure the clamp on the monorail, and make sure the grapplers are reliably fastened to the monorail, fasten the chain snap hook to the safety belt;

(8) climb down by alternate shifting of the grapplers along the monorail, without their disengagement from the guides; secure the grapplers to the monorail by clamping the guides between the ends of grapplers and stops, in this case, the end of the l. h. grappler is to be positioned between cogs, while that of the r.h. grappler, on the strip of the guide rear; the clamp serves as an additional support and is shifted along the monorail in the course of climbing; when bearing on the clamp the monorail guides are clamped by the clamp stops, and its l. h. bent end comes in between the monorail cogs; shift the grappler only after the other grappler is reliably secured on the monorail;

(9) use the reverse procedure to climb up to the cab with the aid of the grapplers;

(10) in drilling, if need be, make use of additional means (including individual ones) and take measures to minimize the process harmful effects to the rated values.

During driving operations NEVER:

(1) allow operation of the outfit with even one safeguard (required for the given job) being absent or defective;

(2) stay at the raise bottom with jobs performed from the platform or during the platform moving along the raise;

(3) allow lifting or lowering the men being out of the cab, or with the cab door opened;

(4) carry out any jobs during motion of the platform;

(5) transport the unfastened equipment, tools and appliances, or explosives not attended by a blaster;

(6) work on the deck under the canopy, with the air cylinders not locked in the extended position by brakes, or unlock the air cylinders with no compressed air therein;

(7) carry out drilling or ventilation without use of water;

(8) open the supply unit cocks with jobs carried out in the raise (before lifting the platform to the face, hang on the supply unit a plate with inscription DO NOT SWITCH ON — MEN AT WORK);

(9) allow emergency climbing up and down the monorail with the use of the individual climbing means of two men simultaneously;

(10) use the individual climbing means which have not passed the routine periodic check;

(11) operate on the platform whose arrester has not passed periodic checks and tests;

(12) drill from the deck without its suspension from the monorail with the help of a safety chain;

(13) allow drivers to operate on the deck having no guards, or without the safety belt on.

Periodic Checks of Safeguards

In service, the outfit automatic eccentric arrester, individual climbing means and the monorail are subject to tests and checks whose methods and frequency are set forth in the following Table 1.

Table 1

What is to be tested (or checked) and intervals	Method of test (or check)	Requirements to be met
1. Grapplers are checked for strength every six months	Grapple monorail with grapplers in operating position and suspend weight of 225 kg from their remote end for 5 min	After testing, grapplers should have no residual deformation or ruptured welds
2. Safety belts are tested for strength every six months	Suspend weight of 180 kg from the middle of fastened belt for 5 min	After testing belt should be free of tears, and buckle, of damage
3. Clamp is tested for strength every six months	Suspend weight of 225 kg from remote end of clamp secured to monorail in operating position for 5 min	Clamp should have no ruptured welds or residual deformation
4. Arrester is to be checked once a week	Remove cover from arrester drum and check condition of spring, drum bosses and attachment of weights	Spring should have no coil fractures, cracks, or residual deformation. Weights are to be spaced at equal distances from shaft center. No dirt is tolerable inside drum
5. Arrester is tested after each adjustment, routine medium and major repairs, and every three months while in service	For arrester test method refer to Section 10 of present Certificate	
6. Monorail is checked once a week	Thoroughly examine attachment of sections to each other and to raise walls in the course of platform motion along raise	Monorail should have no air or water leakage, or ruptured welds. Bolts fastening tie pieces to section supporting brackets and gripping rod nuts should be properly tightened. Sections should have no broken cogs

The results of the periodic checks and tests should be entered into Appendix 5 of the present Certificate.

7. INSTALLATION AND DISMANTLING

Preparing chamber

The chamber is intended for accommodation of the hose winch, supply unit, communication and lighting apparatus, air and water pipelines, as well as for sheltering the raising platform during blasting in the raise.

In practice of driving raises various versions of the chamber layout are used. This accounts for diversity of requirements to be met, both, by the raise itself, and by the methods of rock mucking.

Selection of the version of chamber preparation largely depends on the direction of the raise, starting cut location (haulageway, main roadway, undercutting), availability of mucking facilities, operating conditions in the raise, possibility of car train passage, etc.

The chamber is started from the side of the hanger of the planned raise.

The first meters of the raise opening to provide a place for installation of the monorail strengthened section and assembly of the raising platform are driven from the working floor. The chamber-to-raise junction should be worked so as to make provision for installation of the curvilinear section of the monorail with a radius of curvature equalling 3 m. The recommended minimal sizes of the chamber: the length — 6 m; the width — 2.2 m, and the height — 2.5 m.

Installation Facilities

In addition to the tools included in the outfit standard equipment, the outfit should be furnished with a 1000-kg capacity hoisting winch, cable and

a block to facilitate installation and dismantling operations.

The outfit components are transported to the installation site in the assembled or disassembled state, depending on the size of workings.

For the mass and overall dimensions of the outfit main components, refer to Table 2.

Table 2

Component description	Mass, kg	Overall dimensions, m	Notes
Platform running gear (reducer with air motor and carriages assembled with fram)	830	2.25×1.15×0.7	Brought between rollers and sprockets of running gear are butt-jointed special and short sections
Platform cab	165	2.0×1.15×0.8	Box, casing and door are removed
Platform floor assembled with man-hole cover	220	1.3×1.5×0.25	
Hose winch	475	1.55×1.55×1.15	

Prior to installation of the outfit, it is recommended to check the condition of its separate components, clean them of dust and dirt, restore damaged painting, and eliminate revealed defects.

Outfit installation

After installation and reliable attachment of the hoisting winch to the chamber floor, and suspension of a block with the help of a shothole drilled beforehand, install the outfit using the following procedure:

(1) use six gripping rods to attach to the raise hanger a monorail strengthened section with tie-pieces mounted thereon beforehand. Install the

strengthened section at a definite distance from the chamber roof, depending on the raise angle of inclination. The recommended distances from the chamber roof to the place of installation of the strengthened section are indicated in Table 3.

Table 3

Raise angle of inclination, deg.	Distance from chamber roof to lower shoe of strengthened section, m	Qty of curved sections forming curved part of monorail
60	1.5	4
65	1.75	4
70	2.0	5
75	2.25	5
80	2.5	5
85	2.75	6
90	3.0	6

(2) fit a short (intermediate) section on the top of the strengthened section and attach it with bolts;

(3) connect two intermediate sections with bolts on the chamber floor to make an auxiliary (mounting) section and bring it between the rollers and sprockets of the platform running gear (carriages and the reducer together with the suspension assembled with the frame) with the aid of the mechanism of emergency lowering, or the air motor;

(4) use the hoisting winch to lift and connect the auxiliary section and its running gear to the lower shoe of the strengthened section installed in the raise;

(5) assemble the cab and the deck with braces on the platform frame. When installing the deck, bear in mind that its horizontal position is maintained in driving inclined raises due to the change of the brace length and displacement of the deck itself with respect to the frame. The extreme left-hand holes are used to install the deck on the frame for driving a raise with an inclination angle of 60 deg. The middle holes are used for driving raises with an inclination angles of 75 deg, and the extreme right-hand holes, for driving vertical (90 deg) raises. The deck sizing 1300×1500 mm is used for driving raises 3 to 4 m² in cross section; the deck sizing 1600×1500 mm (with one additional deck) is intended for driving raises with 4 to 5 m² in cross section, the 1600×1800-mm deck (with two additional decks), for driving raises 5 to 6 m² in cross section; and the deck sizing 1600×2100 mm (with three additional decks), for raises 6 to 8 m² in cross section;

(6) join the required number of sections (up to chamber floor) to the auxiliary section, and test the arrester in compliance with the procedure set forth in Para 4, Section 10 of the present Certificate;

(7) use the air motor to lift the platform to the top of the monorail assembled in the raise, and suspend it from the safety chain;

(8) remove the auxiliary section of the monorail, and join a required number of curved sections (see Table 3) to the strengthened section, to bring the monorail to the horizontal position in the chamber, and secure them at the chamber-to-raise junction with the help of gripping rods;

(9) assemble the horizontal portion of the monorail using short and special sections, and secure it

to the chamber roof with gripping rods, having attached a buffer to the free end of the short section;

(10) disengage the platform from the safety chain and lower it with its deck down to the level of the strengthened section in the raise. Dismantle the short (intermediate) section located above the strengthened one, and install the distribution head instead;

(11) bring the platform onto the horizontal portion of the monorail, mount the canopy, guard, and the tool case on the deck, and the cab protective wall facing the monorail, and the protective casing of the winch hose and the screw clamp, on the platform frame;

(12) install the hose winch, supply unit and the communication and lighting apparatus in the chamber, and assemble the air, water, lighting and telephone lines in compliance with the respective circuit diagrams;

(13) install a local ventilation fan in the raise opening.

Dismantling

Upon completion of the raise driving, dismantle the outfit using the following procedure:

(1) disassemble and remove in sequence, from the top downwards, the monorail sections, except for the bottom strengthened section and the intermediate one connected to the top of strengthened section;

(2) bring the platform onto the horizontal portion of the monorail in the chamber, and dismantle the canopy, cab protective wall opposite the monorail, tool case, guard and the screw clamp;

(3) lift the platform along the monorail, and install it with its running gear on the sections remaining in the raise, and suspend the platform from the safety chain;

(4) dismantle the horizontal and curved portions of the monorail;

(5) connect the monorail unit comprising two intermediate sections to the bottom of the strengthened section remaining in the raise, disengage the platform from the safety chain, lower it with its running gear on the unit consisting of two intermediate sections;

(6) make use of the hoisting winch to dismantle the deck, mounting braces, cab, and remove the auxiliary section of the monorail including two intermediate sections together with the platform running gear;

(7) disassemble and remove the remaining sections;

(8) dismantle water, air, lighting and telephone lines, and the hose winch, supply unit, and the communication and lighting apparatus.

Before dismantling the outfit, arrange a reliable roofing in the raise and thoroughly trim its walls; after dismantling the monorail, erect a temporary protective ceiling above the remaining strengthened and intermediate sections to which a monorail curved section is fastened.

The monorail dismantling operations are recommended to be carried out by two drivers from the platform deck under the protection of the protective roofing. In this case, for removal of a successive

section, lower the platform deck down to the bottom of the section to be removed and unscrew nuts from the gripping rods securing the section to the raise hanger; free the bolts fastening the section to be removed with a successive one. This done, take off the section, and drive gripping rods out of shotholes.

The dismantled sections and rods can be lowered down the raise, either on the platform deck, or by means of the hoisting winch installed in the chamber, or on the platform deck with the help of a block secured to the roofing.

It is good practice in repeated use of the monorail sections to change their positions, i. e., install the upper sections which are less worn to the lower positions, and vice versa.

Installation and dismantling operations are to be entrusted to the persons well versed in the outfit design and sequence of installation and dismantling operations outlined in the present Certificate.

8. OPERATION

Preparing for Operation

Upon completion of the outfit installation, fill the lubrication system of the outfit with lubricants in compliance with the Lubrication Chart (Section 9), and try-out the platform, hose winch, canopy, supply unit, distributing head and the guard, as well as the communication, lighting and signalling apparatus. Check the following:

(1) oil leakage through joints, collar sealings, gaskets and plugs of the hydraulic tank, reducer, and air motors of the raising platform and hose winch;

(2) reliable attachment of the canopy to the deck, and the deck to the frame and braces; hinge joints of carriages and the reducer through the suspension to the frame, as well as fastening of the cab to the frame;

(3) good condition of the deck guard, springs and the latch of the manhole cover, shoe brakes for locking rods of the canopy air cylinders, as well as pins for retaining the canopy air cylinders in the vertical position, and the roof in the extreme turning positions;

(4) availability and condition of individual means of climbing the monorail;

(5) serviceability of the air and water pipelines;

(6) condition and functioning of the control system of the platform.

Control of Raising Platform

Motion of the raising platform is controlled from the cab with the help of the handles of the air distributor, and the manual eccentric brake.

To start the motion of the platform:

(1) open the valve of the platform header through which air is admitted to the air distributor of the air motor;

(2) push the handle of the eccentric brake;

(3) turn the handle of the air distributor of the air motor to the right from the neutral position for

upward motion, and to the left, for downward motion.

For stopping the platform motion, use the reverse procedure. The motion speed is controlled by turning the handle of the air distributor from its neutral position.

Operation Procedure

The operation cycle is carried out by two drivers and includes the following operations:

1. **Air sampling and preparing for lifting to the raise face.** Air sampling from the face is accomplished remotely with the aid of a gas analyzer through the nipple of the supply unit. In so doing, set the supply unit cocks to the SAMPLING (ПРОБА) position. If the sampling results are satisfactory, the drivers are to examine the outfit units, attach a new monorail section to the platform with the help of the screw clamp, load the gripping rods, tie-piece and drilling tools on the platform, set the supply unit cocks to the DRILLING (БУРЕНИЕ) position, and start lifting the platform to the face.

