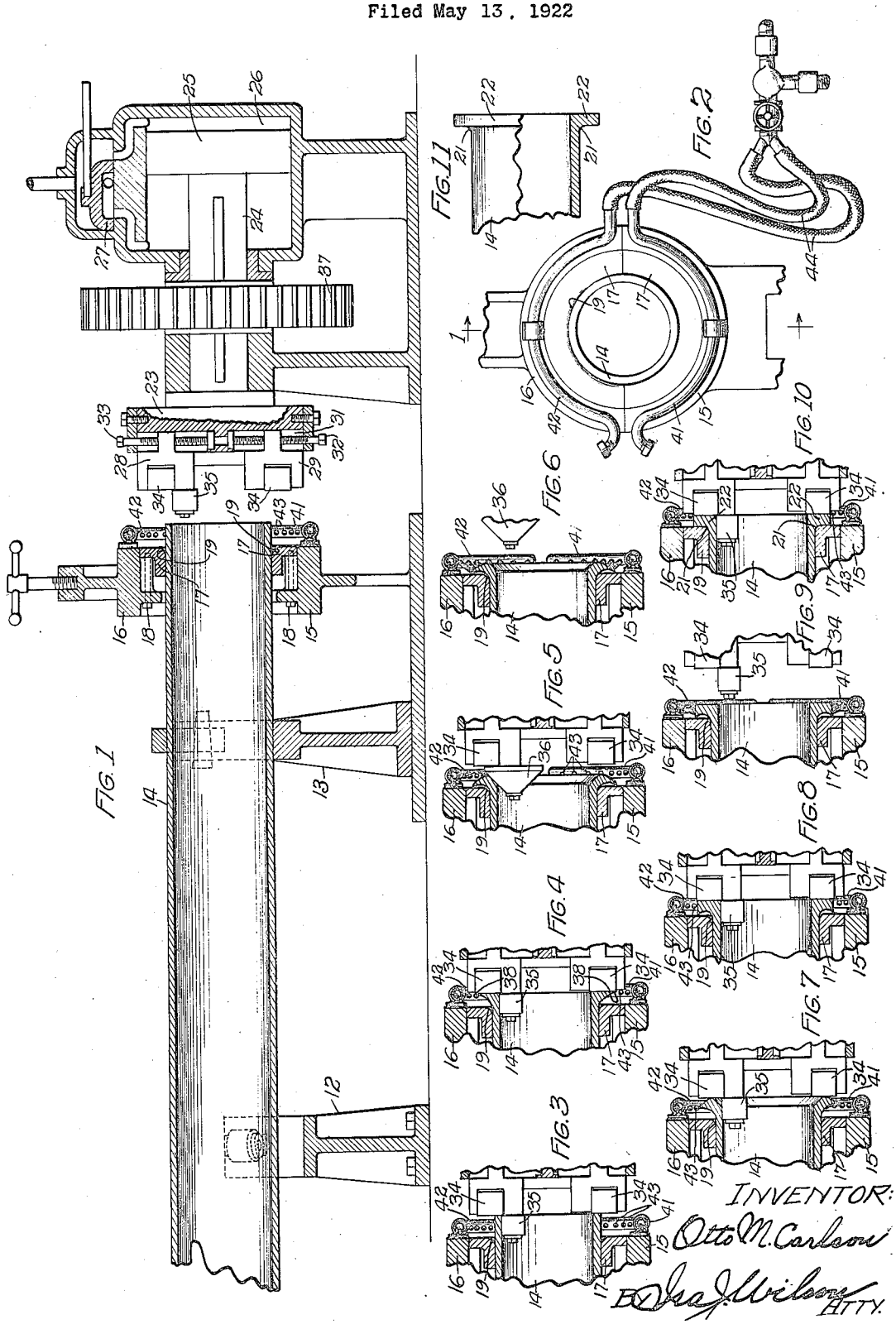
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O. M. CARLSON

METHOD OF LAPPING METAL PIPES

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METHOD OF LAPPING METAL PIPES.

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To all whom it may concern:

Be it known that I, OTTO M. CARLSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Lapping Metal Pipes, of which the following is a specification.

This invention pertains to lapping or flanging the ends of metal pipes, and has particular reference to a novel method of producing a lapped flange on the end of a pipe.

In the production of flanges on metal pipes, it is highly desirable that the metal be caused to flow into the desired flange form so that in the completed flange, the metal particles will be under a minimum of stress. Should the metal be bent and forcibly distorted in an improper way in forming the flange, the particles or grain of the flange will be left under tension and the flange will consequently be more brittle than if the metal is caused to flow in a proper manner into the desired shape.

In order that the metal may be satisfactorily worked into the desired shape, it is customary to work it while hot by exerting pressure thereon which causes the metal to flow into the desired flange form, the pressure upon the metal being resisted by a die which determines the shape of the flange. In working the metal under pressure against such a die, the metal tends to flow radially in all directions from the pipe, with the result that unless provision be made to restrict or confine the flowing metal, the flange will become too large in circumference and too thin in cross-section, as the distance from its base increases. In other words, the metal under pressure during the formation of the flange will follow the line of least resistance, which, of course, is radially outwardly between the dies, producing thereby a flange which decreases in cross-section or tapers from its base toward its periphery, and in order to approximate the required thickness of the metal at the perimeter of the completed flange, an excess of metal must be displaced a considerable proportion of which, being forced radially outwardly beyond the desired perimeter of the finished flange, must be later trimmed off and wasted.

