Ministry of Power and Electrification of the USSR

Glavenergostroymekhanizatsiya

Trust "Energomekhanizatsiya"

Leningrad Experimental Works of Construction Machines

VIBRATORY PILE DRIVER B402

Technical Description and Operating Instructions

B402.00.00.000TO

1984

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1. INTRODUCTION

1.1. The present Technical Description and Operating Instructions called further "Technical Description" is intended to study the design, the principle of operation and the operating procedures of the B402 Vibratory Pile Driver.

1.2. The Technical Description incorporates the specification, the procedures of preservation, transportation, storage, maintenance and other pertinent information necessary to provide the complete utilization of the technical capabilities of the Vibratory Pile Driver.

1.3. When studying the Vibratory Pile Driver, follow additionally the instructions of the Log-Book B402.00.00.000-0.

1.4. The Technical Description is intended for the persons directly involved into the operation of the Vibratory Pile Driver or associated with its utilization.

1.5. The high performance, reliability and minimum labour consumption are provided if the operating and maintenance instructions set forth in the present Technical Description are complied with.

1.6. The Vibratory Pile Driver is being constantly perfected; as a result certain assemblies and components of the machine may differ from those described in the Technical Description.

2. APPLICATIONS

The B402 Vibratory Pile Driver is intended for driving steel sheet piles, pipes, beams and other similar items with a mass up to 2 500 kg and a cross-section up to 150 cm^2 into soil and for removing them from it.

The Vibratory Pile Driver is operated together with a hoisting device at an ambient air temperature of plus 40 °C to minus 40 °C.

3. SPECIFICATION

Table 1

Name of parameters	Rated value
Maximum disturbing force (design value), kN (t.f.)	270(27)
Total static moment of out-of-balance weights (design value), N-cm (kgf-cm)	0; 3 000 (300) 6 000 (600) 9 000 (900); 12 000 (1 200)
Minimum load-carrying capacity of hoisting device when pile is driven, t	6
Maximum permissible forces acting on hoisting device when pile is removed, kN (t.f.)	120(12)
Maximum speed of lifting of hoisting device hook, m/min.	5
Rated oscillation frequency, Hz	23,8
Maximum cross-section of item being driven, cm^2	150
Maximum depth of pile driving into soil, m	
- for sandy soil	25
- for pervious soil	20
Installed power of electric motors, kW	58
Voltage, V	220/380
Working pressure in hydraulic system, MPa (kg/cm^2)	16^{+2} (160^{+20})

Table 1 (con'd)

Name of parameters	Rated value
Minimum permissible pile gripping force at rated working pressure of 16 MPa (160 kg/cm^2), design value, kN (t.f.)	450(45)
Overall dimensions of Vibratory Pile Driver without portable desk and cable, mm, not over:	
- length	1 500
- width	1 095
- height	2 305
Mass of Vibratory Pile Driver, kg, not over	3 285
Mass of Vibratory Pile Driver without portable desk and cable, kg, not over	2 850

Static Moment and Disturbing Force vs. Position of Movable Out-of-Balance Weigths

Table 2

Level of disturbing force		0	I	II	III	IV
Position of out-of-balance weights according to marking on vibrator gear	on upper shafts	0	0	1	1	2
	on lower shafts	0	1	1	2	2
Total static moment of out-of-balance weights, N-cm (kg-cm)		0	3 000 (300)	6 000 (600)	9 000 (900)	12 000 (1 200)
Disturbing force, kN(t.f.)		0	67.5 6.75	135 13.5	202.5 20.25	270 27

4. SCHEDULE OF PARTS OF VIBRATORY PILE DRIVER

4.1. The Vibratory Pile Driver (FIG. 1) consists of the following main parts:

- vibrator B402..01.00.000;
- intermediate shaft B402..02.00.000;
- suspension B402..19.00.000;
- bracket B402..21.00.000;
- frame B402.06.00.000;
- pumping unit B402..07.00.000;
- hydraulic head cap B402 .11.00.000;
- casings B402 .09.00.000; ... 10.00.000; ... 12.00.000; ... 14.00.000;
- cabinet B401A.22.00.000.

4.2. The Vibratory Pile Driver is supplied with a set of spare parts, tools and accessories according to the list of spare parts, tools and accessories B401A.00.00.0003M.

5. DESIGN AND OPERATION OF VIBRATORY PILE DRIVER

5.1. The Vibratory Pile Driver of FIG. 1 is a vibration machine with a directional effect intended to drive steel sheet piles and similar items into soil and to remove them from it when operated together with the hoisting device.

5.2. The B401A Vibratory Pile Driver generates vertically directed oscillation at a given frequency. The oscillation is produced as a result of synchronous rotation of two pairs of out-of-balance weights whose centifugal forces are balanced along

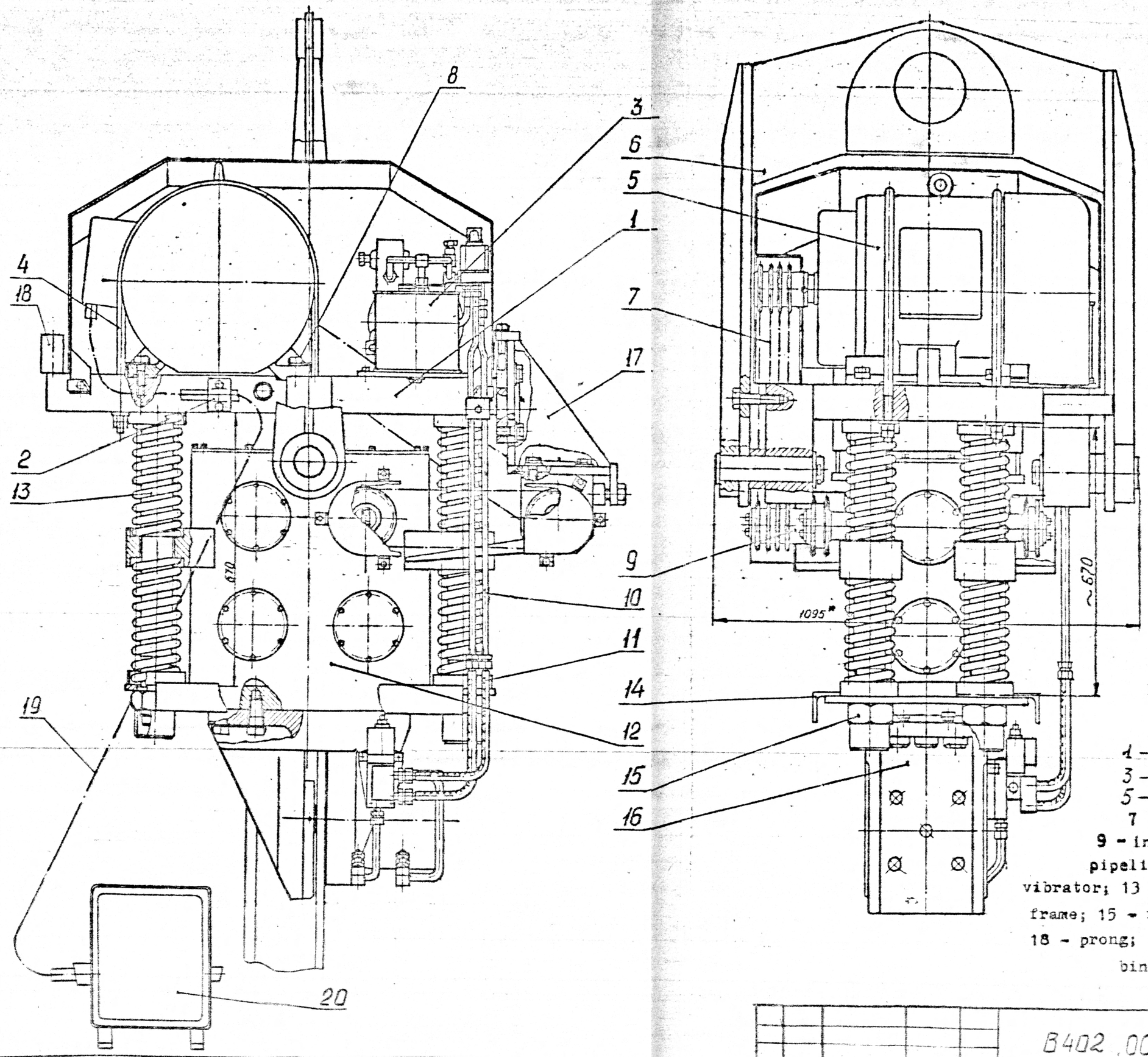

FIG. 1. Vibratory Pile Driver B402.00.00.000.

1 — frame; 2 — cable holder; 3 — 3 - pumping unit; 4 - clip; 5 — electric motor 6 - suspension; 7 - chain transmission; 8 - bolt; 9 - intermediate shaft; 10 - oil pipeline; 11 - pressure hose; 12 - vibrator; 13 - spring mechanism; 14 - small frame; 15 - nut; 16 - head cap; 17 - bracket; 18 - prong; 19 - cable; 20 - electric cabinet; 21, 22, 23 - casings.

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the horizontal axis, but are added along the vertical one and generate an alternating disturbing force.

5.3. The B401A Vibratory Pile Driver belongs to the vibration machines with a cushoned additional load, whose essence consists in that the machine comprises two parts:

- a vibrating part incorporating the vibrator with the head cap and the item being driven that is secured to the head cap;

- a vibration isolated frame with an additional-load plate where the electric motor of the Vibratory Pile Driver, the intermediate shaft and the pumping unit are installed.

Both parts are interconnected via springs that are compressed and accumulate energy when the vibrating part moves upwards and straighten out and, together with the additional-load plate, add a force acting on the vibrating item being driven when the vibrating part moves downwards.

5.4. Due to the cushoned additional-load plate to which a U-shaped suspension is secured, the Vibratory Pile Driver hanged up on the hook of the hoisting device does not transfer the vibration via the suspension to this device.

