July 19, 1932. J. U. DEVINE 1,868,094

METHOD OF AND MACHINE FOR UPSETTING THE ENDS OF PIPE

Filed Oct. 1, 1929 2 Sheets-Sheet 1

Fig. 1.

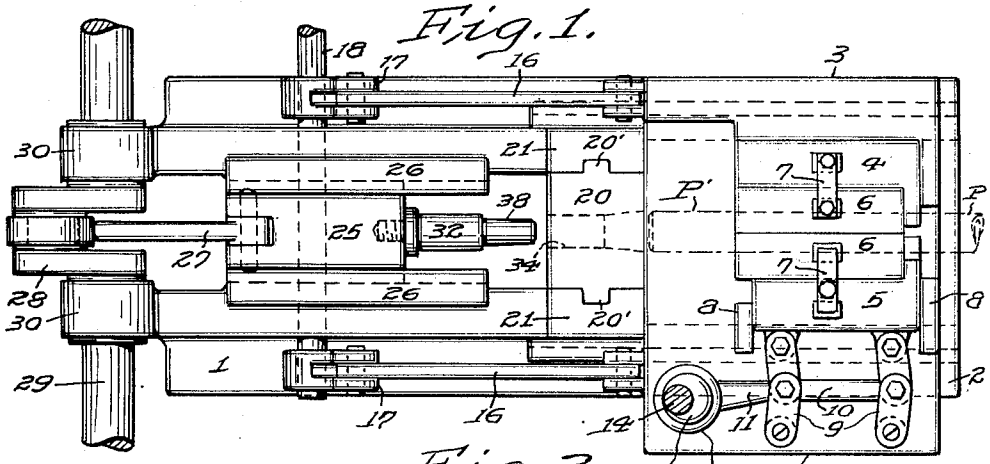


Fig. 2.

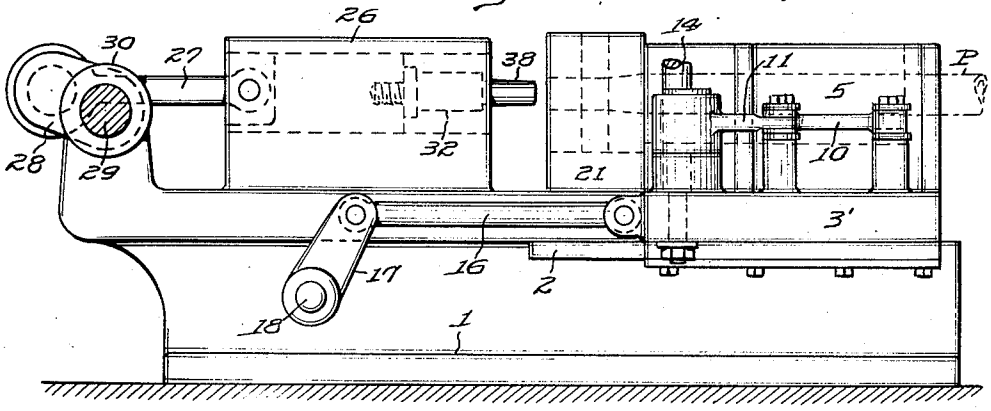
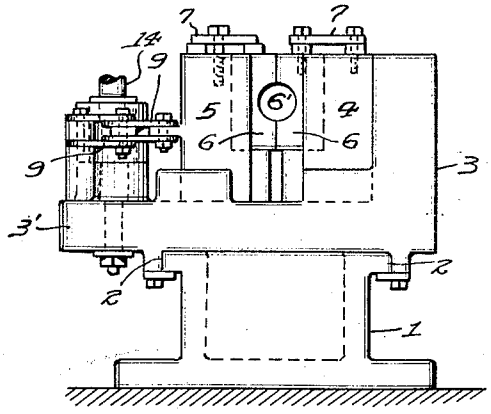


Fig. 3.



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Fig. 4.