2. **Trimming the face and extending the monorail.** With the platform lifted to the top of the monorail, and the canopy installed in the operating position, one of the drivers walks over to the deck, locks the canopy air cylinders in the extended position, throws out the guard to the operating position, and proceeds with trimming the face roof and walls under the protection of the canopy.

Extension of the monorail is carried out by two drivers in the following sequence: remove the mixing head and install and secure with bolts a new section with a distributing head instead; lift the platform onto this section (lifting the platform on a new section, which is not yet secured to the raise walls is allowed, as it involves no hazards); connect the air drifters to the unions of the distributing head, drill shotholes through the holes in the tie-piece, and a new section is fastened with gripping rods to the raise walls. To afford protection from blasting and convenience in installation, it is recommended to install a new section at least 1 m from the face.

It is good practice to install and secure with six gripping rods one strengthened section after every nine intermediate sections.

3. **Drilling shotholes.** Before drilling, suspend the platform from the monorail with the help of the safety chain which is stretched by displacing the platform somewhat down. It is recommended to locate a cut on the raise wall opposite to that mounting the monorail.

With drilling over, open the valve of the distributing head, and make sure the water and air supply through the monorail are cut off, mount the mixing head on the monorail instead of the distributing head; free the platform from the safety chain, and place the guard and the canopy to the transport position.

4. **Shothole charging, blast firing and ventilation.** Transport the explosives to the face by the platform. After charging the shotholes with explosives and wiring of the firing circuit, withdraw the platform to the chamber. Set the supply unit cocks to the

VENTILATION (ПРОВЕТРИВАНИЕ) position, and fire the shotholes. Electrical or squib firing is used.

After blasting the local ventilation fan is switched on. The raise is ventilated by a combination method. The monorail pipes through which air is supplied from the mine pipeline serves as the pressure component of the system, while the raise itself serves as the suction component. Installed in the raise opening is a suction fan provided with a ventilation hose for extraction of the air polluted with gases.

9. MAINTENANCE

Proper servicing, systematic and duly lubrication of the outfit components, periodic inspection and performance of scheduled repairs are essential factors ensuring durable and faultless operation of the outfit.

Inspection

Inspection of the outfit should be carried out at the beginning of each shift. Prior to inspection the components are to be cleaned and washed with water. During the inspection, check:

- (1) condition and fastening of water and air hoses;
- (2) serviceability of brakes, control handles, valves and cocks;
- (3) reliability of hinge joints of the deck, braces, carriages, and the reducer through the suspension from the frame;
- (4) presence of oil in the air motor, reducer and the hydraulic tank of the platform, and the hose winch (no leakage of oil is tolerable);
- (5) good condition of the guide rollers and sprockets of the reducer and carriages;
- (6) easy turning of the arrester drum by hand with the retainer released;
- (7) serviceability of the pendulum device and hose reeling device of the hose winch;
- (8) serviceability of the supply unit and communication, lighting and signalling apparatus;
- (9) availability and condition of the individual climbing means;
- (10) condition and attachment of the monorail;
- (11) condition of the screw clamp, guard and the canopy.

The outgoing drivers should inform the ingoing ones on all faults revealed in the course of the shift. It is recommended to record all faults detected in the course of operation in Appendix 3 of the present Certificate.

In addition to the shiftly inspection, the outfit is subject to the weekly inspection carried out by a special team headed by a mine technical inspector official to thoroughly check the outfit serviceability, reveal and eliminate troubles. The data on the outfit serviceability are to be entered into Appendix 4 of the present Certificate.

Lubrication

Reliability and faultless operation of the outfit largely depend on its regular and qualitative lubrication. Lubrication of the outfit should be performed

at intervals and with lubricants specified in the Lubrication Chart. Bear in mind that application of poor-quality or contaminated lubricants leads to premature wear of parts.

Repairs

Depending on the operating conditions the following formula of the outfit repair cycle is recommended:

T-T-T-T-T-T-T-T-C₁-T-T-T-T-T-T-T-T-C₂-T-T-T-T-T-T-T-T-K, where T is the routine repair, C₁ and C₂ are the medium repairs, and K is the major repair.

Periods between repairs: T—every month; C₁—every ten months; C₂—every 20 months; K—every 30 months.

The routine repair includes the check of the outfit serviceability and adjustments in compliance with the instructions of the present Certificate. In the course of the check, subject to examination are: welds of the frame, cab, deck, canopy, screw clamp, carriages, reducer, suspension and the monorail; threaded joints, gaskets, glands and collar sealings, sprockets, their keying to the shafts, reducer worn pairs, rollers of carriages and reducer, eccentric arrester and platform manual brake, supply unit; also checked and adjusted, if need be, are smooth rotation of the hose winch drum, clearance between the nozzle and the mixer of the supply unit, fastening of the vibration-absorbing plates to the deck, tension of the drive chains of the hose reeling device and the hose winch drum, and the spring tension of the platform manual eccentric brake.

The medium C₁ repair covers the operations within the scope of the routine repair, as well as operations involved in disassembly, checking, repair and replacement of worn parts of the manual brake and arrester, guide rollers of the carriages and reducer, reducer sprockets and the platform arrester.

The medium C₂ repair implies performance of operations within the scope of the routine and the medium C₁ repairs, as well as disassembly, checks, repair and replacement of worn parts of the air motors of the platform, and hose winch, shoe normally-applied brake and mechanism of the platform emergency lowering and the communication and lighting apparatus.

The major repair includes the operations within the scope of the routine and the medium C₁ repairs, as well as full disassembly of the outfit, checks, fault-finding, restoration and replacement of worn components, including base components.

Enter the information on repairs of the outfit and its components into Appendix 5 of the present Certificate.

Replacement of Components

In service, the following outfit parts are subject to replacement:

(1) worms with tooth wear up to 8 mm as measured along the chord at a distance of 6 mm from the tooth point;

(2) worm wheels with a thickness tooth wear up to 6.4 mm, as measured along the normal to the

tooth extension, at a distance of 6 mm from the tooth point;

(3) spur gears ($m=3$) with a tooth thickness worn up to 3.7 mm, as measured at a distance of 3 mm from the tooth point;

(4) sprockets with a tooth thickness worn up to 15 mm, as measured at a distance of 12 mm from the tooth point;

(5) shaft bushing and arrester sprocket with their holes worn up to 45 mm;

(6) eccentrics with more than three crumpled or chipped cutting teeth in succession;

(7) gearings having cracked or chipped teeth and hubs, worn or dented key ways or spline slots, as well as metal galling on booth surfaces;

(8) ball, roller and sliding bearings having wear (play) of more than 0.1, 0.3 and 1.5 mm, respectively;

(9) brake lining with no clearance between the cam and shoes;

(10) collar sealings showing resilience loss and lubricant leakage;

(11) springs with cracks, dents and broken coils;

(12) threaded joints revealing bends, dents or stripped thread;

(13) monorail sections with the guides on which the arrester is to be actuated worn to a size of 48 mm, and with broken cogs or worn cogs to a size of 16 mm;

(14) gripping rods showing bends, stripped or dented thread;

(15) rod pipes with broken lobes.

Lubricant Chart

Description of parts to be lubricated	Qty of lubricating points	Description and designation of lubricant	Method of lubrication	Frequency of check and change of lubricant	Foreign lubricant substitutes
Platform air motor	1	Industrial oil H-40A, GOST 20799-75	Filling case up to oil gauge upper mark	Top up every 5 days	Shell Vitrea Oil 37; Shell Tellus Oil 33 or their analogs
Platform reducer	1	Industrial oil H-20A, GOST 20799-75	Filling up to oil gauge upper mark	Top up every five days. Change at medium and major repairs	Shell Vitrea oil 27; Shell Tellus oil 27, or other similar oils
Pins of reducer, carriages and platform suspension	5	Grease VC-2, GOST 1033-73	Application to their surfaces	At repairs	Shell Axinus tractor grease (Shell, England)
Rollers of reducer and platform carriages	20	Grease VC-2, GOST 1033-73	Packing with spatula	At repairs	Shell Axinus tractor grease (Shell, England)
Platform upper and lower carriages	4	Graphite grease VCcA, GOST 3333-55	Filling with syringe	Every 5 days	Garayle grease AA
Hose winch air motor	1	Industrial oil H-20A, GOST 20799-75	Filling hydraulic tank up to oil gauge upper mark	Top up every 5 days	Shell Vitrea oil 27, Shell Tellus oil 27, or their analogs
Bearing bodies of hose winch shafts	5	Grease VC-2, GOST 1033-73	Packing with spatula	At repairs	Shell Axinus tractor grease (Shell, England)
Shaft and slides of hose reeling device, drive chains of drum and hose reeling device, sector teeth and control cock of hose winch	6	Graphite grease VCcA, GOST 3333-55	Application to their surfaces	Every 5 days	Garayle grease AA
Rod for sampling air (supply unit)	1	Grease VC-2, GOST 1033-73	Application to surface	Every 5 days	Shell Axinus tractor grease (Shell, England)

10. TROUBLE SHOOTING

Trouble	Cause	Remedy
1. When platform moves hose winch pendulum device swings	Maladjusted air flow restrictors of hose winch air motor ducts	Adjust smooth rotation of winch drum by air flow restrictors 69 and 71 (Fig. 15)
2. Lubricant leakage from platform reducer	Damaged seals of reducer covers	Replace seals
3. Uneven (jerky) motion of platform along monorail curved section	Broken coils or residual deformation or reducer compensating springs Several successive cogs on monorail are absent, or cogs heavily worn Disturbed reducer sprocket tooth pitch	Replace defective springs 39 (Fig. 7) in compliance with Para 1, Section 10 Replace monorail faulty section Adjust drive sprocket tooth pitch to Para 2, Section 10
4. Platform arrester operates at permissible lowering speed	Maladjusted arrester mechanism	Adjust and check arrester in compliance with Paras 3 and 4, Section 10

Trouble	Cause	Remedy
5. Remote control of water and air supply through monorail fails to function	Disturbed sealing of supply unit, monorail, air pipelines and valve of monorail distributing head	Eliminate air leakage. To check supply unit tightness: plug branch pipes connecting supply unit to monorail air pipelines and connect vacuum gauge to nipple 17 (Fig. 16); Set supply unit cocks 10 and 25 to SAMPLING position and open compressed air pipelines; in 3 min ejector should generate vacuum gauge pressure of 0.065 MPa in tight supply unit at air pressure in pipeline (at supply unit) of (0.5 ± 0.05) MPa
6. Remote air sampling system fails to function	Overtightened cock plugs of supply unit	Adjust tightening of cock plugs 33 and 62
	Damaged sealing of supply unit air cylinder	Replace sealings
7. Abnormally high vibration during drilling	Disturbed sealing of supply unit, monorail and pipelines	Eliminate air leakage. Check tightness of supply unit as instructed above
	Maladjusted nozzle-to-supply unit ejector mixer clearance	Adjust clearance between nozzle 4 and mixer 9
	Vibration-absorbing plates improperly secured in manhole pockets	Check plates for proper installation in manhole pockets (preliminary compression of plates is 10–0.5 kg)
	Metal sheets covering vibration-absorbing plates come in contact with metal structures of deck	Eliminate touching
	Dirty pockets and vibration-absorbing plates	Clean, wash with water and let deck and plates dry

For trouble shooting of the air motors of the platform and hose winch, refer to respective Service Manuals and Certificates attached to the outfit operation documentation.

1. **Replacement of compensating springs on worm wheels.** To replace compensating springs: undo nut 7 (Fig. 7) and remove sprocket 9; unscrew bolts, remove covers 11 and 45; disengage the worm wheel assembled with shaft 37 from the worm, and take out through the port closed with cover 45; remove bearings 15 and hubs 35 off the shaft; take pins 41 with bushings and damaged springs out of ring 42.

After replacement of compensating springs 39, use the reverse procedure to reassemble the unit.

2. **Replacement of drive sprockets and adjustment of their tooth pitch.** The spare sprockets furnished with the outfit have no key ways. Marking out the keyways on the sprockets is carried out in situ during replacement. For this purpose, fit the sprockets on reducer shaft 37 so that their pitch corresponds to the spacing of centers of drive sprockets (262.5 ± 1 mm). Make keyways on the sprockets, and fit the sprockets on the reducer.

Should the need arise, adjust the sprocket tooth pitch by changing the mesh of the worm wheels with worms. To this end, undo nut 7 and remove sprocket 9; undo bolts and remove covers 11 and 45; adjust the engagement of the worm wheel with the worm.

After reassembly (using the reverse procedure) the accuracy of adjustment is also checked by the sprocket tooth pitch.

3. **Adjustment of arrester** is carried out using the following procedure: undo nut 9 and remove sprocket 7 (Fig. 10); unscrew bolts and remove the cover of drum 48; remove shaft 6 together with disc 45 and weights 44; undo nut 46 and remove the drum; take out eccentric 4. Then, install the drum on the

eccentric, and insert the shaft with the disc and weights. Slightly braking the drum, adjust smooth (with no jerks) rotation of the shaft with a frequency of $1.58-1.72$ s⁻¹ (95–103 rpm). Use nut 25 to adjust the pressure of spring 22 so as to obtain light knocking of the weights against the bosses of the drum. Lock at this moment the spring position with a locknut.

