Drill apparatus having a special drill bit with means for drilling a hole into the sidewall of a tube and upon withdrawal of the bit, for forming a flange around the drilled hole. Pins for forming the flange are movable in bores passing crosswise through the drill bit. When the rotating tip portion of the drill bit is withdrawn from the hole, the pins project from the drill bit to cause a flange encircling the hole to be formed.
AUTOMATIC FLANGING DRILL APPARATUS

The present invention concerns an automatic flanging drill apparatus for drilling a hole in the side of a tube and raising a flange encircling the hole, the apparatus comprising a drill bit and flanging means associated with this bit, which can be made, with the aid of an adjusting means, to protrude from the drill bit below the edges of the hole after the hole has been drilled, and means for withdrawing the flanging means from the hole while they are rotating.

A manually operated flanging drill apparatus of the type described is previously known from the same applicant's U.S. Pat. No. 3,592,038. The apparatus has proved highly useful and as a consequence there has arisen a need to automate the operation of the apparatus so that it becomes possible to make flanged holes in the sides of tubes with great speed in series production.

The first object of the invention is to accomplish an automatically and swiftly operating flanging drill apparatus.

The second object of the invention is to accomplish an automatically operating flanging drill apparatus having the feature of easy adjustment of its operation as well as of the tolerance of the flange.

These aims are attained with a flanging drill apparatus according to the invention, mainly by virtue of the characteristics appearing from the attached drawings.

The invention is described in the following more closely, with reference to the attached drawings, wherein

FIG. 1 presents the drill bit portion of the apparatus in a vertical section, and
FIG. 2 shows the drill bit portion of the apparatus seen from above.

FIG. 3 shows a flanging drill apparatus according to the invention in elevational view.

FIG. 4 shows the section along the line IV—IV in FIG. 3, and
FIG. 5 shows the section along the line V—V in FIG. 3.

FIG. 6 shows schematically a double-acting piston-and-cylinder means belonging to the flanging drill apparatus.

The drill bit portion of the drill apparatus comprises a drill bit 1 and the flanging means 2. The flanging means 2 consists of pins movable in bores passing crosswise through the drill bit. With the flanging means 2 retracted in the drill bit 1, a hole is drilled into the side of the tube until the stop enlargement 4 meets the edges of the hole. By subsequently turning the adjustment means 6 of the flanging means 2 about the drill shank 5, the flanging means 2 can be made to project from the drill bit, whereby when the rotating tip portion of the drill is withdrawn from the hole a flange 3 raised by the pins 2 and encircling the hole will be formed.

The adjustment means 6 has in its conical surface helical grooves 7, in which the projections 8 of the flanging means 2 engage. If follows that rotation of the adjustment means 6 about the drill shank 5 causes a movement of the flanging means 2 in their axial direction. At the same time the angle of rotation of the adjustment means 6 determines the amount by which the flanging means 2 project.

By the aid of the spiral spring 9 the adjustment means 6 is normally held in a position in which the flanging pins 2 are retracted into the drill bit 1. In this case a stop 12 affixed to the drill bit shank 5 rests against a stop 10 affixed to the adjustment means 6 (FIG. 2). When, while the drill bit portion of the apparatus is rotating, the adjustment means 6 is braked in a manner which will be understood later, the adjustment means 6 will rotate with reference to the drill bit 1,5 against the force of the spring 9 until the stop 12 meets the second stop 11 of the apparatus. By means of the adjustment screw 13 the angle may be accurately set through which the adjustment means 6 will rotate with reference to the drill bit 1,5. This enables the tolerance of the flange 3 to be accurately fixed.

The drill bit portion described above is mounted in a drill apparatus illustrated by FIG. 3. To a conventional drill press 14 an ancillary attachment 15 has been added, by the aid of which the rotational motion of the drill press is also translated into a feed motion of supporting legs 16, which are movable with reference to the frame of the apparatus. This is necessary so that after the hole has been drilled the drill apparatus can be pulled up from the hole, together with its enlarged flanging means 2. The feed motion of the supporting legs 16 has been accomplished in the manner illustrated in FIG. 4, so that a nut member 17, split to bipartite, can be engaged with the rotating stem 18, which carries a left-handed thread. The nut components 17 are guided in slideways 19 integrally connected with the supporting legs 16. Normally, the spring 20 keeps the nut components 17 disengaged from the thread on the stem 18. This enables the legs 16 to move freely in their axial direction in their slideways in the frame of the apparatus 15. The linkage mechanism moving the nut components 17 is in the position illustrated by dot-and-dash lines.

The feed motion of the legs 16 is engaged by pulling the wire 21, whereby the linkage mechanism seen in FIG. 4 causes the pins 22 to be pushed towards each other and the nut components 17 to be pressed around the threaded stem 18. The pins 22 have been attached by threads to pins 23 turnable about a vertical axis, whereby the position of the nut components 17 can be accurately adjusted. Although, owing to the design of the linkage, the path of motion of the fixing pins 23 deviates from the axial path of the pins 22, this has no practical significance because the movement of the pin 22 is minimal (for instance, 1 mm).

In FIG. 5 a U-shaped friction brake 24 can be seen, by the aid of which a braking of the adjustment means 6 is affected for the purpose of expanding the flanging means 2 from the drill bit. By a pull exerted on the wire 25 the friction brake 24 is made to press against the periphery of the adjustment means 6. FIG. 6 shows a hydraulically or pneumatically operating, double-acting piston-and-cylinder means, with the piston rod 26 of which the wires 21 and 25 are connected. When pressurised fluid is conducted into the part of the cylinder 27 on the side of the piston rod, the piston rod 26 will pull the wires 21 and 25, with the consequence that with the friction brake 24 operating the flanging means 2 are expanded, immediately followed by the engagement of the feed motion of the supporting legs 16.

The control of the piston-and-cylinder means 26, 27 takes place automatically by means of a two-position control valve 28, by the aid of which pressure can be alternatingly applied to both sides of the piston. To the lower knob 31 of the control valve 28 an actuating rod
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3. Apparatus according to claim 1, characterized in that the flanging means (2) consist of pins moving in bores passing crosswise through the drill bit (1) and the motion of which is controlled by an adjustment means (5) rotatable about the drill shank (5) within certain limits against the force of a spring (9) and in grooves (7) on the conical surface of which projections (8) of the flanging means engage, and that with the adjustment means (6) a friction brake (24) controlled by said control valve (28) is connected, by the aid of which friction brake the adjustment means (6) can be rotated with reference to the drill bit (1), against the force of the spring (9) in order to expand the flanging means (2) from the drill bit (1).

4. Apparatus according to claim 2 characterized in that the stop (12) restricting the rotation of the adjustment means (6) has been provided with an adjustment screw (13) for fixing the tolerance of the flange.

5. Apparatus according to claim 3 characterized in that the spring (9) is a spiral spring, one end of which is attached to the adjustment means (6) and the other end to the drill shank (5).

6. Apparatus according to claim 1 characterized in that a first control means (3) is an actuating rod moving along with the frame (14) of the drill apparatus and which when it meets the surface of the work piece delivers an actuating pulse to the control valve (28).

7. Apparatus according to claim 1 characterized in that a second control means (34) has been attached to the movable supporting legs (16) and arranged to deliver to the control valve (28) a return pulse.

8. Apparatus according to claim 7 characterized in that the control valve (28) controls a double-acting piston-and-cylinder means, to the piston rod (26) of which wires (21, 25) have been attached, one of which (21) connects with a linkage mechanism opening and closing a bipartite feed nut (17) and the other (25) connects with the friction brake (24) of the adjustment means (6).

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