This allows usual commercial-design electric motors to be used to drive the vibrator and the pump, the pumping unit to be installed on the additional-load plate in contrast to other types of vibratory pile drivers provided with stationary-type pumping units and the driving and removal of sheet piles and other similar works to be performed together with any hoisting device having the specification meeting the requirements for the hoisting device as specified in the Log-Book of the Vibratory Pile Driver.

5.5. The main working part of the Vibratory Pile Driver is the vibrator 12 comprising a housing and four shafts with gears pr

vided with out-of-balance weights on the shafts, the shafts being mounted within the housing.

The vibrator is driven by a chain transmission 7 from an electric motor 5 installed on a frame 1 via an intermediate shaft 9 movably secured to the frame. In the lower portion the frame has four rods on which the vibrator is put by means of lugs and secured by means of a small frame 14 and nuts 15. Installed on the frame is a pumping unit 3 supplying the working fluid into the cylinder of the hydraulic head cap 16 under pressure.

The head cap is detachably secured to the vibrator bottom, has a housing with a groove for the sheet pile installation, a hydraulic cylinder and hardened inserts having teeth (knurl) on the working surface.

In addition to the Vibratory Pile Driver, secured pivotally is a U-shaped suspension 6 used to suspend the Vibratory Pile Driver on the hook of the hoisting device.

The Vibratory Pile Driver is provided with an electric cabinet accommodating the starting and protective equipment for the motors of the Vibratory Pile Driver and the pumping unit, the control and monitoring devices. Furthermore, the Vibratory Pile Driver is supplied with a cable used to supply the electric energy from the electric cabinet to the Vibratory Pile Driver.

5.6. In the driving of piles, the operation of the Vibratory Pile Driver is performed in the following manner. On the working place (site), the Vibratory Pile Driver is hanged by means of the U-shaped suspension on the hook of the hoisting device, the lever from the set of spare parts, tools and accessories is put on the prong of the frame 1, and the Vibratory Pile Driver is turned into the horizontal position. The groove of the head cap of the Vibratory Pile Driver is placed on an end of the sheet pile. The

pumping unit is turned on, and the pile is gripped.

The hoisting device lifts the Vibratory Pile Driver together with the pile until the free end of the pile comes off from the soil by 100 to 200 mm. Make sure visually that the pile is reliably gripped in the head cap. Lower the pile to the mark or introduce it into the lock of the pile that has been already driven. Turn on the Vibratory Pile Driver and drive the pile to the specified depth, then the pile is released and the driving of the next pile is performed.

5.7. The operation of the Vibratory Pile Driver for removing piles is performed in the following manner.

The Vibratory Pile Driver hanged on the hook of the hoisting device is put on the pile end protruding from the soil by means of the head cap groove. The pumping unit is turned on, the pile is gripped. The Vibratory Pile Driver is turned on, and the pile is lifted at a speed of 0.5 to 1 m/min. by means of the winch of the hoisting device.

The pile removal can be performed by two methods.

First method. A slight pull of the lifting cable is produced by lifting the hook before the Vibratory Pile Driver is turned on, causing the lower springs of the Vibratory Pile Driver to compress. The Vibratory Pile Driver is turned on for 0.5 to 1 minute, not increasing the lifting force. On expiration of this time, the pile is torn off from the soil under the action of the elastic forces of the springs. Then the lifting force is smoothly increased and the pile removal is performed. The speed of hook lifting should be within 0.5 to 1 m/min.

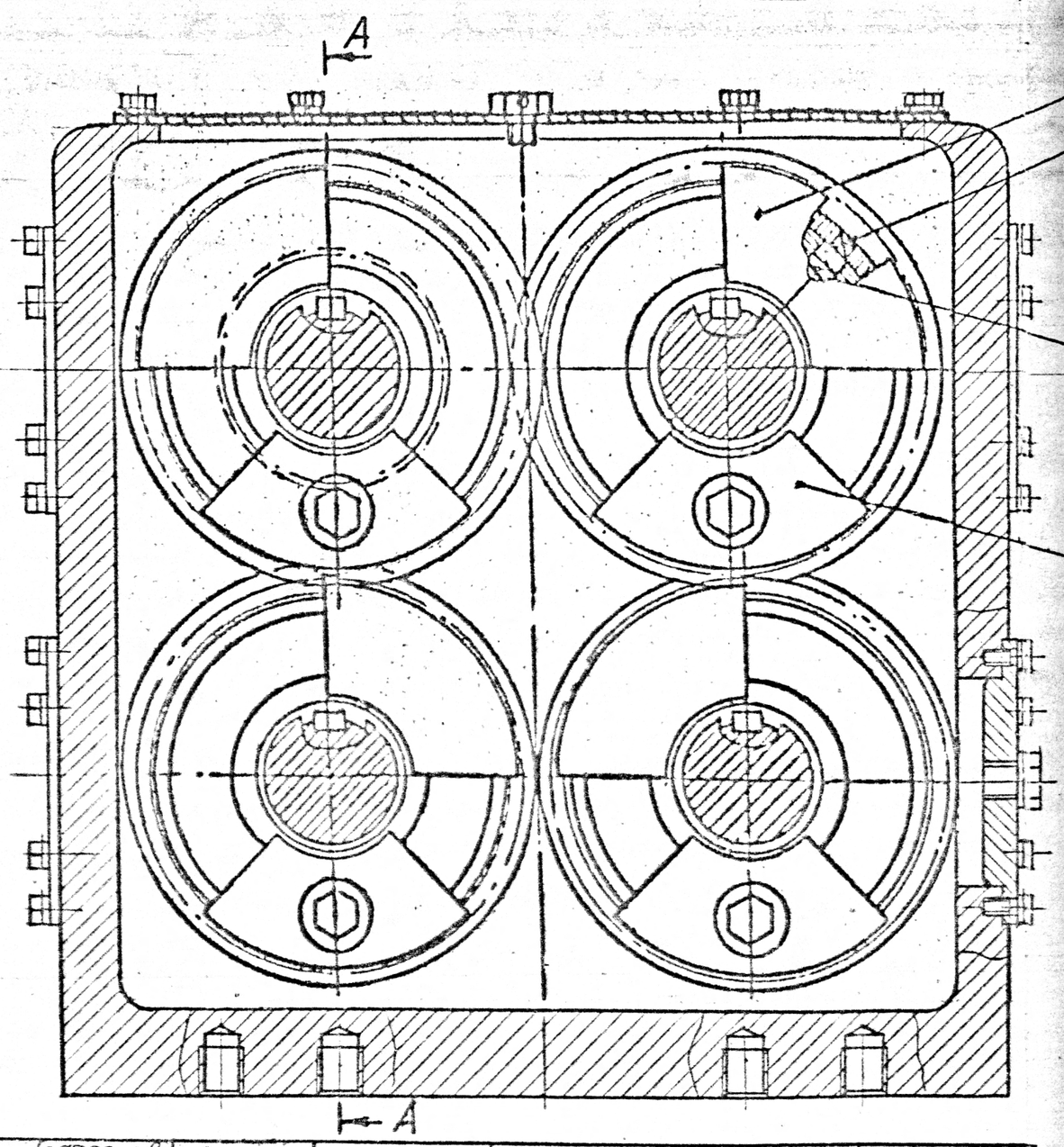
Second method. With the lifting cable in free state, the Vibratory Pile Driver is turned on. When the vibrating sheet pile is driven by 2 to 4 cm into the soil, the lift of the pile is started at a speed approximately equal to the speed of the pile downward mo-

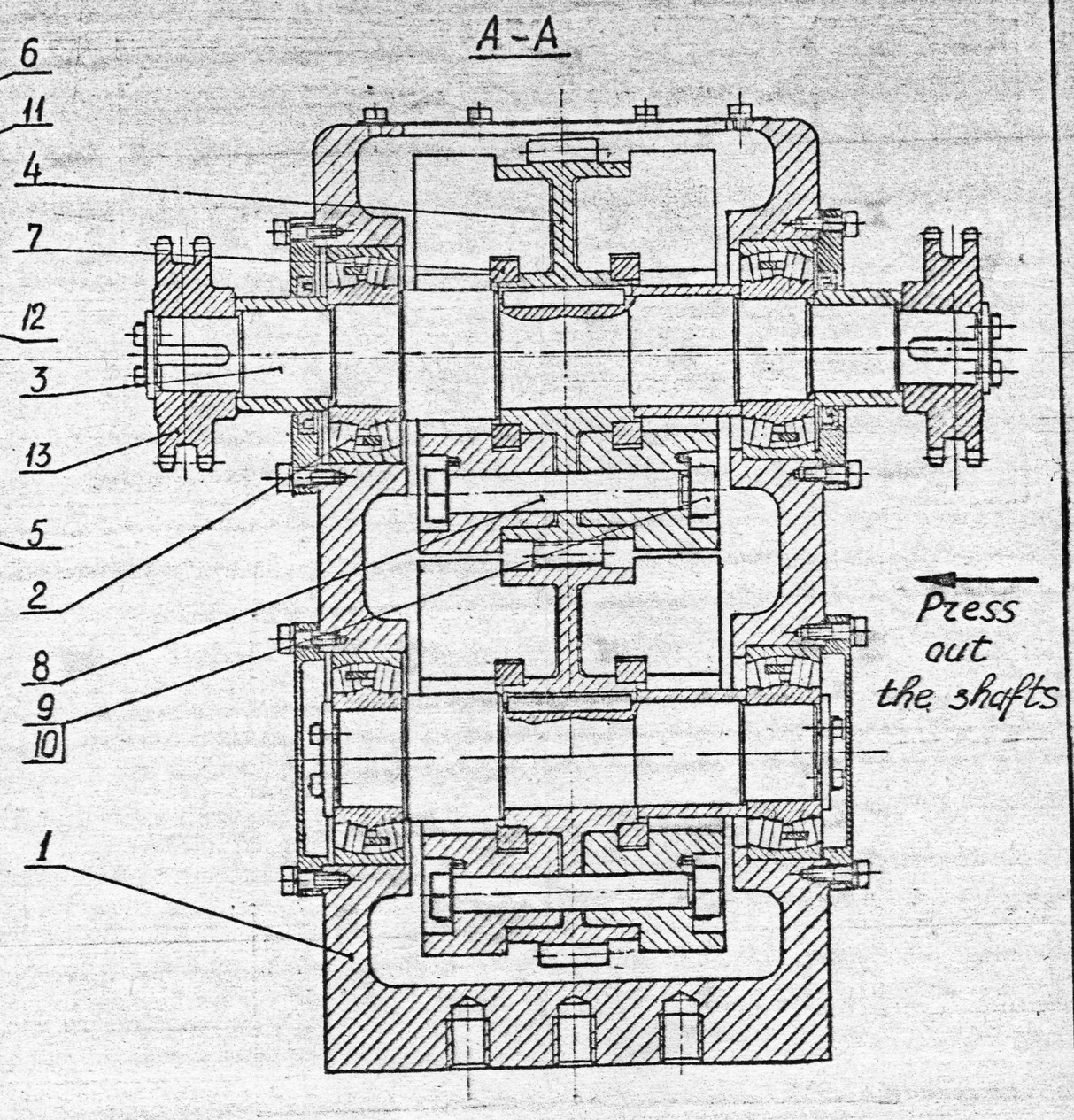
vement. The force required to lift the pile will be approximately equal to the doubled weight of the Vibratory Pile Driver with the pile.