The check for proper adjustment is carried out by applying to the shaft a rotary motion at a frequency less than that used in the adjustment. The weights in this case should not interfere with the drum bosses.

Reassemble the adjusted arrester using the reverse procedure.

In reassembly, install eccentrics 2 and 4 so that clearance B between their flats equals 74–75 mm that is required to pass the curvilinear sections of the monorail.

4. **Arrester testing** is carried out with the platform carrying a load amounting to 750 kg at the raise-to-chamber junction on the auxiliary section of the monorail, whose bottom shoe should be reliably wedged in the floor. In doing so, somewhat lift the platform, and place it with its lower transverse beam of the frame on a bar 100×100 mm in cross section, and 1000 mm long, vertically standing on the floor; mark the platform position on the monorail and cut off compressed air; release the manual eccentric brake and the shoe brake, and lock the brake handles; disconnect the air motor from the reducer by screwing out sleeve 46 (Fig. 7) and withdrawing splined shaft 50. Then, standing at a safe distance, drive out, or withdraw with the help of a winch rope, the bar, and after the platform comes to a stop, measure the distance the platform has covered, and turn arrester drum 48 (Fig. 10) until the drum bears with its groove against retainer 31.

After tripple testing a statement is compiled which includes the serial Nos of the outfit and arrester; and information on test site and the personnel comprising the inspection board, results of the pretest inspection; the length of the way covered by the platform before stopping (due to operation of the arrester); results of the aftertest inspection of the arrester, and the conclusions of the board.

The test results are considered satisfactory if the length of the way covered by the platform before stopping, in each of three tests, does not exceed 500 mm, and the inspection reveals no defects. Otherwise the arrester is to be removed from the platform, disassembled (the revealed defects eliminated), adjusted, reinstalled, and subjected to test once again.

11. STORAGE

The outfit is delivered in the preserved state. The preservation of the outer surfaces is removed by means of rags moistened with white spirit, or gasoline.

The spare parts and tools are depreserved by washing them in an oil bath at an oil temperature of 80—120 °C.

It is recommended before placing the outfit in storage to do as follows:

(1) clean the outfit from dirt and dust, and restore damaged painting;

(2) subject the open thread, unpainted surfaces and surfaces with metal coatings, as well as spare parts and tools to preservation with grease ПБК. GOST 19537—74 (recommended substitute—Shell Otina Compound);

(3) preserve the internal surfaces (air motors of the platform and hose winch, air cylinders of the canopy and supply unit, and the platform air distributor) with lubricant K-17, GOST 10877—76 (recommended substitutes—AN-VV-576 and Shell Ensis Compound) by pouring it through air admission ducts in the bodies in the amount of 0.15 to 0.3 kg, and idling for 10—15 s at a compressed air pressure of 0.1 MPa;

(4) plug all holes.

The outfit is to be stored indoors or under a shed, with parts and tools packed in tight boxes, and the monorail sections stacked with wooden spacers between the section rows.

12. ACCEPTANCE CERTIFICATE

The КПБ-4А raise driving integrated outfit, serial No. _____, has been found fit for service.

Stamp here

Date, manufactured _____

Accepted by _____
(signatures)

13. ARRESTER TEST AND ACCEPTANCE REPORT

Arrester serial No. _____

Characteristic	Test results
Distance covered by platform before its stopping by arrester, mm: first test second test third test	

The arrester has been tested and found fit for service

Stamp here

Tested and accepted by _____
(signature)

14. PRESERVATION CERTIFICATE

The КПБ-4А raise driving integrated outfit, serial No. _____, has been subjected to preservation at the Manufacturing plant.

Date, preserved _____

Effective period—3 years (5 years for spares and tools)

Preserved by _____
(signature)

Accepted by _____
(signature)

Stamp here

15. PACKING CERTIFICATE

The K11B-4A raise driving integrated outfit, serial No. _____ has been disassembled for transportation and packed by the Manufacturing plant.

Quantity of packages _____

Date, packed _____

Accepted by _____
(signature)

Stamp here

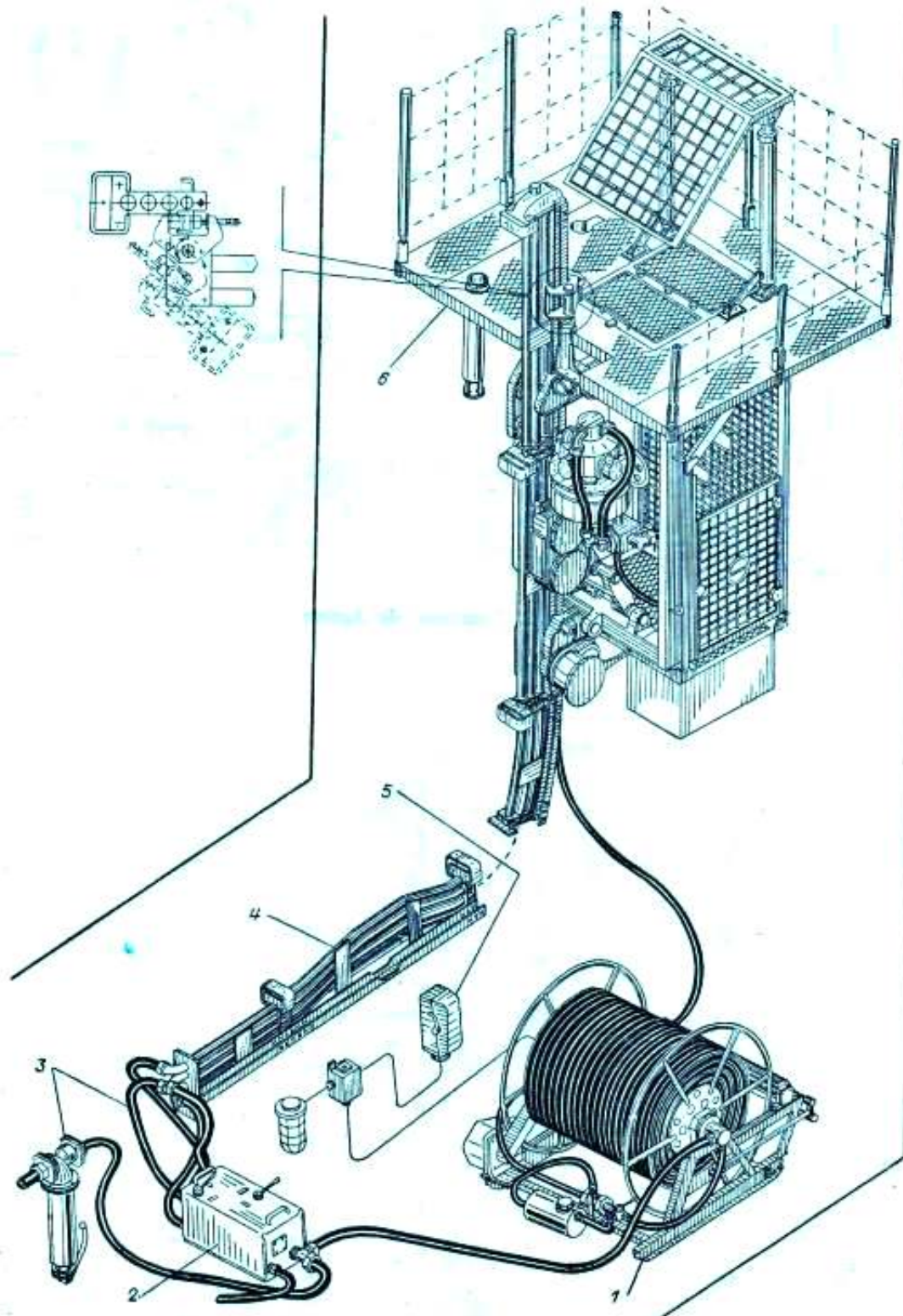


Fig. 1. KIB-4A Raise Driving Integrated Outfit;

1—hose winch; 2—supply unit; 3—air piping; 4—monorail; 5—communication and lighting apparatus; 6—raising platform

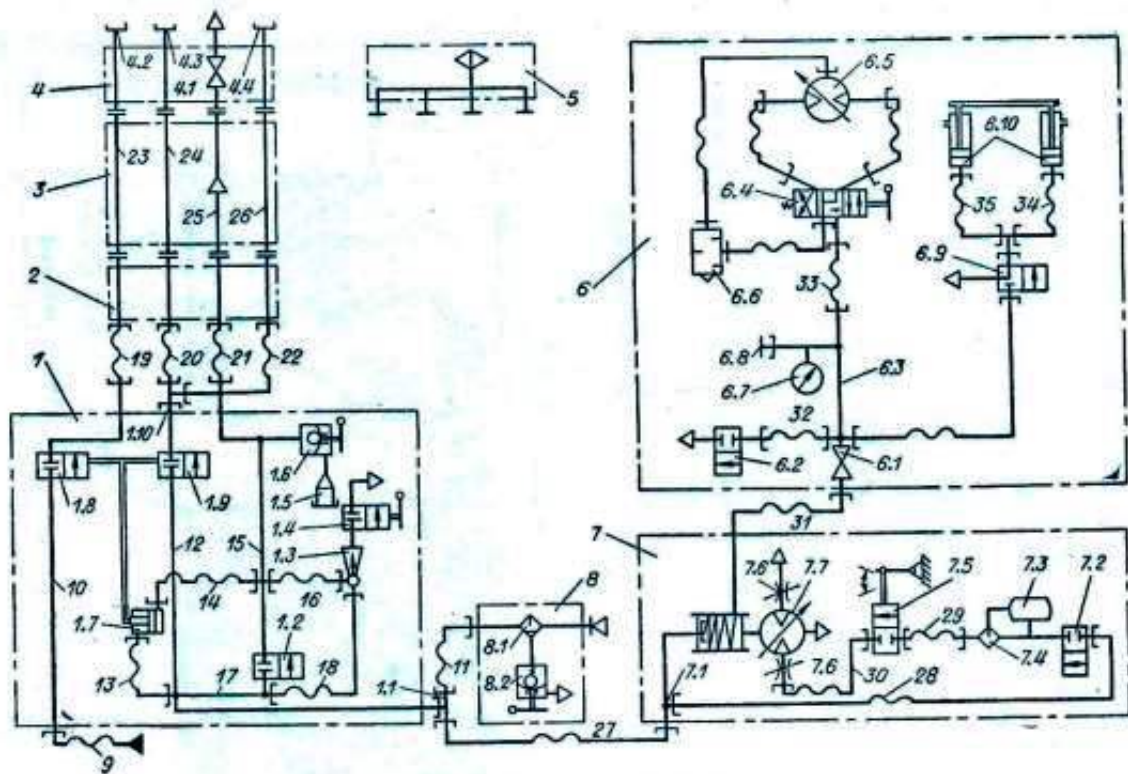


Fig. 2. Compressed Air System

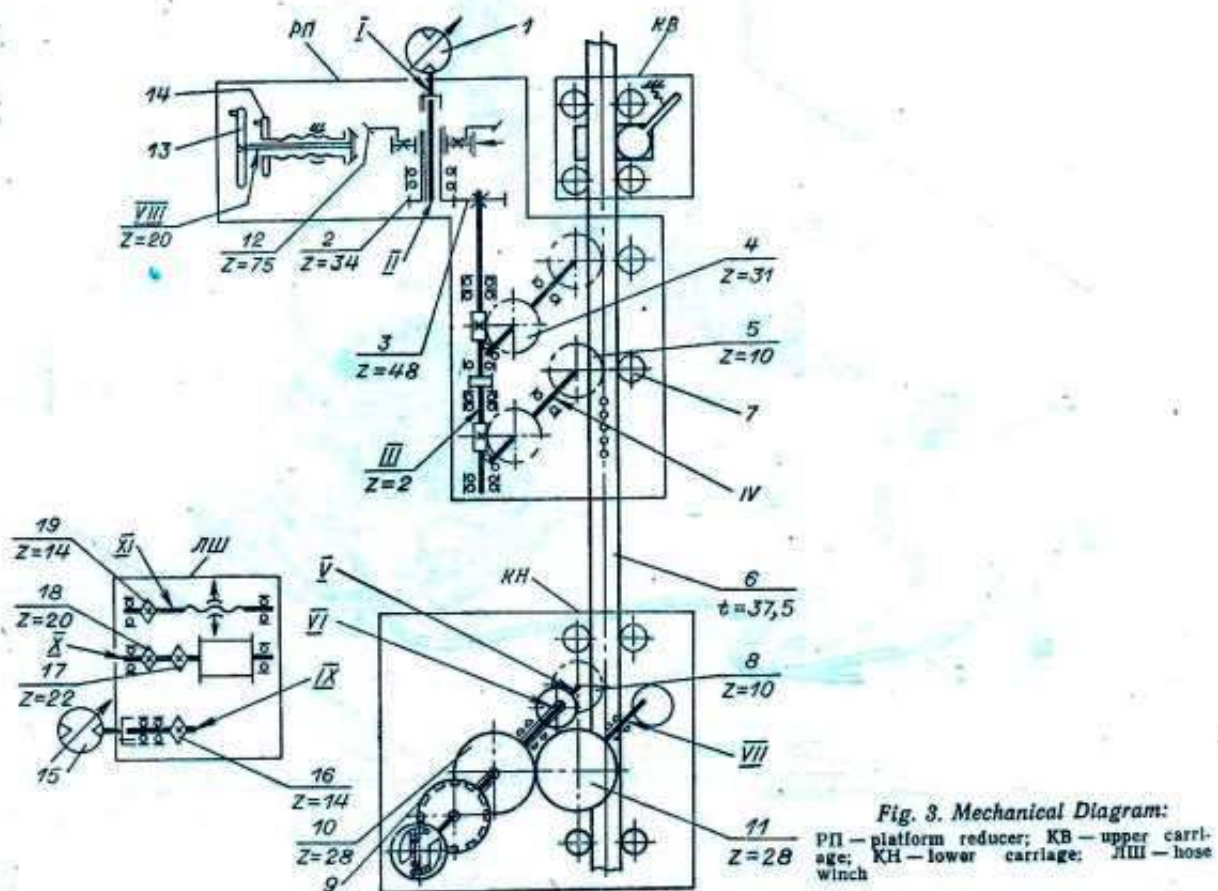


Fig. 3. Mechanical Diagram:

