

B. J. MULLEN.

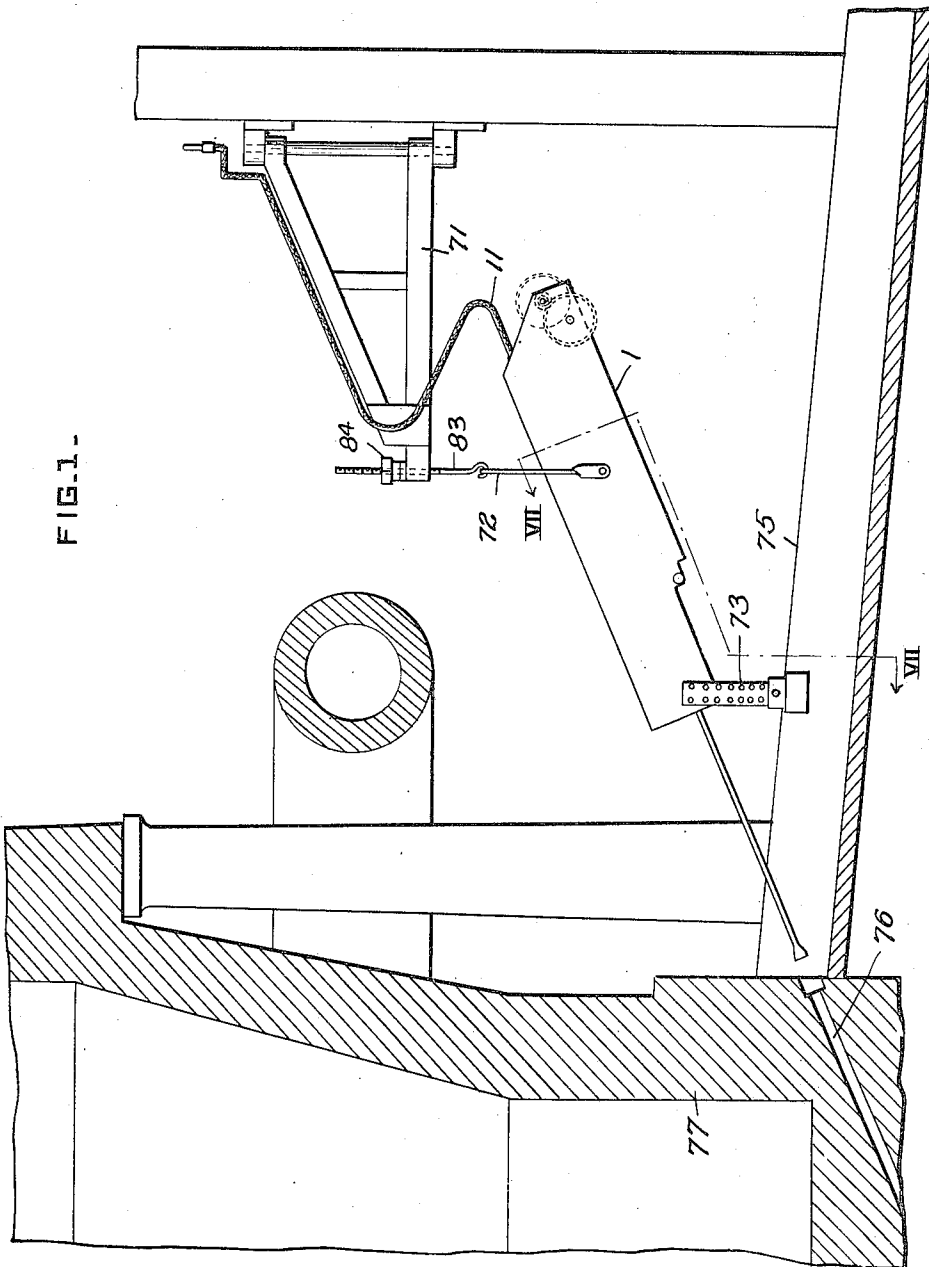
MACHINE FOR TAPPING BLAST FURNACES.

