

March 2, 1926.

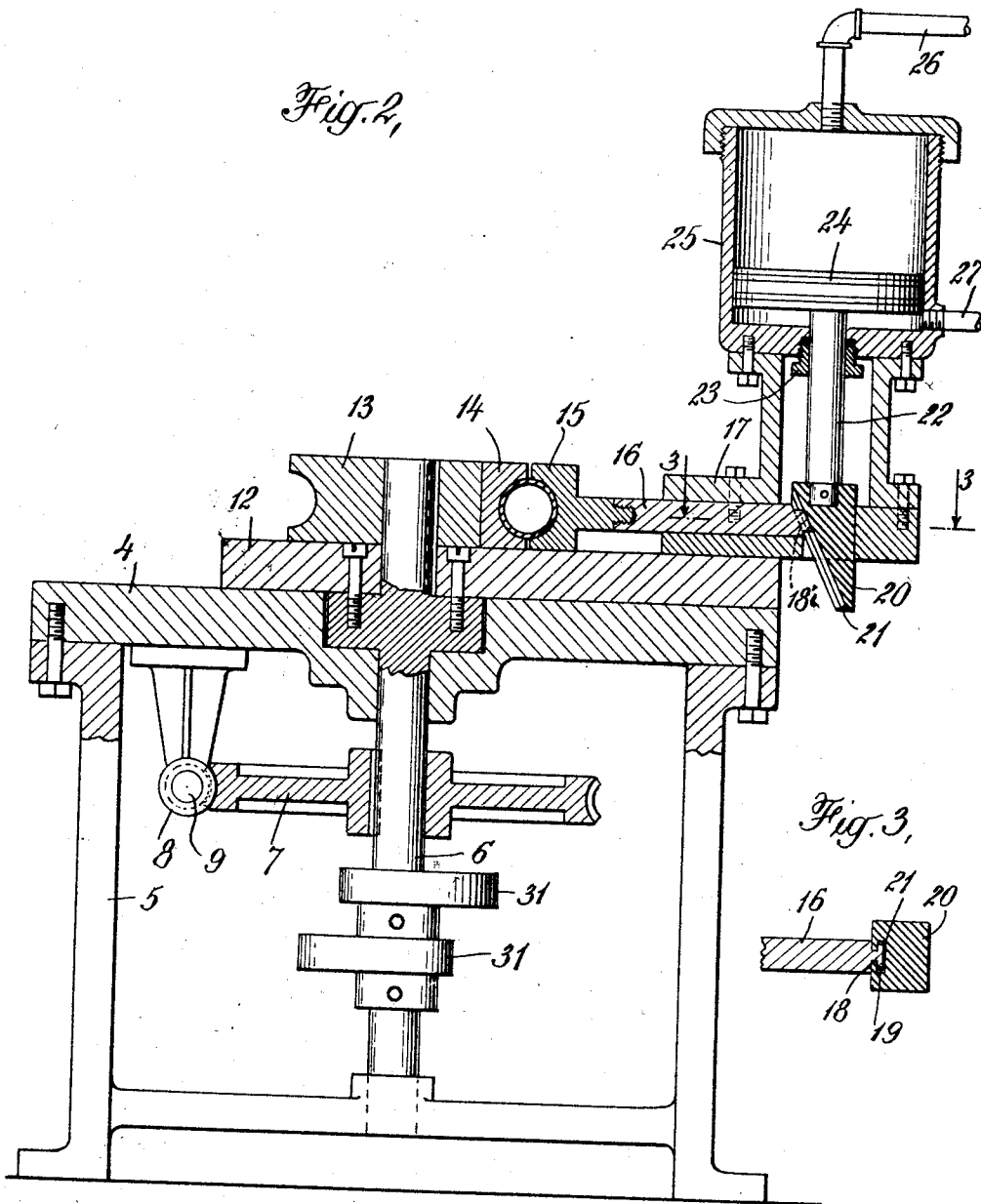
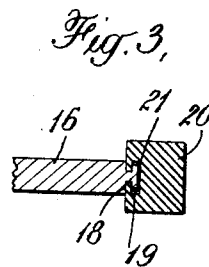
S. A. SNELL

BENDING MACHINE

Filed May 20, 1925

1,575,014

2 Sheets-Sheet 2



INVENTOR

S. A. Small

BY

BY
Rene Davis Martin Edwards
ATTORNEYS

ATTORNEYS

UNITED STATES PATENT OFFICE.

