



НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

Metal-cutting machines. Lecture 8.

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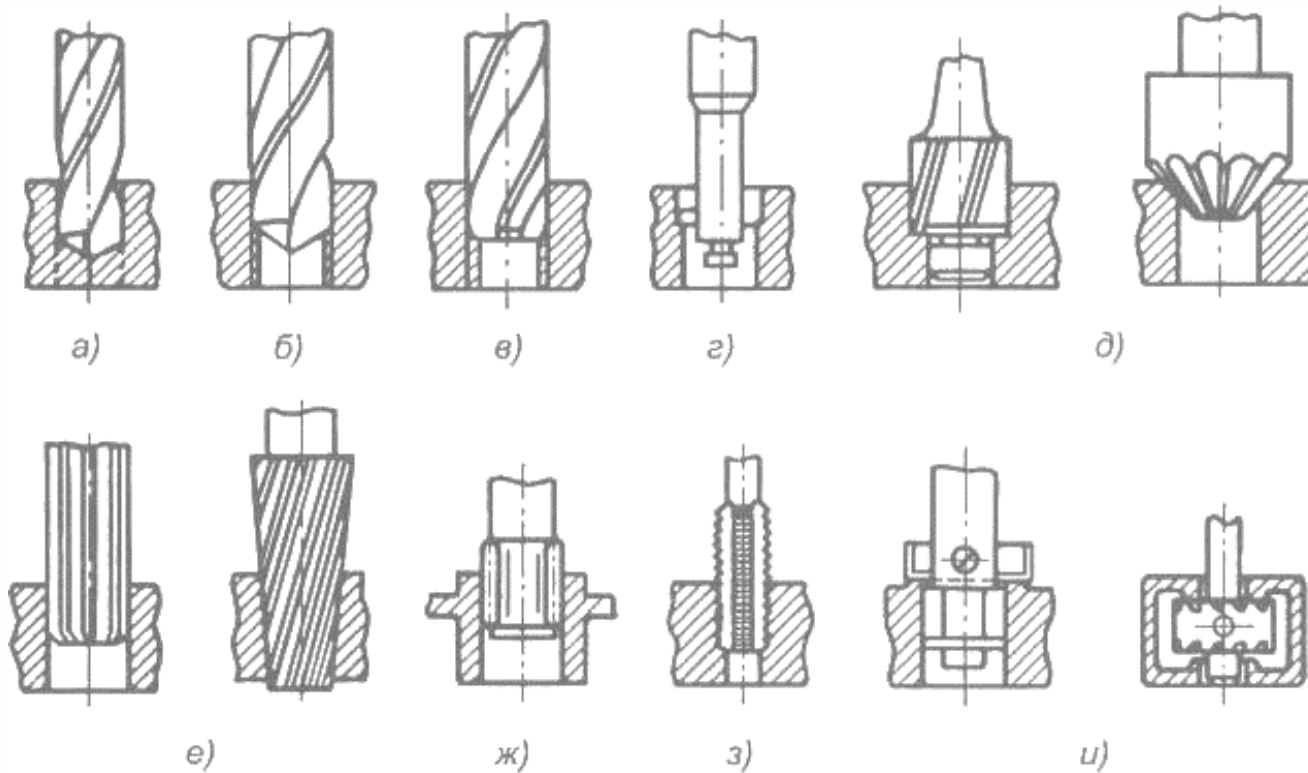


Drilling and boring machines

Designed for the following operations:

- drilling of through and blind holes, while ensuring the precision parameter of not lower than 12-13 and quality of $Ra = 6,3...15$ microns;
- reaming of holes – increases the diameter of the twist drill;
- sinking, allowing us to obtain higher quality and a smaller value of the roughness parameter of the surface of the hole compared to drilling – accuracy 11-13 quality class, $Ra = 10...15$ mm;
- bore by the cutter on the drilling machine;
- countersinking performed to obtain the holes of the cylindrical and tapered holes and chamfers under heads of bolts and screws;
- reaming the holes used to obtain the required parameters of accuracy (7... 11 quality) and roughness ($Ra = 1,25...5$ μm);
- the smoothing produced by a special roller bars, or beading with the appointment of seal – smoothing ridges on the surface of the hole after deploying parts from aluminum and other soft metals and alloys;
- Tapping a tap;
- counter-boring – trimming the ends of external and internal tides and bosses.

