

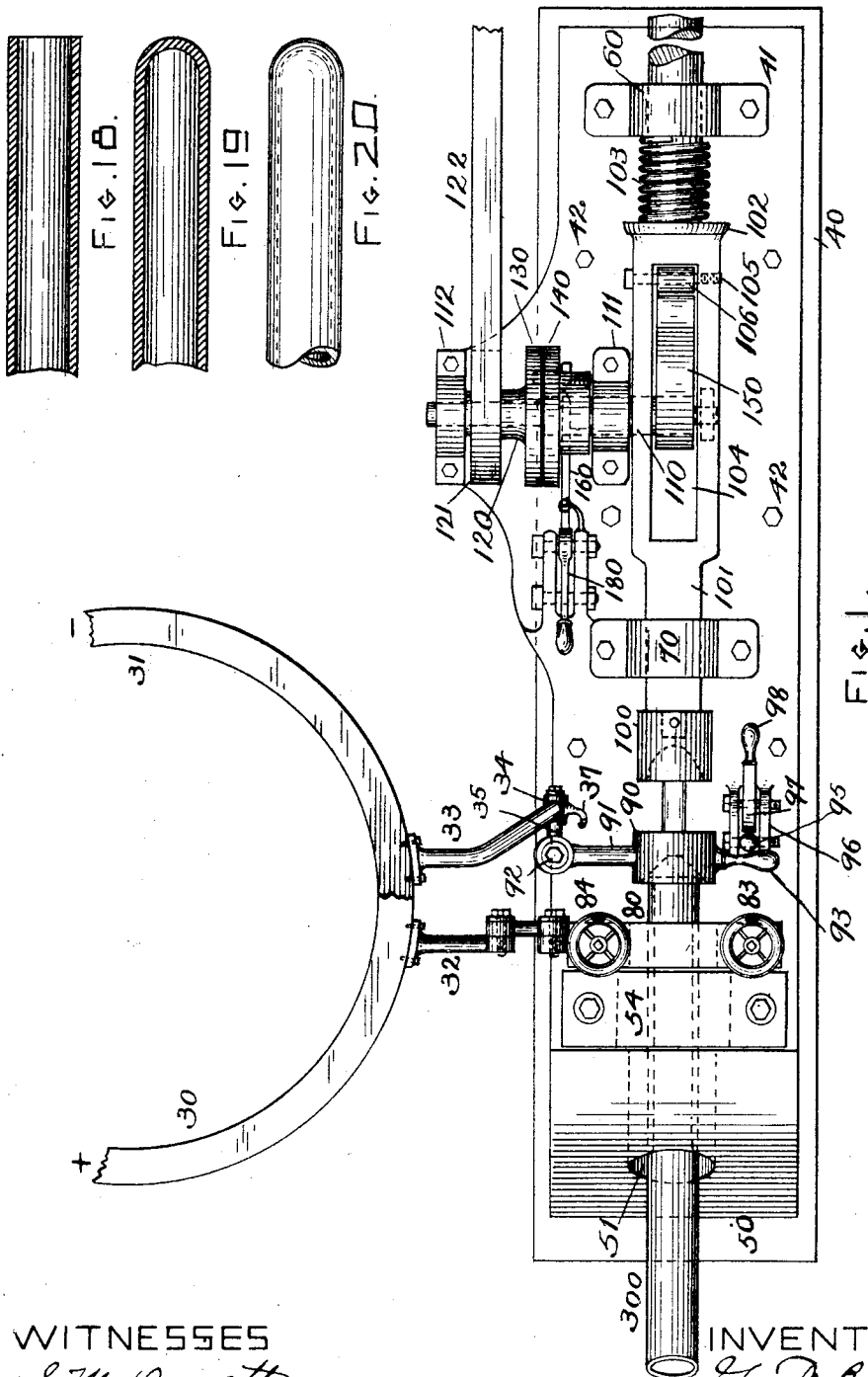
(No Model.)

5 Sheets—Sheet 1.

G. D. BURTON & E. E. ANGELL.
MACHINE FOR CLOSING ENDS OF TUBES.

No. 537,014.

Patented Apr. 9, 1895.