SAMUEL ARCHIBALD SNELL, OF DETROIT, MICHIGAN, ASSIGNOR TO AMERICAN METAL PRODUCTS CO., OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

BENDING MACHINE.

Application filed May 20, 1925. Serial No. 31,641.

To all whom it may concern:

Be it known that I, SAMUEL ARCHIBALD SNELL, a subject of the King of Great Britain, residing at 5986 Epworth Boulevard, Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Bending Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to bending machines, particularly machines for use in bending steel tubing.

The object of the invention is to provide an improved construction for a bending machine whereby to adapt it for more rapid operation, for operation requiring less manual effort and for the production of more reliable and uniform bends.

Bending machines of this type as heretofore made have usually consisted of a bending form mounted upon a power driven shaft and a manually operated clamp adapted to clamp a piece of tubing tightly to the bending form so that when the latter is rotated by power the portion of the piece of tubing gripped to the form by the clamp is carried around with it.

With a bending machine of this construction the operation of making bends in tubing is both laborious and time-consuming. It is laborious because the piece of tubing must be clamped to the bending form under an exceedingly heavy pressure, a pressure measured in tons. It is time-consuming because the movable member of the clamp must be movable over an extended range, more particularly so because when the tube is released from the clamp it springs back a considerable amount and the movable member must travel over a range greater than this retrograde movement of the tube. When the clamp is manually operated, the mechanism for advancing and retracting the movable member must include reduction gearing in order that the requisite pressure may be applied and the time consumed in operating the movable member is the greater because of this reduction gearing.

When such a mechanism is employed for applying bends to a great number of similar articles, the time consumed and the

labor involved make the operation much more costly than is desirable.

In accordance with the present invention, a bending machine is provided whereby these objectionable characteristics of the machines heretofore employed are eliminated. A clamp for the tube to be bent is provided but the movable member of this clamp is operated pneumatically or hydraulically. The cylinder and the piston employed for this purpose are connected to the movable member of the clamp through a non-yielding connection preferably consisting of co-acting cam surfaces inclined at such an angle that the pneumatic devices may advance and retract the clamping member, but pressure of the tube against the latter will not serve to retract it. This clamping member, together with the entire operating mechanism therefor are mounted upon a support which is rotatable with the bending form. In association with these parts is a movable block adapted to bear against the tube immediately adjacent to the movable member of the clamp, the relation of these parts being such that the initial application of a bending force to the tube throws the tube into tight engagement with this block, as a result of which the block moves forward with the tube as the bending form is turned and the bending operation takes place between this movable block and the bending form.

This and other features of the invention will be better understood by reference to the accompanying drawings in which Fig. 1 is a plan view of the machine; Fig. 2 is a sectional elevation of the same and Fig. 3 is a detail view in section of a portion of the mechanism for moving the clamp member on the line 3 of Fig. 2.

Referring to these drawings, 4 indicates a bed mounted on a suitable base 5 and having a shaft 6 journaled for rotation therein. On this shaft is a worm wheel 7 driven by a worm 8 mounted on a horizontal shaft 9. This shaft is arranged to be driven in opposite directions and by means of pulleys 10 and 11 either of which may be connected to the shaft 9 by a suitable clutch mechanism indicated diagrammatically in Fig. 1.

Mounted on the shaft 6 is a table 12 and immediately above this table is the bending form 13 which is keyed to the shaft 6. It

is generally circular in form and has a circumferential groove corresponding in contour to the shape of the article to be bent. At one point in its periphery the form 13 is notched to receive a block 14 which forms one of the clamping members for clamping the tube to be bent.