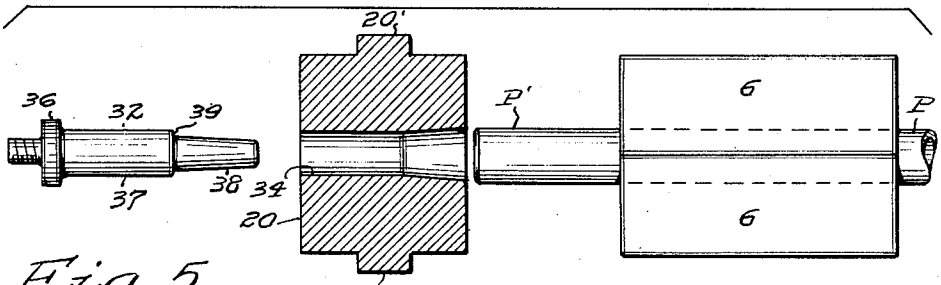


Fig. 5.

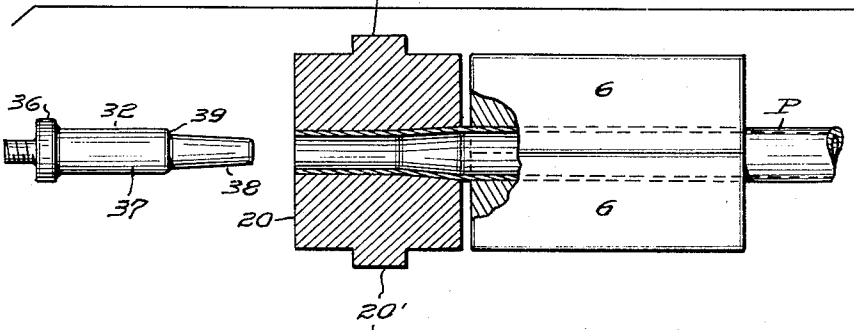


Fig. 6.

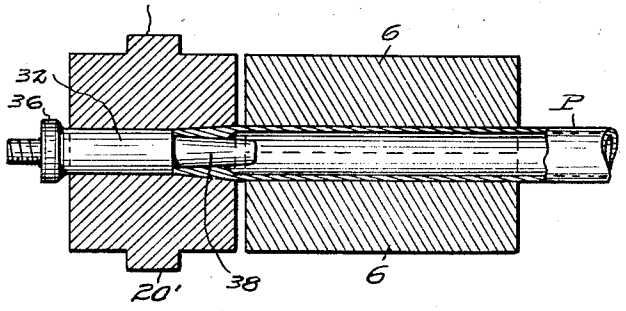
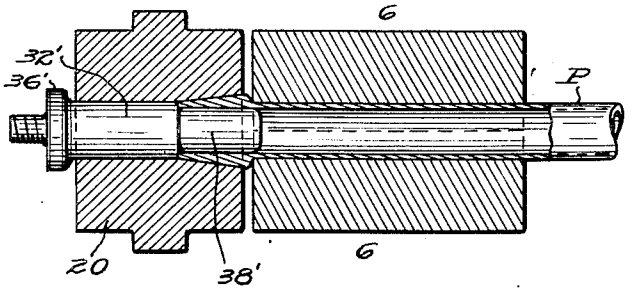


Fig. 7.



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METHOD OF AND MACHINE FOR UPSETTING THE ENDS OF PIPE

Application filed October 1, 1929. Serial No. 396,502.

In the manufacture of drill pipe and certain other sorts of pipe and tubes, it is common practice to thicken the walls of the pipe adjacent its ends to enhance its strength at the point where the threads are subsequently cut. It has hitherto been customary to perform this operation by placing the end of the pipe between a pair of forming dies separable in the plane of the longitudinal axis of the pipe and respectively provided with semi-cylindrical grooves for its reception when the dies are closed on the pipe, and to then bring a shouldered plunger against the end of the pipe so as to crowd the metal back on itself and into the space between the forward end or nose of the plunger, which is usually of less diameter than the bore of the pipe, and the wall of the bore, with resulting upsetting or thickening of the wall from the end of the pipe inwardly for the desired distance, but due to the fact that the dies in which the pipe is held during this operation are of necessity separable on the plane of the pipe axis, a pair of diametrically opposed relatively thin fins are formed on the end of the pipe by metal which is forced up between the dies during the upsetting operation, and these fins must be subsequently removed by chipping, grinding or the like with resulting enhancement of production costs.

