April 5, 1932. J. F. L. BAKER 1,852,101

CYLINDER FORMING MACHINE

Filed Jan. 7, 1929

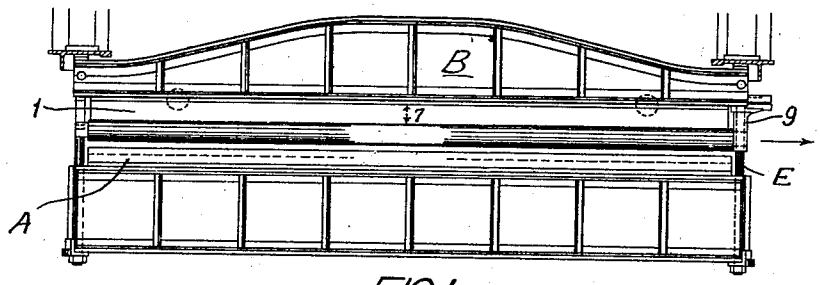

FIG. 1

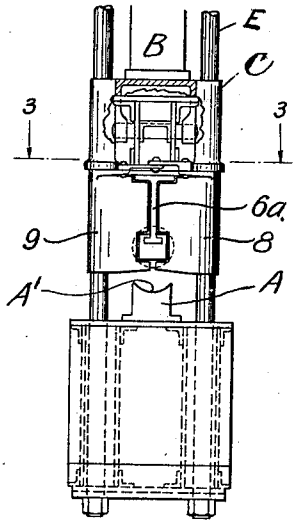

FIG. 2

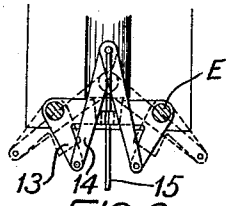

FIG. 3

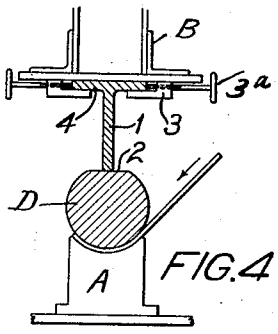

FIG. 4

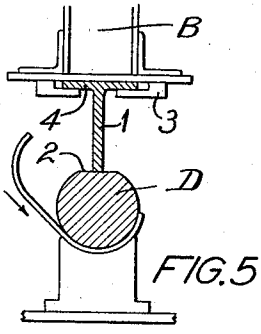

FIG. 5

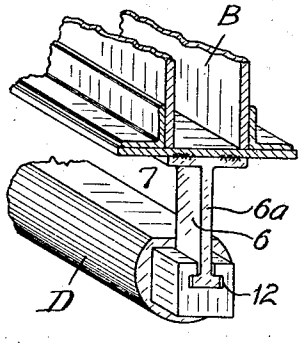

FIG. 7

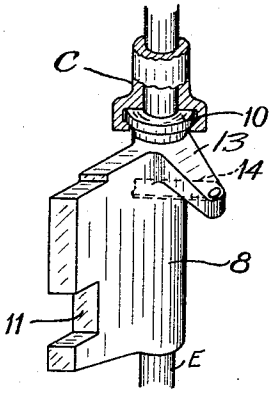

FIG. 8

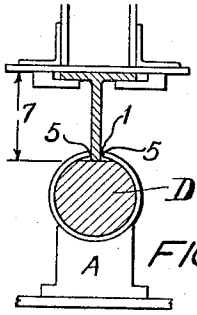

FIG. 6

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1,852,101

UNITED STATES PATENT OFFICE

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CYLINDER-FORMING MACHINE

Application filed January 7, 1929. Serial No. 330,804.

This invention relates to a machine for forming heavy steel sheets, light and medium plates, or similar material, into tubes, such as water pipes and the like.

A cylinder-forming machine of the kind above referred to is shown and described and claimed as to its broader aspects in my co-pending application Serial No. 170,191, filed February 23, 1927, patented January 15, 1929, No. 1,698,904 of which the present application is a continuation-in-part. That machine is adapted for bending a very heavy steel plate, say, two inches thick, into a tube, say, ten feet long and about forty inches diameter.

My present invention adapts a machine of that general class to a somewhat different kind of work, namely, the rapid production of cylinders from thinner material and shaped to smaller diameter. For example, this invention is adapted for bending into accurate cylindrical form a sheet of steel whose thickness is, say, five-eighths inch, width four feet, length forty feet, producing a cylinder fifteen inches diameter, the forming operation being performed in such manner that the longitudinal edges of the finished tube will be slightly separated and parallel to each other ready to be closed together in a subsequent operation on a different machine and finished by welding or riveting.