Drilling and boring machines



Operation performed on drilling machines: a) drilling holes; b) boring; c) – core; d) boring; d) – countersinking; e) deployment; g) pressing; h) – cutting of internal thread; i) – zachowanie.

Main types of drilling and boring machines:

- vertical drilling;
- single and multi-spindle semi-automatic machines;
- radial drilling;
- jig boring;
- horizontal boring;
- horizontal drilling for deep drilling.

The main parameters of the cutting conditions when drilling:

- supply;
- cutting speed;
- the depth of cut.

Feed when drilling movement of the drill along the axis for one turn (or for one revolution of the workpiece, if it rotates).

The following types of filing for drilling:

S_0 - per revolution of drill bit, mm/Rev;

s – feed rate, mm/min.



Vertical drilling machines are mainly used in single and small batch production for making holes in various materials as well as thread-cutting taps, for which they provided special cartridges.

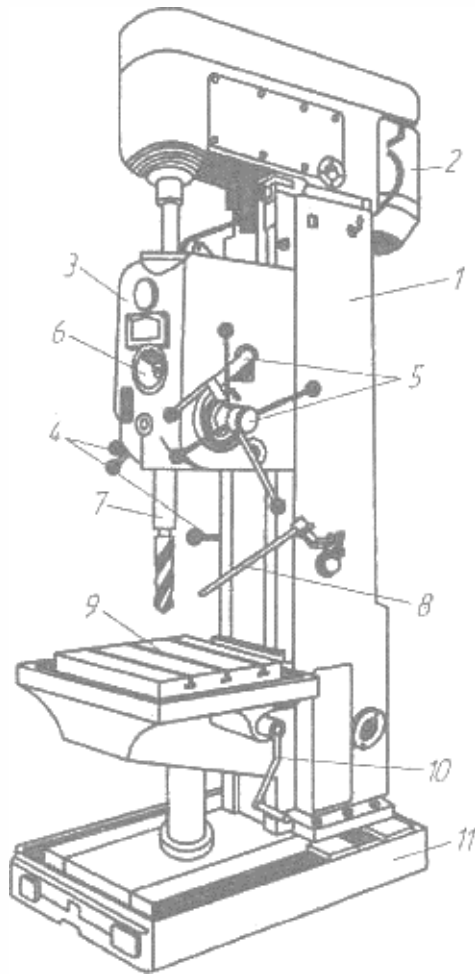
In case of necessity the universal machines of this group are provided with appropriate devices and can be used in series and even mass production.

Currently all layouts drilling machines all of the mechanisms responsible for rotational and translational motion, combined in one drilling head with individual drive.

The Size range of vertical drilling machine can be divided into three groups:

- light table – diameter of 3, 6, 12 mm;
- medium size – diameter 18, 25, 35, 50 mm;
- heavy – of a diameter more than 50 mm.

Vertical drilling machines



Vertical drilling machine:

- 1 – a column (hour);
- 2 – the motor;
- 3 – drilling head;
- 4 – arm switching boxes speeds and feeds;
- 5 – the helm manual feed;
- 6 – limbo control of treatment depth;
- 7 – spindle;
- 8 – nozzle cooling;
- 9 is a table;
- 10 – arm lift table;
- 11 – base plate.

Vertical drilling machines

The main movement in vertical drilling machines is the rotation of the spindle with a permanently attached tool.