ПП — platform reducer; КВ — upper carriage; КН — lower carriage; ЛШ — hose winch

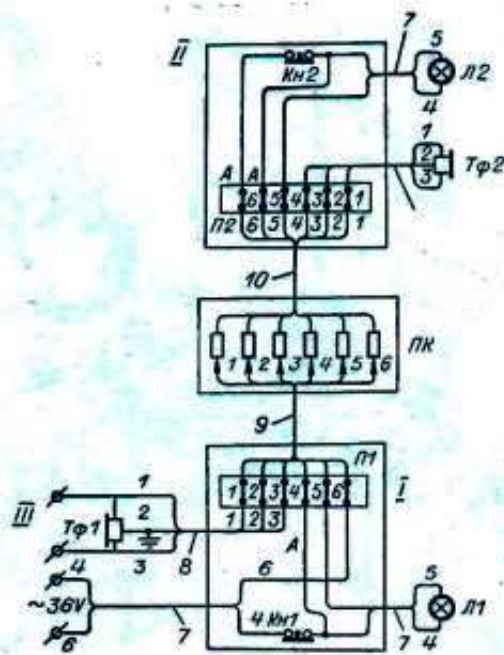


Fig. 4. Electric Circuit Diagram:

I — first terminal box; II — second terminal box; III — to mine telephone line

List of electric circuit elements

Ref. No. in Fig. 4	Description	Qty
Tφ1, Tφ2	Telephone set	2
Л1, Л2	Mine light	2
ПК	Hose winch current collector	1
Кн1, Кн2	Normally closed button	2
П1, П2	Terminal set	2
1—6	Cable cores	—
7	Cable, L=4.3 m	3
8	Cable, L=1.65 m	2
9	Cable, L=10.25 m	1
10	Cable, L=126 m	1
A	Wire, L=0.2 m (S=1.0 — 1.5 mm ²)	3

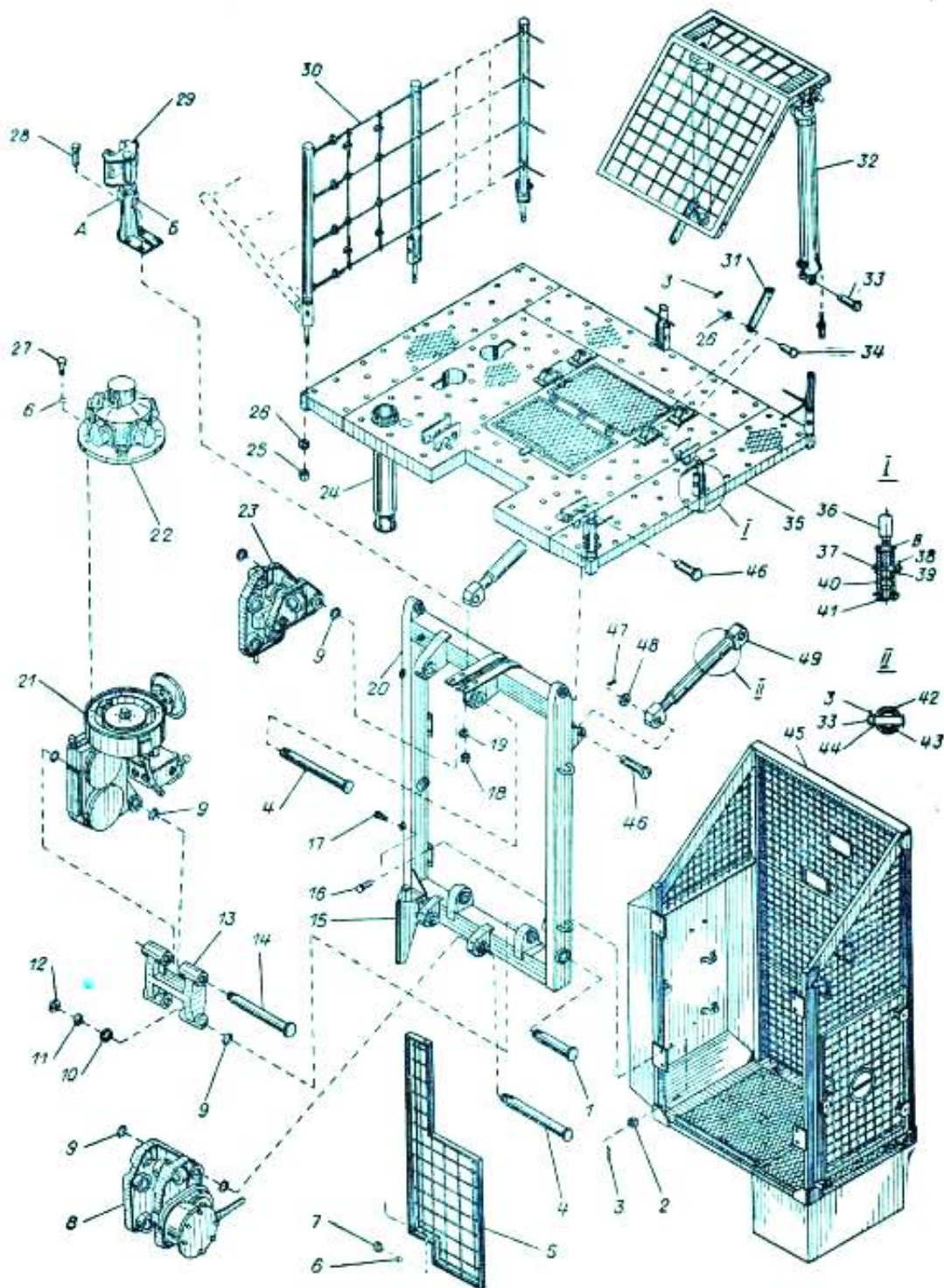


Fig. 5. Raising Platform:

1, 4, 14 — pin; 2, 7, 12, 18, 25 — nut; 3, 38, 47 — cotter pin; 5 — wall; 6, 10, 11, 19, 26, 39, 44, 48 — washer; 8 — lower carriage; 9 — ring; 13 — suspension; 15 — casing; 16, 17, 27, 28, 41 — bolt; 20 — frame; 21 — reducer; 22 — piston-type air motor ПИ-16; 23 — upper carriage; 24 — case; 29 — screw clamp; 30 — guard; 31 — tie; 32 — canopy; 33, 34, 37, 49 — axle; 35 — deck; 36 — post; 40 — riser; 42 — cylinder; 43 — rod; 45 — cab; 49 — brace (assy)

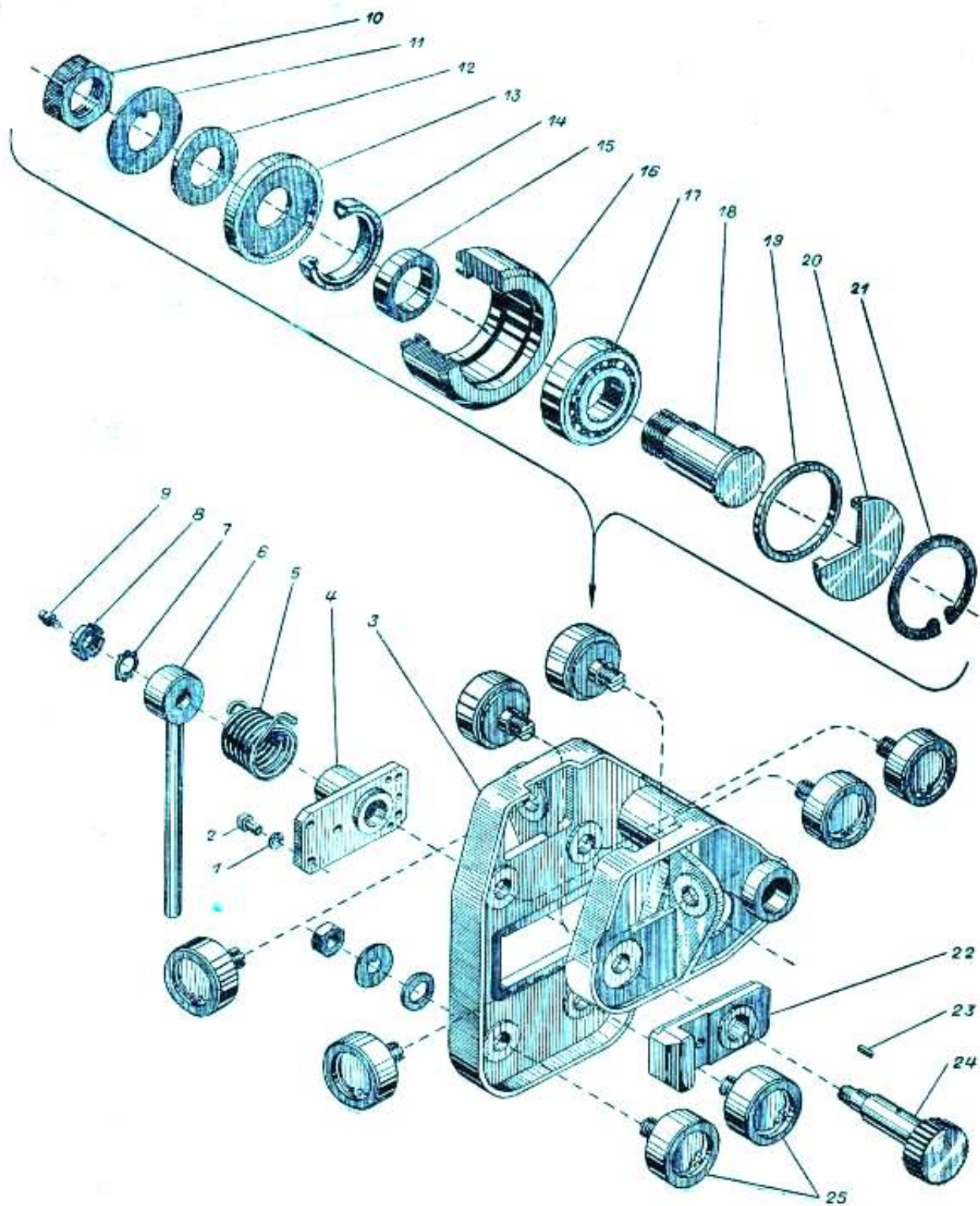


Fig. 6. Upper Carriage:

1, 7, 11, 12 — washer; 2 — bolt; 3 — body; 4 — cover plate; 5 — spring; 6 — handle; 8, 10 — nut; 9 — roller; 13, 19, 21 — ring; 14 — collar; 15 — bushing; 16 — roller; 17 — bearing; 18 — pin; 20 — cover; 22 — eccentric body; 23 — key; 24 — eccentric; 25 — roller (assy)