APPLICATION FILED AUG. 18, 1915. RENEWED JUNE 6, 1918.

1,276,252.

Patented Aug. 20, 1918.

5 SHEETS—SHEET 1.



WITNESSES

J. Herbert Bradley
Frieda E. Hoff.

INVENTOR

Benjamin J. Mullen
by Chas. and Chas.
his attor nees.

B. J. MULLEN.

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5 SHEETS—SHEET 2.

FIG. 2.

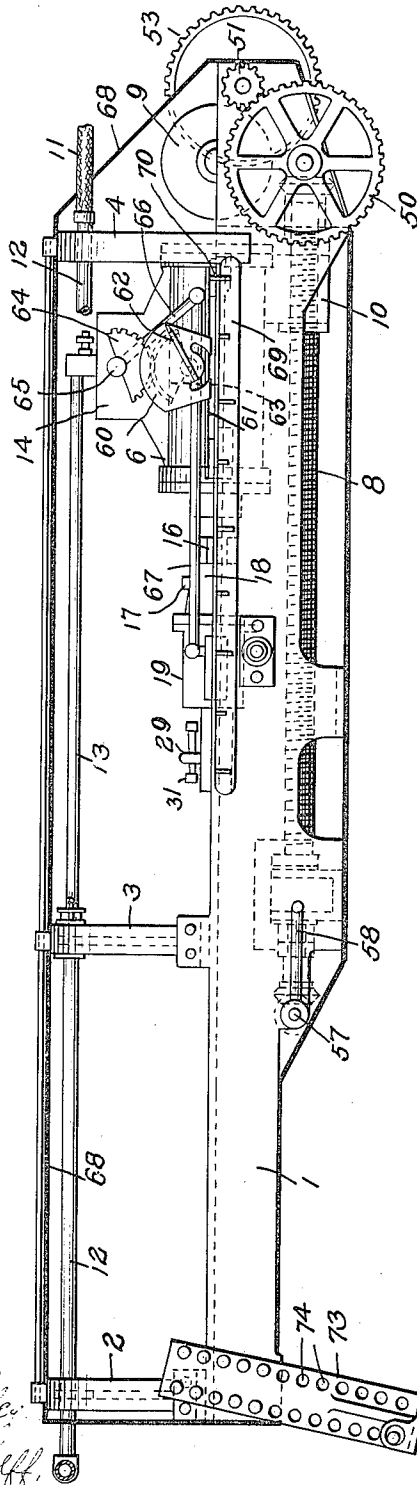
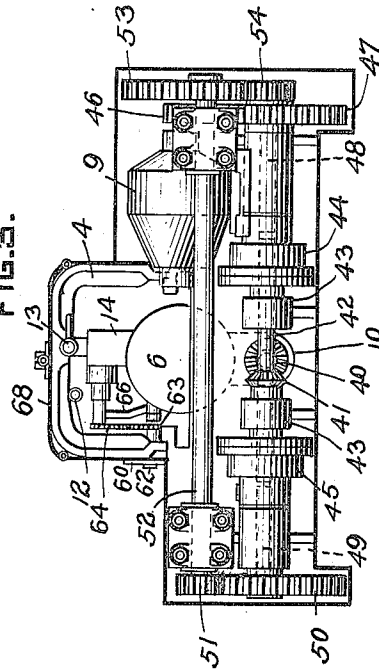


FIG. 3.



WITNESSES

J. Robert Bradley
Frieda E. Wolff

INVENTOR

Benjamin J. Mullen
by Chas. and Chas. J.
his attorneys.