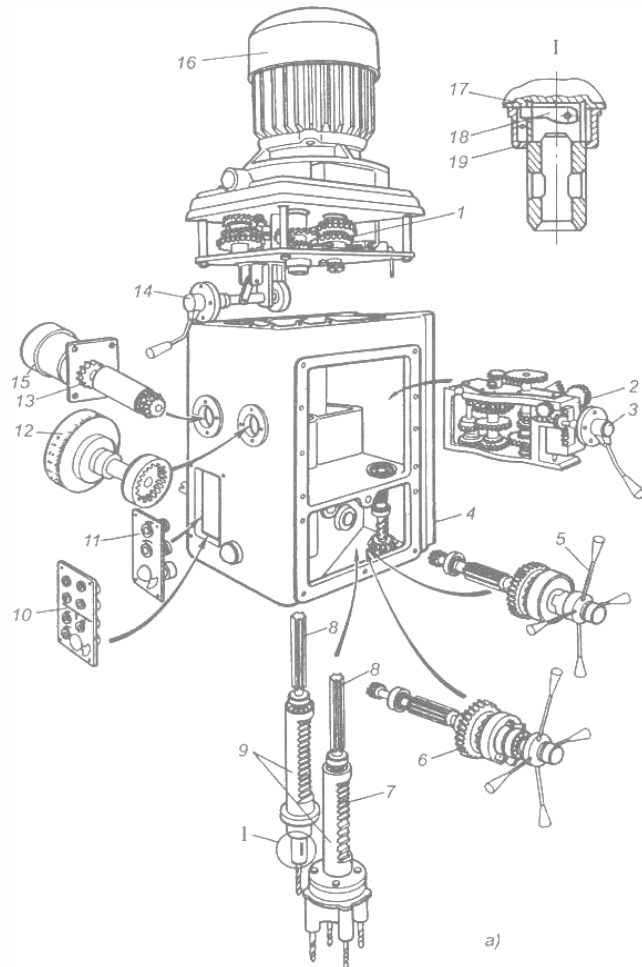
The movement of the feed in machines of this type carried out by vertical movement of the spindle. The workpiece is usually mounted on the machine table.

The alignment of the bore of the workpiece and the spindle is obtained by movement of the workpiece.

Drilling head consists of an iron casting on which are mounted the box of speeds and feeds, and intra – spindle and control mechanisms. The spindle is mounted on two ball bearings in the sleeve to ensure traffic flow.

Drilling head vertical drilling machine usually installed at the front and has a vertical movement. Also, on some machines, can be moved vertically and the table on which the workpiece is fixed.

