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APPARATUS FOR FORMING OVAL STRUCTURAL HIGH CARBON STEEL TUBES

Original Filed Aug. 18, 1922 2 Sheets-Sheet 1

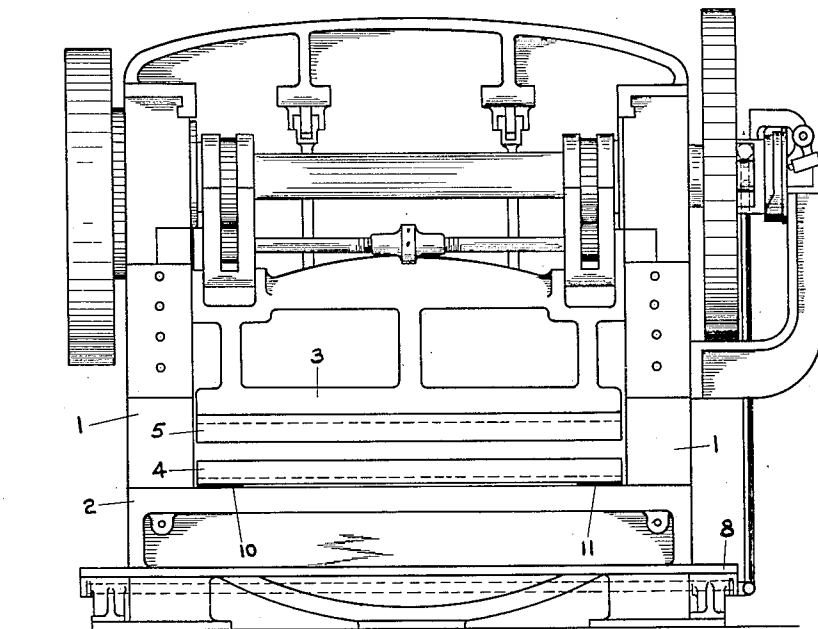


Fig. 1

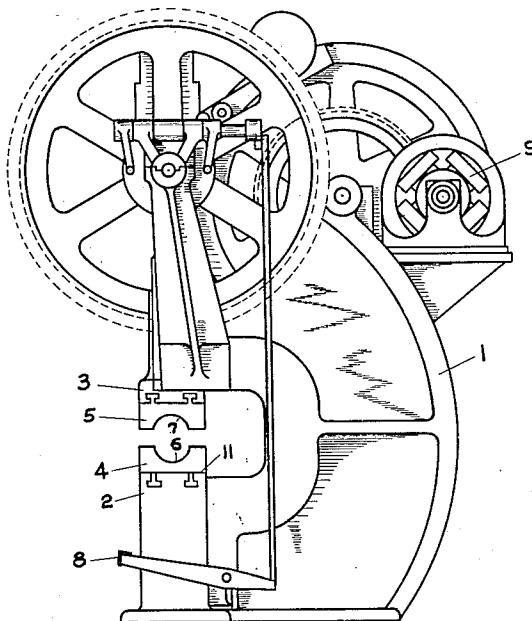


Fig. 2

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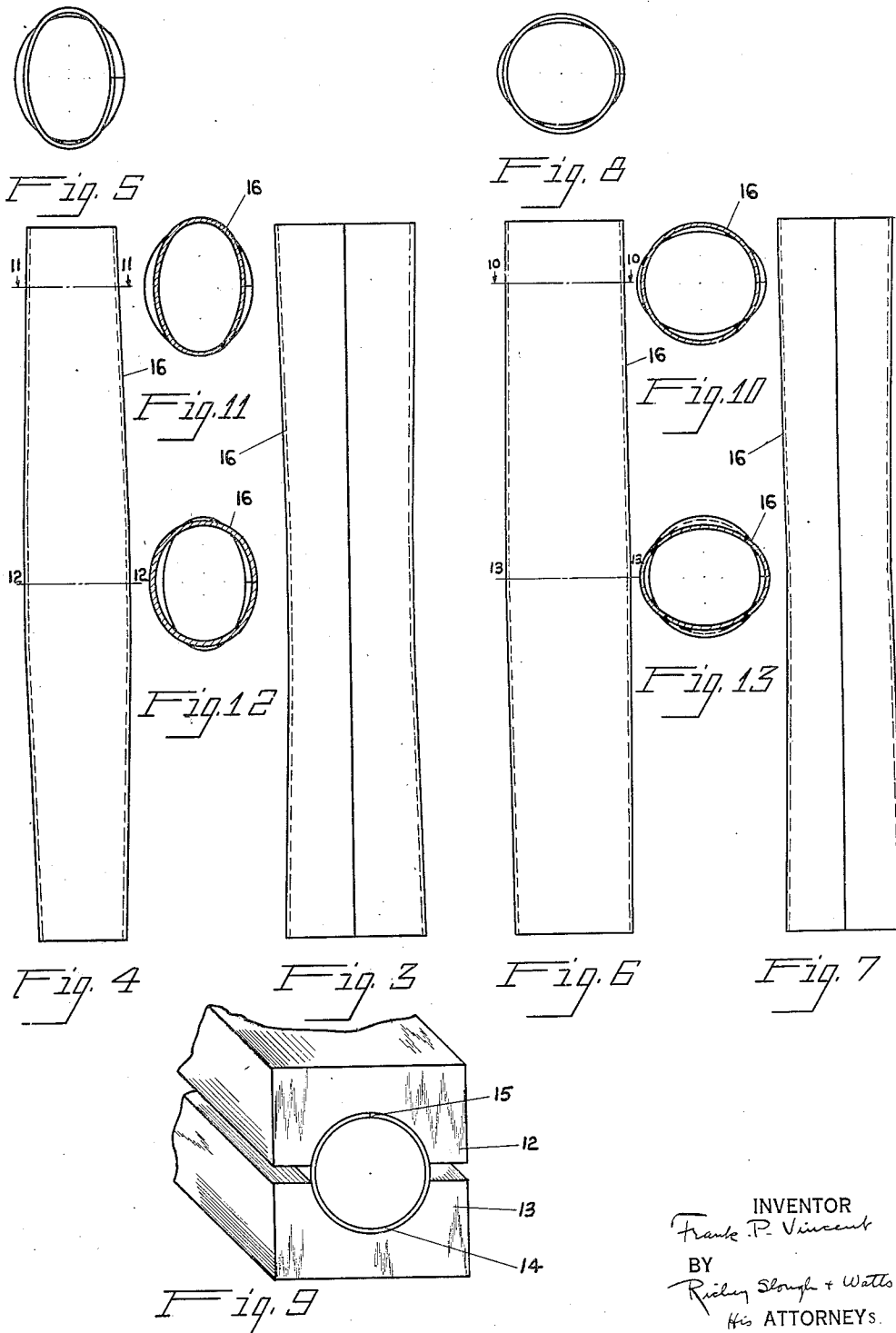
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UNITED STATES PATENT OFFICE

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APPARATUS FOR FORMING OVAL STRUCTURAL HIGH-CARBON-STEEL TUBES

Original application filed August 18, 1922, Serial No. 582,588. Divided and this application filed June 23, 1924. Serial No. 721,680.

My invention relates to apparatus for forming oval structural high-carbon steel tubes and particularly to such apparatus for producing tubes of this character from sheet steel which contains a high percentage of carbon, the sheet steel being rolled into tubular form and thereafter caused to take the shape of an irregular oval tube, the diameter of which is preferably increased in at least one direction at some particular point intermediate the ends of the tube.

An object of my present invention is to provide an improved apparatus for so deforming a high carbon steel tube preliminarily formed of sheet metal in general cylindrical shape, whereby the inequalities in the form of the tube will be eliminated and the tube be formed throughout its length to give it a desired irregular oval form, the same being accomplished by pressure applied to the tube in a particular way and without the necessity of pre-heating the tube.

Another object of my invention is to provide a tube so formed that it will have the maximum of rigidity at an intermediate portion so that they will be highly efficient for the purpose of forming portions of structures such as bed spring side frame members and the like.

Another object of my invention is to provide means for forming the tube having a general oval cross sectional shape with ends which are substantially circular, when this is desired, for the purpose of fitting attaching brackets having circular openings to the ends of the tubes, such as for instance, bed spring side frame member end brackets.

This application is a division of my previously filed application, Serial No. 582,588 filed August 18, 1922.

My invention will be better understood by reference to the accompanying drawing which illustrates a preferred embodiment of my invention.

Referring to the drawings—

Fig. 1 shows a front elevational view of a machine embodying my invention;

Fig. 2 shows a side elevational view of the machine illustrated in Fig. 1;

Fig. 3 shows a plan view, shortened, of

a tube formed in accordance with my invention;

Fig. 4 is a similar view of the same tube as shown in Fig. 3 except that the view is taken from a point at right angles to that of Fig. 3;

Fig. 5 shows an end view of the tube of Fig. 4.

Fig. 6 shows a plan view, shortened, of a modified form of the tube formed in accordance with another embodiment of my invention.