The other clamping member is a block 15 which is secured in any suitable manner to a slide 16 adapted to move horizontally in a housing 17 secured upon the table 12. The end of this slide 16 is provided with an inclined cam surface as indicated at 18 and a T-shaped member 19 projects from this cam surface. The end of the slide cooperates with a cam 20 whose surface coacting with the end of the slide 18 is inclined as shown in Fig. 2. It is inclined at a relatively small angle to the vertical whereby downward pressure on the member 20 will cause it to move downwardly and thereby move slide 16 to the left in Fig. 2 whereas pressure on the slide to the right will be ineffective to move the cam 20 upward. In the inclined face of the cam 20 is a T-shaped groove 21 which receives the T-shaped member 19 on the slide 16.

The cam 20 is carried by a rod 22 which passes through a stuffing box 23 and is secured at its upper end to a piston 24 adapted to reciprocate within a cylinder 25. Connections for air or other fluid are made to the upper and lower ends of the cylinder 25 through the pipes 26 and 27.

On the bed 4 is mounted a support 28 in the form of an angle plate which serves as a support and guide for a block 29 adapted to move horizontally in the direction of the length of the tube to be bent and having in one face thereof a groove corresponding to the groove in the bending form 13.

With the bending mechanism so constructed the operation of bending a piece of tubing is as follows: The supply of air to and the exhaust of air from opposite ends of the cylinder 25 is controlled by a four-way valve of ordinary construction. This valve is turned to position for admitting air through the pipe 27 and allowing it to exhaust through the pipe 26 as a result of which the piston 24 is raised carrying with it the cam 20. By reason of the connection of this cam to the slide 16 through the T-shaped member 19 and the groove 21, this upward movement of cam 20 causes the slide 16 and the clamping block 15 mounted thereon to be moved to the right to carry the block away from the block 14 on the bending form 13. This having been done the tube to be bent is mounted in position with the portion thereof where the bend is to be made passing between the block 29 and the bending form 13 and between the clamping members 14 and 15. The tube may be suitably held at other points if desired

as for instance by means of such a bracket as that shown at 30 in Fig. 1. With the tube so positioned the air controlling the valve is moved to the position for admitting air to cylinder 25 through pipe 26 and exhausting it therefrom through pipe 27. This presses the piston 24 downward carrying with it the cam 20 and the cooperating inclined surfaces of this cam and the slide 16 cause the clamping member 15 to be moved to the left in Fig. 2 to carry it into engagement with the tube to be bent and cause the tube to be gripped under heavy pressure between these two clamping members, the pressure applied to the tube being commensurate with the pressure of the air admitted to the cylinder 25. These preparations having been made, power is applied to the shaft 9 through one of the pulleys 10 and 11 to cause rotation of the shaft 6 and table 12 and all of the parts carried by the table in the direction indicated by the arrow in Fig. 1. As the table 12 is thus rotated, the clamping members 14 and 15 together with the entire operating mechanism for the member 15 are carried around about the axis of the shaft 6. As this movement of the parts begins the tube is caused to press laterally against the wall in the groove of the block 29 with very considerable pressure so that these two parts are locked in tight frictional engagement and as the movement continues the block 29 moves along on its supporting member 28 with the tube. The bending actually occurs between the coacting walls of the block 29 and the form 13. After the bending operation has been carried far enough, rotation of the shaft 9 is discontinued and this may be effected automatically as for instance by means of mechanism actuated by one of the cams 31, shown in Fig. 2 as mounted upon the shaft 6, and mechanism actuated by those cams and controlling the clutches for the pulleys 10 and 11 shown in Fig. 1. Then the air valve is turned to its opposite position so as to admit air through the pipe 27 and thereby raise the piston 24 and cam 20 and retract the slide 16 and clamp block 15. This retractile movement must extend over a considerable range because the tube will follow the block in its retractile movement a substantial distance by reason of the spring action of the tube itself.

When the clamp block 15 has been retracted a sufficient amount, the bent tube is taken out of the machine and the table 12 and all of the parts mounted thereon are rotated back to their initial position by power applied to the shaft 9 and the apparatus is then in condition to have another piece of tubing to be bent inserted therein as before.

With this mechanism the making of simi-

lar bends in a large number of pieces of tubing can be effected rapidly and with a relatively small expenditure of power. This is due primarily to the fact that the clamping block 15 may be moved over an extended range quickly and when in its clamping position may have any desired amount of pressure applied to it, and the mechanism for effecting this is non-reversible in the sense that reverse pressure applied to the clamping block by the tube will not cause retractile movement of the block.

