United States Patent

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[54] AUTOMATIC MACHINE FOR PREPARING THE ENDS OF METAL PIPES FOR THE DRAWING OPERATION

2 Claims, 2 Drawing Figs.

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[51] Int. Cl. B21d 41/00
[50] Field of Search 72/296, 306, 370, 371, 386, 393, 394, 399, 400, 401, 402, 403, 404

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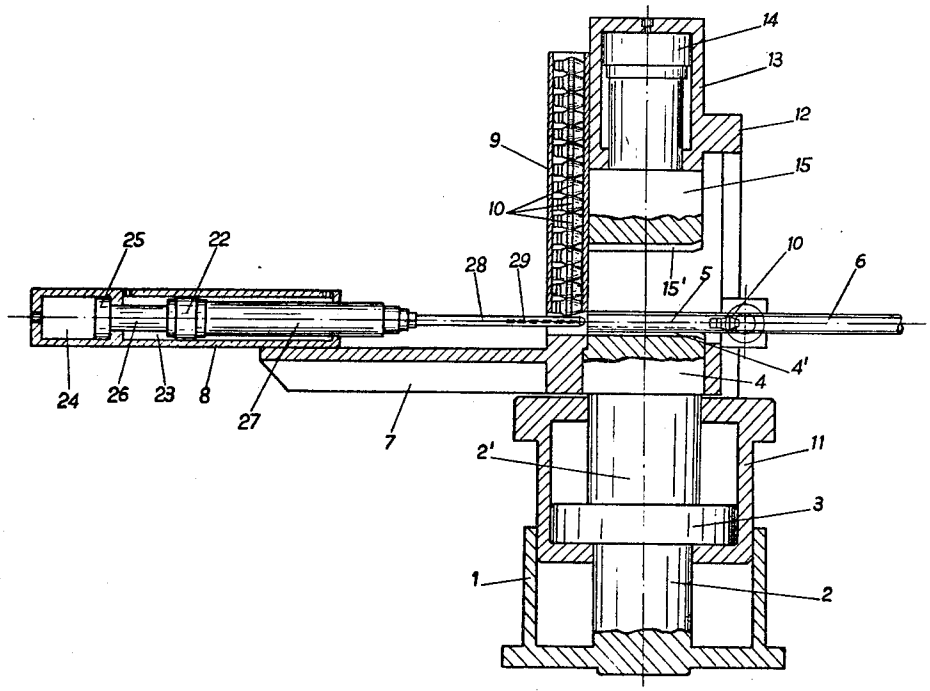
ABSTRACT: A machine which automatically performs the operations for preparing the extremities of metal pipes prior to drawing is disclosed. The machine introduces lubricating oil and a drawing mandrel to the inside of the pipe, produces one or more dents on said pipe, to stop and position the said mandrel and forms the extremity of the pipe to the desired shape and dimensions required by the pipe-drawing machine.