It is therefore a principal object of the present invention to provide a method of and apparatus for upsetting or thickening the ends of pipes or tubes which is not open to this objection and which, therefore, is adapted to upset or thicken the pipe wall without producing any exterior fins or other projections whatsoever upon the pipe.

A further object of the invention is to reduce the wear and tear on the dies in which the pipe is disposed during the upsetting operation and which in the methods hitherto in use has been a matter of considerable moment.

A still further object of the invention is the provision of a novel form of machine satisfactorily operative for the performance of my improved method.

Still other objects, advantages, operations and novel features of construction and design comprehended by the invention are hereinafter more particularly mentioned or will be apparent from the following description of one manner of performing it by means of a machine of the character of that to which reference has been made and which is illustrated in the accompanying drawings.

My improved method will be most readily comprehended by first describing the said machine and then pointing out the manner in which it is employed in the performance thereof, it being, however, distinctly understood that the practice of the method is in no way confined to the use of a machine of the specific character of that herein disclosed as various modifications may be made in the said machine and, under certain conditions, machines of other types may be utilized if desired without departing from the spirit and scope of the said method as hereinafter defined and claimed. However, a machine of the character of that herein illustrated and described may preferably be utilized under most conditions for the performance of the method as the same is satisfactorily operative, of a construction not liable to become damaged or get out of order under the conditions of use to which it is necessarily subjected, may be readily operated by a laborer of average intelligence and is capable of turning out the work with the rapidity and accuracy requisite for modern manufacturing requirements.

In the said drawings Fig. 1 is a top plan view of the machine; Fig. 2 a front and Fig. 3 an end elevation thereof. Figs. 4, 5 and 6 are fragmentary views, partially in central section and partially in elevation, showing the sequence of positions assumed by certain of the parts of the machine and the manner in which they operate upon the pipe during the performance of the method where the pipe is being upset or thickened inwardly, while Fig. 7 is a view corresponding to Fig. 6 but showing the positions assumed by the parts and the pipe when the latter is being upset or thickened outwardly as hereinafter more fully explained.

Referring now more particularly to the

machine shown in Figs. 1 to 3 inclusive, the same comprises a generally longitudinally extending base 1 provided at one end with laterally spaced ways 2 upon which is mounted a longitudinally reciprocable carriage generally designated as 3. On this carriage are disposed a pair of grip holders 4 and 5 which are laterally spaced apart and cut out on their opposed inner faces for the reception of the pipe grips 6—6 which are held in position in the holders by clamps 7—7 of any suitable type. Each pipe grip is in the form of a rectangular block provided in its inner face with a longitudinally extending semi-cylindrical groove so that when the grips are brought together as shown in Fig. 3 a cylindrical or substantially cylindrical orifice 6′ is formed for the reception of the pipe, of such size that when the grips are closed down on the pipe the latter will be firmly held thereby in the orifice. The grip holder 4 is supported rigidly on the carriage in any suitable way, while the grip 5 is arranged to be moved in and out transversely to enable the pipe to be introduced into and removed from between the grips. For this purpose the grip holder 5 may be arranged to slide between guides 8—8 disposed on the carriage adjacent the ends of the holder and any suitable means provided for effecting the requisite movement of the latter, for example and as shown, a pair of toggle links 9 respectively connected at one end with the holder and at the other with the carriage which is extended outwardly beyond the base as at 3′ to form a suitable support for the toggle links and their actuating mechanism. The latter may comprise a link 10 connecting the centers of the toggle links and an arm 11 extending from the center of one of the links to an eccentric strap 12 surrounding an eccentric 13 disposed on a vertical shaft 14 provided with any suitable rotating means (not shown), the arrangement being such that by rotating the shaft in one direction the toggle links may be broken or thrown to sharply angular position so as to move the grip holder 5 and its grip 6 transversely outward, while by rotating the shaft in the other direction the holder and grip may be moved inwardly to substantially the position shown in the drawings so as to close the grips on the pipe after it has been disposed between them. While mechanism of substantially the character to which I have referred is preferably employed for actuating the movable grip holder and grip, other means may be utilized for the purpose if desired, as the specific construction thereof is but a matter of choice.