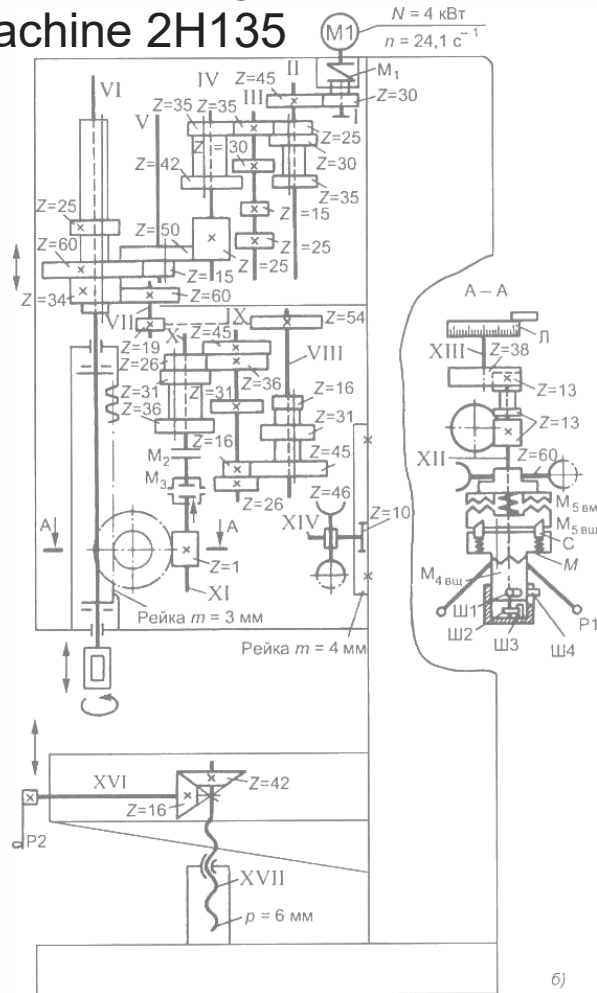
Vertical drilling machines



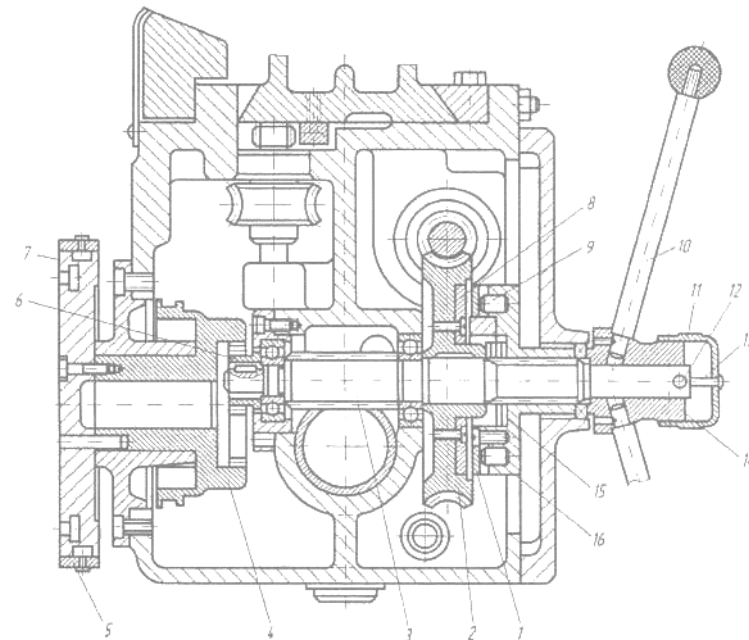
General view of the drilling head of the machine mod. 1H125 (2H135):

- 1 – gearbox;
- 2 – the feed box;
- 3, 5, 14 – arms control;
- 4 – piece drilling heads;
- 6, 7, 9, 13 – control mechanisms;
- 8 – spline spindle;
- 10, 11 control panel;
- 12 – limbo;
- 15 – electric drive accelerated movement of the spindle;
- 16 – electric motor;
- 17 – yoke;
- 18 – Cam;
- 19 – cover.

The kinematic scheme of a vertical drilling machine 2H135



The mechanism of the feed drive of the machine

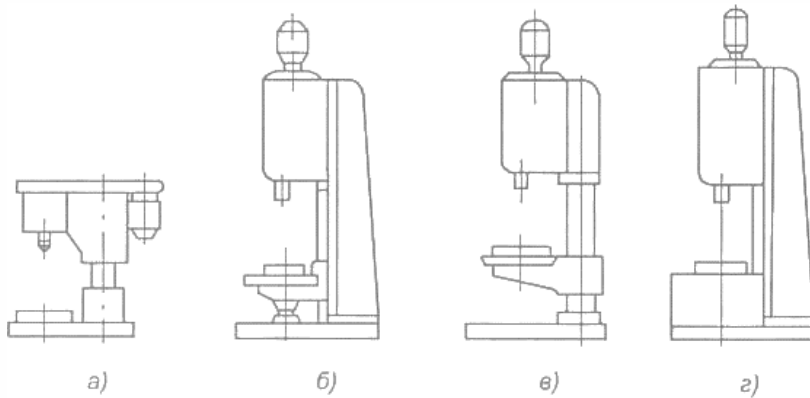


Vertical drilling machines

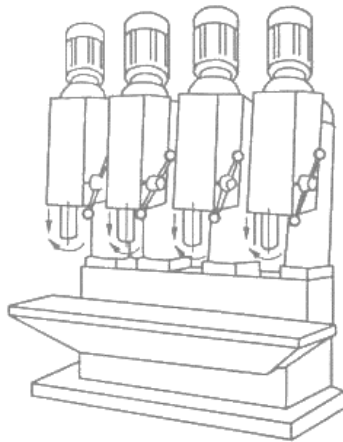
Feeder is driven by the box feeds a couple of gears and is designed to perform the following functions: manual feed of the tool and the workpiece, including labor supply, manual advance supply, including labor supply, manual removal of the spindle up, manual feed, commonly used for threading.

For a visual reference of the depth of the processing tool is adjusted manually until it makes contact with the workpiece, and the left arm with pins set the dials to the zero position. The depth of treatment count on the scale on the cylindrical surface of the limb.

Drilling head is equipped with automatic shut-off mechanism for feeding that is activated upon reaching the desired drilling depth. The machine is also provided with a system of safety devices excluding the possibility of breakage due to overload.

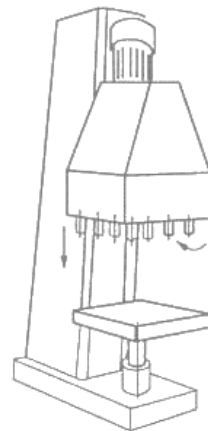


A



д)

Б



е)

Layout vertical drilling machines

(A – single-spindle;

B – multi-spindle):

a – table;

b – medium size on the box;

in – medium in size with round base;