WITNESSES

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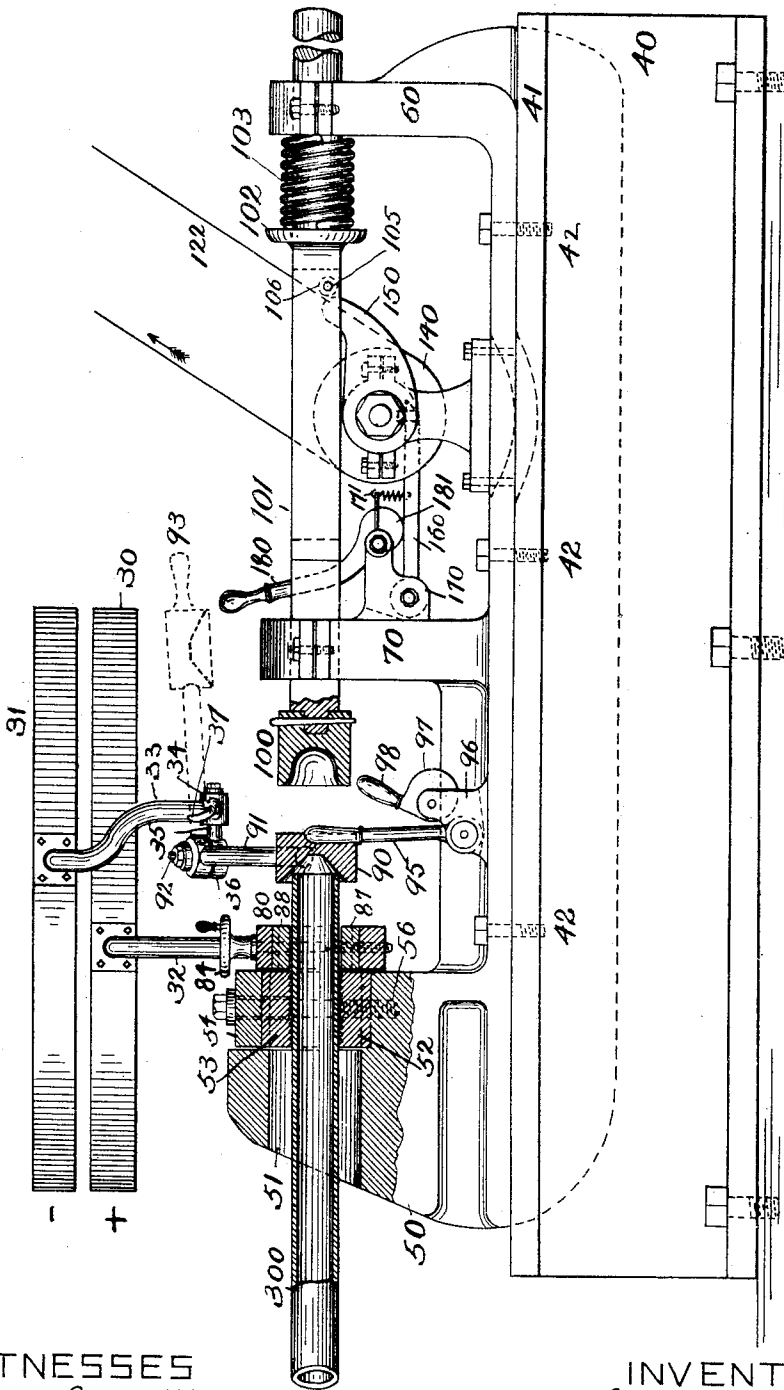
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