Means are provided for reciprocating the carriage 3 on the ways 2 such, for example, as a pair of links 16 disposed on opposite sides of the machine and respectively connected at one end to the carriage and the other to cranks 17 on a transversely extending shaft 18 carried by the base of the machine and actuated in any suitable way, so that by rotating the shaft through a limited arc in one direction or the other the carriage may be drawn forward, that is, toward the left when viewed as in the drawings, or retracted in the opposite direction.

Suitably rigidly yet removably supported on the base of the machine in front of, that is, adjacent the left hand side of the carriage when viewed as in Figs. 1 and 2, is a forming die 20 hereinafter more specifically described. This die is preferably exteriorly rectangular and may be provided on its side faces with ribs 20′ adapted to seat in corresponding grooves in a pedestal 21 rising from and integral with the base of the machine; this pedestal is cut out downwardly from its upper face so as to properly receive the die when lowered thereinto and afford vertical support thereto, while the engagement of the ribs with the grooves in the pedestal prevents the die from moving longitudinally in either direction. However, any other means for rigidly supporting the die on the base may be utilized if preferred.

On the opposite side of the die from that on which the carriage is disposed is arranged a head 25 adapted for longitudinal reciprocation in ways 26 carried by the base, said reciprocation being effected by any suitable means such, for example and as shown, as a pitman 27 extending from the head to a crank 28 on a transversely extending shaft 29 supported in suitable bearings 30 carried by the base of the machine, the shaft being driven in any convenient way. This head is operative to support at its end adjacent the die the swaging plunger 32 hereinafter more particularly described and which is adapted when the head is moved toward the die to enter the latter and upset the pipe disposed therein.

It will thus be apparent that with a machine of the general character of that just described, the pipe P whose end is to be upset or thickened may be disposed in alignment with the semi-cylindrical grooves in the pipe grips 6—6 when the carriage is in retracted position, and by suitable operation of the grip holder actuating means then clamped in position in the grips with its end P′ projecting beyond the latter for a considerable distance as indicated in Fig. 1, the space between the forward faces of the grips and the adjacent face of the die being so calculated as to permit this result. The die 20 is provided with a central bore 34 in axial alignment with the pipe when clamped in the grip as aforesaid, and adapted to receive the projecting end P′ of the pipe when the carriage is advanced, thus bringing the parts from the position shown in Figs. 1, 2 and 4 to substantially that shown in Fig. 5. From an inspection of Figs. 4, 5 and 6 it will

be noted that the bore in the die is desirably slightly inwardly tapered for a portion of its length from the side or end at which the pipe is introduced when the die is intended for inwardly upsetting the pipe end; (in practice this taper is very slight but is exaggerated in the drawings for the sake of clearness), and as the mouth of the tapered portion of the bore approximates the normal outside diameter of the pipe, it will be of course apparent that when the pipe is fully seated in the die the forward end thereof beyond the tapered portion of the bore is slightly reduced in diameter as shown in Fig. 5.

The swaging plunger 32 to which reference has been made is screwed into or otherwise removably mounted in the head 25 and comprises a head 36 which seats against the plunger, a cylindrical portion 37 forming a close sliding fit in the cylindrical portion of the bore of the die 20 and, when intended for inwardly upsetting the pipe end, with a tapered or frusto-conical extremity or nose 38, the greatest diameter of which is adjacent the cylindrical portion 37 but is less than that of the latter so that a shoulder 39 is formed at the junction of the tapered and cylindrical portions which, in width, approximates the thickness of the pipe wall.