Mr. severe;

d – machines with constant spindles having a common frame;

e – machines with adjustable

articulated by the United spindles



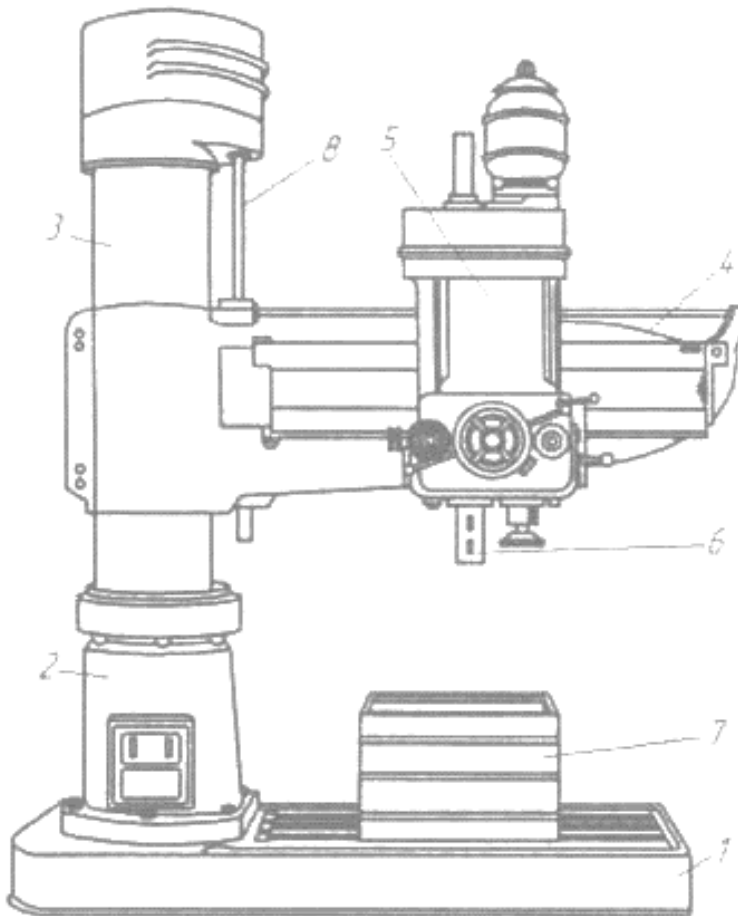
Radial drilling machines

Radial drilling machines are designed to handle a variety of holes and the surface of the end tool (drill, countersink, reamer, tap) in the major body parts. In contrast to the vertical drilling in radial drilling machines with the alignment axis of the workpiece spindle axis is achieved by movement of the spindle relative to the stationary workpiece.

When working on these machines, the item remains stationary while the spindle with a drill is moved relative to the workpiece and is installed in the desired position.

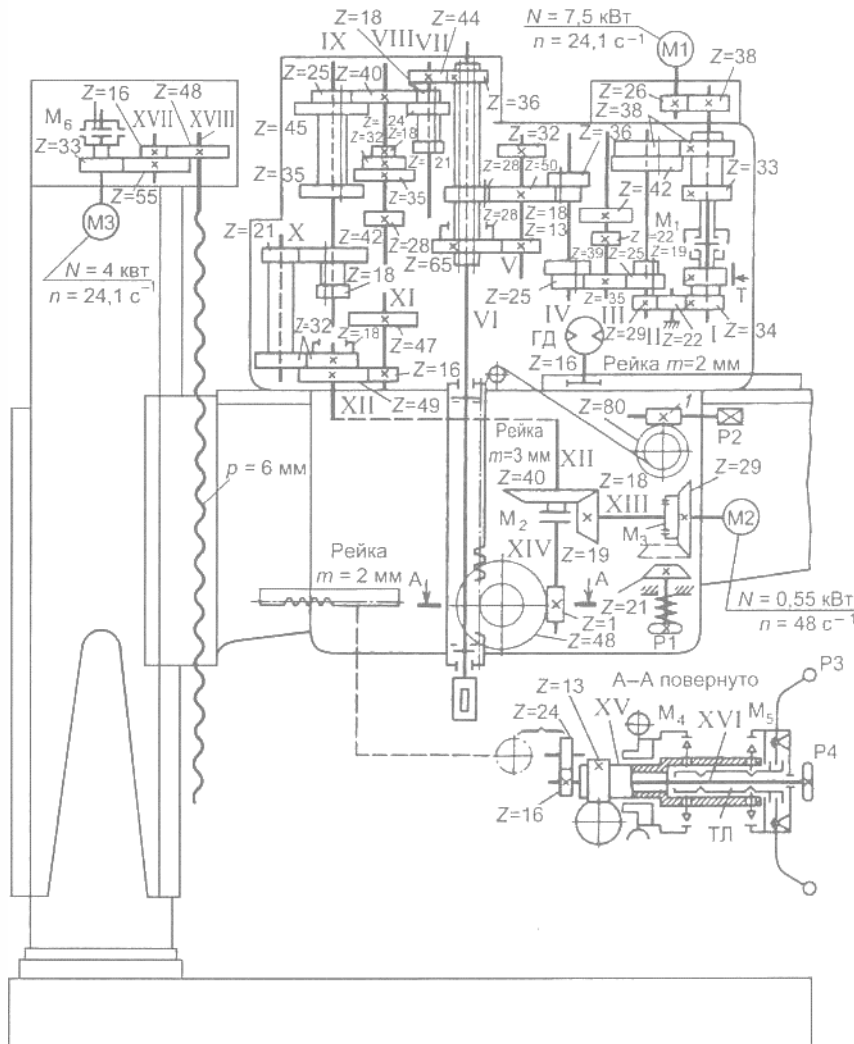
On the base plate of such a machine is equipped with a Cabinet with a fixed pillar, wearing a sleeve turning around the column by 360 °. Sleeve mounted on the cross member, which has a horizontal guide to move the drill heads. Inside the head placed a box of speeds and feeds and the site of the spindle. On the front cover are the controls.