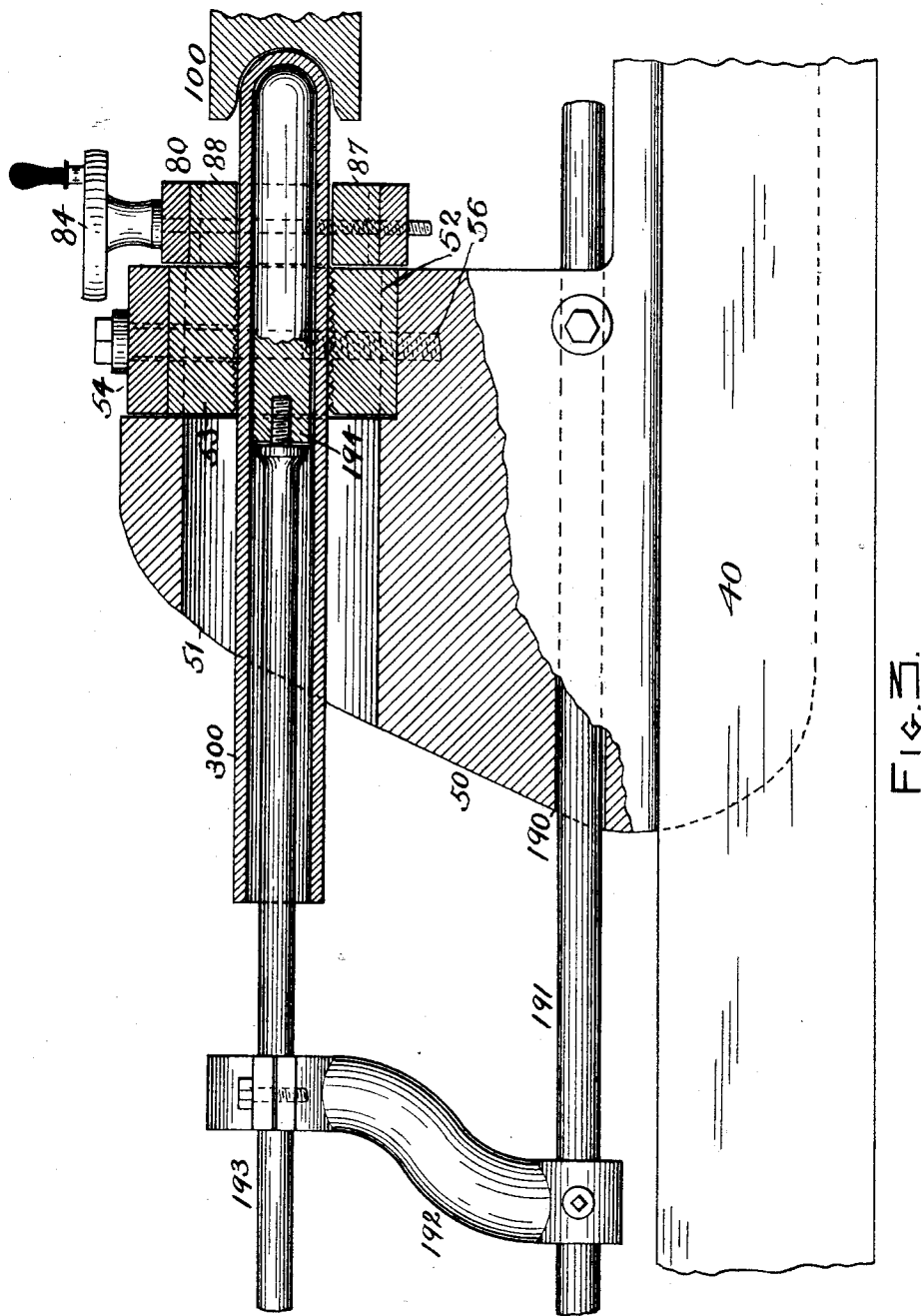
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(No Model.)