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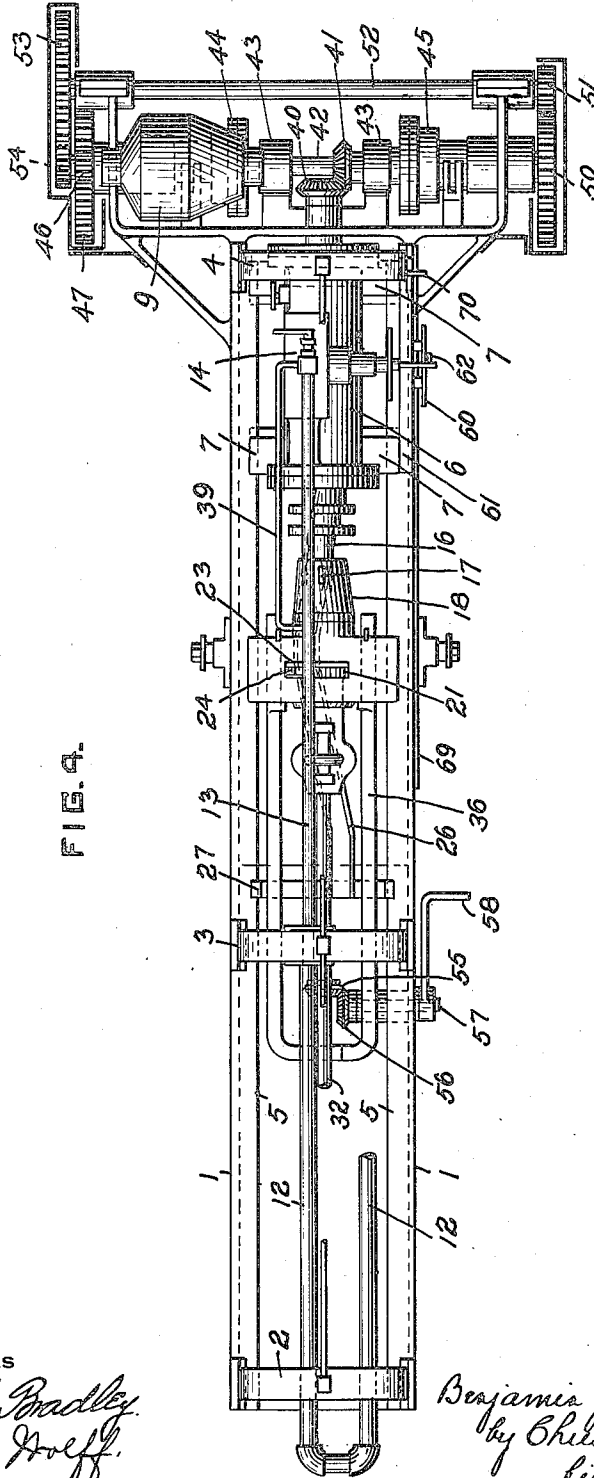


FIG. 9.