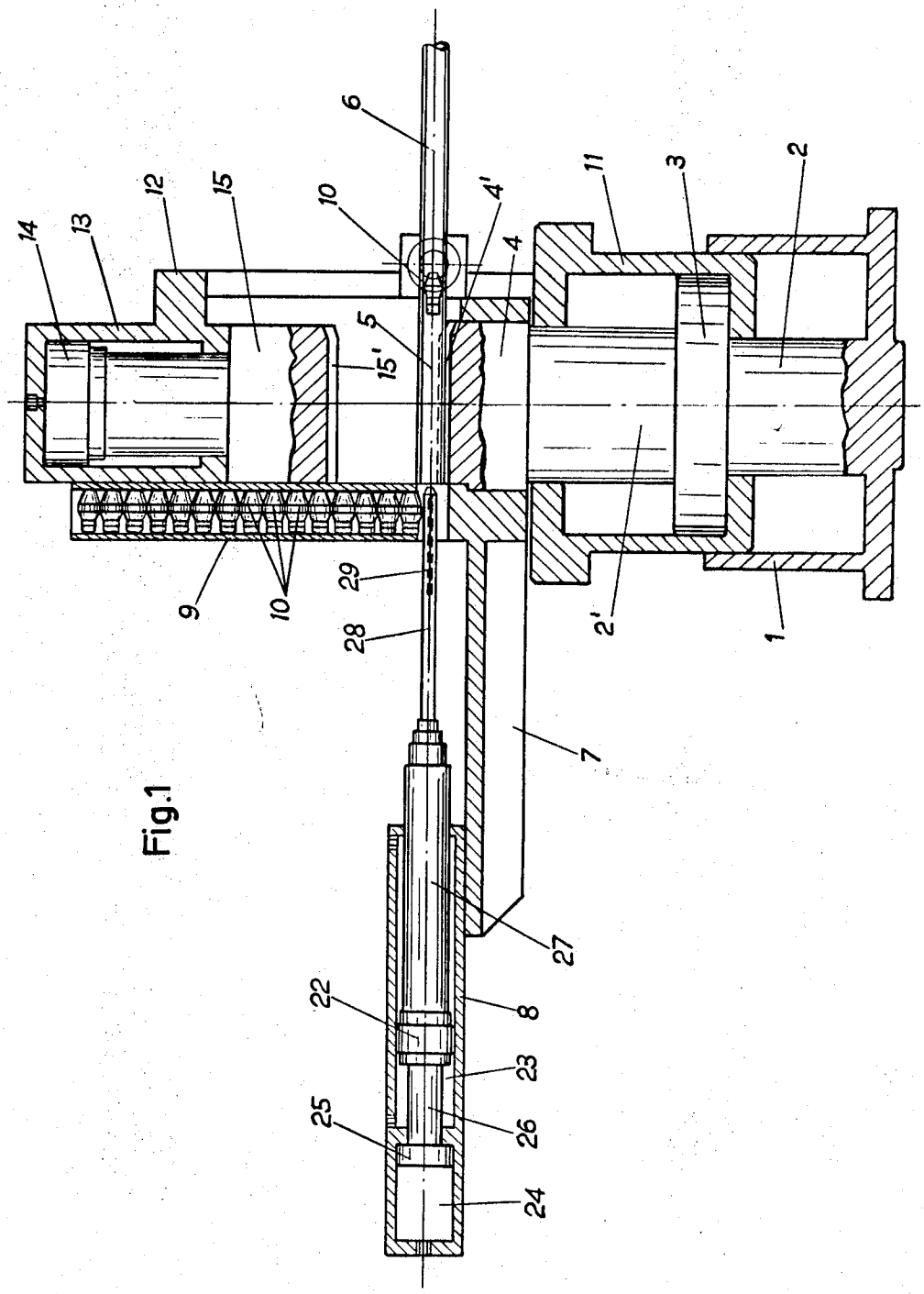


Fig.1

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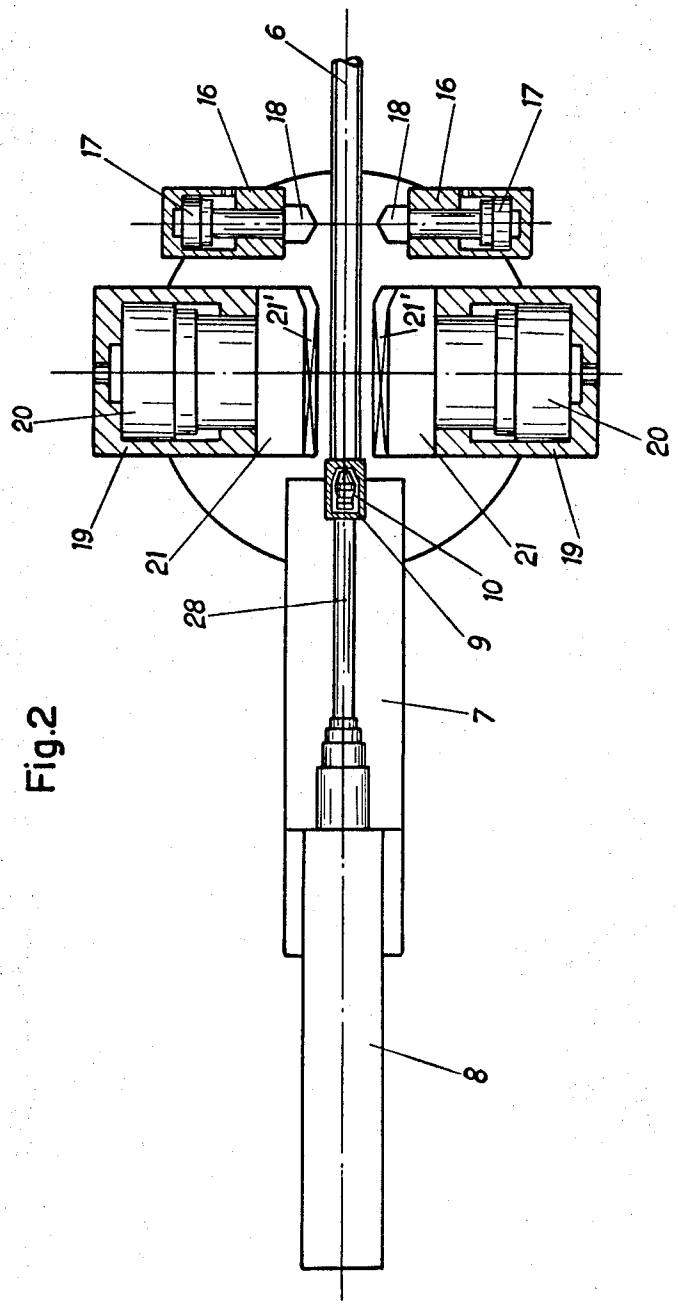