5 Sheets—Sheet 4.

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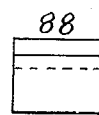
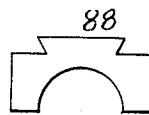
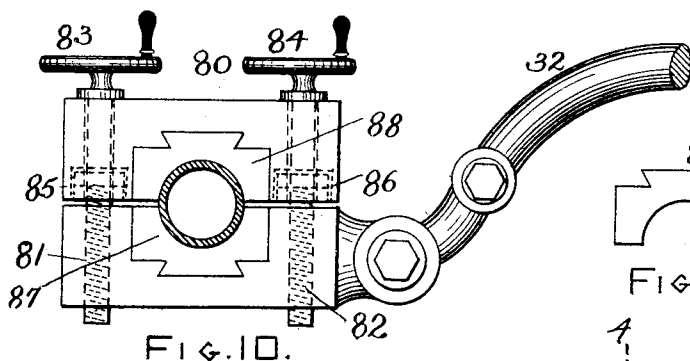


FIG. 11.

FIG. 12.

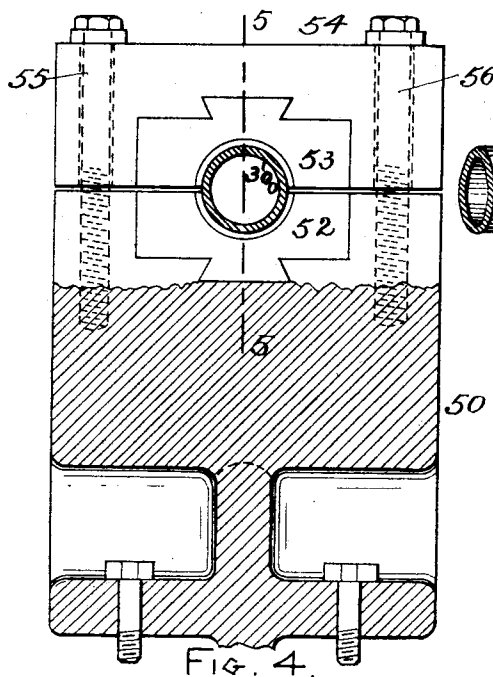


FIG. 4.

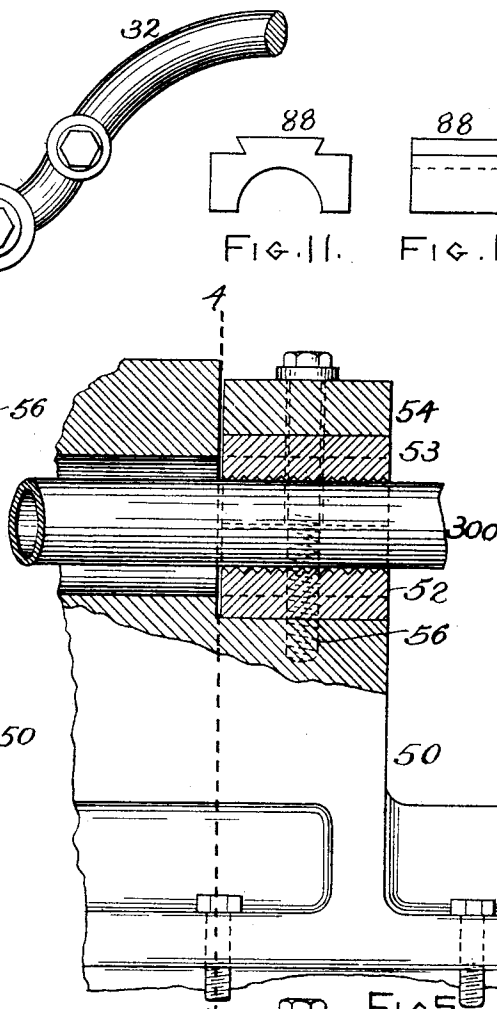


FIG. 5.

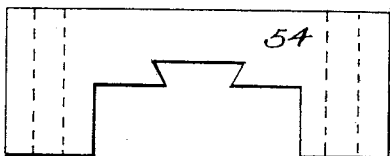


FIG. 6.



FIG. 8.

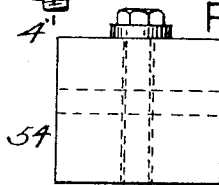


FIG. 7.



FIG. 9.