6. DESIGN AND OPERATION OF COMPONENT PARTS OF VIBRATORY PILE DRIVER

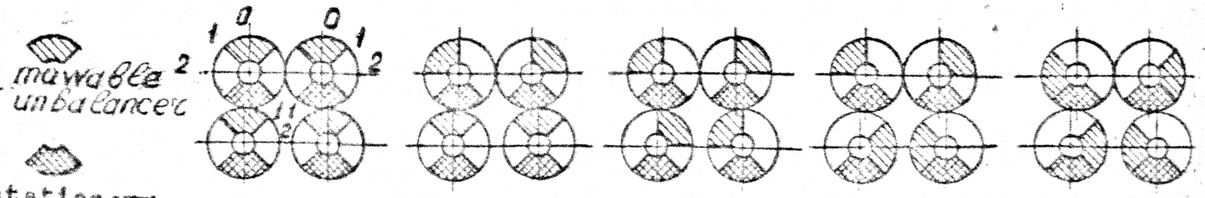
6.1. The vibrator (FIG. 2) incorporates a housing 1, four shafts 3 journaled in roller bearings 2 in it and having gears 4 installed on them, the gears being provided with stationary out-of-balance weights 5 and movable out-of-balance weights 6 installed on both sides of every gear. The stationary out-of-balance weights arranged on different sides of every gear are fastened to each other together with guide rings 7 stiffly by means of a common coupling bolt 8, a nut 9 that are locked by bent washers 10.

The movable out-of-balance weight is an annular sector with an angle of 90 °. On the external annular portion, the out-of-balance weight has a guide step that enters the annular notch of the gear. In the lower annular portion, the movable out-of-balance weight has a groove used to receive the guide ring 7 while in the upper one it has a cylindrical hole used to receive the arrester 11 with the spring 12 and a hole used to receive a small crowbar used to change the out-of-balance weight into the desired position. The movable out-of-balance weight has its lower portion bearing against the hub of the gear and is secured by the arrester 11. The cylindrical portion of the arrester enters the hole of the out-of-balance weight while its square portion enters the groove of the flange of the gear 4. The arrester has beads preventing its falling-out from the nest. The gear flange has a window for removing the





degree of disturbing force / unbalancer	0	I	II	III	IV
upper pair	0	1	1	1	2
lower pair	0	0	1	2	2



unbalancer setting diagram;

FIG. 2. Vibrator B402..01.00.00

1 - housing; 2 - roller bearing; 3 - shaft; 4 - gear; 5 - stationary out-of-balance weight; 6 - movable out-of-balance weight; 7 - guide ring; 8 - coupling bolt; 9 - nut; 10 - bent washer; 11 - arrester; 12 - spring; 13 - sprocket

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arrester with the spring in the event of disassembling. The window is reliably closed by a special washer preventing the arbitrary falling-out of the arrester when it is worn and errors take place in the change of the out-of-balance weights. When the movable out-of-balance weights are changed into the position "0", "1" or "2", the spring-loaded arrester 11 is recessed through the viewing window by means of two special small crowbars into the out-of-balance weight body, the arrester projection leaving the groove of the gear rim and releasing the out-of-balance weight for a turn. After the movable out-of-balance weight is turned into a new position, the arrester is pushed out by the spring 12 and its projection enters the other groove of the gear rim that corresponds to the new position.

The combinations of various positions of the movable out-of-balance weights listed in Table 2 produce a static moment of the out-of-balance weights varying from 0 to 10 000 N-cm (1 000 kg-cm) and a corresponding disturbing force from 0 to 250 kN (25 000 kgf).

The vibrator is driven via the upper (driving) shaft 3 having its ends protruding beyond the housing and carrying the sprockets 13 brought into rotation by driving roller two-row chains of the intermediate shaft. The other three shafts are driven ones and driven by toothed wheels. In the upper part of the vibrator housing, there is a window closed by a cover with a gasket, that is used to assemble, disassemble and inspect the vibrator.

In the bottom the vibrator housing has ten blind threaded holes to secure the head cap to it, two blind cylindrical holes to fix the head cap and one threaded hole closed with a plug for the drainage of the waste oil from the vibrator.

On the end-face walls the vibrator has four viewing windows closed with covers. The change and installation of the out-of-balance weights into respective positions (see Table 2) are performed via the viewing windows. A threaded hole with a bolt is pro-

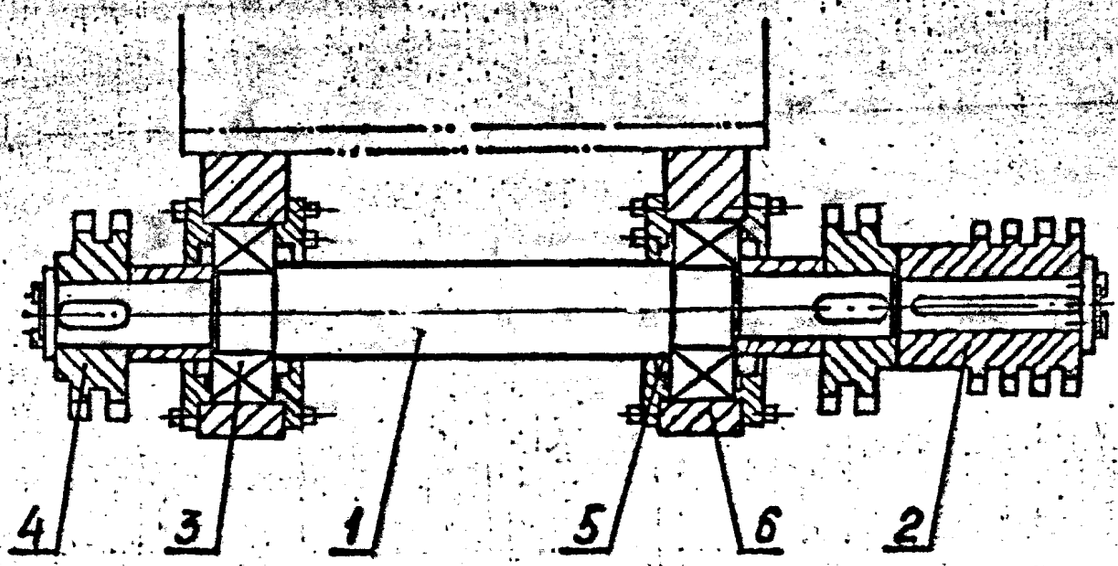

FIG. 3. Intermediate Shaft B402 .02.00.000.

1 - shaft; 2 - sprocket; 3 - roller bearing; 4 - sprocket; 5 - sealing ring; 6 - bearing housing

vided in the lower cover on the side opposite to the intermediate shaft for checking the oil level in the vibrator.

On the sides the vibrator has eight holes with strengthened bosses where the bearings and the shaft ends are arranged. Six holes are closed with blind covers while two holes are closed with covers with holes via which the protruding ends of the vibrator driving shaft pass.

In the middle portion, on the side of the end-face walls, four bosses are welded to the housing for installation of the cushioning spring mechanism.

6.2. Intermediate shaft (FIG. 3).

The intermediate shaft consists of a shaft 1 with bearings 3 and sprockets 2 and 4 and two bearing housings 6. The bearing housings are used to secure movably the intermediate shaft to the bracket. The intermediate shaft is an intermediate member receiving the electric motor torque by means of a four-row sprocket and transmitting it to the sprockets of the vibrator driving shaft by means of two two-row sprockets.