In the performance of the method, the heated end of the pipe is introduced to the die as above described to assume the position shown in Fig. 5, and the swaging plunger which, of course, is mounted with its axis coincident with that of the pipe and bore in the die, is then progressively advanced into the pipe, thus bringing the shoulder 39 against its end face, after which further advancing movement of the plunger is effective to crowd the metal of the pipe back on itself and into the space between the nose of the plunger and inner wall or surface of the pipe until when the movement of the plunger is completed the adjacent pipe metal has assumed substantially the shape shown in Fig. 6 with resulting thickening or upsetting of the pipe wall. The plunger is now retracted so as to clear it from the die and the carriage moved away from the latter so as to clear the end of the pipe therefrom, after which the sliding grip holder is moved outwardly and the pipe removed from the machine, thus completing the operation.

It will be of course appreciated that as the bore in the die 20 presents an uninterrupted annular surface in any plane normal to the axis of the pipe within the zone or area in which the outward radial movement or flow of the metal occurs while it is being crowded back by the plunger, it is impossible for any of the metal to be forced outwardly beyond such surface so as to form a fin or other projection on the pipe since the radial distance through which the metal can flow in any such plane is equidistantly limited at all points around the perimeter of the pipe.

It will be noted that a certain amount of clearance is preferably left between the adjacent faces of the pipe grips and die 20 when the pipe is fully entered in the latter, but as only the extremity of the pipe is ordinarily heated before the pipe is introduced in the die and as the length of the die 20 is such as to extend considerably behind the zone where the metal flow occurs, it is found under practical conditions of operation that there is no swelling or other material disturbance of the relatively colder pipe metal exposed in this clearance space, the displacement of the pipe wall under the action of the plunger being confined solely to that portion of the pipe which lies within the die.

While the foregoing description as well as the figures therein referred to have been directed more particularly to the performance of the method and to the forms of dies and plungers utilized where the pipe is to be inwardly upset as best shown in Fig. 6, the practice of the method is in no way limited thereto as it may be used with equal facility for upsetting the end of the pipe outwardly so as to maintain the bore of the pipe of constant diameter and provide a raised cone-shaped surface on its exterior for the reception of the pipe threads. In this connection reference may be had to Fig. 7, generally corresponding to Fig. 6, but showing a die and plunger suitable for upsetting the end of the pipe outwardly. For this purpose the cylindrical portion of the bore in the die 20 may be of a diameter substantially similar to the outside diameter of the pipe, while the conical portion of the bore is of somewhat greater diameter at its mouth than the outside diameter of the pipe; correspondingly, the cylindrical portion 32′ of the plunger is arranged to form a snug sliding fit in the cylindrical portion of the die bore while the nose 38′ of the plunger is cylindrical instead of tapered and corresponds substantially with the internal diameter of the pipe. Thus, after the pipe has been entered in the die and the plunger is advanced, the metal at the end of the pipe is crowded outwardly into the space between the nose of the plunger and the wall of the conical portion of the die and thus forms a conical enlargement on the outer surface of the pipe substantially as shown in Fig. 7.

While my improved method of thickening or upsetting the ends of drill pipe and the like is particularly desirable because the formation of fins or other projections on the pipe surface is entirely avoided, it is also of advantage in minimizing the wear on the dies employed. Hitherto where a pair of sepa-

rable forming dies have been utilized as hereinbefore described, it has been found that the latter wear very rapidly adjacent the seam formed between them at their plane of separation, so that new dies are required at relatively short intervals with resulting enhancement of production costs. In accordance with the present invention, however, as the forming die 20 is entirely devoid of seams, the wear to which it is subjected is constant and similar at all points in the bore as well as extremely gradual, while there is no opportunity for scale or other foreign objects to lodge between the dies, as where separable forming dies are employed, and prevent their properly closing about the pipe.

It will of course be understood that a machine such as I have described may be readily adapted for use with various sizes of pipe by merely changing the pipe grips, die and plunger and may be used with equal facility for upsetting the pipe either inwardly or outwardly by employing plungers and dies of suitable conformation for the performance of the desired function. Furthermore, as above mentioned, the particular or specific details of construction and arrangement of the various parts of the machine are a matter of choice and may thus be varied as desired.