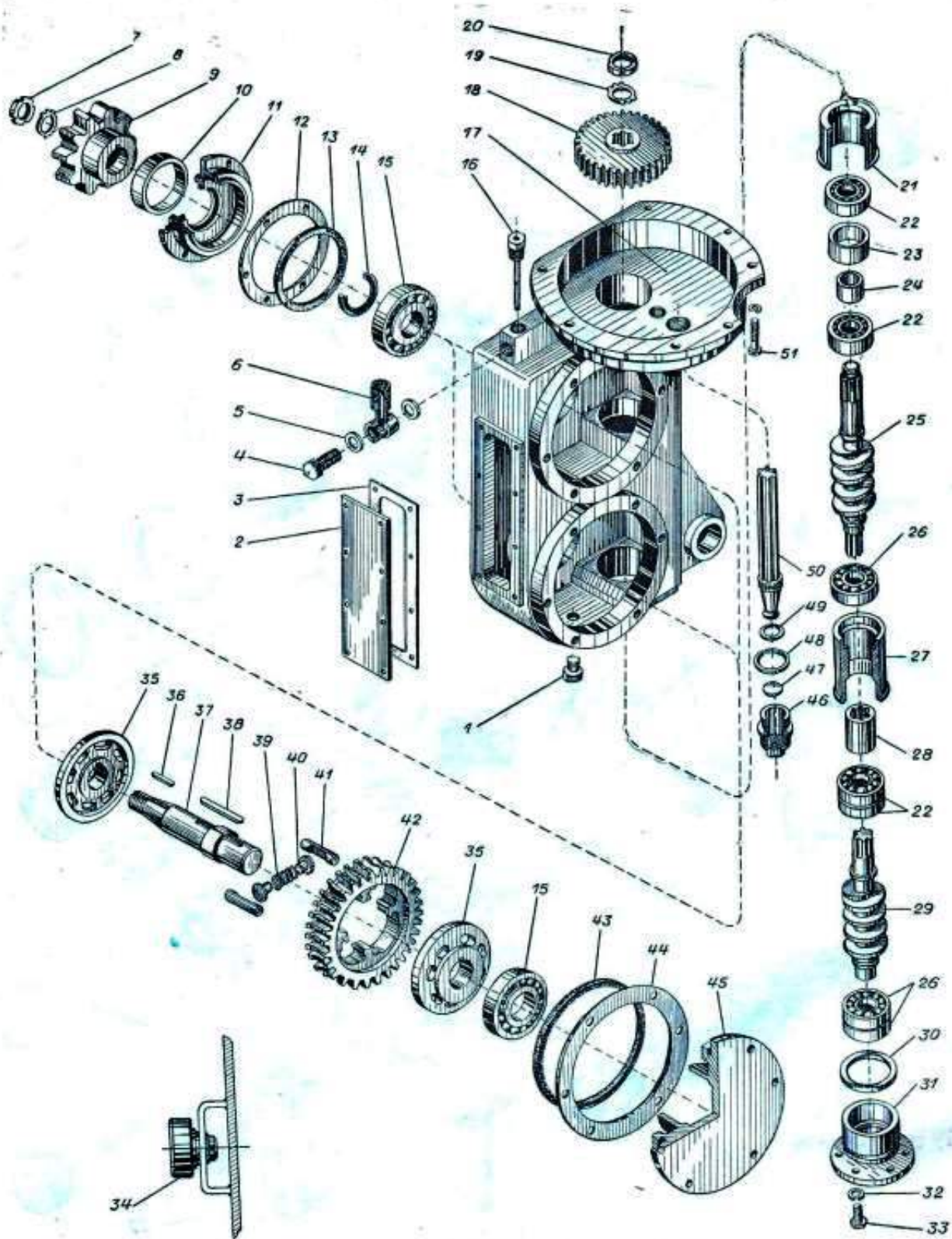


Fig. 7. Reducer:

1 — plug with metric thread; 2, 11, 45 — cover; 3, 12, 44, 48 — gasket; 4, 33, 51 — bolt; 5, 8, 19, 32 — washer; 6 — breather; 7, 20 — nut; 9 — sprocket; 10, 13, 30, 43, 40 — ring; 14 — collar; 15, 22, 26 — bearing; 16 — oil gauge; 17 — body; 18 — wheel; 21, 27, 31, 40 — sleeve; 23, 24, 40 — bushing; 25, 29 — worm; 28 — coupling; 34 — roller; 35 — hub; 36, 38 — key; 37 — shaft; 39 — spring; 41 — pin; 42 — ring; 47 — disc; 50 — shaft

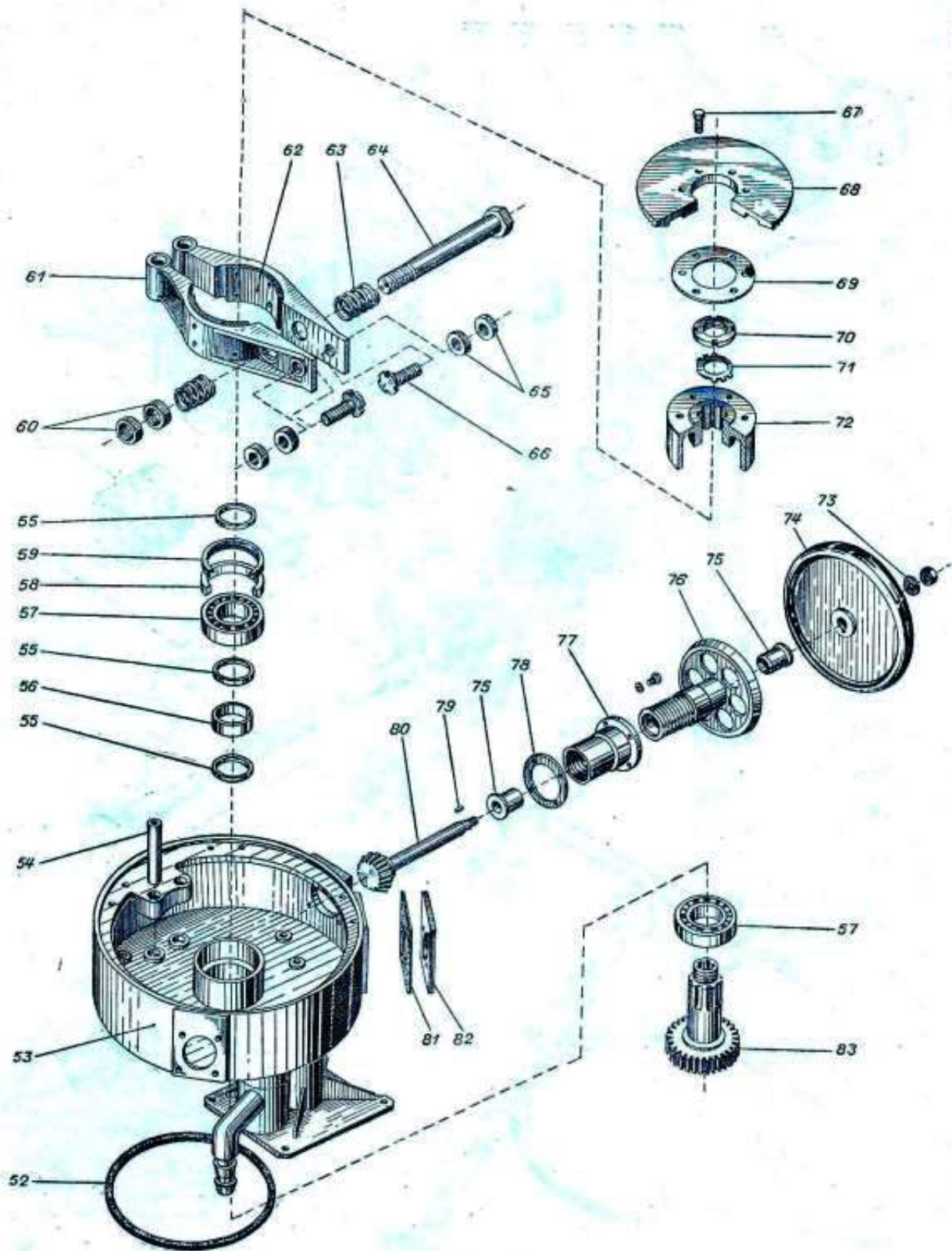


Fig. 8. Reducer:

52, 55, 58 — ring; 53 — body; 54 — pin; 56, 75 — bushing; 57 — bearing; 59 — collar; 60, 65, 70 — nut; 61 — shoe; 62 — brake band; 63 — spring; 64, 67 — bolt; 66 — screw; 68 — gear wheel; 69, 78, 81 — gasket; 71, 73 — washer; 72 — pulley; 74, 76 — flywheel; 77, 82 — cover; 79 — key; 80, 83 — pinion

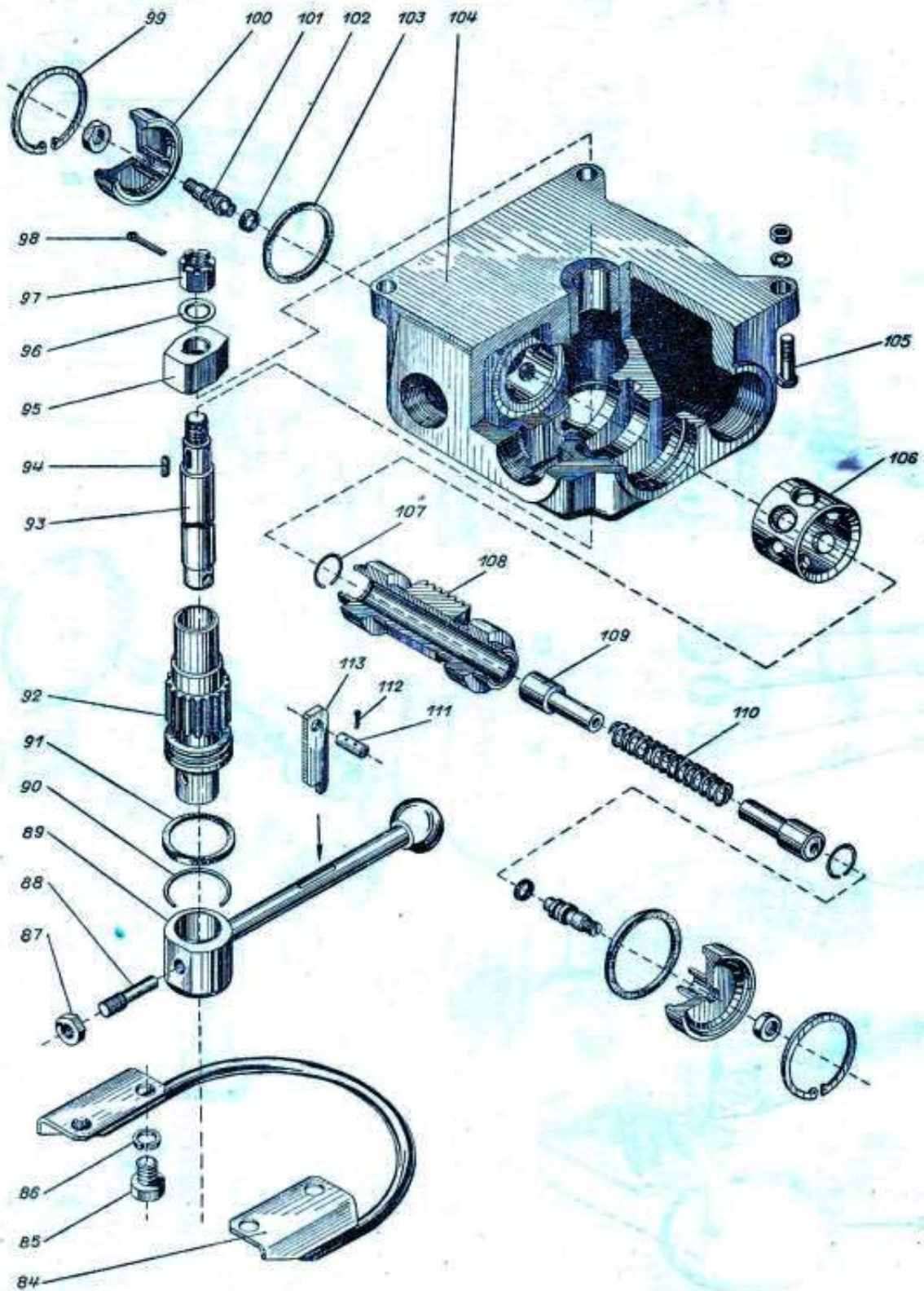


Fig. 9. Reducer:

84 — handrail; 85, 105 — bolt; 86, 96 — washer; 87, 97 — nut; 88, 101 — screw; 89 — handle; 90, 91, 99, 102, 103, 107 — ring; 92 — pinion; 93 — shaft; 94 — key; 95 — cam; 98, 112 — cotter pin; 100 — cover; 104 — body; 106 — sleeve; 108 — control valve; 109 — stop; 110 — spring; 111 — axle; 113 — retainer