WITNESSES

J. Herbert Bradley
Frieda E. Hoff

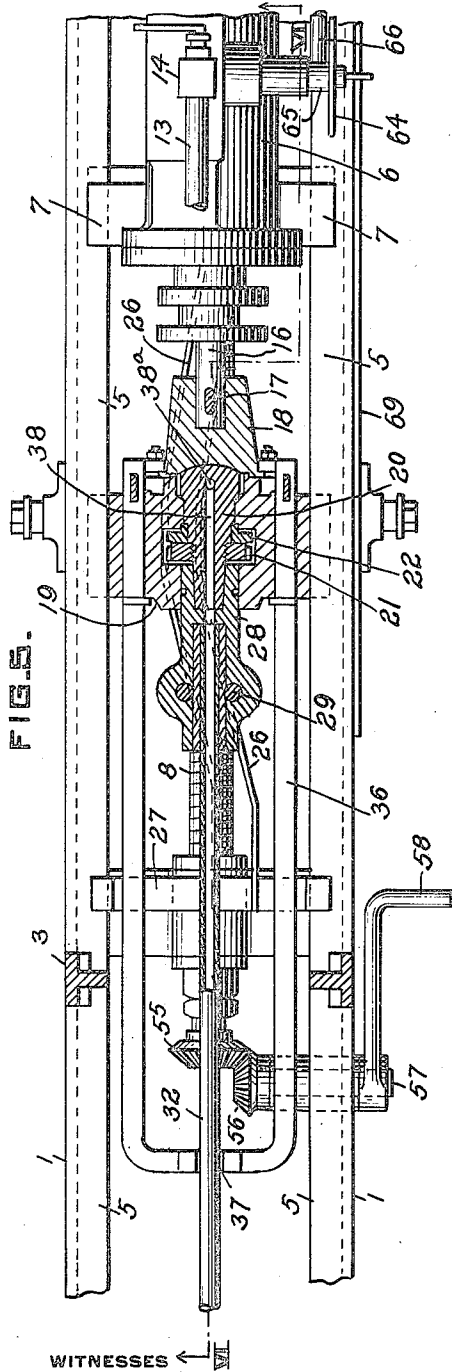
INVENTOR

Benjamin J. Mullen
by Christy and Christy
his attorneys

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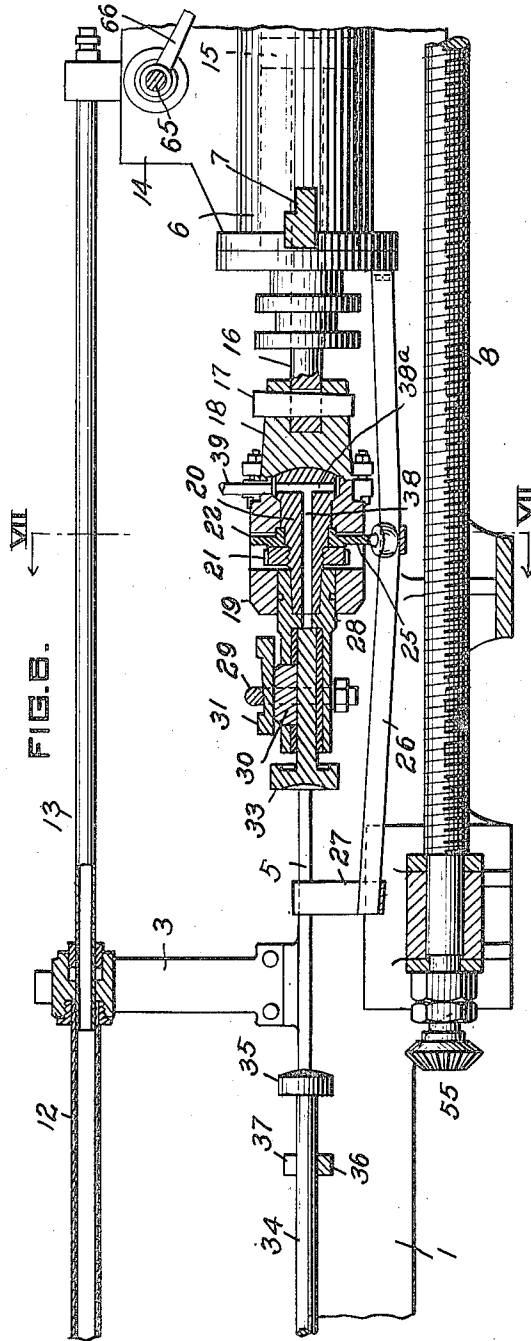
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5 SHEETS—SHEET 4.