Radial drilling machines



Radial drilling machine: 1 – plate;
 2 – stand;
 3 – column;
 4 – traverse;
 5 – spindle head;
 6 – spindle;
 7 – the table.

Radial drilling machines



Kinematic diagram of radial drilling machine mod. 2554

Boring machines

Boring machines are designed as drill, to handle the holes, usually by boring a pre-cast surfaces, firmware, etc. in addition, on boring machines, you can grind the end surface, milling of plane, cut threading, drilling and countersink.

Boring machines are divided into the following types:

horizontal boring;

coordinate boring;

diamond-boring machines (fine boring) machines.

Horizontal boring machines

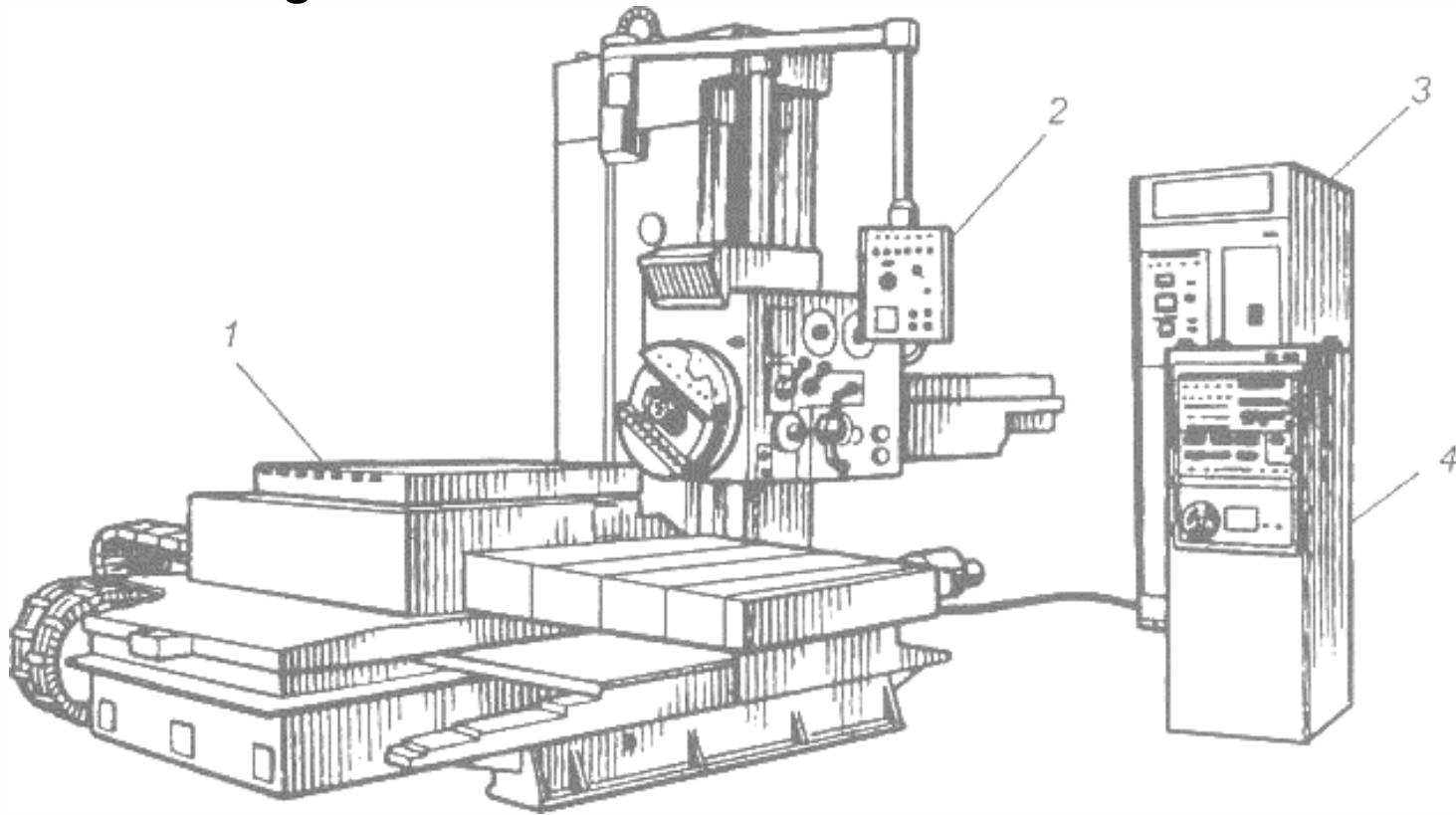
A distinctive feature of horizontal boring machines is the presence of a horizontal spindle, making the movement of the axial feed. The diameter of the extraction spindle, which defines the base size of the machine, lies in the range 80...320 mm. Used for making holes in large parts.