I claim:

1. A bending machine comprising the combination of a rotatable bending form, a movable clamping block for clamping a member to be bent to the bending form, and holding it at one point against movement relative to the form, a fluid pressure mechanism movable with the bending form and lying out of the plane of the latter, a connection between this mechanism and the clamping block through which the mechanism moves the block toward and away from the bending form and applies pressure to the block to grip the article to be bent between the block and the form, and power driven devices for rotating the bending form and the clamping block and the power driven mechanism and the connection between this mechanism and the block.

2. A bending machine comprising the combination of a rotatable bending form, a movable clamping block for clamping an article to be bent to the bending form and holding it at one point against movement relative to the form, a fluid pressure mechanism movable with the bending form and lying out of the plane of the latter, a non-yielding connection between the fluid pressure mechanism for the clamping block for moving the latter toward and away from the bending form and for applying pressure to it to grip the article to be bent between it and the bending form, and power driven devices for rotating the bending form, the clamping block and the fluid pressure mechanism for the clamping block.

3. A bending machine comprising the combination of a rotatable bending form, a movable clamping block for clamping an article to be bent to the form and holding it at one point against movement relative to the form, actuating mechanism for the block comprising a cylinder and piston disposed out of the plane of the bending form, a piston rod secured to the piston, and cam surfaces on the piston rod and clamping block arranged at an acute angle to the length of the piston rod, and power driven devices for rotating the bending form, the clamping block, and the actuating mechanism for that block.

4. A bending machine comprising the combination of a rotatable bending form, a

clamping block movable with the form and also movable toward and away from the latter, actuating mechanism for the block comprising a movable cam engaging the clamping block for moving it toward the bending form to grip an article to be bent between the block and the form and to hold the article at one point against movement relative to the form, interlocking parts on the block and the cam for causing retractile movement of the cam to retract the block, and means for moving the cam to produce a movement of the block, and power driven devices for rotating the bending form, the clamping block, and the actuating mechanism for that block.

5. A bending machine comprising the combination of a rotary support, a bending form mounted thereon, a movable clamping block also mounted on the support adjacent the form, this block being movable away from the form to permit the insertion of an article to be bent between it and the form and movable toward the form to clamp the article and to hold it at one point against movement relative to the form, a stationary support disposed adjacent the form, a slide block mounted on the support and movable in the support as the form is rotated, this block permitting the article to be bent to be inserted between it and the form and acting to prevent the article from springing free from the form during the bending operation, a fluid pressure mechanism mounted on the rotary support out of the plane of the latter, this mechanism being connected to the clamping block and operable to move the latter toward and away from the form, and power driven devices for rotating the support and the parts carried thereby.

6. A bending machine comprising the combination of a rotatable bending form, a stationary support, a movable slide block mounted in the support adjacent to the form in position to have the member to be bent inserted between it and the form and adapted to move with the member as the form is rotated, and to prevent the member from spring from the form during the bending operation, a movable clamping block adapted to grip the member to be bent between it and the form, a non-reversible power-actuated mechanism for moving the clamping block toward and away from the form and for applying pressure to the block when in contact with the member to be bent and power actuating devices for rotating the bending form and the clamping block and the said non-reversible power-actuated mechanism.

7. A bending machine comprising the combination of a rotary support, a bending form disposed on the support and rotatable therewith, a stationary support, a slide block mounted on the support adjacent the form

in position to permit the article to be bent to be inserted between it and the form, this slide block moving with the form as the latter is rotated and acting to prevent the article from springing free from the form. 5 during the bending operation, a clamping block mounted on the rotary support and movable toward and away from the form, this clamping block being operable to hold the member to be bent against movement 10 relative to the form, a cylinder and piston mounted on the rotary support out of the plane of the form, a cam actuated by the piston and coacting with the clamping block to move the latter toward the form and to clamp the member to be bent between it and the form, a connection between the cam and the clamping block whereby the retractile movement of the cam will retract the block, and power actuated devices for rotating the 20 rotary support.

In testimony whereof I affix my signature.

SAMUEL A. SNELL.