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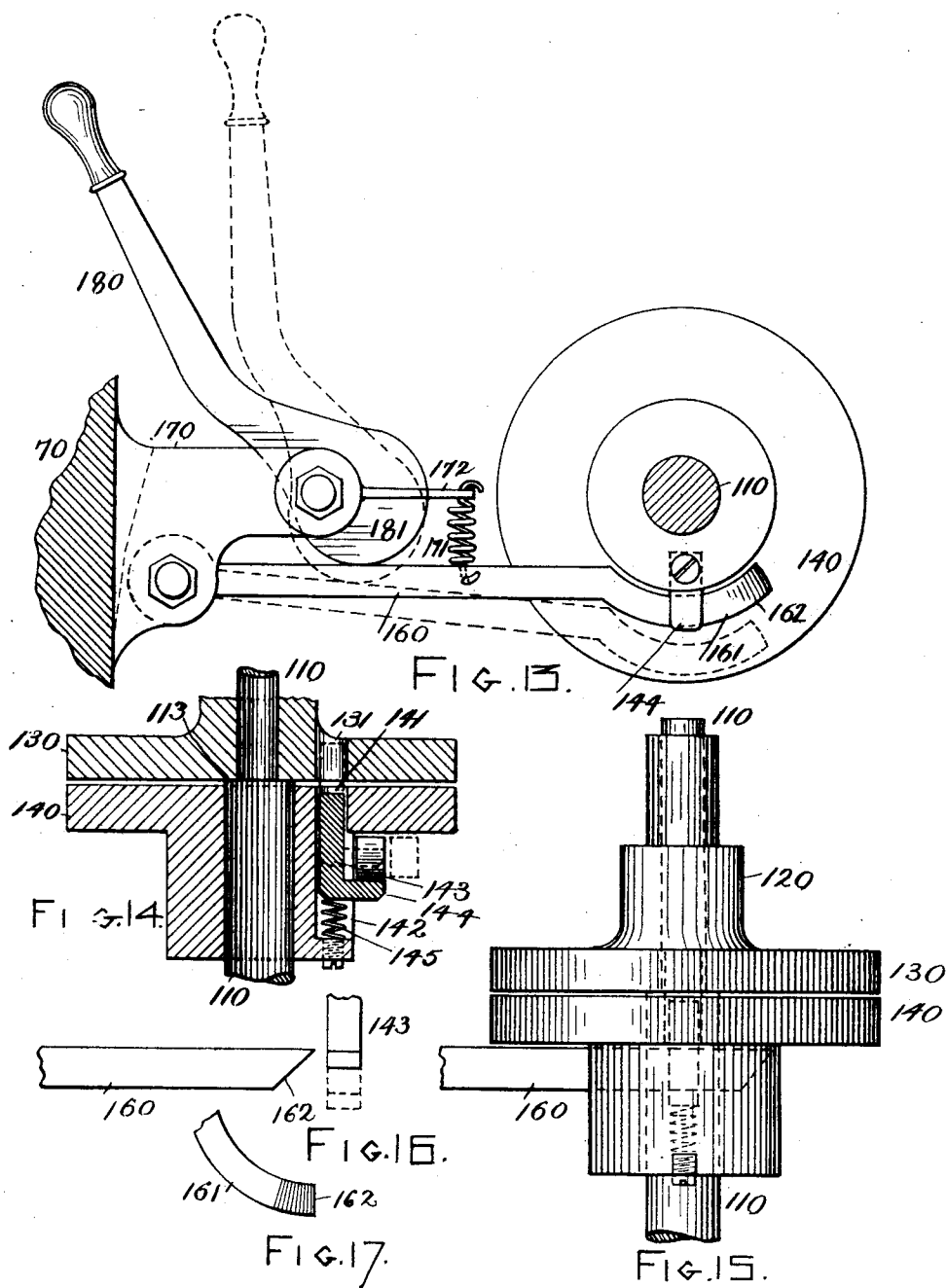
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UNITED STATES PATENT OFFICE.

GEORGE D. BURTON, OF BOSTON, AND EDWIN E. ANGELL, OF SOMERVILLE,
MASSACHUSETTS, ASSIGNORS, BY MESNE ASSIGNMENTS, TO SAID BURTON.

MACHINE FOR CLOSING ENDS OF TUBES.

SPECIFICATION forming part of Letters Patent No. 537,014, dated April 9, 1895.

Application filed May 4, 1893. Serial No. 473,014. (No model.)

To all whom it may concern:

Be it known that we, GEORGE DEXTER BURTON, residing at Boston, in the county of Suffolk, and EDWIN ELLIOTT ANGELL, residing at Somerville, in the county of Middlesex, in the State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Machines for Closing the Ends of Tubes, of which the following is a specification.

This invention relates to the closing of the ends of metallic tubes and pipes, such as boiler tubes, gas pipes, water pipes and the like.

The object of the invention is to avoid the expense of the screw-cap usually employed for this purpose, and to secure a closed end integral with and as strong as the body of the tube or pipe.