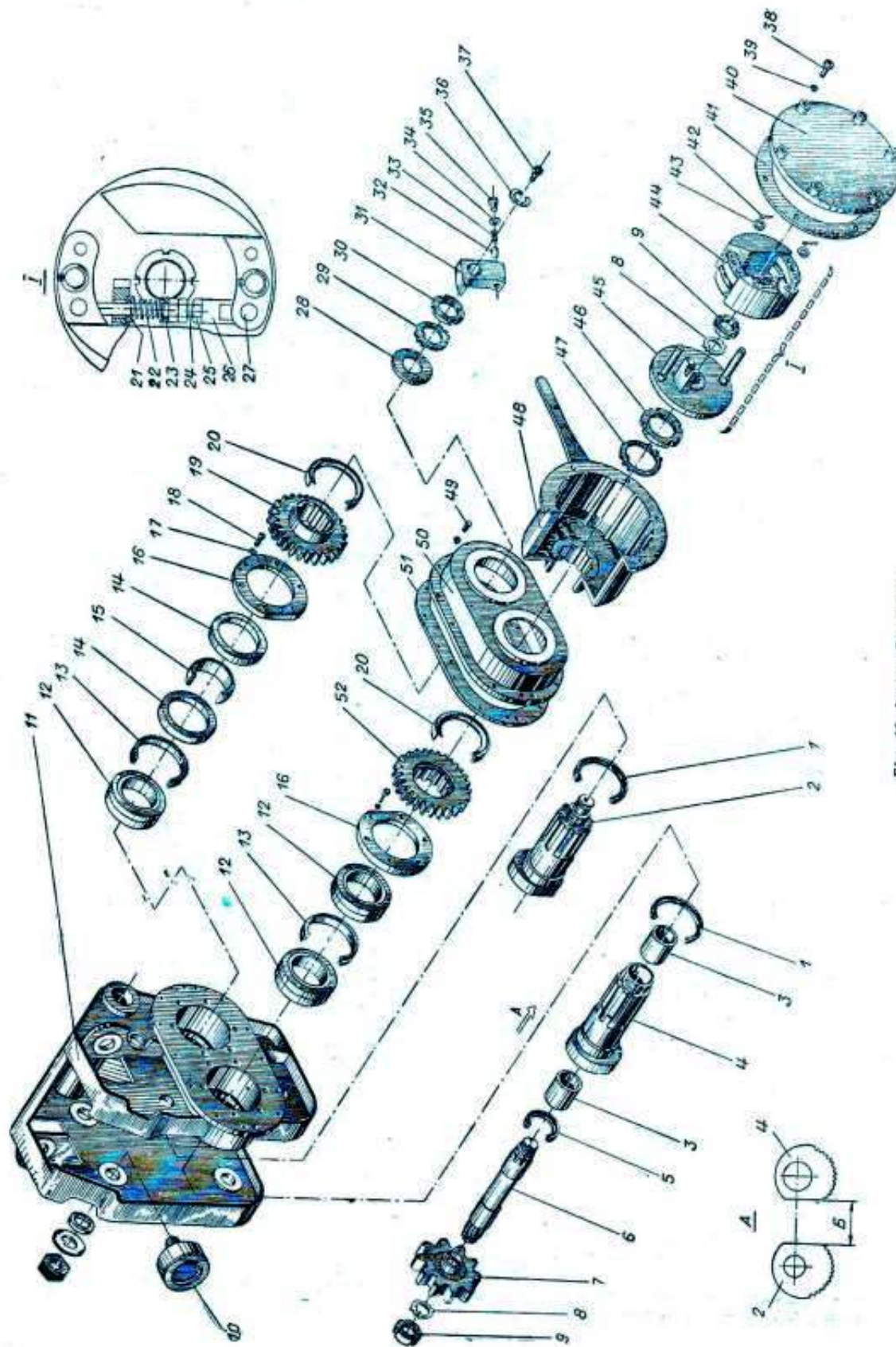


Fig. 10. Lower Carriage:

1, 5, 30 — collar; 2, 4 — eccentric; 3 — bushing; 6 — shaft; 7 — sprocket; 8, 17, 21, 23, 28, 29, 34, 35, 43, 47 — washer; 9, 25, 30, 46 — nut; 10 — roller; 11 — body; 12 — bearing; 13, 14, 15, 36 — ring; 16, 40, 50 — cover; 18, 49 — bolt; 19, 52 — gear wheel; 22, 33 — spring; 24 — tie; 35 — shackle; 27 — axle; 31 — retainer; 32 — stop; 35 — plug; 37 — roller; 38 — screw; 41, 51 — gasket; 42 — collar; pin; 44 — weight; 45 — disc; 48 — drum

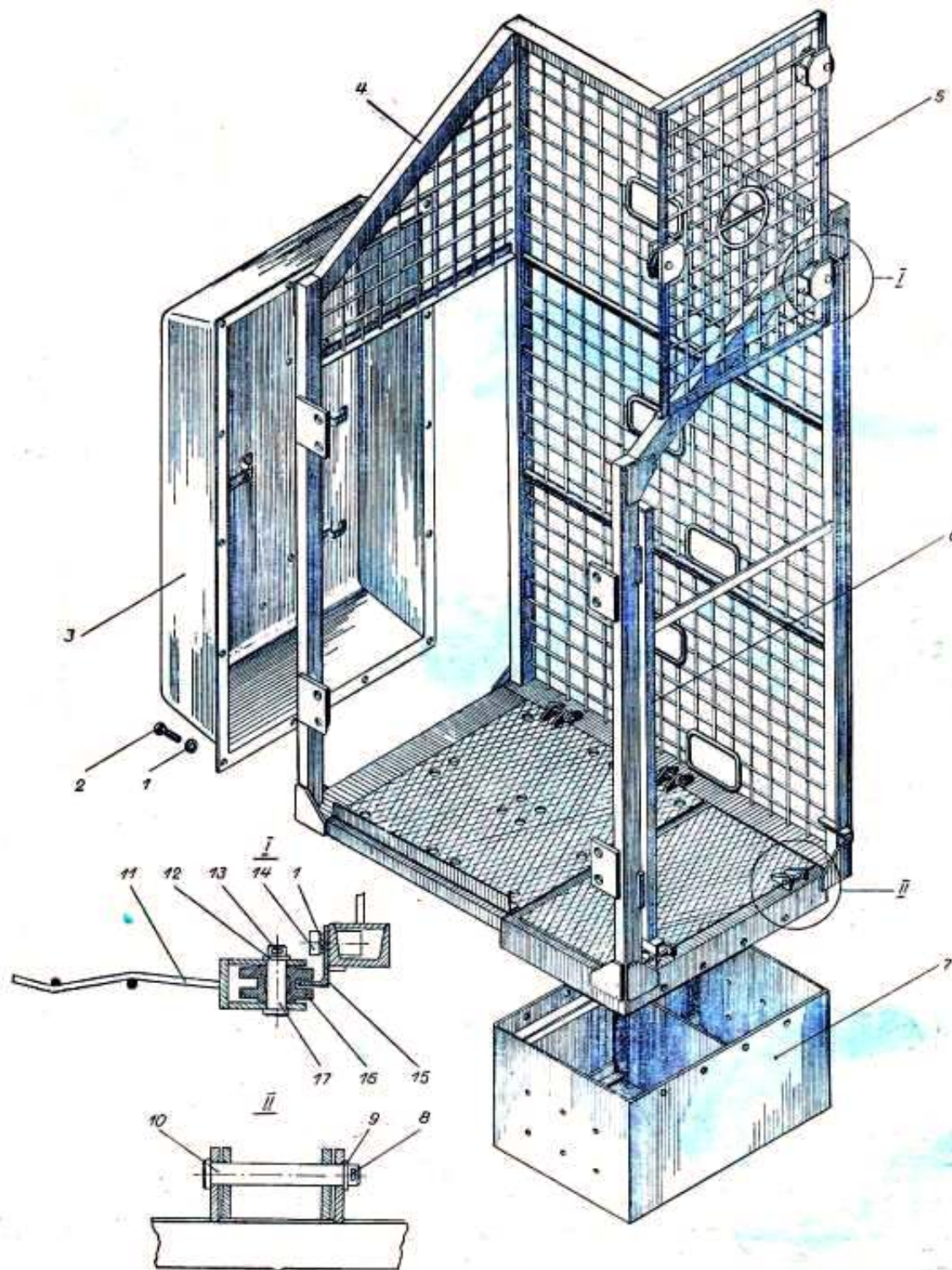


Fig. 11. Cab:

1, 9, 12 — washer; 2, 14 — bolt; 3 — casing; 4 — frame; 5 — door; 6, 15 — guide; 7 — box; 8, 13 — cotter pin; 10, 17 — axle; 11 — net; 16 — roller

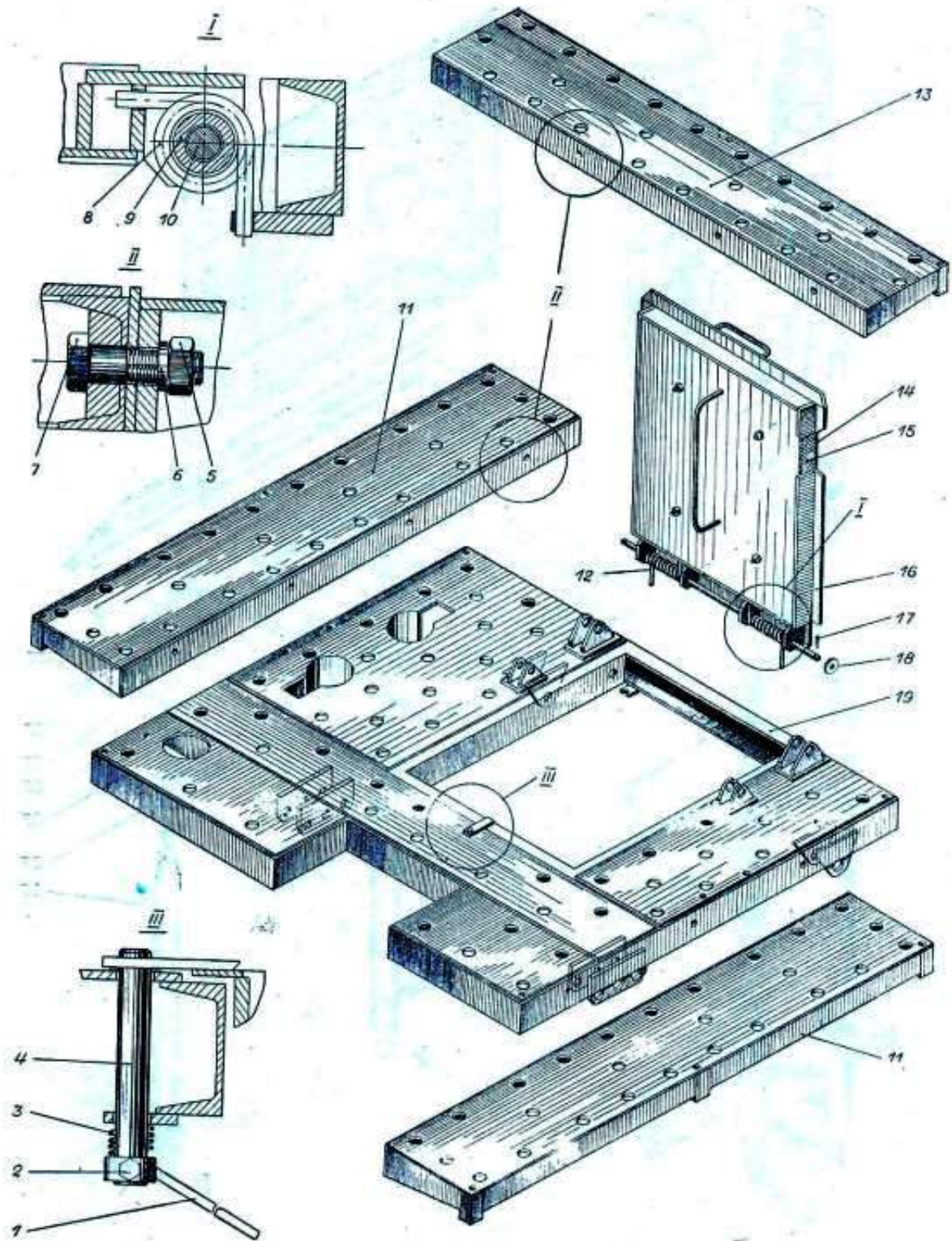


Fig. 12. Deck:

1 — handle; 2, 7 — bolt; 3, 6, 12 — spring; 4 — latch; 5 — nut; 6, 18 — washer; 9 — guide; 10 — axle; 11, 13, 19 — floor; 14 — cover strip; 15 — plate; 16 — manhole (assy); 17 — cotter pin