6.3. Frame (FIG. 4).

The frame of the Vibratory Pile Driver is a supporting structure. It incorporates an additional-load plate 1, a cleat 2 for fastening the bracket with the intermediate shaft, rods 3 and rings 4 for installing the springs, lugs 5 for securing the suspension and a stop 6. The following threaded holes are provided on the additional-load plate: four holes for securing the electric motor, four holes for securing the pumping unit; four holes for

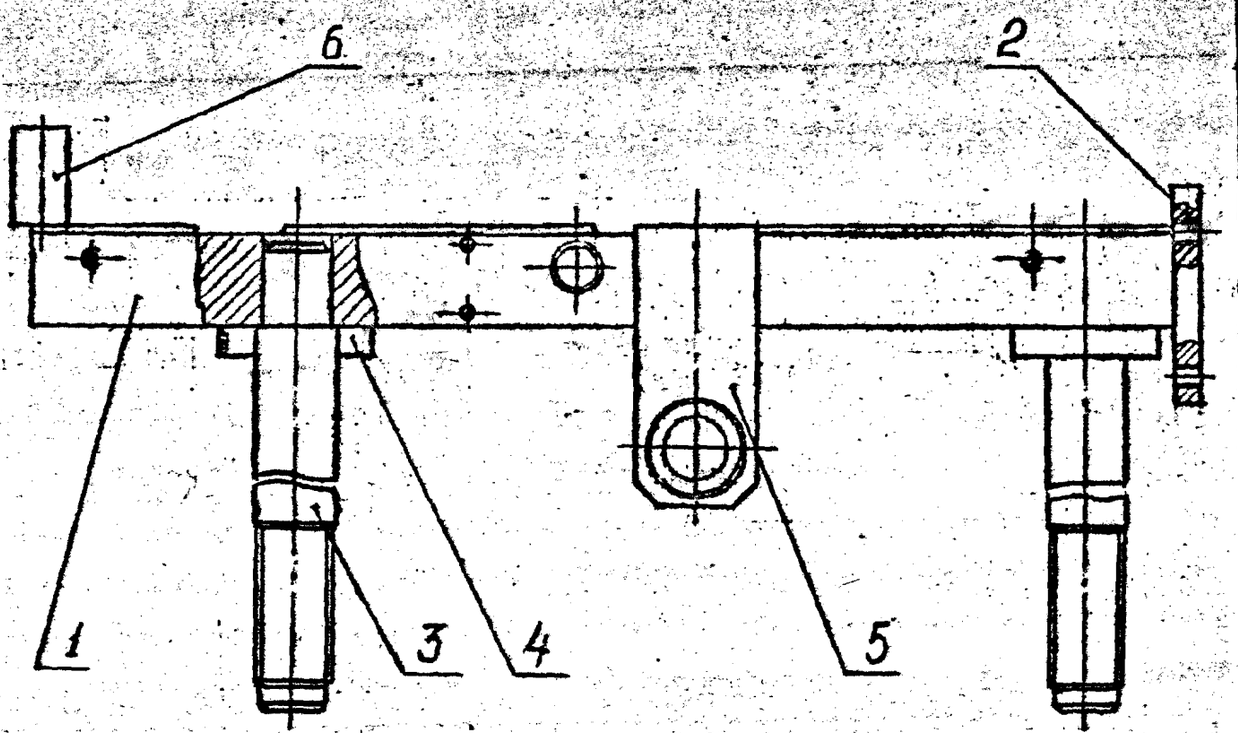

FIG. 4. Frame B401A.03.00.000.

1 - plate; 2 - cleat; 3 - rod; - ring; 5 - lug; 6 - stop

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securing the casing; two holes for securing the cable and four through holes for securing the motor by means of clips.

The rods 3 of the frame pass through the lugs of the vibrator. Springs 10 (FIG. 1) are put above and below the lugs on the rods 3 of the frame. The small frame 14 (FIG. 1) is put on the frame rods from below. The frames and the vibrator are fastened to the frame rods by means of the nuts 15 (FIG. 1).

The bracket with the intermediate shaft is movably fastened to the cleat 2 on a side. The movable connection of the intermediate shaft with the bracket and that of the bracket to the frame allow the tensioning of the chains of the Vibratory Pile Driver to be performed by means of screw mechanisms installed on the bracket and moving the intermediate shaft in the vertical and horizontal planes, thus providing the tensioning of the four-row chain from the electric motor to the intermediate shaft and two horizontal chains from the intermediate shaft to the vibrator.

6.4. Suspension 6 (FIG. 1).

The suspension is of a U-shaped welded construction. In the upper portion it has a window for its hanging on the hook of the hoisting device while in the lower portion, tie-rods with bushings for the pivotal connection to the frame of the Vibratory Pile Driver are provided on both sides.

The suspension is used to hang the Vibrator Pile Driver on the hook of the hoisting device. It is pivotally fastened to the frame of the Vibratory Pile Driver and provides the turn of the Vibratory Pile Driver into the position convenient for securing the items to be driven in the head cap.

6.5. Bracket 17 (FIG. 1).

The bracket is welded from plates. It incorporates a base, a plate, two ribs and four cleats. The plate and the base are provided with grooves. The intermediate shaft of FIG. 3 is movably secured to the base through the grooves by means of the bearing housings. The bracket is movably secured to the frame of the Vibratory Pile Driver through the grooves by means of the plate. The bracket cleats have threaded holes for installation of the screws of the chain tensioning mechanism. The bracket is a supporting structure of the intermediate shaft and provides the tensioning of the chain transmissions of the Vibratory Pile Driver by the available screw mechanisms.

6.6. Small frame 14 (FIG. 1).

The small frame is welded from two angles and sheets; there are four guide rings for springs and four holes to pass the rods of the frame of the Vibratory Pile Driver in the corners (FIG. 4).

The small frame is used as a support for four lower springs of the Vibratory Pile Driver, perceives the force from the hoisting device and transfers it through the springs to the vibrator.

6.7. Pumping unit (FIG. 5).

The pumping unit consists of a base, an oil tank, a panel with an electrically-controlled slide valve, an electric motor of the pump, a relief valve and oil pipelines.

6.7.1. The base of the pumping unit is welded from plates as a plate and is a supporting structure of the unit. Fastened to the base are the oil tank, the electric motor of the unit with the

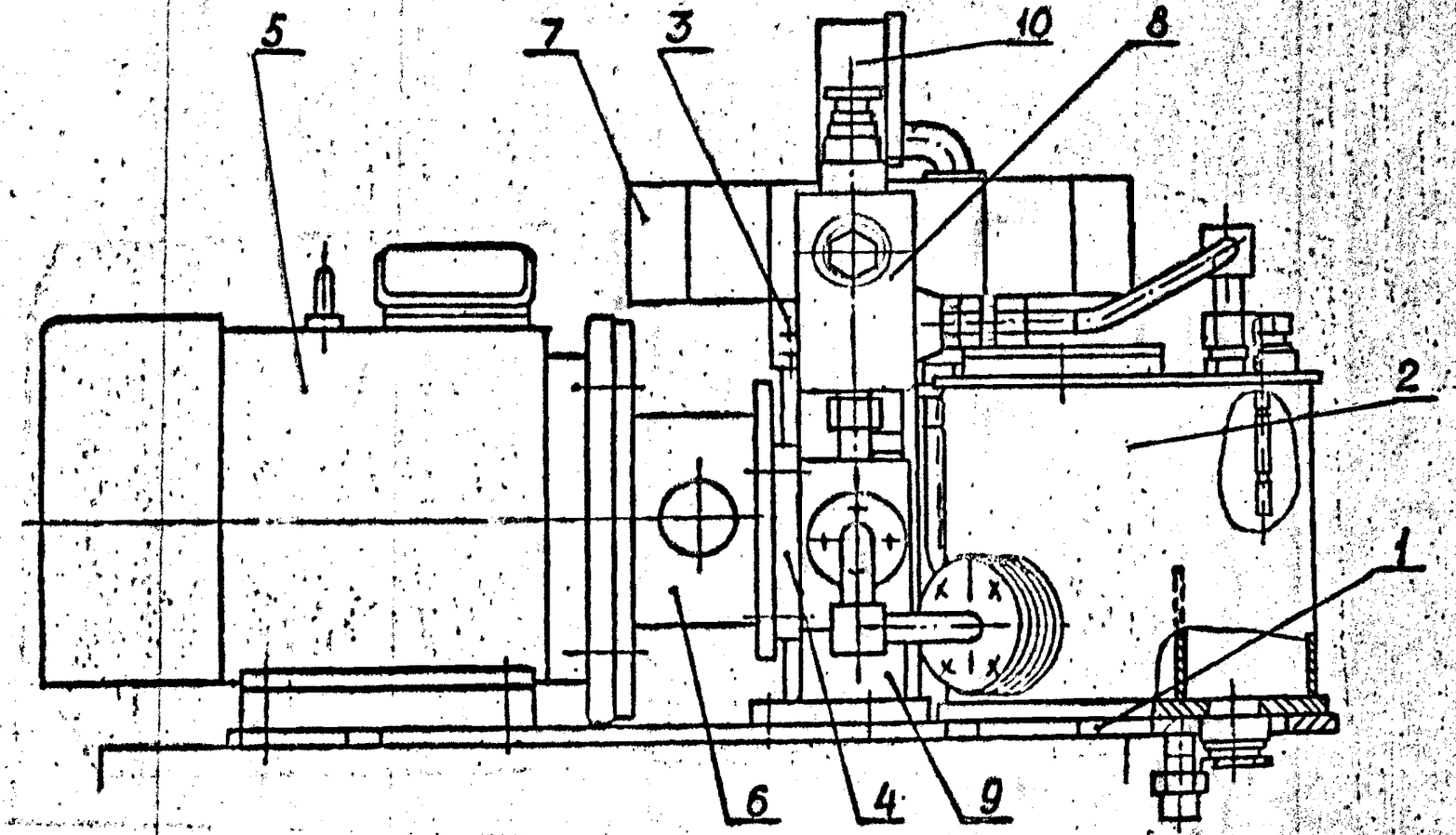

FIG. 5. Pumping Unit B401A.07.00.000

1 – base; 2 – hydraulic tank; 3 – panel; 4 – pump; 5 – electric motor; 6 – flange; 7 – reversible slide valve; 8 – relief valve; 9 – bracket; 10 – pressure gauge

pump, the bracket with the panel and the electrically-controlled slide valve.

6.7.2. The oil tank is welded as a vertical cylinder with two flat bottoms. The upper bottom has a tank filler, unions for the drainage of the waste oil from the hydraulic cylinder and the relief valve and for the oil dip stick. The lower bottom is provided with a drain hole closed with a plug. There is a suction connection pipe at a side of the lower bottom; the oil tank is secured to the unit base by means of the legs and bolts.

6.7.3. The panel is a plate with holes for securing the electrically-controlled slide valve to it and for supplying the working fluid to the slide valve and for removing it from the latter.

The panel is secured to the unit base by means of a bracket.

6.7.4. The pumping unit operates in the following manner. The electric motor is set into rotation from an external electric power supply line. The electric power is supplied through the electric cabinet where the starting and protecting equipment is accommodated as well as the control buttons of the pumping unit. The pump is fastened to the electric motor by means of a flange, The shaft of the pump is connected with the shaft of the electric motor with the aid of a sleeve-type clutch. The pump rotated by the electric motor sucks the oil from the tank through a filter and feeds it over the pressure pipeline to the slide valve controlled electrically. Installed on the pressure pipeline is a relief valve by-passing the working fluid into the oil tank if the pressure in the hydraulic system exceeds the rated value (at the end of sheet pile gripping).