Fig. 7 shows a plan view, shortened, of the tube of Fig. 6 taken from a point at right angles to that of Fig. 6.

Fig. 8 shows an end view of the tube of Fig. 7.

Fig. 9 shows a perspective view of the die plates employed to compress the tube ends of the irregular oval tubes of Figs. 6 and 7 into substantially circular cross sectional shape.

Figs. 10 and 13 are different transverse sections taken on the tube of Fig. 6 at the points indicated in Fig. 6. Figs. 11 and 12 are different transverse sections of the tube taken at points indicated in Fig. 4.

Referring now to the drawings in all of which like reference characters indicate like parts, at 1, I show the frame of a press which embodies the principles of my invention. At 2, I show a lower jaw for the said press rigidly mounted therein, and at 3, I show a reciprocating upper jaw for the press, at 4 I show a forming die mounted on the upper surface of the lower jaw 2, and at 5 I show an upper forming die member secured to the upper or reciprocating press jaw on its under side, the two forming dies presenting their forming faces toward each other, and in the forming faces of each I provide longitudinally extending grooves 6 for the lower die, and 7 for the upper die, these grooves are preferably symmetrical in transverse dimensions throughout the operating length of the die, and are each preferably formed as a part of a cylinder less than half a cylinder and are therefore parti-cylindrical in form.

The grooves 6 and 7, when the dies 4 and 5 are brought nearly, but preferably not quite,

together by downward movement of the upper reciprocating jaw carrying the upper die, define an approximately oval opening extending the full length of the dies, the opening, however, being preferably normally symmetrical with regard to lateral cross sections throughout its length, the opening comprising opposing portions each constituting something less than a half circle, such portions being brought nearly together. The opening under such conditions will also correspond closely to the outside dimensions of the brazed tubes to be operated upon, although there will be a slight difference in that the vertical dimension of the opening under such a condition would be slightly less than such outside dimensions.

The material for the tubes is rolled into sheets of high carbon steel of the requisite thickness and width, being rolled into tubular form, the rolling giving the tubes a form substantially cylindrical, the diameter of the cylindrical tubes thus prepared being such that the tube when flattened to make it take the desired oval shape as described in connection with the latter steps of the process employed, will produce a tube having the requisite major and minor cross-sectional axes dimensions.

The seams of the tubes thus prepared are now brazed, or the edges at the seam secured together in any other suitable way, but I prefer to braze such a seam, it not being necessary for the purpose for which I use such tubes, to make a fluid tight seam, it only being essential for the purposes for which my tubes are intended to secure a strong joint, not a tight joint necessarily, although my invention might be employed in connection with such structures where a tight joint might be desirable. The tubes may be cut to length either before or after brazing, but I prefer to cut them to length before the brazing.

The brazed tubes, substantially of cylindrical shape and of proper length, are now introduced into the press having the die plates 4 and 5 as before described, the cylindrical tube being placed in the groove 6 for the lower die plate.

Now, prior to the operation of the press, and before the press is used to form these tubes of proper irregular oval shape, and preferably when the lower die plate 4 is being positioned on the jaw 2, I place preferably between the die plate 4 and the lower jaw 2, near the ends of the jaw such as at 10 and 11, sheets of paper or like equivalent material for the purpose of proper thickness such as paper having a thickness of .008 inches, so that the lower die plate is supported at either end on the paper sheets and secured to the lower jaw 2 with the paper sheets near the ends of the jaw, and between the die and the jaw.

The cylindrical tube now being positioned

as before described in the groove in the lowermost die plate, the operator by operating the press as by stepping on the pedal lever 8 will cause power from the motor 9 operating through suitable gears to cause the jaw 3 to descend vertically to such a distance that the tube will be pressed between the upper and lower die grooves to such an extent that the pressure will slightly cause the lower die plate 4 and to a less extent, the upper die plate 5, to yield at their intermediate portions so that the pressure on the intermediate portion of the tube will be relieved relative to the pressures at the ends of the tube, and the difference in pressures will be gradual, lessening from the ends of the tube towards the center of the tube.

I find that a tube so formed is thicker in the direction of its minor axis at the middle portion than it is at the ends, though not so thick in the direction of its major axis, and that it is possible to secure tubes of desired proper form having an enlarged central portion which will be uniform, there being a practically negligible loss due to "culls" whereby under previously known processes for making oval tubes from steel of this character, the large number of culls produced caused a very serious loss, and which loss is now practically eliminated.