Fig.2

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AUTOMATIC MACHINE FOR PREPARING THE ENDS OF METAL PIPES FOR THE DRAWING OPERATION

This invention relates to a machine which automatically performs the various operations required for preparing the extremities of metal pipes to be drawn and in particular automatically introduces the lubricating oil and a drawing mandrel to the inside of the pipe, produces one or more dents on said pipe to stop and position the drawing mandrel, and finally forms, at the extremity of the pipe being processed, the desired shaped and dimensions for the pipe to be further processed in the pipe-drawing machine.

As is known, the extremities of metal tubes to be drawn must be suitably prepared before being passed to the drawbenches (in the case of straight tubes) or to the drum blocks (in the case of tubes wound in rolls), so as to permit easy introduction in the die and easy grasping by the traction devices of the drawing machines. Further, in the drawing of tubes wound in rolls use is normally made of floating, olive-shaped mandrels (exceptionally in the drawing of straight tubes also) which must be introduced in the inside of the tubes. The mandrels must be arrested and positioned therein by means of one or more dents obtained by plastic deformation of the pipe or tube.

These preliminary operations for preparing the tubes which have been heretofore carried out partly by hand, by utilizing suitable implements, and partly by means of machines which normally perform a single operation on the tube. The individual steps in such a manual process are: (a) lubrication of the interior sidewalls of the tube with lubricating oil (effected manually or with the aid of a suitable metering device); (b) formation of one or more dents in the pipe (performed manually or with the aid of a simple fixture); (c) introduction of the olive-shaped mandrel (accomplished manually); (d) shaping of the end position of the pipe (normally of cylindrical shape, effected on special machines, with hydraulic or mechanical control).

It will be apparent that the cycle of operations described above involves particularly high costs, due both to the considerable times required by the manual operations and to the additional times necessary between the various operations carried out on different equipment or machines, thereby slowing down the rate of the drawing operations. Further, due to the successive positionings of the tube during the various operations, frequent waste may result.

According to the present invention there is provided an automatic machine which prepares the extremity of metallic tubes for the drawing operation so as to eliminate the disadvantages mentioned above.

The automatic machine of this invention consists of:

1. stationary section having:
   - A. a lower die with a support seat for the extremity of the tube;
   - B. a pair of side punches actuated by hydraulic cylinders and movable towards the axis of the tube to deform the latter inwardly and laterally to produce a pair of dents thereon;
   - C. a magazine for olive-shaped mandrels which feed such mandrels in line with the end portion of the tube;
   - D. a cylindrical thrust bar coaxial with the extremity of the tube and actuated by a hydraulic cylinder, which bar can be displaced axially relative to the tube to release the lowermost olive-shaped mandrel from the loader and subsequently push it into the tube, said bar being provided with a central bore through which the lubricant is fed into said tube with the aid of feeding means, before the introduction of the mandrel.
2. Further, said machine includes a movable section, comprising:
   - E. a support integral with a hydraulic cylinder which actuates an upper die which is brought into engagement with the upper portion of the extremity of the tube, so as to lock it against said support seat;

   - F. two side punches or dies, actuated by hydraulic cylinders and movable towards the axis of the tube to laterally inwardly deform the extremity of the tube.

