UNIT FOR CUTTING PIPES

N. I. Koshtorev, V. G. Kuznetsov, and N. A. Yakovenko

Engineers at a service company, which specializes in preventing and eliminating spouters, have developed a unit for cutting pipes of circular cross section, especially during emergency operations at the mouth of a well.

The structure of the unit (Fig. 1) consists of two main components: a housing 1 and a yoke (not shown in the figure). The housing consists of two plates 5 and 7, which contain a slit and are bolted together. The housing encloses a gear wheel 8, drive pinion 6, intermediate gear wheels 4, tool holder 2, and tool feed mechanism 3.

The main gear wheel has a boring, which allows it to be installed on slide bearings in the bottom plate of the housing. This wheel has a slit, which is of the same size as the slit in the housing and is used to guide the unit and mount it on the side of the pipe that is to be cut. The shafts of the gear wheels, which transmit torque from a hydraulic motor to the main gear wheel, are installed in slide bearings. The hydraulic motor, together with the drive pinion mounted on its shaft, is attached to the bottom plate by a flange.

A clamping ring is inserted in a boring in the top plate of the housing. To prevent vibration of the tool during work, the gaps in the slide bearings are regulated by having the ring press against the disk of the main gear wheel.

The tool holder is located on the top plate of the disk of the gear wheel and is secured by bolts that travel through threaded holes in the disk. By changing the number of holes used, it is possible to change the variant used to install the tool holder in order to cut pipes of different diameters. The tool holder consists of a slide bar that moves along a guide of the "dovetail" type.

The slide bar contains rectangular grooves to install the cutter, and it also has three holes. A feed screw is screwed through one of the holes and provides for transverse feed of the tool during cutting. The other two holes are for mounting the locking rod and carrier of the unit. The locking rod and the carrier are used to adjust the transverse motion of the tool (the depth of the cut).

The tool feed mechanism consists of a ratchet wheel, a pusher equipped with a dog, and a specially shaped ring. The ring permits reciprocating motion of the pusher. The ring varies in height about its circumference and is inserted in a boring in the bottom plate of the housing.

The pusher consists of a casing, the dog, a roller, two shafts, and springs. The springs press the dog against the ratchet wheel during the operation of the unit. The pusher is installed in a guide bushing, which is pressed into the disk of the gear wheel, next to the ratchet wheel. The bottom part of the pusher rests on the shaped ring through the intervening roller. The dog, which provides for rotation of the ratchet wheel, is installed on a shaft in the top part of the housing above the gear-wheel disk. The pusher is pressed against the shaped ring by a spring that acts through a bracket. The screw along which the bracket moves has a section that prevents the pusher from rotating during the operation of the unit.

A post located on the top surface of the disk of the main gear wheel has a slit which permits the movement of a spring-opposed catch. The post also has two holes, one for the feed screw and one for the locking rod. When the spring is compressed, the catch enters a channel on the feed screw and prevents its axial movement during cutting. The catch is fixed in position by the rod during this time. The ratchet wheel is mounted on the feed screw by a pin, and the body of the ratchet wheel contains a spring which forces back the tool holder. The end of the feed screw has a head, which is used to move the screw manually.

The housing is installed on the yoke by means of three fingers welded to the housing's bottom plate. The fingers have a smooth cylindrical surface for seating them in the assembly holes in the yoke. The fingers also have threaded channels to secure the housing with the aid of nuts.
Assembly and Operation of the Unit. First the yoke is mounted on the pipe which is to be cut. The yoke can be mounted in one of two variants.

In the first variant, the unit is mounted and operated under conditions not associated with extreme situations (blowouts, spouters, fires, etc.). The yoke is placed on the pipe, and a nut on a swing bolt is used to set the desired gap between the cramps of the half-yokes. Then thrust bearings are pressed against the pipe by means of adjusting screws. Here, the axis of the pipe is aligned with the axes of the assembly holes used to install the housing of the unit.

In the second variant for mounting the yoke, the possibility of operation of the unit under emergency conditions is taken into account. In this case, the axes of the pipe and the holes are aligned on a template (a pipe having the same dimensions as the pipe being cut). The unit is mounted on the pipe by tightening the nut on the swing bolt until a gap of the specified size exists between the cramps of the half-yokes.

Then the fingers on the bottom plate of the unit are used to install the housing on the yoke. The nuts on the housing are used to tighten it against the yoke. The hydraulic motor is connected to a hydraulic power system, which supplies it with hydraulic fluid. The rotation of the motor shaft is transmitted through the intermediate gear wheels to the main gear wheel, which begins to rotate around the pipe. The intermediate gear wheels are positioned so that they engage the main wheel at two points. Thus, torque is continuously transmitted to the main wheel from the hydraulic motor, despite the presence of the slit in that wheel.

The tool holder and the tool feed mechanism rotate around the pipe together with the main gear wheel. The roller of the pusher simultaneously rolls around the specially shaped ring, while the body of the pusher undergoes reciprocating motion. The dog attached to the body of the pusher rotates the ratchet wheel one tooth for each revolution of the main gear wheel. The feed screw rotates with the ratchet wheel, pushing the slide bar of the tool holder along with the tool. Thus, the cutter is fed in the transverse direction during the cutting operation.

The tool holder and the carrier, secured in a hole in the holder, both move together with the slide bar. The position of the carrier can be controlled and fixed by means of a set screw. The regulated gap between the end of the carrier and the head of the locking rod ensures the required depth of cut, since after the gap has been chosen (during the movement of the slide bar) the carrier begins to force the locking rod out of the hole in the catch. The freed catch is moved away from the feed screw by a spring, and the same spring then moves the screw away from the post. This action in turn moves the slide bar of the tool holder, i.e., the tool is removed from the cutting zone. After the cutting operation has been completed, the rotation continues until