While I have herein described with considerable particularity one manner of performing my improved method as well as a machine by which it may be conveniently practised, I do not thereby desire or intend to specifically confine myself thereto as various changes and modifications may be introduced in the performance of the method, and machines other than that to which I have referred employed for the practice thereof if desired, without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. A machine of the class described, comprising a base, a carriage longitudinally reciprocable on the base, pipe gripping means carried by the carriage, a solid forming die carried by the base and having a bore adapted for the reception of the end of the pipe when gripped in said means, means for effecting relative movement between the carriage and the die operable to move the pipe into the latter when gripped by said gripping means, a plunger adapted to axially enter the pipe when the latter is disposed in the die, and means for effecting relative movement between the pipe and the plunger.

2. A machine of the class described, comprising a base, a carriage slidable on the base, means for reciprocating the carriage, pipe gripping means carried by the carriage and adapted to hold a pipe in operative position thereon, a solid forming die supported on the base and having a bore extending from one side to the other thereof and adapted to receive the end of the pipe when the pipe is supported in the gripping means and the carriage moved relatively toward the die, a plunger having a shoulder adapted to engage the end of the pipe when in the die and a nose adapted to enter the pipe, and means for forcing the shoulder of the plunger against the end of the pipe to thereby crowd the metal thereof against the nose of the plunger.

3. A machine of the class described, comprising a base, a carriage slidable on the base, means for reciprocating the carriage, a reciprocal head adapted to support a plunger, means for reciprocating the head, a solid die disposed between the carriage and the head and having a bore extending through the die and adapted to receive the end of a pipe when moved into the die by the operation of the carriage, and means for progressively forcing the plunger against the end of the pipe when disposed in the die to effect a radial flow of the pipe metal between the die and the plunger.

4. In a machine of the class described, a solid die having a bore extending therethrough adapted to receive the end of a pipe, means disposed on one side of the die for introducing the pipe into the bore and thereafter operatively holding it therein, a plunger disposed on the other side of the die in alignment with said bore and provided with a nose adapted to extend into the pipe and a shoulder adapted to engage the end of the pipe, and means for progressively forcing the shoulder of the plunger through said bore and against the end of the pipe when the pipe is disposed in the die so as to crowd the pipe metal in advance of said shoulder between the nose of the plunger and the adjacent surface of the bore of the die.

5. A machine adapted to upset the opposite ends of a pipe, comprising a solid forming die having an opening extending through it and of uninterrupted circular cross section in any plane normal to its axis, means for rigidly supporting the die, means disposed on one side of the die for gripping the pipe and moving one end thereof into the die opening and thereafter operatively holding it therein, a plunger disposed on the opposite side of the die from the pipe gripping and moving means and provided with a nose adapted to enter the pipe and a shoulder behind the nose, and means for moving the plunger into the die in a direction opposite that in which the pipe is moved thereinto to thereby force the shoulder of the plunger against the end of the pipe and radially displace the pipe metal adjacent said end, said pipe moving means and said plunger moving means being respectively operable to thereafter withdraw the pipe and the plunger from the die in opposite directions, the opening in the die being

so formed as to present no obstacle to such withdrawal.

6. A machine adapted to upset the opposite ends of a pipe, comprising a solid forming die having an opening extending through it and of uninterrupted circular cross section in any plane normal to its axis, means for supporting the die, means operative to effect relative movement between the pipe and the die to thereby effect disposition of the end of the pipe within said opening and adapted to maintain said end therein during subsequent upsetting operations, a plunger disposed adjacent the die and provided with a nose adapted to enter the pipe and a shoulder behind the nose, and means for moving the plunger into the die toward the pipe to thereby force the shoulder of the plunger against the end of the pipe and radially displace the pipe metal adjacent thereto, said several means being respectively operable to effect relative movement in opposite directions of the pipe and the plunger with respect to the die to effect longitudinal separation of the upset pipe and the die, the opening in the die being so formed as to present no obstacle to such movement.

In witness whereof I have hereunto set my hand this 27th day of September, 1929.

JOHN U. DEVINE.