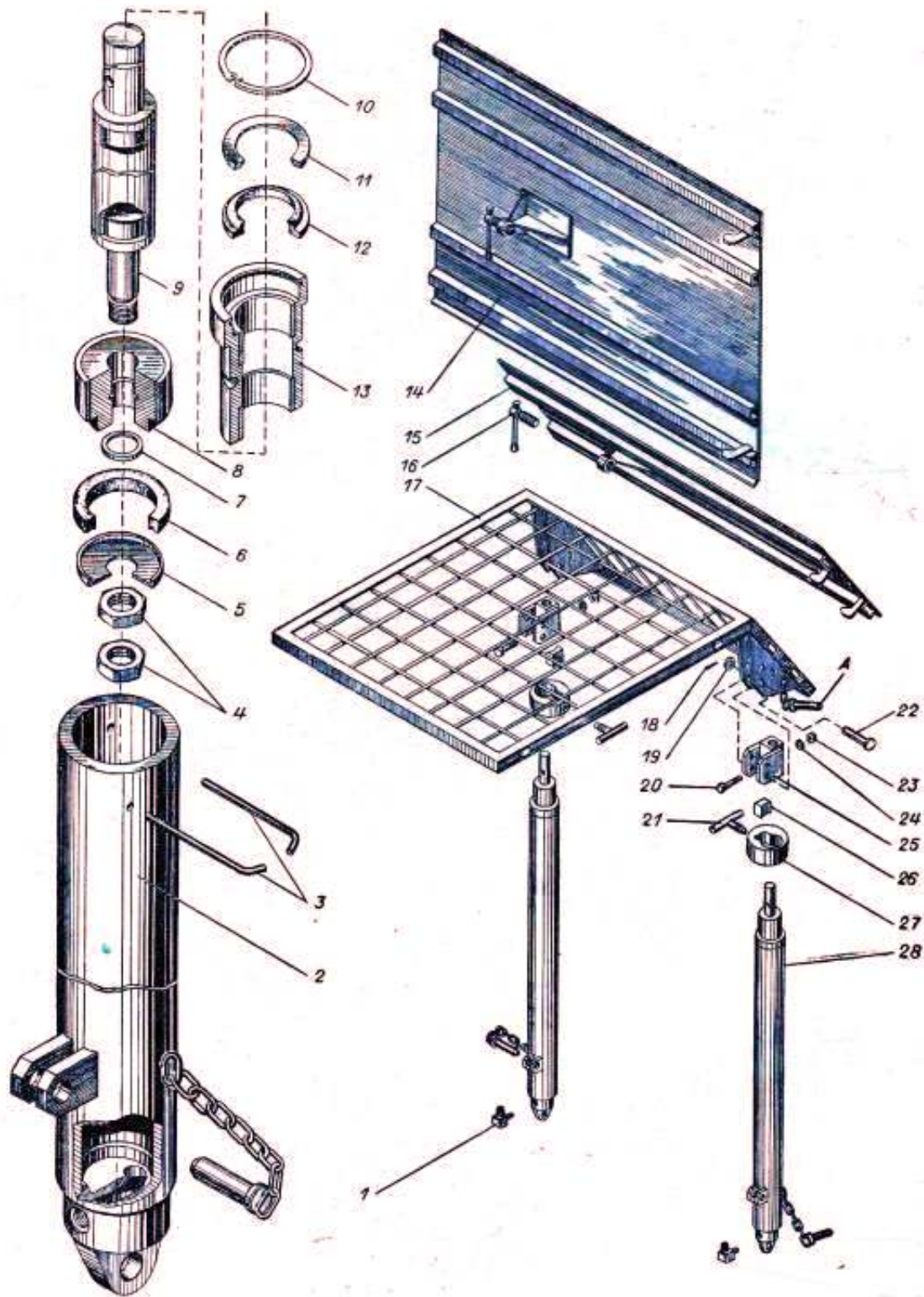


Fig. 13. Canopy:

1 — elbow; 2 — cylinder; 3 — wire; 4, 23 — nut; 5, 11 — collar holder; 6 — collar; 7, 10 — ring; 8 — piston; 9 — rod; 12 — dirt wiper; 13 — sleeve; 14, 15 — shield; 16 — screw; 17 — roof; 18 — cotter pin; 19, 24 — washer; 20 — bolt; 21 — handle; 22 — axle; 25 — trunnion; 26 — brake shoe; 27 — body; 28 — air cylinder (assy)

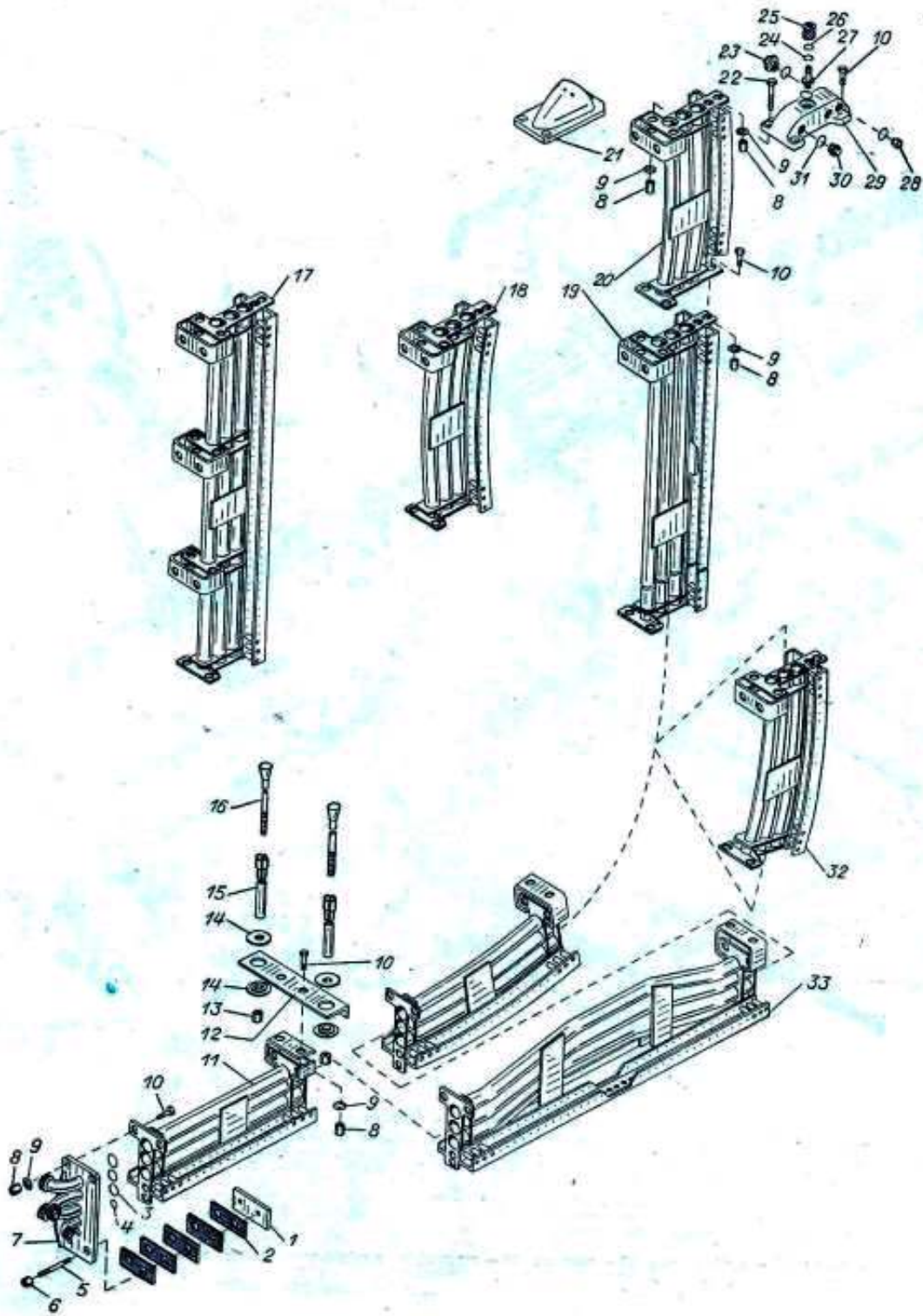


Fig. 14. Monorail:

1 — strip; 2 — shock absorber; 3, 4, 24 — ring; 5 — stud; 6, 8, 13 — nut; 7 — support; 9, 14 — washer; 10, 22 — bolt; 11 — short section; 12 — tie piece; 15 — pipe; 16 — rod; 17 — strengthened section; 18 — concave section; 19 — intermediate section; 20 — convex section; 21 — mixer; 23 — union; 25 — plug; 26, 31 — gasket; 27 — straight-way fitting; 28 — cap; 29 — body; 30 — plug; 32 — curved section; 33 — special section

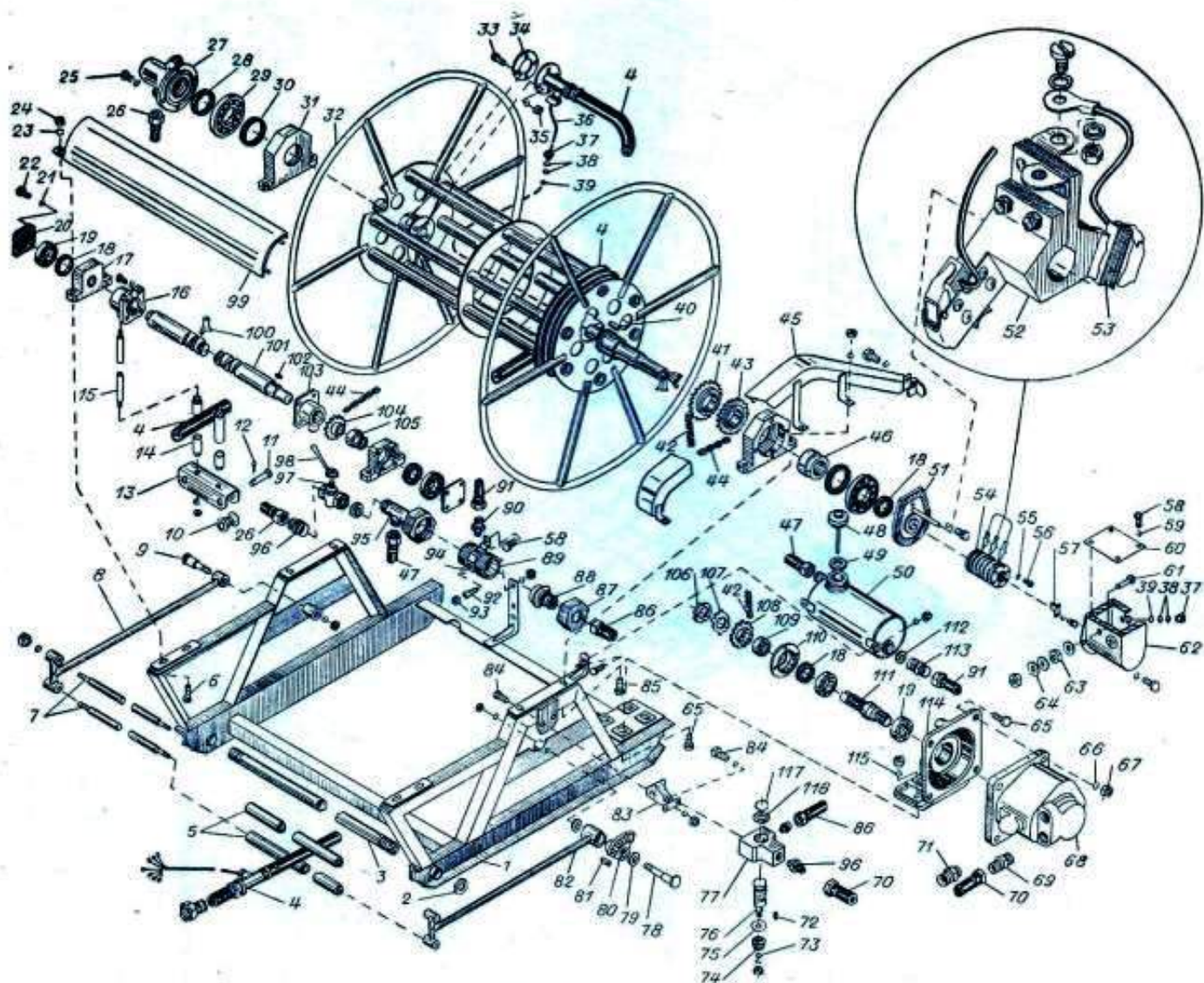


Fig. 15. Hose Winch:

1 - frame; 2 - locknut; 3 - guide; 4, 20, 47, 70, 86, 91 - hose; 5, 10 - roller; 6, 22, 25, 33, 58, 61, 65, 84, 85 - bolt; 7 - tie; 8, 82 - lever; 9, 78 - pin; 11 - axle; 12 - cotter pin; 13 - slide; 14 - pipe; 15 - rod; 16 - l.h. slide; 17, 31, 77, 89 - body; 18, 28, 30 - collar; 19, 29 - bearing; 20, 48, 51, 60, 110 - cover; 21, 23, 39, 55, 59, 64, 66, 73, 75, 79, 107, 115 - washer; 24, 35, 37, 63, 67, 93, 106 - nut; 27 - inlet; 32 - drum; 34, 38, 49 - gasket; 36 - cable; 40, 72, 81, 102 - key; 41, 43, 104, 108 - sprocket; 42, 44 - chain; 45, 62, 99 - casing; 46, 105, 109 - bushing; 50 - hydraulic tank; 52 - brush holder; 53 - brush; 54 - current collector; 56, 101 - screw; 57 - holder; 68 - air motor ДАР-14М; 69, 71 - air resistor; 74 - gear; 76 - control valve; 80 - sector; 83, 114 - bracket; 87 - captive nut; 88 - adapter; 90 - screwed-in straight-way fitting with taper thread; 92 - needle; 94, 116, 117 - ring; 95 - T-piece; 96 - adapter; 97 - coupler-joined cock; 98 - handle; 100 - retainer; 103 - r.h. slide; 111 - shaft; 112 - filter; 113 - straight-way fitting