I am aware that it has heretofore been proposed to restrict the radial displacement of the metal forming the flange by employing a die provided with a recess in which the flange is formed, the circumferential wall of this recess serving to limit the radial displacement of the metal and determine the size of the flange.

My present invention is designed to enable the formation of a flange of the required dimensions and strength without the employment of a recessed die by utilizing the marginal portion of the partially formed flange as a restricting or confining agency for limiting the radial displacement of the metal so as to thereby cause the metal subsequently displaced to assume a position within the confines imposed by this restricting margin, thus enabling the production of a flange of the desired thickness from base to perimeter in which the metal will be under a minimum tension and only a minimum quantity will be trimmed off in the final finishing operations upon the flange.

Another purpose of my invention is the provision of a method by which a flange as thick or thicker, from its base to its very perimeter, than the original walls of the pipe from which it is formed, may be produced, so that the flange will be at least as strong as the pipe itself and dangers of fracture or leakage at the joints of the pipe sections formed by the connection of two opposed flanges is entirely, or at least very largely, obviated.

Another purpose of my invention is to so work the metal into the desired flange form that it will be caused to flow into position without being subjected to excessive bending strains or left under such tension as would weaken its structure, the metal of the completed flange being left therefore in substantially normal condition, as distinguished from being under an undesirable stress. The flange therefore possesses maximum strength, not only because of the quantity, but also of the condition of the metal embodied in its structure.

For the purpose of facilitating an understanding of my invention, I have illustrated on the accompanying drawings one form of machine adaptable for carrying my improved method into effect, but it should be

manifest that it is not restricted to any particular mechanism.

Referring to the drawings:—

Fig. 1 is a longitudinal sectional view of a pipe flanging machine capable of carrying out my invention;

Fig. 2 is a face view looking toward the die, showing the location of the chilling apparatus;

Figs. 3 to 10 inclusive are fragmentary sectional views illustrating successive steps in the formation of the flange; and

Fig. 11 is a view of a completed flange.

The machine herein shown for illustrative purposes merely may be substantially of the type disclosed in Patent No. 1,076,592, granted October 21, 1913, and comprises pipe supports or standards 12 and 13 upon which the pipe 14 to be lapped rests, and a die or forming mold clamp comprising the fixedly mounted lower section 15 and the movable upper section 16 adapted to be separated from the lower section to permit the introduction and withdrawal of the pipe. The die itself 17 is of ring form also made in two sections carried by the upper and lower portions of the clamp respectively and secured in position by suitable bolts 18 or other fastening means. It will be observed that this ring die has a flat operating face having a curved juncture 19 with the portion opposed to the pipe 14 so as to provide in the completed flange a thickened portion or fillet 21 (Fig. 11) which reenforces and strengthens the juncture of the completed flange 22 with the body of the pipe 14.

A rotary head 23 is carried by a shaft 24 which is adapted to be reciprocated longitudinally by any suitable mechanism, that illustrated herein comprising a plunger 25 adapted to be pneumatically or hydraulically reciprocated in its housing or cylinder 26, the movements of the piston being controlled by a slide valve 27 of any preferred construction.

A pair of slidable blocks 28 and 29 adjustably mounted in a groove 31 formed in the face of the head 23, are radially adjustable by means of screws 32 and 33 to accommodate the blocks to pipes of various sizes. Each of these blocks carries a roller 34 having its axis extending radially of the head 23 and one of the blocks carries a roller 35 having its axis disposed parallel with the shaft 24 and the pipe 14 to be operated upon. While only one roller 35 is illustrated, it should be understood that when large size pipes are to be lapped, the process may be expedited by equipping each of the blocks 28 and 29 with such a roller. A conically-shaped roller customarily referred to as a belling roller 36 is adapted to be slipped into position over the roller 35 for performing certain operations which will be later explained, this roller being adapted to be slipped off and laid aside when not required.

The shaft 24 and the head 23 carried thereby are adapted to be revolved from any suitable source of power, preferably transmitted through a gear wheel 37 splined on the shaft 24 so as to permit of reciprocatory movements of the shaft.

In carrying out my improved method, the end of the pipe to be flanged is first heated to the required temperature and then placed in the machine, substantially in the position shown in Fig. 1, with its heated end projecting beyond the face of the die, in which position it is clamped or held against movement in any suitable manner. The shaft 24 carrying the head 23 is then revolved and the head is forced under pressure toward the projecting end of the pipe, disposing the rollers 34 against the end of the pipe and the roller 35 within the pipe, as shown in Fig. 3. Under the pressure of the revolving rollers 34, the metal at the end of the pipe is gradually upset into substantially the form indicated by reference character 38 (Fig. 4), the roller or rollers 35, as the case may be, serving to maintain the interior diameter of the pipe during the upsetting operation. The head is then backed off and the belling roller 36 is slipped over the roller 35, whereupon the head is again revolved and forced against the upset end of the pipe. The belling roller flares or bells the upset portion of the pipe substantially into the position shown in Fig. 5, and when this operation has been completed, it is customarily preferable to remove the pipe from the machine and reheat it, although my method is not restricted to such re-heating for the reason that with some sizes and qualities of pipe all of the operations may be performed consecutively with only one heating of the pipe, whereas with extremely large sizes of pipe it may be necessary in some instances to reheat more than once.