Main parts of horizontal boring machine is a fixed front and a rectangular rotary table, movable in longitudinal and transverse directions relative to the axis of the spindle.

In the absence of a rear rack on such machines can produce console processing of the workpieces on all four sides. The table is equipped with an automated counting device of the angle of rotation (every 90°) and an optical device for measuring the angle of rotation (through 90°). The spindle unit is mounted in high precision bearings, ensures long preservation of accuracy, improved rigidity and vibration resistance.

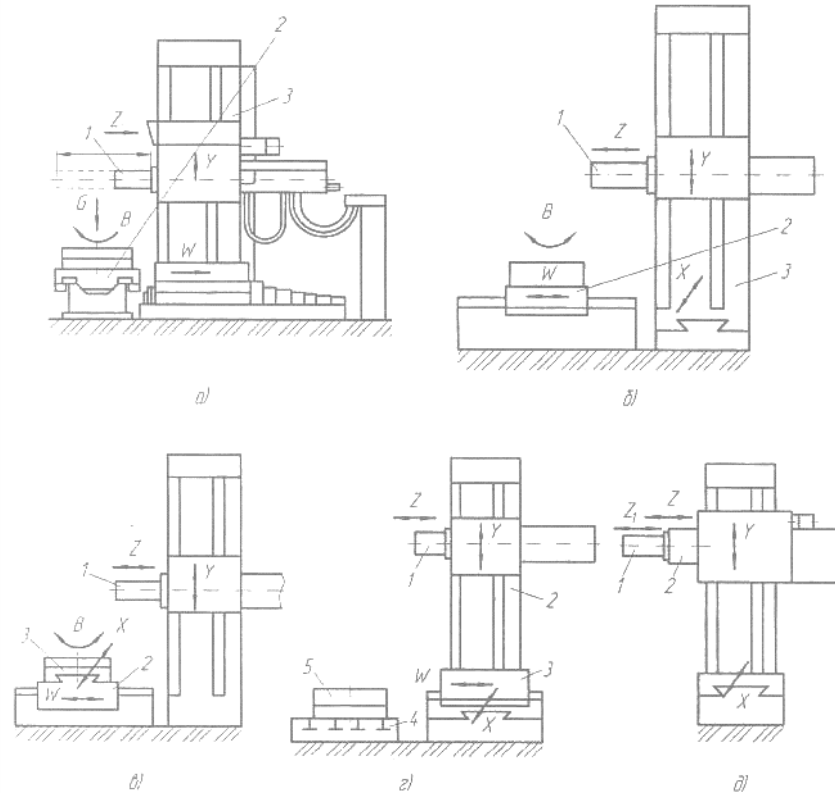
The guide frame and the slide table usually have a telescopic protection devices and automatic centralized lubrication.