Figure 1 of the accompanying drawings represents a plan of this tube-ending machine; the parts being in position for electrically heating the end of the tube to be closed. Fig. 2 represents a front elevation thereof. Fig. 3 represents on an enlarged scale a side elevation partly in longitudinal section of a portion of this machine, the parts being in position for forging the end of the tube which has been rendered plastic by the electric currents, into an integral closing cap, a mandrel being shown within the tube. Fig. 4 represents on an enlarged scale a transverse section on line 4—4 of Fig. 5, of the head stock and its clamp for holding the pipe or tube during the forging operation. Fig. 5 represents an enlarged side elevation partly in longitudinal section of a portion of said head stock on line 5—5 of Fig. 4. Fig. 6 represents on an enlarged scale an end elevation of the upper member of the head stock clamp. Fig. 7 represents on the enlarged scale a side elevation thereof. Fig. 8 represents on the enlarged scale an end elevation of the dove-tailed upper jaw of said clamp detached. Fig. 9 represents on the enlarged scale a side elevation thereof, partly in section. Fig. 10 represents on the enlarged scale an end elevation of one of the electrodes for passing the electric current into or out of the tube to be closed, being the electrode which grasps the pipe at some distance from the end of the tube as distinguished

from the electrode which is in contact with the extremity thereof. Figs. 11 and 12 are detail views of the dove-tailed detachable jaws of said clamp. Fig. 13 represents an enlarged side elevation of the mechanism for operating the forging hammer for shaping the ends of the tubes into closing caps. Fig. 14 represents a diametrical section of the clutch constituting a part of said mechanism. Fig. 15 represents a plan view thereof. Fig. 16 represents a plan of the clutch lock and of a portion of the releasing device therefor. Fig. 17 represents a front view of the actuating end of said releasing device. Fig. 18 represents a longitudinal section of a tube, one end of which is to be closed. Fig. 19 represents a longitudinal section of a piece of tubing, the end of which has been closed by this process. Fig. 20 represents a side elevation of a piece of tubing having a closed end forged by this process and machine.

The same reference numbers indicate the same parts in the different figures.

The electric current of large volume and low voltage for heating the ends of the tubes or pipes to be closed, may be obtained from a converter or transformer similar to that shown in the patent of the United States, No. 475,232, granted to the Electrical Forging Company as the assignee of Burton, Eddy and Briggs, dated May 17, 1892, or from any other source of an electric heating current of low potential and large ampère.

The ring 30 may represent the positive pole of such a transformer and the ring 31 may represent the negative pole thereof. A dependent bracket 32 composed of copper or other highly conductive material is attached to or connected with the ring 30 and a similar bracket 33 is connected with the ring 31 and provided at its lower end with a sleeve 34, carrying a lateral arm 35. The arm 35 is provided at its outer end with a flat bearing 36.

A bench 40 may serve as the supporting frame of the machine. A bed-plate 41 is attached to the bench 40 by means of bolts 42. The bed-plate 41 is provided with a head stock 50, a tail stock 60 and an intermediate standard 70.

The head stock 50 is recessed on its inner end and is provided with a longitudinal open-

ing 51 through which the tubes are fed. This head stock is provided with a pipe holder for rigidly holding the pipe or tube while being operated upon. The pipe holder herein shown comprises two clamping jaws 52 and 53 shown in detail in Figs. 4 to 9. These jaws which are preferably composed of hardened steel, have semi-circular concave clamping faces, which are preferably serrated as shown in Fig. 9. The lower jaw 52 is set in a recess in the head stock and the upper jaw 53 is set in a recess in a movable block 54, both jaws being provided with dove-tail ribs on their upper and lower sides respectively which engage corresponding grooves in the stock and block. The jaws are thus detachable and can be changed for different sizes of pipe. Clamping screws 55 and 56 passing through holes in the block 65 and engaging screw-threaded sockets in the head stock serve to tighten and release the pipes from the clamping jaws.

An electrode 80 is connected with the bracket 32 and may consist as herein shown of a clamp, the lower member of which is attached to said bracket, the upper member being supported and adjusted by means of adjusting screws 81 and 82. The upper portions of these screws pass loosely through holes in the upper member and the lower portions are screw-threaded and engage screw-threaded holes in the lower member. Hand wheels 83 and 84 are attached to the screws at their upper ends for turning them. The upper member is provided in its lower face with recesses near opposite sides and the adjusting screws are provided with nuts or flanges 85 and 86 which are disposed in said recesses and serve to support the upper member and lift it when the screws are turned upward. The lower member is provided with a clamping jaw 87 set in a recess therein, said jaw having a dove-tailed rib on its under side which engages a dove-tailed groove at the bottom of said recess. The clamping face of this jaw is arc-shaped or semi-circular to fit the pipe to be clamped. The upper member is also provided with a similar clamping jaw 88 set in a recess in the upper face of said clamp and having a dove-tailed rib engaging a corresponding groove in the top of said recess. The lower face of this jaw is similarly concave or made semi-circular to fit the tube to be clamped and heated. These parts may be composed of copper or other highly conductive metal, or their size may be such as to render them more highly conductive than the tube to be heated.