In general the type of cylinder forming machine comprehended in my co-pending application above referred to comprises an anvil formed with a longitudinal groove in its working face, a movable die-carrying frame comprising a strong-back having downwardly projecting crossheads near its ends, a die having its ends mounted in the crossheads and disposed normally parallel with the anvil. The die is adapted to press the sheet progressively into the groove. The strong-back and die are spaced apart to receive the curved part of the sheet between them. Means is provided for actuating the die-carrying frame, as for example, a hydraulic engine, and provision is made for detaching an end of the die from the frame to permit the removal of the completed cylinder.

The specific means illustrated in my previous application above referred to for removing the finished work consists of a pivotal connection between the reciprocating frame and an end of the die, the other end of the die adapted to be swung out from its normal position in the frame to permit removal of the completed cylinder.

The previous application also describes the use of removable struts connecting the strong-back and die, in order to prevent any appreciable springing of the die when subjected to heavy duty.

My present invention embodies certain improvements in the form of the die, in the construction and arrangement of the struts between the die and the strong-back and in the means for supporting the end of the die while the completed work is being stripped from it.

Moreover, the present invention includes an improved die-supporting means that permits the work to be removed without swinging the die outwardly from its normal position. The structure also includes a new kind of cross-head attached to the strong-back. This cross-head embodies what I term a die keeper, being a hinged member adapted to operatively engage when closed, an end of the die and adapted to be opened and closed so as to release the end of the die and afford passage for the finished work during its removal from the die.

With the foregoing and certain other objects in view which will appear later in the specification, my invention comprises the devices described and claimed and the equivalents thereof.

In the drawings Fig. 1 is a side elevation of a tube-forming machine embodying my improvement.

Fig. 2 is an enlarged fragmentary end view showing the die in raised position.

Fig. 3 is a view of the gate-actuating mechanism as seen from above.

Figs. 4, 5 and 6 are respectively sectional details showing the various steps in the forming of a tube.

Fig. 7 is a perspective view partly in section showing the hanger connection between the delivery end of the die and the strong-back.

Fig. 8 is a perspective view partly in section, of one of the leaves of the keeper.

As is clearly shown in the drawings, a machine embodying my invention consists in the anvil A whose upper face is formed with a longitudinal groove A′, a working frame, which consists in a vertically reciprocatable strong-back B having crossheads C at its ends carried upon suitable guide-rods E and a die D carried by the crossheads, the die being below and spaced from the strong-back B to permit the curved part of the plate to enter between them.

Since the tube to be formed is of light material, but very long and of small diameter, it becomes essential to support the die D throughout substantially its entire length so as to avoid all possibility of upward springing. It is not absolutely necessary that the strut member 1 which is inserted between the top of the die and the strong-back shall extend as a continuous piece throughout the entire length of the die D, but the points of support should be sufficiently close together to prevent any appreciable springing of the die. I have, therefore, shown as an example a strut member 1 which is preferably a plate standing edgewise on the top face 2 of the die made substantially flat for that purpose. The strut member 1 is carried by the strong-back B and is held upright, that is, perpendicular, to the flat face 2 of die D by lugs 3 or other suitable means on the strong-back. The lugs engage a pair of flanges 4 on the strut plate 1, as shown in Figs. 4 to 6, so the latter may have limited sidewise movement on the upper face of the die, to prevent its binding when it is engaged by the edges 5 of the tube at the completion of the bending operation, as shown in Fig. 6. The sidewise movement can be limited, as desired, by means of adjusting screws 3*a*, threaded in lugs 3, as shown in Fig. 4.

The strut member 1 effectually prevents springing of the die D and transmits directly from the die to the strong-back all stresses that would otherwise cause the die to bow upward in the middle under load.

The delivery end of the die is held suspended from the strong-back by means of a die-supporting hanger 6, preferably in the manner shown in Fig. 7. Since the work is to be removed from the die D by stripping it off endwise in the direction of the arrow, Fig. 1, that portion 6*a* of the hanger which spans the space 7 between the strong-back B and die is made thinner than the slit between the longitudinal edges 5 of the formed tube. The tube when being stripped off from the anvil passes the hanger 6 the same as it passes strut member 1, shown in Fig. 6.

Whenever a piece of work is being removed from the machine, the hammer 6 supports the delivery end of the die but while the work is being shaped by the die D the working load is transmitted from the crosshead to the die by means of a keeper 8, 9, made so as to be opened and closed. This die keeper is adapted when closed to operatively grasp an end of the die D and when opened is adapted to release the die and swing out of the way to afford passage for the finished work during its removal from the die.