WITNESSES

J. Herbert Bradley
Frieda E. Hoff



INVENTOR

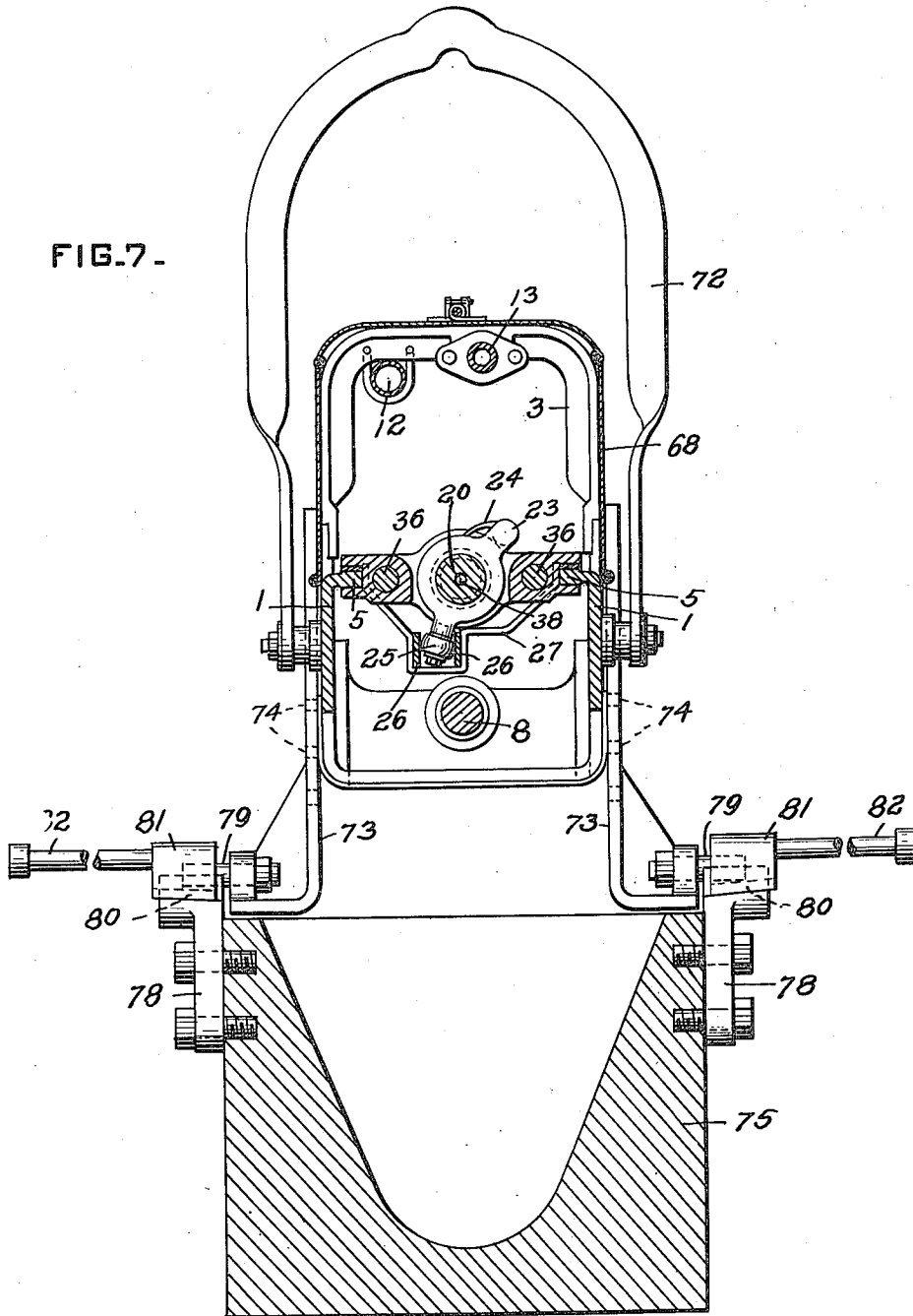
Benjamin J. Mullen
his attorney and counsel
his attorneys

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5 SHEETS—SHEET 5.

FIG. 7.



WITNESSES

J. Herbert Bradley
Frieda E. Wolff

INVENTOR

Benjamin J. Mullen
by Chas. J. Chisley and Chisley
his attorneys

UNITED STATES PATENT OFFICE.

BENJAMIN J. MULLEN, OF LEETONIA, OHIO.

MACHINE FOR TAPPING BLAST-FURNACES.

1,276,252.

Specification of Letters Patent.

Patented Aug. 20, 1918.

Application filed August 18, 1915, Serial No. 46,107. Renewed June 6, 1918. Serial No. 238,604.