An electrode 90 having a hollow conical contact face for engaging the extremity of the tube to be heated, is connected with the bracket 33, being supported on a swinging arm 91 pivoted to the bearing 36 of the arm 35 by means of the pivot pin 92. A handle 93 is attached to this electrode whereby it may be swung into and out of operative position. When in operative position, engaging the end

of the tube to be heated, as shown in Fig. 2, the electrode 90 is held in that position by means of an arm 95. This arm is pivoted to lugs 96 attached to the bed-plate and is locked in upright position with its handle in contact with the handle 93 of the electrode by means of a cam 97 also pivoted in said lugs and provided with a handle 98. The inoperative position of this electrode is illustrated by dotted lines in Fig. 2, in which case it is swung upward at right angles to its normal position and held by a hook 37 attached to the sleeve 34 of the bracket 33.

A forging hammer 100 having a hollow cup-shaped face for forging the open end of a tube into a closed end is attached to a sliding rod 101 supported in the standard 70 and tail stock 60. This rod has a flange 102 near its rear end between said tail stock and standard and a spring 103 disposed on said rod between said tail stock and flange, tends to thrust said rod and hammer toward the head stock. This rod has a longitudinal slot 104 and a transverse pin 105 passes through said slot. An anti-friction roller 106 is disposed on said pin in said slot.

A transverse shaft 110 is supported on pedestal brackets 111 and 112 supported at a point about mid-way between the tail-stock and standard. The outer portion of this shaft is of larger diameter than the inner portion and a shoulder 113 is formed near its inner end. A tubular driving shaft 120 is disposed loosely on the smaller portion of the shaft 110 and provided at its outer end with a driving pulley 121 to which motion is communicated from any suitable source of power by a belt 122. A clutch serves to connect the shafts 120 and 110 so that motion may be communicated when desired from the former to the latter. Any suitable clutch or other means for communicating motion may be employed. The clutch herein shown comprises a disk 130 fixed on the inner end of the tubular driving shaft 120 and a disk 140 fixed on the larger part of the shaft 110 adjacent to the shoulder 113. The disk 130 has a slot 131 and the disk 140 has a slot 141 in position to register with the slot 131. The hub of the disk 140 is provided with a groove 142 in line with the slot 141. A locking key 143 having a lug 144 at its outer end is disposed in said groove, its inner end entering said slot 141, and a spring 145 disposed in said groove between the outer end of said slot and the outer end of said key, tends to thrust the latter through the slots of both disks to lock them together.

A cam 150 is disposed on the shaft 110 at a point opposite the slot 104 in the rod 101. At each rotation of the shaft 110, the cam 150 engages and releases said rod either directly or through the medium of the anti-friction roller 106 or other device for this purpose. The cam during its engagement pushes the rod backward against the tension of the spring 103 and instantly it passes the point of en-

gagement the spring forces said rod and its hammer 100 toward the head stock with a striking blow.

Any suitable means for disengaging the clutch may be used. The means herein shown are an arm 160 pivoted to a lug 170 on the standard 70, a spring 171, and a hand lever 180 having a cam 181. The arm 160 has an arc-shaped portion 161 which extends under the hub of the clutch member 140, and a beveled extremity 162 adapted to engage the lug 144 of the locking key 143 for retracting the latter. The spring 171 is attached at its upper end to an arm 172 projecting from the lug 170 and at its lower end to the arm 160, and tends to hold said arm in position for engagement with said key. The cam of the lever 180 bears against the arm 160 and when swung into the dotted position of Fig. 13, depresses said arm out of engagement with the clutch key and permits the key under the action of the spring to lock the clutch members.