Such tubes, as shown in Figs. 3 and 4, may be used as bed spring side frame members, since due to their form whereby the thickness is greater at their intermediate portions, they resist bending, and especially twisting stresses such as are incidental to the use of such side frame members in practice; these side frame members may be suitably attached to the end frame members of a bed spring, such end frame members being of angle iron or other forms, in any desired way, as by forming flanges on the ends of the tubes, or by brackets having tube end receiving sockets and attaching flanges.

In Figs. 6, 7, 8, 10 and 13, I illustrate a different form of irregular oval tube which may be produced by my invention. In this embodiment of my invention, after the tube has passed through the processes as before described, the ends of the tubes are inserted between die plates 12 and 13, Fig. 9, for a short distance, and the die plates are then brought together to compress the tube, the tube being so inserted that its major axis is in substantially a vertical plane, the cooperating grooves 14 and 15 which compress the ends of the tubes 16 and 17, Figs. 6, 7 and 8, are of substantially semi-circular cross sectional shape, and when brought nearly together, define a cylindrical opening, and compress the tube ends into substantially cylindrical shape.

This is of special advantage where it is desired to employ the oval form of tubes for rigidity in constructions such as bed spring

side frame members where the brackets for connecting the side member oval tubes, as produced by my invention, to the bed spring frames, such brackets commonly having cylindrical shaped sockets adapted to receive the commonly employed cylindrical tubular bed spring side frame members.

Having thus described my invention as it may be practiced in varying ways, I wish it to be understood that other forms of tubes than those specifically illustrated are contemplated in my invention, and that my invention is not limited to the precise means and methods herein illustrated and described, but the spirit of my invention may be had in structures departing widely therefrom.

What I claim is:—

1. In a press for forming irregular, hollow metal articles the combination with a pair of press jaws of two dies having cooperating recessed faces, one die carried by each jaw, one die having a flexible portion and supports adapted to support said flexible die on the jaw at the ends of said portion.

2. In a press for forming irregular oval high carbon steel tubes in which the minor axes increase in length towards the central portion of the tube, the combination with a pair of press jaws, a pair of die plates for the said jaws each having a parti-cylindrical groove in its face, means for securing the said die plates on the jaws, spacing means between one of the said die plates and its jaw near the outer ends of the said plate, said die plate being constructed of slightly resilient material, whereby when the said jaws are brought to their nearest adjacent position, with a proper cylindrical high carbon steel tube interposed between the said die plate grooves, the pressure applied to opposite sides of the said tube will be greatest nearer the tube ends and less towards its central portion.

3. A pair of dies for forming irregular, hollow metal articles, the article contacting surfaces of which are normally substantially cylindrical, one of said dies having a flexible portion and means to support the die so that said portion may flex in operation to permit the formation of an article having varying cross sections.

4. In an apparatus for forming irregular, hollow metal articles, the combination of a pair of dies having work receiving recesses of normally uniform cross section, one of said dies having a flexible section and means for supporting the dies so that said section may flex during a forming operation whereby the space between the dies becomes of varying cross section.

5. In a press for forming irregular, hollow articles of hard metal, the combination with a pair of press jaws having means for moving them toward and from each other,

of a pair of recessed dies one carried by each jaw, one of said dies being flexible, and supporting means supporting said die at the ends only of the flexible portion.

6. A one-piece flexible transversely concave forming die.

7. In a press for forming irregular hollow metal articles without the use of a mandrel or other filler, the combination with a pair of press jaws of two recessed dies, one carried by each jaw, one die having a flexible portion and supporting means for supporting said last named die on the jaw to permit said portion to flex under forming pressure.

8. A pair of dies for forming irregular hollow metal articles while interiorly unsupported, each having a normally partial cylindrical recess in its working face, and one of the dies being flexible to permit the space between the dies to vary as an article is formed.

9. An apparatus for forming hollow metal articles while interiorly unsupported which comprises a pair of dies having normally straight complementary grooves, one of the dies being flexible and means for supporting said flexible die to permit limited flexure when forming pressure is applied thereto.

10. A pair of metal-forming dies having normally complementary recessed surfaces, one of the dies being flexible and means for supporting said flexible die to flex away from the other under forming pressure.

11. A pair of forming dies, one of which is flexible and resilient, the dies having normally complementary recessed adjacent surfaces, means for supporting the flexible die at spaced points between which it may flex away from the other, and means for limiting said flexure.

12. A pair of forming dies having normally complementary recessed adjacent surfaces, one of which dies comprises a flexible beam, and supports therefor permitting the beam to bend away from the other die at its unsupported points under forming pressure.

In testimony whereof I hereunto affix my signature this 17th day of June, 1924.

FRANK P. VINCENT.