I have devised a suitable form of keeper which is shown in Figs. 2, 3 and 8. It consists in a pair of hinged leaves 8, 9, the knuckles of which are provided with flanges 10 by which they are swiveled in counterbores provided at the lower ends of the crossheads C. The free edge of each leaf is formed with a recess 11 to fit over the end of the die which may be shaped for the purpose, as shown at 12 in Fig. 7, or if desired the recess 11 in the leaf may be made to conform to the shape of the body of the die itself. When the two leaves are closed, as shown in Fig. 2, they form practically integral parts of the crosshead C, so the strong-back and the end 12 of the die are at such times connected together by an exceedingly strong connection capable of withstanding the enormous working pressures that are transmitted through it from the hydraulic engine to the die. Thus when the leaves 8, 9 are closed the entire crosshead is, for practical purposes, the equivalent of a unitary casting, but when the leaves are opened they afford free passage through which the tube can be pulled lengthwise and removed from the die D.

The leaves can be opened and closed simultaneously by any suitable means, as for example that shown in Fig. 3, where each leaf is provided with an outwardly projecting arm 13 having a link 14 pivoted to it, the other ends of the links being pivoted together after the manner of a toggle joint which can be actuated by an operating bar 15 to open and close the leaves, as indicated by the dotted and full lines.

When the machine is in operation the leaves are closed and the sheet of material is fed in between the die and anvil, as shown in Figs. 4, 5 and 6, the successive downward pressing movements of the die causing the material to curl around it. Preferably one margin is operated on, as shown in Fig. 4, and then the other margin, as shown in Fig. 5, and lastly the middle part as shown in Fig. 6, requiring three operations in all to finish. The final shape and position of the finished sheet is indicated in Fig. 6, where the two longitudinal edges 5, 5 are spaced apart, presenting a slit through which the strut member 1 projects. If the work happens to require it, a slight sidewise movement of the strut member may take place in the lugs 3, thus preventing binding or cramping, and keeping the die D free from any lateral strains that might otherwise be brought upon

it by the pressure of the work against the side of the strut member 1.

To remove the work the hinged members or keepers 8, 9 are opened outwardly, as indicated by the dotted lines in Fig. 3, after which the work can be stripped from the die, the thin portion 6a of the hanger shown in Fig. 7, permitting its passage.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a tube forming machine including vertically reciprocatably crossheads, a strong-back connecting the same and a die carried by said crossheads below and spaced from said strong-back, the top of the die formed to present a substantially flat bearing face, a strut member inserted between said face and strong-back, means on the strong-back holding the strut member in operative position yet permitting its limited sidewise movement upon said bearing face, a die-supporting hanger connecting the delivery end of the die with the strong-back, that portion of the hanger which spans the space separating the strong-back and die formed to be received between the longitudinal edges of the formed tube, a die keeper pivotally mounted on one of said crossheads so as to be opened and closed and adapted when closed to operatively engage an end of said die and when opened adapted to release the die to afford passage for the finished work during its removal from the die.

2. In a tube forming machine including vertically reciprocatable crossheads, a strong-back, a die carried by said crossheads below and spaced from said strong-back, a strut member inserted between said die and strong-back, means on the strong-back holding the strut member in operative position yet permitting its limited sidewise movement, a hanger connecting the delivery end of the die with the strong-back, that portion of the hanger which spans the space separating the strong-back and die formed to be received between the longitudinal edges of the formed tube.

3. In a tube forming machine including vertically reciprocatable crossheads, a strong-back, a die carried by said crossheads below and spaced from said strong-back, a strut member inserted between said die and strong-back and means on the strong-back holding the strut member in operative position yet permitting its limited sidewise movement, for the purposes set forth.

4. In a tube forming machine including vertically reciprocatable cross heads, a strong-back, a die carried by said crossheads below and spaced from said strong-back, a strut member inserted between said die and strong-back capable of limited sidewise movement, a die-supporting hanger connecting the delivery end of the die with the strong-back, a die keeper pivotally mounted on one of said crossheads so as to be opened and closed and adapted when closed to operatively engage an end of said die and when opened adapted to release the die to afford passage for the finished work during its removal from the die.

5. In a tube forming machine including vertically movable crossheads, a strong-back, a die carried by said crossheads below and spaced from said strong-back, a die keeper comprising a pair of oppositely hinged leaves pivotally mounted on one of said crossheads so as to be opened and closed and adapted when closed to operatively engage an end of said die and when opened adapted to release the die to afford passage for the finished work during its removal from the die, and means for supporting the delivery end of the die from the crosshead.

In testimony whereof, I affix my signature.

JOHN F. L. BAKER.