The electrically-controlled slide valve directs reversely the flow of the working fluid over the oil pipelines to the cavities of the hydraulic cylinder of the head cap. Provided on the oil

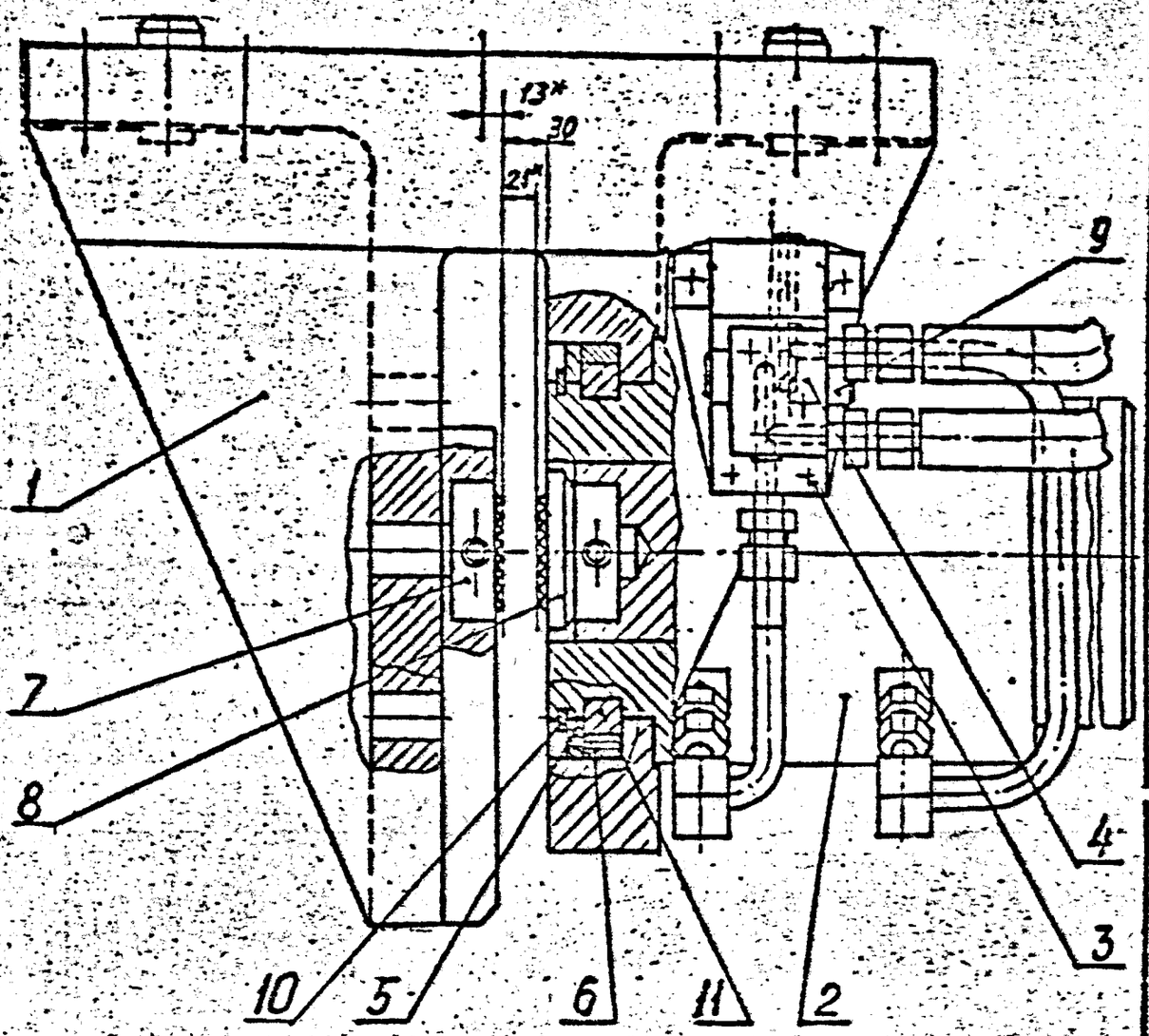

FIG. 6 Hydraulic Head Cap
B401A.11.00.000

1-housing; 2-hydraulic cylinder; 3-hydraulic panel; 4-hydraulic panel; 5-ring; 6-ring; 7-insert; 8-insert; 9-hydraulic lock; 10-ring; 11-split ring

supply line from the pressure main to the relief valve is a threaded hole closed with a plug for connection a pressure gauge that is installed when the monitoring and the adjustment of the pressure in the hydraulic system by means of the relief valve are performed.

6.8. Head cap (FIG. 6).

The head cap incorporates a housing 1, a hydraulic cylinder 2, a hydraulic lock of double-sided action and two inserts.

6.8.1. The housing is moulded, has a base with holes for its securing to the vibrator housing and two jaws reinforced by ribs. Formed between the jaws is a space in the shape of a groove where the sheet pile is inserted to. The jaws have round holes: one for fastening the hydraulic cylinder with the right-hand insert, the other for securing the left-hand insert 7.

6.8.2 The hydraulic cylinder 200 mm in diameter incorporates a housing 1, a rod 2, pistons 3 and 4, a cover 5, a spring 6, a bucket (a sleeve) 7, rubber glands and rings. The hydraulic cylinder is the principal actuator for gripping the sheet pile in the head cap.

Details from positions 11,13 and I carry out a role of a spring hydraulic accumulator, which ensures gripping of the sheet pile in the head cap for all the period of its driving (removal) when pumping plant is switched off.

6.8.3. The hydraulic lock is used for the reliable locking of the rodless cavity of the hydraulic cylinder after the oil supply is ceased into the rodless cavity and in the event of a break in the oil pipelines supplying the working fluid to the hydraulic cylinder.

6.8.4. The inserts are made from the XBГ steel thermally treated to a hardness HRC 55 to 60 units, have knurl on the working surface. The teeth of the knurl intrude into the metal of the sheet pile and hold it in the head cap.

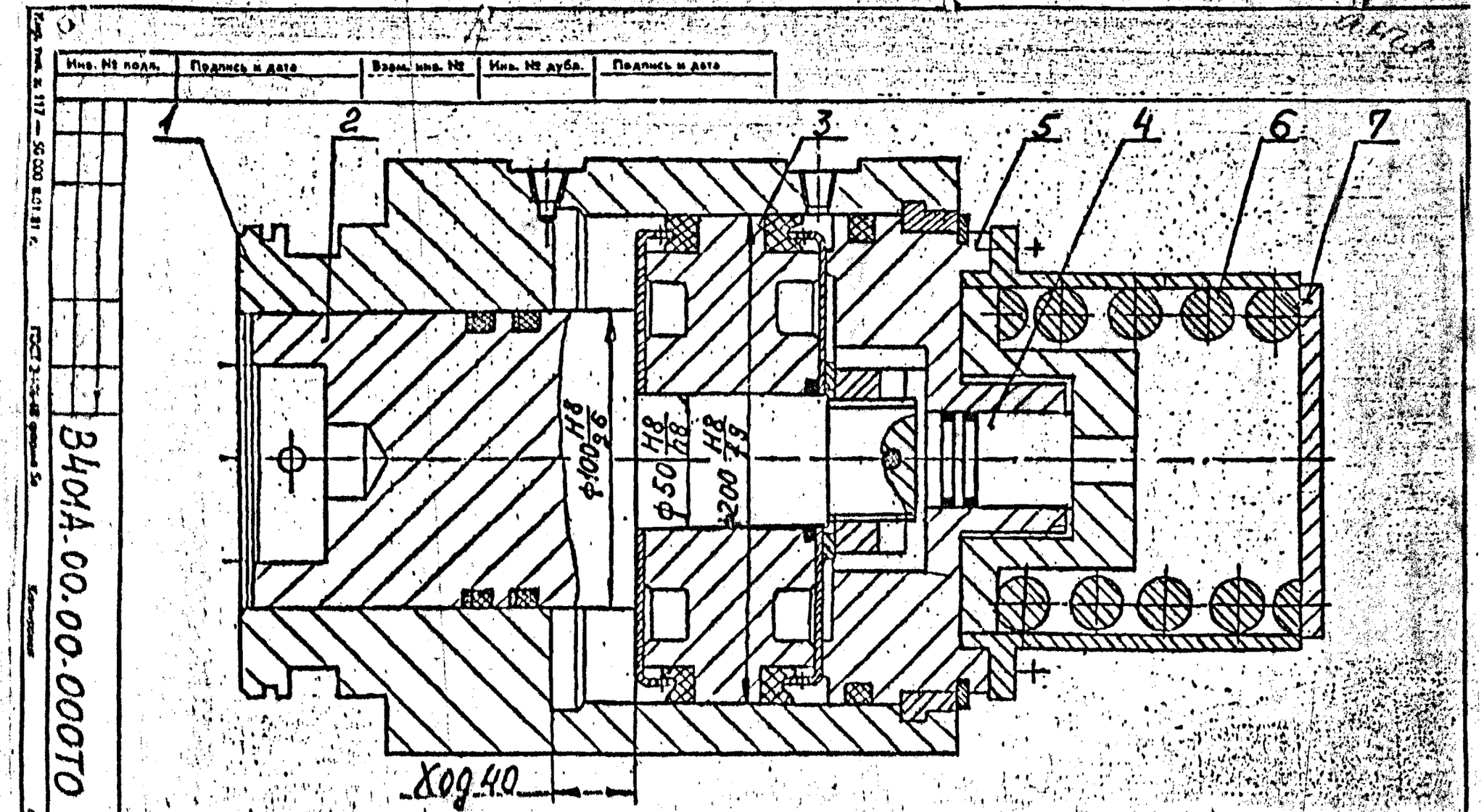

FIG. 7. Hydraulic Cylinder B401A.11.02.000
1 - housing ; 2 - rod ; 3 - piston ; 4 - piston ; 5 - cover ;
6 - spring ; 7 - cover

6.9. Electric cabinet.

The cabinet is of the box-type shape and is made from steel sheets. It comprises a housing, a plate with the starting and protecting equipment for the electric motors of the Vibratory Pile Driver and a panel carrying measuring instruments and pushbuttons used to control the operation of the Vibratory Pile Driver. Furthermore, the cable used to connect the electric equipment of the Vibratory Pile Driver to the cabinet is hanged on the hook of the electric cabinet.