The head stock may be provided with a bore 190 in which a rod 191 is adjustable. A standard 192 is attached to the outer end of this rod. A mandrel rod 193 is clamped at its outer end in the upper end of the standard 192 and carries at its inner end a mandrel 194. This mandrel may be disposed within the tube to be closed and serves as a shaping device against which the metal of the outer end of the tube is forged into a cap integral with the tube by the hammer 100.

In the use of this apparatus, a tube as 300 is passed through the opening 51 in the head stock and clamped between the jaws 52 and 53 on said head stock, its inner end projecting beyond said jaws a sufficient distance to engage the electrode 90 when in operative position as illustrated in full lines in Fig. 2. This pipe is grasped a short distance from its end between the clamping jaws 52 and 53 and the electrode 90 by the electrode 80. The concave face of the electrode 90 is adapted to tubes of different diameters. The electric circuit is closed by that portion of the pipe between the electrodes and a heavy heating current passes through said portion in either direction as desired—in the case illustrated from the positive ring 30 through the bracket 32, through the clamping electrode 80, through that portion of the pipe 300 between the electrodes, through the electrodes 90, through the arms 91 and 35, and then through the bracket 33 to the ring 31 of the transformer. The current may be reversed if desired, or it may normally pass in the opposite direction. The electric current of large volume passing through that portion of the pipe between the electrodes, quickly heats it and renders it plastic. When a proper degree of plasticity is attained, the handle of the cam 97 is swung toward the head stock, releasing the arm 95, which is swung in the opposite direction. This releases the electrode 90 which is swung away from the end of the tube, then lifted,

the arm 93 turning axially in the sleeve 34 to permit said lifting, and then swung toward the tail stock over said sleeve and engaged by the hook 37 thereon, and held in the position illustrated in dotted lines in Fig. 2. The clamping electrode 80 is also released from the tube and said tube is still held firmly by the clamp of the head stock. Then the lever 180 is swung into the dotted line position of Fig. 13 whereby the arm 160 is depressed and the clutch key released. This key under the action of its spring then locks the clutch members causing a rotation of the shaft 110. The rotation of this shaft in connection with the spring 103 operates the hammer 100 whose cup-shaped face engages the plastic end of the tube and shapes it by a series of blows into a cap integral with the body thereof. The mandrel 194 which may be placed in the tube is preferably applied to shape the interior of the cap into symmetrical form. When the cap is properly shaped by a sufficient number of blows the cam lever 180 is swung toward the head stock and the arm 160 under action of the spring 171 swings up under the hub of the clutch member 140 and the lug of the locking pin 143 is engaged by the beveled end of said arm and withdrawn from its locking position whereby the cam shaft is stopped and the hammer ceases to operate. The tube is then withdrawn and another inserted.

It is seldom necessary to re-heat the end of a tube to form a cap, but if desired the electrode 90 can be readily brought back into contact therewith for that purpose. A tube thus closed is as strong at its closed end as at any other part, and the closing can be effected more economically than by a screw cap, and the closure is absolutely tight.

We claim as our invention—

1. The combination of means for holding a tube to be closed at one end, two electrodes adapted to supply to said tubes, an electric heating current of sufficient volume to soften the metal thereof between said electrodes, a pivoted arm carrying one of said electrodes whereby it may be swung out of position when the tube is sufficiently heated, a mandrel for the interior of said tube, and a forging hammer having a flaring face adapted to operate in connection with said mandrel to forge a cap on the end of said tube integral therewith from the softened material thereof.

2. The combination of a head stock provided with a pipe holder, an electrode adapted to grasp a pipe, another electrode provided with a flaring face and attached to a pivoted arm, an oscillating arm for supporting said electrode arm, and a forging hammer in line with said pipe holder.

3. The combination of a head stock, the pipe holder therein, the two electrodes connected with opposite electric poles and adapted to grasp the pipe, one of said electrodes being adapted to be swung out of position, the forging hammer in line with said pipe holder, the

spring for actuating said hammer, the cam shaft provided with a cam for retracting said hammer, a driving shaft and means for connecting and disconnecting said driving shaft
5 with said cam shaft, substantially as set forth.

4. The combination of a pipe holder, an electrode adapted to grasp a pipe around its periphery, an electrode attached to a swinging arm and adapted to grasp the extremity of said
10 pipe, means for locking said electrode in operative position, means for holding it in inoperative position, and a forging hammer having

a concave face disposed in line with said pipe holder.

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