After the belling operation and the reheating, if such is found necessary, the pipe is replaced in the machine, as shown in Fig. 6, substantially in the position from which it was removed, as shown in Fig. 5, i. e., the perimeter of the partially formed flange is contiguous to the face of the die.

At this point in the method the peripheral margin of the partially formed flange is cooled to harden the metal and thereby produce a retaining or restricting ring formed from the metal of the flange itself, which serves to restrict further radial displacement of the metal, thereby limiting the diameter of the flange to be formed and causing the subsequently displaced metal to assume a position within this ring which will result in a flange of the desired thick-

ness. The cooling operation is effected by discharging sprays of cooling liquid directed against the peripheral margin of the partially formed flange. A plurality of spray pipes 41 and 42 are accordingly mounted on the lower and upper sections 15 and 16 respectively of the mold clamp, these pipes being provided with spray apertures 43 arranged to discharge the cooling liquid in the required direction, and the liquid is supplied to these pipes under suitable pressure from any preferred source, the upper pipe 42 being preferably connected with the source of supply through a flexible hose 44 which will permit this pipe to be raised and lowered with the movable section 16 of the mold clamp.

When the cooling operation is being performed, the partially formed flange is disposed contiguous to the face of the die 17, as shown in Fig. 6, in order that the cooling liquid may not flow between the die and the flange and cool the metal at the base of the flange. After the cooling operation has been completed, the pipe is moved outwardly away from the die into the position shown in Fig. 7 whereupon, the belling roller 36 having been removed, the partially formed flange is subjected to the action of the rollers 34 and 35 which forces the flange into substantially the form shown in Fig. 8, from an inspection of which it will be observed that the diameter of the flange has not been increased, since the cooled marginal ring prevented, during this operation, further radial displacement of the metal.

When the flange has been worked substantially into the form shown in Fig. 8, the cooling liquid is again turned on momentarily to cool the exposed periphery of the flange so as to prevent radial displacement of that metal which now lies between the previously cooled ring and the end face of the flange. The operation of the rollers 34 and 35 is then continued until the metal has been worked into final form, wherein as will be apparent from Fig. 10, it lies flush against the face of the die and is of substantially uniform thickness from the base to the perimeter of the flange and is slightly thicker at the juncture of the flange with the pipe, forming the reenforcing fillet 21, as previously explained. A flange thus formed may be as thick, or even thicker than the walls of the pipe, thus ensuring great strength. The flange is customarily finished by machining its outer face to provide a smooth surface which will ensure a tight joint and the periphery is also machined to truly circular form.

It should be apparent from the foregoing that a flange formed by my novel method may be made of any desired thickness within reason, that all of the displaced metal is utilized where it is effective in producing a flange of the required thickness and without wasting the metal by displacing it outwardly beyond the desired perimeter of the completed flange. The metal being caused to flow into position remains in the completed flange under a minimum of stress, and the flange therefore, because of its thickness and the condition of its metal, possesses a maximum of strength. The flange, furthermore, is reenforced at its base where the greatest strains are imposed, by the fillet 21.

In the practice of my novel method, the mode of procedure may obviously be varied within wide limits without departing from the essence of the invention as set forth in the following claims.

I claim:

1. The method of lapping pipes, which consists in heating the portion of the pipe to be flanged, working the heated metal into rough flange form, cooling the circumferential margin of the partially formed flange to restrict the radial displacement of the metal, and then working the metal thus restricted into final flange form.

2. The method of lapping pipes, which consists in heating the portion of the pipe to be flanged, working the heated metal into flange form, and cooling the circumferential margin thereof during the formation of the flange.

3. The method of lapping pipes, which includes displacing the metal of the pipe walls into flange form, and limiting the diameter of the flange being formed by hardening the circumferential margin thereof.

4. The method of lapping pipes, which includes displacing the metal of the pipe walls into flange form, and limiting the diametral dimensions of said flange by reducing the ductility of the circumferential margin of the flange during the formation thereof.

5. The method of lapping pipes, which consists in heating the end of the pipe to be flanged, upsetting by longitudinal pressure said heated portion of the pipe, cooling the circumferential margin of said upset portion, and forcing the metal restricted by said cooled portion, into flange form.

6. The method of lapping pipes, which consists in heating the end of the pipe to be flanged, upsetting the end of said heated portion, belling said upset portion, re-heating said end, cooling the circumferential margin of said upset portion, working the metal within the cooled margin into rough flange form, extending the area of the cooled portion, and working the metal embraced by said cooled area into final flange form.

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