6.10. Casings.

The pumping unit, the motor and the driving chains of the Vibratory Pile Driver are covered with casings.

7. OPERATION OF ELECTRIC SYSTEM IN GRIPPING (RELEASING) OF PILE, Dwg. B401A.00.00.00033

7.1. Gripping of pile.

Connect the automatic unit P2 to the power supply line by depressing the pushbutton. Apply the voltage to the coil of the starter K2 of the hydraulic pump drive and to the first electromagnet of the slide valve via the circuit 2-3-4-5 by depressing the pushbutton S4.

The starter latches itself, the electromagnet changes the slide valve to the position of communication of the hydraulic system pressure line with the rodless cavity of the hydraulic cylin-

der.

The oil is fed under the pressure into the hydraulic cylinder and displaces the piston with the rod into the position of gripping of the pile and clamps the pile end in the head cap

and simultaneously displaces the piston 4 (fig.7), to the left and compresses the spring 6, which accumulates an energy and ensures gripping of the sheet pile in the head cap after switching off the pumping plant.

7.2. Releasing of pile.

To perform the release, depress the pushbutton S3 that deenergizes the first electromagnet and applies the voltage to the second electromagnet of the slide valve. As a result the pile is released. The unit stops operating when the pushbutton S3 is released.

8. GENERAL OPERATING INSTRUCTIONS

8.1. When the Vibratory Pile Driver is received by the user, the latter should check if its set is complete in accordance with the Log-Book.

The Vibratory Pile Driver should be depreserved, and an entry about its depreservation should be made in the Log-Book. Perform the maintenance of the Vibratory Pile Driver.

8.2. Carry out the visual inspection of the Vibratory Pile Driver and its component parts for breaks and other defects that can occur during the transportation.

8.3. Check out the tightness of joints and breaks in the vibrator and in the oil tank.

8.4. Connect the electric cabinet to the Vibratory Pile Driv-

er and to the power supply line after the inspection is finished and the found defects are eliminated.

8.5. Carry out the performance test of the Vibratory Pile Driver. For this purpose, install the Vibratory Pile Driver on strips in the vertical position. Check the operation of the Vibratory Pile Driver by turning on the electric motor for 2 to 3 seconds. Put the Vibratory Pile Driver into the horizontal position on strips (see Clause 5.6), connect the head cap, insert a metallic plate sized at least 10 x 100 x 260 (material - steel CT.3) into the slit (between the inserts) and perform the gripping of the plate by means of the inserts, turning on the pumping unit and the head cap for gripping.

Check the embedding of the theeth into the plate body by measuring the imprint depth; the depth should be at least 1.2 mm.

The head cap should be connected to the Vibratory Pile Driver by means of bolts M30X70 of a strength category not below 10.9 in accordance with [illegible] (material - steel 40X or other of equal strength). The locking is performed only with bent washers in pairs or using the head cap edge (the set of fasteners for the head cap is supplied).

9. SAFETY PRECAUTIONS

9.1. Persons who reached 18 years passed the training and the knowledge check in the safety in building, handling and piling works and received the certificate for the right of operating the Vibratory Pile Driver, studied the present Technical Description and Operating Instructions, learned practically the operation of the Vibratory Pile Driver and have an experience in driving and removing piles are allowed to operate the Vibratory Pile

Driver.

9.2. Work supervisors must carry out a detailed briefing of the persons who are to operate the Vibratory Pile Driver on rules and safe operation techniques prior to the works. The persons who have not been present at the safety briefing are not allowed to work.

9.3. When the works listed in these Instructions are performed, the safety regulations must be complied with in pile driving as well as "Rules for erection of electric installations (ПУЭ-76)" and "Safety regulations" (ПТБ).

9.4. Never operate the Vibratory Pile Driver if:

- there are any troubles in it;
- its neutral wire or it is not earthed.

9.5. Before the electric motor of the vibrator drive is turned on for the performance test, the personnel must comply with the safety precautions and stay at a distance of at least 3 meters away from the Vibratory Pile Driver, and keep clear of the chain side.

9.6. During the operation of the Vibratory Pile Driver, unauthorized persons are not allowed to be at the working site while the attending personnel should stay not closer than 30 meters from the Vibratory Pile Driver.

9.7. It is forbidden to introduce any modifications into the construction of the Vibratory Pile Driver, that are not agreed with the manufacturing plant.

10. PREPARATION FOR OPERATION

10.1. Before starting the work, check the Vibratory Pile Driver and its component parts by the visual inspection for defor-

mations, cracks, weakening of screw joints, leakage of the working fluid from assemblies of the hydraulic system, that of the lubricant from the vibrator. Check up the tension of chains; the total deflection of the upper and lower branches should not be over 15 mm; the locking of the threaded joints should be performed only by means of bent washers or split pins.

10.2. Check up whether the lubricant is in friction assemblies and the working fluid is in the oil tank of the pumping unit. Lubricate friction assemblies and add the working fluid into the oil tank, if necessary.

The full volume of hydraulic system charge is 10 liters, that of the vibrator is 6 liters. The capacity of the oil tank is 7 liters.

10.3. Connect the electric board of the Vibratory Pile Driver to a 220/380 V electric power supply line by means of a flexible four-wire power cable for a voltage of 500 volts (three phase wires and one neutral wire) with a cross-section of at least 3 x 35 + + 1 x 10 at the voltage of 380 V and at least 3 x 50 + 1 x 16 at the voltage of 220 V. If the cable length exceeds 30 m, the cross-section is increased to reduce its electric resistance since the elevated cable resistance can make impossible the start of the electric motor owing to a large voltage drop across the cable as produced by the starting current reaching 500 ampers and over.

The connection to the electric power supply line, the earthing of the neutral, the earthing and the operation of the Vibratory Pile Driver should be performed in strict compliance with the current "Rules for erection of electric installations (ПУЭ) " and the "Rules of operation of users' electric installations".

10.4. Check up whether the head cap installed on the Vibratory Pile Driver is suitable for the items which will be driven or

removed.

The head cap supplied with the Vibratory Pile Driver is intended for driving only sheet piles of the types Larsen IV, Larsen V.

If it is necessary to drive other items in accordance with the specification of the Vibratory Pile Driver, the operating organization may adapt another head cap to be attached to the vibrator in manner similar to that used for the head cap supplied or install an adapter on the item to be driven so as to provide its clamping in the head cap like the sheet pile. The material of the adapter is steel Ст.3 СП5.

Perform the adjustment of the relief valve (see Clause 11.4.2 and Section 13).

10.5 Depending upon the kind of soil into which the submersion will be carried out and the mass of the item to be driven, adjust the level of the disturbing force in accordance with Table 2.

Table 2

Kind of soils	Mass of item being driven, kg	Required total static moment of out-of-balance weights, kg-cm	Level of disturbing force
Sandy soils saturated with water	500	250	I
	1000	250	I
	1500	500	II
	2000 and over	750	III
Pervious clay soils	500	250	I
	1000	500	II
	1500	750	III
	2000 and over	1000	IV

Set in the Vibratory Pile Driver shipped to the user is level II of the disturbing force, i.e. the movable out-of-balance weights of the upper and lower shafts are set in position "I" (see FIG. 2).

The change of position of the movable out-of-balance weights is performed through the windows made in the vibrator housing. For this purpose, withdraw the covers of the vibrator side windows. Recess the spring-loaded arrester by means of a special small crowbar, insert a second small crowbar into the hole of the out-of-balance weight and, holding the gear, turn every out-of-balance weight into the desired position (see FIG. 2). When the out-of-balance weight is changed into other positions, take care that the arrester enters completely the groove of the gear rim and that each pair of gears (the lower pair and the upper pair) has all out-of-balance weights set in similar position "0", "1" or "2" according to the marking. After the movable out-of-balance weights are changed into new positions, the vibrator window covers should be tightly closed.

The operation of the Vibratory Pile Driver with the out-of-balance weights of the upper and lower shafts in non-similar positions will lead to occurrence of transverse oscillation of the vibrator and, ultimately, to its destruction.

10.6. Carry out the performance test of the Vibratory Pile Driver (see Clause 8.5).

10.7. If it is necessary to check the operation of rotary parts of the Vibratory Pile Driver without vibration, all movable out-of-balance weights (eight in number) of the upper and lower shafts should be set in the position "0".

10.8. The correct direction of rotation of the vibrator shafts is considered to be such at which in the horizontal chains the upper branches are driving.

10.9. The Vibratory Pile Driver is hanged on the hook of the hoisting device with a load-carrying capacity of at least 6 tons for the driving. When the removing is performed, the required load-carrying capacity can rise up to 12 tons depending upon the removal force. The device used to secure the Vibratory Pile Driver on the hoisting device should prevent its self-disconnection.

11. OPERATING PROCEDURES

11.1. Driving of sheet piles.

11.1.1. Place the sheet pile so that one of its ends is on a support 600 to 500 mm high. Arrange the Vibratory Pile Driver under the lifted end of the pile, turn it through an angle of about 90 ° and put the head cap on the pile end until the pile end face bears against the head cap plate.

11.1.2 Switch on the pump and clamp the sheet pile. Visually according to the fact of insertion of tenons (teeth) into the body of the sheet pile, make it sure that gripping of the sheet pile in the head cap has taken place, and by pushing button S5 stop the pump motor (continuous work of the pump can result in its failure)

11.1.3. Lift the Vibratory Pile Driver with the sheet pile into the vertical position until the free end of the pile is apart from the soil by 100 to 200 mm, make sure visually that the pile is reliably clamped in the head cap and introduce it into the lock of the pile that has been driven earlier, then the Vibratory Pile Driver is lowered until the pile bears against the soil, turn on the electric motor of the Vibratory Pile Driver and perform the driving.