To all whom it may concern:

Be it known that I, BENJAMIN J. MULLEN, residing at Leetonia, in the county of Columbia and State of Ohio, a citizen of the United States, have invented or discovered certain new and useful Improvements in Machines for Tapping Blast-Furnaces, of which improvements the following is a specification.

My invention relates to machines for tapping the iron notches of blast furnaces. In my application, Serial No. 4,918, filed January 28, 1915, I have shown and described a machine for the same purpose, and have therein explained in detail some of the difficulties encountered in opening iron notches. The same operating considerations apply to the machine of my present application.

It is the object of my present invention to improve the details of construction of the machine shown in my aforesaid application, and to provide a machine which may to a greater extent than possible with the earlier machine, be adequately operated and controlled at a safe distance from a furnace.

In the accompanying sheets of drawings, which form part of my specifications, I have illustrated the preferred embodiment of my present invention. Figure 1 is a side elevation of the machine in operative position beside a blast furnace, a portion of the furnace being shown in section; Fig. 2 a side elevation, to enlarged scale, of the machine of Fig. 1, the protecting casing being removed from the side; Fig. 3 a rear end view of the machine; Fig. 4 a top plan view thereof; Fig. 5 a plan view, to enlarged scale, of the central portion of the machine; Fig. 6 a sectional view taken on the broken line VI VI, Fig. 5, but showing the machine as being provided with different tools than indicated in Fig. 5; and Fig. 7 a sectional view, to enlarged scale, the plane of view being indicated by the lines VII VII of Figs. 1 and 6.

The operating parts of my present tapping machine are borne by a suitable elongate frame 1, which, except for yokes 2, 3 and 4, is preferably an integral casting. The sides of the frame are provided with oppositely disposed guides 5, on which there is mounted for longitudinal movement a fluid pressure cylinder 6, provided with laterally extending arms 7 for engaging such guides.

The complete description of the mechanism for moving the cylinder upon the guides will be explained hereinafter. It is sufficient for the present to state that, as shown herein, I preferably provide for this purpose a single feed screw 8 rotatably mounted in the center of the frame 1 and driven, through suitable connections, by means of a motor 9. The cylinder is provided with a downwardly extending arm 10 which engages the screw.

The first feature of my invention which I will describe in detail concerns the arrangement of conduits for supplying motive fluid to the cylinder 6. The motive fluid, preferably compressed air, may be led to the machine through a flexible pipe 11 (Fig. 1) adapted to be readily connected at the rear of the machine to a rigid conduit 12 attached to the rear yoke 4. The conduit 12, as seen particularly in Fig. 4, extends forwardly to the front end of the machine, being connected in turn to the yokes 3 and 2, and thence rearwardly, and parallel with the line of advance of the cylinder 6, to the yoke 3. Telescoping with the conduit 12 is a second conduit 13, connected to the valve chest 14 of the cylinder, and adapted to move with the cylinder. By such an arrangement, the motive fluid may be carried to the cylinder without the prejudicial circumstances of a conduit moving outside of the machine, and without employing flexible conduits adjacent to the movable machine parts.

The cylinder is provided with a piston 15 connected to a piston rod 16, which in turn is attached by means of a pin 17 to a piston rod nut 18. This nut is bolted to a cross-head 19, which is provided centrally with a rotatable spindle 20, and which slidably engages the guides 5. The spindle is provided with ports 38 and 38^a, so that air, taken from the chest 14 through the flexible conduit 39 (Fig. 4), may flow through the spindle to the drill rod presently to be described. As seen particularly in Figs. 5, 6 and 7, the spindle 20 has attached to it a ratchet wheel 21, and adjacent to such wheel there is rotatably mounted on the spindle a disk 22 having a projecting arm 23 provided with a pawl 24 adapted to engage the teeth of the ratchet to turn the spindle. The disk 22 is further provided with a second arm 25, which moves in an inclined guide 26, con-

connected at one end to the head of the cylinder 6, and supported at its front end by a stirrup 27, which slidably engages the guides 5. Thus, as the cross-head is caused
5 to reciprocate, the spindle is rotated by these pawl and ratchet connections.