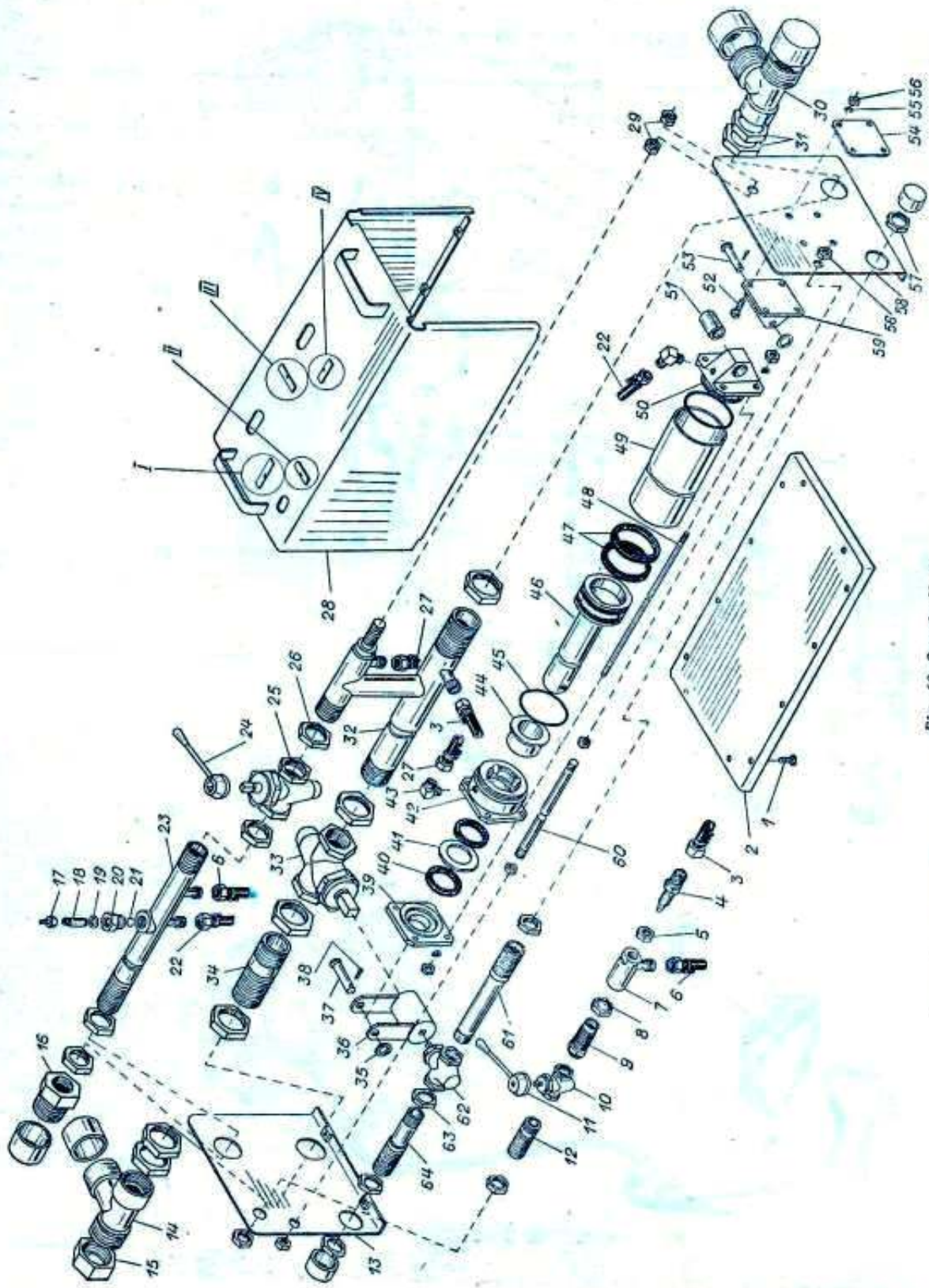


Fig. 16. Supply Unit:
 I - ventilation; II - sampling; III - ventilation; IV - sampling; drilling
 1 - bolt; 2 - frame; 3, 6, 22, 27 - hose; 4 - nozzle; 5, 30, 36 - nut; 7 - body; 8, 26, 31, 57, 63 - locknut; 9 - mixer; 10, 25, 33, 59 - coupler-joined cock; 11, 24 - handle; 12, 34 - branch pl.
 13 - l.h. side member; 14, 30 - I-piece; 15 - plug; 16 - main; 17 - nipple; 18 - rod; 19, 40, 47 - collar; 21, 41, 45 - ring; 23, 61, 64 - pipe; 28 - casting; 32 - frame; 35, 55 - washer; 36 - shackle; 37, 53 - axle; 38 - cotter pin; 39, 42, 50 - cover; 43 - screwed-in elbow with lapar three-
 set; 44, 51 - bushing; 46 - piston; 48 - stud; 49 - cylinder shell; 54 - cover plate; 58 - r.h. side member; 59 - bracket; 60 - fit

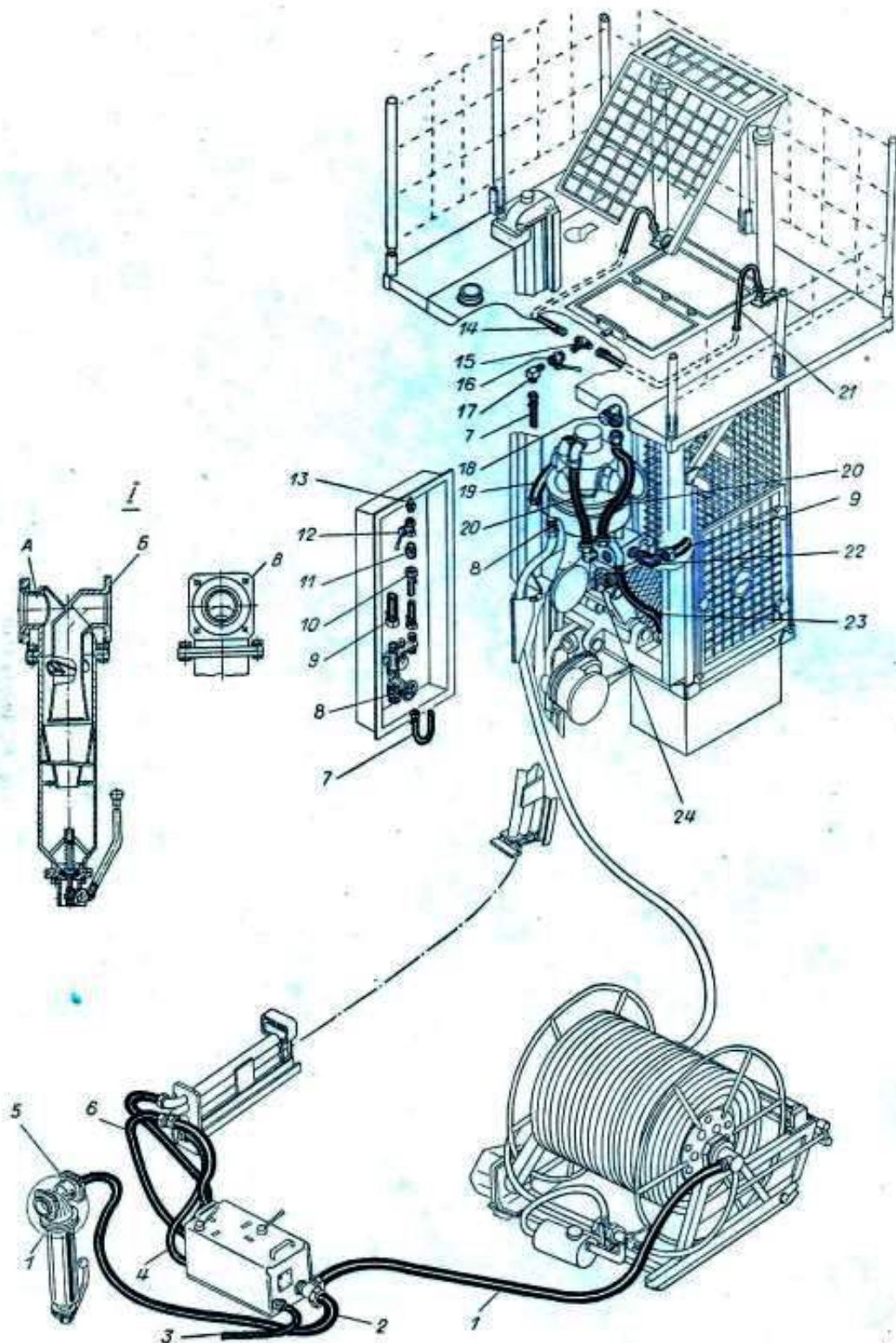


Fig. 17. Air Piping:

1, 2, 3, 4, 6, 7, 9, 10, 14, 19, 20, 21, 23 — hose; 5 — pipeline filter $\Phi M-63$; 8 — header; 11 — straight-way fitting; 12, 16 — coupler-joined cock; 13 — tip; 15 — T-piece; 17, 18, 22, 24 — elbow

SET OF SPARE PARTS, TOOLS AND ACCESSORIES
Spare Parts

Appendix 1

Description	Designation	Parent unit (designation)	Qty			
Sprocket	31.223.001.01.048	31.223.005.000	2			
Link C-ППЛ-19.05-2950 GOST 13568--75						
Rings GOST 18829--73						
038-044-36-2-2						
050-060-58-2-2						
Collars GOST 8752--79						
1.1-50×70-1						
1.1-85×110-1						
1.1-90×120-1						
Spring				ПК 14.11.02.002	ПК 44.11.01.000	2
Spring						
Spring						
Roller						
	31.223.001.01.042	31.223.005.000	2			
	31.223.001.01.065	31.223.005.000	4			
	31.212.001.010	ПК 44.11.01.000	8			
		31.212.005.000	10			
		31.223.005.000	2			
Brush MF4 GOST 2332--75; K1-5, 6.3×8×20; wire ПИИ 0.35 1=100 mm; lug 4БГТ-0.16-0.5		31.200.005.000	6			

Tools and Accessories

Description	Designation	Qty		
Tommy bar	ПК 14.00.08.001	1		
Chisel 2810-0194 Кд21.хр GOST 7211--72				
Wrench				
Wrenches GOST 2839--80				
7811-0003 H Д1 Кд21.хр				
7811-0021 H Д1 Кд21.хр				
7811-0023 H Д1 Кд21.хр				
7811-0025 H Д1 Кд21.хр				
7811-0041 H Д1 Кд21.хр				
7811-0043 H Д1 Кд21.хр				
7811-0045 H Д1 Кд21.хр				
Wrench 7812-0375 40X Кд21.хр GOST 11737--74	ПК 14.00.08.020	1		
Wrenches GOST 16984--79				
7811-0316 1 Кд21.хр				
7811-0317 1 Кд21.хр				
7811-0319 1 Кд21.хр				
Wrench 7813-0004 Кд21.хр GOST 18981--73				
Hammer 7850-0054/001 Кд21.хр GOST 2310--77				
Screwdriver 7810-0394 Кд21.хр				
Pliers 7814-0253 Кд21.хр GOST 5547--75				
Head 1 GOST 3027--75				
Grapplers	ПК 14.00.08.030	1		
Chain (for platform suspension to monorail)				
Syringe 2 GOST 3643--75				
			31.215.001.000	3
			ПК 14.00.00.060	1

SET OF OPERATION DOCUMENTATION

Appendix 2

Description	Qty of copies
ПБ-4А Raise Driving Integrated Outfit. Certificate	1
ПБ-4А Raise Driving Integrated Outfit. Parts Catalogue	1
IAP-14M Air Motor. Certificate	1
III-16 Piston-Type Air Motor. Certificate	1
III-16 Piston-Type Air Motor. Service Manual	1

IN-SERVICE TROUBLES RECORD (FILLED IN SERVICE)

Date	Component description and designation	Trouble and symptoms	Cause of trouble (failure), operating hours of faulty component	Measures taken	Person in charge

Date	Component description and designation	Trouble and symptoms	Cause of trouble (failure), operating hours of faulty component	Measures taken	Person in charge

MAINTENANCE RECORD
(Filled in service)

Date	Type of maintenance	Condition report	Person in charge

REPAIRS RECORD
(Filled in service)

Component description and designation	Reason for repair	Date		Repair agency	Hours (cycles, kilometers, work-shifts) in operation	Kind of repair (routine, medium, major, etc)	Work done	Signature of person in charge of	
		In	out					repair	acceptance

Component description and designation	Reason for repair	Date		Repair agency	Hours (cycles, kilometers, workshifts) in operation	Kind of repair (routine, medium, major, etc)	Work done	Signature of person in charge of	
		In	out					repair	acceptance

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