In operation of the machine the movable section thereof is moved downwardly by means of a hydraulic cylinder after the upper die has been brought against the extremity of the tube, and after said two side punches of the stationary section have laterally deformed said extremity, so as to impart to the latter a cylindrical shape of lesser diameter as compared to the original one.

For a better understanding of the present invention one particular embodiment thereof will now be described with reference to the accompanying drawings, wherein:

FIG. 1 schematically shows a vertical section of the machine according to the present invention, in the position taken by its various parts and components before starting the processing operations, and

FIG. 2 shows a plan view, partially in section, of the machine of FIG. 1.

Referring to the drawings, the machine comprises a bedplate, not shown, to which is fastened the part 1, integral with the rod 2 of a piston 3 which carries, through another rod 2', a die 4 provided with a suitable seat or cradle 4', which receives the extremity 5 of the tube 6. To the bedplate of the machine there is further fastened a support 7 to which a hydraulic cylinder 8—to be described later—is secured, and a vertical magazine 9 for olive-shaped mandrels 10.

A piston 3 is disposed at the inside of a hydraulic cylinder 11 (which also constitutes the movable section of the machine) which is integral with a support 12 provided with a hydraulic cylinder 13 whose piston 14 actuates a die 15 also provided with a suitable seat 15' arranged for cooperation with the upper portion of the extremity 5 of the tube 6.

To the bedplate of the machine is further fastened a pair of hydraulic cylinders 16, whose pistons 17 actuate the punches 18, the extremities of which are V-shaped and are arranged to plastically deform the pipe on opposite sides, so as to form a pair of dents thereon. On the movable section 11 of the machine two hydraulic cylinders 19 are provided having pistons 20 integral with dies 21 and punches 21' of suitable shape, arranged for plastically deforming, on opposite sides, the extremity 5 of the tube 6.

The cylinder 8 is provided with a first piston 22 which slides in a first chamber 23 of said cylinder and which provides for axial movement of a thrust bar 28 arranged for entering into the extremity 5 of the tube 6 so as to push an olive-shaped mandrel 10 in the inside of the latter. The second piston 25 of the cylinder 8 performs its movement in a second chamber 24 and its rod 26 slides in a chamber (not shown) provided at the inside of the rod 27 of piston 22, in order to pressurize the lubricating oil contained therein and to cause it to flow out through a bore 29 provided at the inside of the thrust bar 28.

The various hydraulic cylinders described above are connected, by means of suitable pipings (not shown) with appropriate sources of pressurized fluid. The hydraulic circuit also includes suitable devices of known kind (such as valves, distributors, timing devices, limit switches and the like) by which the various hydraulic cylinders can be actuated in selected sequence and in the instants desired, so as to automatically perform the following sequence of operations.

The tube 6 is initially placed on the upper seat 4' of the die 4 with the end of the tube against the surface of the loader 9 facing towards the die 4. In this manner a very accurate positioning of the tube is obtained, and this positioning is maintained during all the subsequent processing stages of the tube on said machine. Subsequently, hydraulic fluidactuates piston 14 of cylinder 13, thereby pushing the die 15 against the end portion 5 of the tube; the seat 15' thus, in cooperation with seat 4' of die 4, firmly locks the end of tube 5 in place.

At this point the first processing stage (denting of the tube) begins, by sending oil under pressure into the chambers of the hydraulic cylinders 16, whose pistons 17 and punches 18 are pushed towards the tube and the punches 18 to plastically

deform said tube on opposite sides, thereby forming a pair of dents thereon.

To perform the next operation (lubrication), oil under pressure is sent into the chamber **24** of the cylinder **8**, thereby causing displacement of the piston **25** integral with the rod **26**, and the latter sends oil under pressure into the inside of the bore **29** of the thrust bar **28**. The duration of the lubrication step can be controlled by means of a timing device and, after completion of this operation, the piston **25** is brought back to its initial position.