The speed of lowering of the Vibratory Pile Driver should be such that a certain slack of the load cable is formed (the suspension with the hook occupying a position inclined at an angle of 15 to 20 ° with respect to the vertical line).

When the driving of the sheet pile is discontinued (failure)

owing to a hard inclusion, remove the pile by 600 to 800 mm and then lower it quickly. If it is impossible to overcome the hard inclusion by two or three such attempts, the further driving of this pile should be discontinued.

It is strictly forbidden to overcome hard inclusions by operating the Vibratory Pile Driver to provide the pushing action since this leads to a failure of the machine.

After the driving is finished, the Vibratory Pile Driver is disconnected from the sheet pile by turning on the Vibratory Pile Driver for 1 to 2 s, if necessary, and inspected; the cycle is repeated if no defects are found.

11.2. Removal of sheet piles.

It is recommended to utilize the cranes KC-8161, MKG-100, CKG-160 and others meeting the requirements of Clause 11.2.1.

11.2.1. The Vibratory Pile Driver is secured to the sheet pile in the same manner as in the event of driving; the electric motor is turned on and a slow lifting of the Vibratory Pile Driver with the pile is performed.

For the successful pile removal the required speed of lifting of the hoisting device hook should be within 0.5 to 1 m/min, while the load-carrying capacity limiter should be adjusted to a load-carrying capacity not over 12 tons. If the starting of the sheet pile is delayed, the operating Vibratory Pile Driver is maintained at the maximum removing force of 12 tons at the hook during several minutes. When performing the lifting, care should be taken that the complete compression of the lower springs does not occur owing an excessive speed of removal since this can lead to failure of the Vibratory Pile Driver as well as will cause a dangerous vibration of the crane. Furthermore, one may first turn on the

Vibratory Pile Driver for several minutes with the hoisting cable in the free position. When the sheet pile is driven into the soil by 2 to 4 cm, the lifting of the pile is started.

It is recommended at the beginning of the sheet pile recovery to turn on the pump plant for 2-5 seconds to clamp the sheet pile. Combined action of clamping force and vibration increases depth of tenons insertion into the body of the sheet pile.

11.3. Duties of personnel in performing work

11.3.1. The supervision of operation of the Vibratory Pile Driver and its maintenance should be performed by the personnel specially appointed for this purpose. As a rule, the pile driving team incorporates a crane operator, a locksmith, an assistant of the crane operator, etc. These persons are responsible for the maintenance and servicing of the Vibratory Pile Driver as well as for the complying with the operating procedures.

11.3.2. The duties of the team are:

- to accept the Vibratory Pile Driver allotted to them from the previous shift at the beginning of the shift and to give it up to the next shift at the end of the shift;

- to examine the Vibratory Pile Driver at the beginning of the works and at the end of the shift: the electric motor, the drive, the suspension, the frame, the intermediate shaft, the vibrator, the securing joints, the welded seams, the starting and monitoring electric equipment, the electric cable, the hydraulic system, the inserts used to secure piles;

- to observe, throughout the shift, the correct operating of the Vibratory Pile Driver, not to allow its incorrect placing on the ground and impacts against other objects (piles, pattern, building constructions); place it on ground only by the side opposite to the chain tensioning device;

- to provide the reliable securing of the pile in the head cap; there should be no spallings, cracks and other defects on the inserts;

- not to allow the duration of continuous operation of the electric motor to be over 30 min. and the incorrect direction of rotation of the vibrator (the correct direction of rotation is such for which the upper branches of the horizontal chains are driving).

If the incorrect direction of rotation is detected, call the electrician on duty and eliminate the defect.

11.3.3. If any troubles are detected in the operation of the Vibratory Pile Driver (unwanted noise, transverse vibration of the vibrator, etc.), stop immediately the work, perform a thorough visual inspection and eliminate the defect.

11.3.4. The attending personnel must strictly comply with all instructions of the present manual, especially those pertaining to the safety precautions and the maintenance.

11.4. Measuring instruments

11.4.1. The principal parameter representing the load of the operating Vibratory Pile Driver is the current consumed by the electric motor of the vibrator. Therefore, the current should be continuously monitored by means of the ammeter of the electric board of the Vibratory Pile Driver. The current should not exceed 170 A at the voltage of 220 V and 100 A at the voltage of 380 V for a 55 kW electric motor.

Any increase of the rated current above the values specified leads to a failure of the electric motor. It should be kept in mind that at a constant setting of the movable out-of-balance weights a reduction in the mass of the item being driven which is connected to the vibrator leads to an increase in the amplitude of vibration, resulting in an increase in the current of the electric motor. The reduction in the vibration amplitude is acieved by re-

ducing the static moment of the out-of-balance weights.

11.4.2. There is a pillar with a plug for installation of a pressure gauge in the hydraulic system on the pressure line of the pumping unit between the pump and the distributor. Unscrew the plug and install the pressure gauge daily prior to the works, when Clauses 8.9, 10.6 are fulfilled. Use the pressure gauge to monitor the working pressure in the hydraulic system when the plate (pile) is clamped by the head cap. The pressure should be within 160 + + 20 kg/cm^2. The pressure gauge should be withdrawn after the pressure check since it will fail when vibration effects on it. The pressure gauge should be stored by the attending personnel.

11.4.3. In order to monitor and to limit the forces at the hook when the pile is removed, the limiter of load-carrying capacity (load moment) of the crane should be adjusted to the value corresponding to the load-carrying capacity of 12 tons with the suitable boom or the Vibratory Pile Driver is hanged on the hook through the extension dynamometer with a scale up to 15 to 20 tons, that is used to observe the value of the removing force.

12. TROUBLESHOOTING

Trouble	Probable causes	Remedies
Transverse vibration is generated in operation	Not all lower movable out-of-balance weights or not all upper ones are set in similar positions	Open side covers of vibrator, check position of out-of-balance weights, using marking on gear rim.

Trouble	Probable causes	Remedies
	Arrester of movable out-of-balance weight is cut	Check state of arresters, withdraw cut part of arrester, install new arrester, then set movable out-of-balance weight in desired position
Sparks and heating as result of friction between vibrator lug and rod on one or two guide rods of frame in short time after turning-on	Spring nut is unlocked and unscrewed	Tighten nut (nuts) as required and lock it (see size 670 in FIG. 1)
	Spring is fractured	Replace spring
Electric motor drones, but does not rotate, when turned on	Break of one phase	Check power supply circuit (cable, connection of ends, control board)
	Jamming of any assembly to which electric motor rotation is transferred	Detect defects of electric motor, intermediate shaft, vibrator by successive check and eliminate defect
Electric motor does not pick up speed, current drain exceeds rated current	Total static moment of out-of-balance weights has high value, does	Reduce static moment of out-of-balance weights by one or more steps so that current of electric motor does

Trouble	Probable causes	Remedies
	not correspond to mass of item being driven	not exceed rated one
	Excessive amount of oil is poured into vibrator housing	Check amount of oil, drain excessive amount
Vibrator suspension spring is fractured	Excessive force of removal of piles, operation with large amplitude of vibrator vibration	Replace spring Monitor removing force Reduce static moment of out-of-balance weights
Horizontal chains vibrate excessively in operation	Chains are stretched	Pull chains by displacing intermediate shaft in horizontal direction. Replace chains if they are stretched excessively.
Knock in head cap assembly	Slackening of connection of head cap to vibrator	Tighten bolts securing head cap and lock them
With electric motor turned on, electric shock is experienced when sheet pile	Electric motor insulation breakdown, contact of current-carrying	Stop immediately work, disconnect machine from power supply line and call electrician in order to elimi-

Trouble	Probable causes	Remedies
or Vibratory Pile Driver is touched or spark is formed when movable sheet pile touches pile that has been driven	conductor with housing of terminal box of electric motor, break of circuit of neutral or earthing	nate trouble
Strong heating of vibrator housing	Excess or lack of oil in housing, failure of bearings of shafts of out-of-balance weights	Check amount of oil and add oil, if necessary, check bearings of shafts, lubricate or replace them, if necessary
Insufficient sheet pile clamping force	Lack of oil in hydraulic tank, relief valve is adjusted incorrectly	Check oil and add it into tank, if necessary, re-adjust relief valve
Clamping of sheet pile is insufficient or is weakening	Leakage of oil through connection from hydraulic cylinder to hydraulic lock, leakage of oil in non-return valve of hydraulic lock, Leakage of oil in hydraulic cylinder	Perform check and tighten nuts, pipe connections, if leakage is detected in connections of oil pipeline; repair or replace hydraulic lock, if leakage is in hydraulic lock; replace sealing ring, if leakage is in hydraulic cylinder

13. MAINTENANCE

13.1. The normal and failure-free operation of the Vibratory Pile Driver depends, to a great extent, upon its correct service, systematic maintenance and opportune repair.

13.2. The maintenance of the Vibratory Pile Driver is performed by the persons operating it with the help of specialists in repair and servicing of buliding machines (electricians, locksmiths), if necessary.

13.3. The following types of maintenance are established:

- mainenance No. 1 (for every shift);
- maintenance No. 2.

13.3.1. The shift maintenance is carried out before the beginning of the work. Perform the following works at the beginning of the shift:

- check up all threaded connections, tighten them, if necessary;
- check up the tension of the driving chains and adjust it, if necessary, clean them from dust, dirt with washing by means of kerosene;
- coat the chains with a thin layer of synthetic grease in accordance with [illegible] or its substitutes;
- inspect the springs and the welded seams for defects;
- check up the state of securing and connection of the electric cables;
- check up the state of the oil pipelines and their connectiors;
- check whether lubricant is in the friction assemblies, lubricate them, if necessary;

- check up the oil level in the tank of the pumping unit and in the vibrator, add it, if necessary.