Horizontal boring machines



General view of the layout of horizontal boring machine mod. 2A622Φ2-1:
1 – machine; 2 – pendant control; 3 – power switch Cabinet control; 4 – Cabinet with CNC equipment.

Horizontal boring machines



The layout of the horizontally-boring machines with additional axial displacement, carried out: a — bar; — Desk; d — tool along with stand on the sled; d — spindle



Coordinate-boring machines

Coordinate boring machines are mainly used in the processing of parts to the surfaces where high demands are placed on accuracy. The machines allow drilling and boring holes (including fine-boring*), countersink, to produce a numerical milling planes and dovetail grooves, thread cutting tap. By using an inclined-rotary table it is possible to process the holes are located at an angle to the base surfaces.

The machines can be used as measuring machines for inspection of linear dimensions in three axes, angular dimensions center distance. You can make exact markings in the form of punch, and to make the division and marking on metal surfaces.

The machines are divided into two with a vertical spindle axis and column with vertical and horizontal spindle axis (in the domestic machine tool horizontal layout is not used).

*under a thin boring understand final finishing machining of holes, performed with a diamond tool.

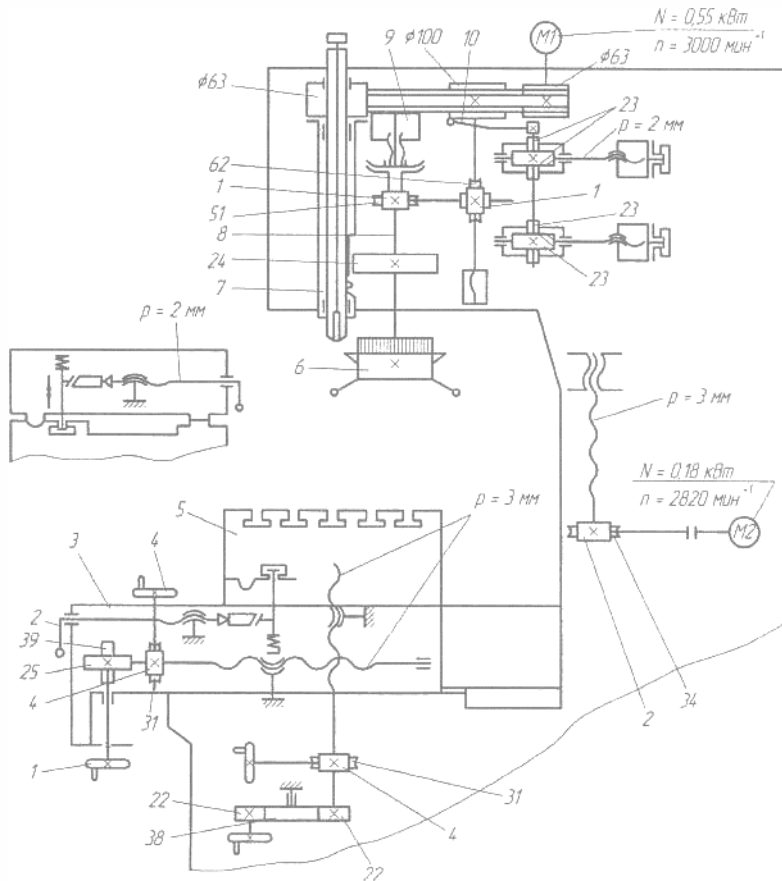


Coordinate-boring machines

Coordinate-boring machines can be used as measuring machines to check size of components and precision layout work. To avoid temperature influences on the accuracy of these machines must be installed in isolated areas where a constant temperature of 20° C.

Feature of jig boring machines is that they are equipped with optical devices allowing to count whole and fractional part of the size. Therefore, the accuracy of the reference displacement of the table does not depend on mechanisms that move the table, and is not broken when the wear of the mechanisms. In normal operation machines provide accuracy of setting the center distance in the rectangular coordinate system is 0.001, polar – 5 arc.sec.

Coordinate-boring machines



Kinematic diagram of jig boring machine