The next operation (i.e. the introduction of the olive-shaped mandrel) is carried out by first displacing piston **22** of the cylinder **8**, so that the thrust bar **28** will withdraw away from the mandrel magazine **9** and thereby release one of the olive-shaped mandrels **10** allowing it to drop into correspondence with the axis of the tube **5**. After the mandrel has dropped into correspondence with the axis of tube **5**, piston **22** is displaced in a direction so as to push said mandrel into the interior of the tube **6**, until said mandrel reaches the desired position in correspondence with the dents formed during the preceding operation. The thrust bar is then brought back to its starting position shown in FIG. **1**. At this point of the cycle, the punches **18** which have performed the indenting operation, as aforesaid, will also be brought to their starting position; to do so, it will be only necessary to exert a suitable action on the hydraulic pistons **16**.

The subsequent operation (i.e. the formation of a cylindrical point at the end **5** of the tube) is performed, according to an already known system in the sharpening machines of the prior art, i.e. by cooperation, on the tube, of two paris of dies or punches, each of which will exert on said tube two forces in opposite directions, namely directed towards the inside of the tube, which display their action in a plane nearly at right angles to the plane of action of the forces produced by the dies or punches of the other couple.

Therefore, by actuating hydraulic cylinders **19**, the dies **21** and punches **21'** advance towards the axis of the tube and deform locally the end portion **5** of said tube, imparting thereto a 8-shaped squashed form of constant section. Simultaneously, piston **3** of the hydraulic cylinder **11** is actuated thereby causing the downward movement of the movable section **11** of the machine which, as aforesaid, is integral with the support **12** of the cylinder **13**; therefore, during the downward movement of said section **11** of the machine, the die **15** will exert, on the upper side of the tube, an adequate pressure to which will correspond—as a reaction—a corresponding pressure exerted by the die **4** on the lower side of said tube. In this manner, to the part **5** will be imparted a cylindrical shape of lesser diameter than that of the tube prior to the deformation.

By suitably acting upon the hydraulic cylinder **11** (movable section of the machine) and upon the cylinders **13** and **20**, the various parts will be subsequently brought back to their starting positions, corresponding to those shown in the drawings and to the initial configuration of the cycle.

Of course, the various operations described above can be carried out in a fully automatic manner, by providing suitable control devices of known kind, or they can be fully or partly actuated manually.

Further, it is possible to perform the operations described above by providing controls of mechanical (instead of hydraulic) kind, as it will be apparent to those skilled in the art.

It will be understood that many modifications and variations can be introduced in the preferred embodiment of the present invention described above, concerning both the shape and the arrangement of the various parts as well as the sequence of the various stages of the cycle described, without departing from the spirit and the scope of the invention as claimed.

I claim:

1. A machine which prepares the extremities of metal tubes for a drawing operation comprising:

1. a stationary section which comprises:
   - A. a lower die with a support seat for the extremity of the tube;
   - B. a pair of detent forming punches actuated by hydraulic cylinders and movable toward the axis of said tube from opposite sides thereof to deform the said tube laterally and inwardly to produce a pair of dents thereon;
   - C. a mandrel magazine for feeding mandrels into correspondence with an open end portion of the tube;
   - D. a cylindrical thrust bar coaxial with the end of the tube and actuated by a hydraulic cylinder, which bar can be displaced axially relative to the tube so as to release a lowermost mandrel from the mandrel magazine and to subsequently push the said mandrel into the tube, said thrust bar being provided with a central bore through which lubricant is fed into said tube before the introduction of the mandrel;
2. an upper movable section which comprises:
   - E. a support which in part forms a first hydraulic cylinder wherein the piston of said first hydraulic cylinder is integral with the stationary section of said machine;
   - F. a second hydraulic cylinder carried above said support, a piston included in the second hydraulic cylinder, said piston being operatively connected to an upper die, said piston and die being movable toward the axis of said tube;
   - G. two side punches or dies carried by said support and actuated by hydraulic cylinders, said punches or dies movable towards the axis of the tube to laterally deform the extremity of the latter.

2. An automatic machine for preparing the extremities of metal tubes as claimed in claim **1**, wherein the said means for feeding the lubricant comprise a chamber provided at the inside of the cylindrical thrust bar and a piston inside of said chamber.