Lubricate the friction assemblies and the rolling-element bearings with grease ЦИАТИМ-201 in accordance with [illegible] or its substitutes - universal middle-smooth grease УС-I, УС-2 in accordance with [illegible] as well as other equivalent greases.

Fill the vibrator with transmission tractor oil with additive agent ЭФО ТЭ-I5-ЭФО in accordance with [illegible] or its substitutes:

- industrial oils И-20А, И-30А, И-40А, И-50А in accordance with [illegible];

- compressor oil К-12 in accordance with [illegible] as well as other equivalent oils.

Utilize all-season oil МТОТИ in accordance with [illegible], oil АМГ-I0 in accordance with [illegible] or other equivalent oils as the working fluid for the hydraulic system, taking into account the seasonal properties of the oil used;

- check up the state of the inserts and replace them, if necessary;

- check up the adjustment of the relief valve.

13.3.2. Maintenance No. 2 is performed in every 100 operating hours.

Carry out the following works:

- open all side covers of the vibrator housing and of all bearings;

- remove the driving chains;

- drain the oil and wash internal devices and external frictioning components with kerosene;

- inspect visually with great care gears, out-of-balance

weights, arresters, shafts, bearings, suspension hinges, sprockets, chains and threaded connections.

Replace components that have become unfit for use with new ones.

Carry out the arrester replacement through the windows in the vibrator housing. For this purpose, recess the spring-loaded arrester by means of a small crowbar, insert a second small crowbar into the out-of-balance weight hole and, holding the gear, turn the out-of-balance weight with the arrester towards the groove in the gear rim, that is closed with the cleat bolted to the gear. Withdraw the cleat and, closing the arrester hole with a finger, take the arrester pushed out by the spring from its nest.

Reverse the procedure to re-install the arrester.

The driving chains undergo a careful treatment in the following manner:

- put the chains into the kerosene bath for 8 to 10 hours;
- wash them in kerosene and, after wiping, dip them into grease with graphite additive heated up to + 40 °C to 50 °C; try that it penetrates into the hinges of the bush and the roller by multipe drawing of the chain through the grease. Hang the chains treated in the grease for cooling and draining of exceesive grease into the bath;
- close all vibrator covers and secure them by means of bolts with reliable locking, then pour clean oil into the vibrator housing up to the desired level;
- put the chains and adjust their tension.

To adjust the tension of the chains, proceed as follows:

- pull the horizontal branches of the chain transmissions so that the total deflection of the upper and lower branches be not

over 15 mm;

- check up the tension of the vertical chain by depressing one of the branches; the deflection should be not over 5 mm.

Take care that the vertical chain is not twisted on the sprockets. In order to eliminate the twisting, the sprocket on the electric motor can be slightly displaced to the shaft end and thoroughly locked by the setting screw.

For the hydraulic system:

- drain the oil from the hydraulic system;

- withdraw the oil tank, wash it with kerosene and re-install it;

- fill the hydraulic system with oil.

13.4. Repair instructions.

13.4.1. Intervals and content of the repairs are defined by the intensity of operation. The scheduled repairs involve the replacement of sealing rings, rings, inserts, sprockets, bearings, gears in the event of their substantial wear hindering the normal operation (for example, increase in the current consumed by the electric motor).

13.4.2. General disassembling - reassembling of the Vibratory Pile Driver:

- withdraw the pins and remove the suspension, withdraw the casings, slacken the chains, withdraw the clamps of the electric motor, the electric motor, the pumping unit, the bracket with the intermediate shaft. Turn the Vibratory Pile Driver so that the plate is below, unscrew the nuts on the rods and withdraw the vibrator.

Reverse the procedure to reassemble the machine; when the nuts are tightened on the rods, the size 670 mm (see FIG.1) should be

provided while the chains should be pulled as described in Clause 11.2.4.

13.4.3. Disassembling - reassembling of vibrator:

- drain the oil from the vibrator;

- withdraw all covers, sprockets;

- press out the shafts as shown in FIG. 2, the toothed wheels together with the out-of-balance weights being removed from the housing as separate assemblies;

- mark the mutual arrangement of components of every assembly, paying attention to the mutual arrangement of the gears and the out-of-balance weights and to the setting of the out-of-balance weights for various levels of the disturbing force.

Reverse the procedure to reassemble the vibrator.

After the reassembling is finished, pour the oil into the vibrator to the desired level.

13.4.4. Disassembling - reassembling of head cap:

- remove the head cap and place it on pads with the plate facing downwards;

- unscrew the lock screws through the holes in the left-hand jaw (FIG. 6). Screw, in turn, the bolts into the threaded holes of rings "5" and "6" and withdraw the rings from the nests. Remove split ring (sliding block) "11"in parts;

- disconnect the oil pipelines and withdraw the hydraulic lock;

- diconnect the hydraulic cylinder from the head cap housing.

13.4.5. Disassembling - reassembling of hydraulic cylinder:

- disconnect the bolts securing cover "6" of FIG. 7;

- withdraw cover "6", sliding blocks "5", cover "4" and the piston with the rod.

Reverse the procedure to reassemble the head cap.

13.4.6. Press out the pins securing the inserts from the hydraulic cylinder rod and the left-hand jaw of the head cap by means of a knock-out and withdraw the inserts. For replacement of the inserts in the assembled Vibratory Pile Driver:

- press out the pin from the left-hand jaw, withdraw the insert;

- turn on the head cap cylinder for clamping, move the rod until it bears against the left-hand jaw, press out the pin from the rod, move the rod into the hydraulic cylinder by approximately 15 mm and withdraw the insert.

Reverse the procedure to reinstall the inserts.

After the reassembling of the Vibratory Pile Driver is finished, pour the oil into the oil tank and the vibrator to the desired levels.

Lubrication chart

Lubrication point	Grade of lubricant	Method of lubrication and amount of lubricant	Intervals of lubrication
Vibrator housing	Industrial oil И-20А, И-30А, И-40А, И-50А in accordance with	Pour 6 liters	Change of lubricant in every 100 operating hours, continuous monitoring
	Compressor oil К-12 in accordance with		
Two-row chains	Fat grease I-I3 in accordance with Synthetic grease	Drawing of chains in grease heated up to 50° with gra-	Surface lubrication without dismantling every shift, lubrication by coating

Lubrication point	Grade of lubricant	Method of lubrication and amount of lubricant	Intervals of lubrication
	in accordance with	phite additive	and heating every 10 operating hours
Four-row chain	Ditto	Ditto	Ditto
Bearings of electric motor and intermediate shaft	ЦИАТИМ-201 in accordance with	Fill bearing housing by 3/4th of volume	Twice a year
Oil tank and hydraulic system	All-season oil МТОТМ in accorance with, oil АМГ-10 in accordance with or other equivalent oils	Pour 7 liters	At least once a month

14. PRESERVATION

14.1. Prior to storage for a long time (over one month) the the Vibratory Pile Driver should undergo the preservation.

14.2. Prior to the preservation, clean thoroughly the Vibratory Pile Driver from dust, dirt, corrosion and oil, restore da-

maged coatings. The cleaning of the Vibratory Pile Driver should be carried out by a method excluding any damage to the working surfaces of assemblies and mechanisms and to the protective coatings applied.

14.3. Utilize the following lubricants for the preservation:

For storage during one to six months:

- for the hydraulic system: the working fluid (see Clause 13.3.1). (Fill completely the entire hydraulic system);

- for the vibrator: the working fluid (see Clause 13.3.1);

- for the friction surfaces and the surfaces not protected with coatings: press cup grease C in accordance with GOST 4366-76;

For storage during a period over six months:

- for the hydraulic system: the working fluid;

- for the vibrator: lubricant K-17 in accordance with GOST 8581-78;

- for the closed friction assemblies and the mechanisms which are not accessible for preservation without disassembling: cup grease УС-1, УС-2 in accordance with GOST 1033-79;

- for the open friction assemblies, the surfaces not protected with coatings: lubricant ПВК in accordance with GOST 19537-74, lubricant АМС-3 in accordance with GOST 9142-78 or other equivalent lubricants.

15. STORAGE

15.1. If there are interrupts in the operation of the Vibratory Pile Driver, the latter should be placed for storage.

15.2. The following types of storage are established:

- a short-term storage - up to one month;

- a long-term storage - over one month.

15.3. For the short-term storage, the Vibratory Pile Driver may be arranged outdoors, but be covered with a canvas.

15.4. For the long-term storage, the Vibratory Pile Driver should undergo the preservation, the electrical equipment should be withdrawn and given for storage in a dry, heated room. The Vibratory Pile Driver should be stored in a closed room or under a shelter. It should be placed on wooden blocks.

The storage time without re-preservation is established to be not over 3 years.

15.5. An entry should be made in the Log-Book about the fact that the Vibratory Pile Driver is placed for storage.

16. TRANSPORTATION

The Vibratory Pile Driver may be transported by any type of transport provided the rules established are complied with.

16.1. The transportation to the work site may be performed without packing by a crane whose load-carrying capacity should be at least 5 tons, by a truck or other vehicle. For transportation by a truck the machine should be loaded and secured to prevent any damage to the board and the hydraulic equipment of the head cap.

16.2. For transportation from site to site widely separated by a truck, the requirements of Clause 16.1 should be met. For transportation by other types of transport the Vibratory Pile Driver should be placed as shown in Dwg. B401.17.00.00.

LIST OF ENCLOSED DRAWINGS

B401A.01.02.011	Toothed wheel
B401A.01.02.012	Toothed wheel
B401A.01.02.008	Arrester
B401A.01.00.012	Sprocket
[illegible]	[illegible]
B401A.02.00.005	Sprocket
B401.15.00.01	Four-row sprocket
B401A.11.00.001	Insert
B401A.11.00.005	Insert
B401A.01.02.009	Spring
H12-06	Spring
СТШ3II03-24-75	High-pressure hose 12 x 500
B401.17.00.00	Packing of Vibratory Pile Driver

B401A.00.00.000Г3	Hydraulic diagram
B401A.00.00.000Э3	Circuit diagram
B401A.00.00.000Э4	Wiring diagram