To the front end of the cylinder there is attached a tool-holding chuck which may be of any suitable form. As shown herein, such
10 chuck comprises a body portion 28, a U-bolt 29, a key 30 and a wedge 31. In Fig. 5 the chuck holds a drill rod 32, and in Fig. 6 a hammering-head 33. It will be understood that to remove a tool it is only neces-
15 sary to hammer rearwardly the wedge 31, and that, a new or different tool being substituted, it may be firmly clamped in the chuck by striking the forward end of the wedge.

In the normal operation of tapping a notch, the usual practice is first to employ a drill rod 32, and thereafter to use a tapping
20 bar 34 (Fig. 6) provided with a head 35. Both of these tools are supported by means of a U-shaped bar 36 attached to the cross-head 19 and provided at its end with a receiving slot 37. The bar 36, in addition to serving as a support for either a drill or
25 tapping bar, also serves as a withdrawing bar for hammering rearwardly the head 35 of the tapping bar after iron has been reached in the notch, or when for other reasons it becomes necessary to withdraw
30 such bar. By this construction and arrangement of parts it will be seen that the tools may be quickly substituted one for the other, and that, when using a tapping bar 34, the reciprocation of the piston may be rendered effective either to drive the bar
35 forwardly into the notch or rearwardly out of the notch the head 35 being struck, respectively, either by the hammer-head 33 or the withdrawing bar 36.

As already stated, the cylinder 6 is caused
45 to move longitudinally of the frame 1 by means of the feed screw 8, driven by a motor 9. Preferably I provide two driving connections between said motor and screw so that the cylinder may be moved at two
50 speeds, one more rapid than the other. For this purpose the screw-shaft 8 is provided with a bevel pinion 40, meshing with a second pinion 41, which is attached to a stub shaft 42 supported by suitable bearings 43
55 forming part of the frame 1. To the opposite ends of the shaft 42 there are attached the driven elements of yielding clutches 44 and 45, preferably magnetic clutches. Motion is imparted to the driving element of
60 the clutch 44 by means of pinion 46 attached to the armature shaft of the motor 9, pinion 47 and shaft 48, to which the pinion 47 and the driving member of the clutch 44 are attached. The driving member of
65 the clutch 45 is attached to a shaft 49 which

is driven through pinion 50 secured thereto, pinion 51, shaft 52, pinion 53, and pinion 54 secured to the shaft 48. Thus, when in operation, the motor 9 will be effective to drive simultaneously the driving members of both
70 clutches 44 and 45, and, depending upon which of these clutches is rendered operative, the shaft 42 will be driven to turn the feed screw. The motor 9 may be driven in either direction so that the cylinder 6 may
75 be fed forwardly or rearwardly at either speed and according to the requirements of service. Furthermore, the piston may be caused to reciprocate while the cylinder is being thus fed.

Means are also provided for turning the feed screw 8 by hand. For this purpose the front end of the screw is provided with a bevel pinion 55, which meshes with a second pinion 56 secured to a shaft 57, rota-
85 tably mounted in the frame 1 and provided with a crank 58.

It will be understood that, in the operation of the machine, the feeding speed of the cylinder will be regulated according to the length
90 of the piston stroke. If the drilling or the driving of a tapping bar is stoutly resisted, the length of the piston stroke will be shortened automatically, provided of course that the feed of the cylinder is more rapid than the
95 driving power of the piston. On the other hand, if the resistance is small and the feed of the cylinder is at a less speed than the driving power of the piston, the stroke of the piston will be long. That there may be
100 a proper regulation of the feeding of the cylinder with relation to the length of the piston stroke, and furthermore, that such regulation may be controlled at a safe distance from the furnace (this being im-
105 portant in cases of extremity), I provide an indicator mechanism for showing the length of each piston stroke. Such mechanism preferably consists of a dial 60 secured to a bar 61 attached to the arms 7 of the cylinder
110 6, and a hand 62 movable over the face of such dial. The hand or pointer is attached to a rocking segmental gear, which gear is also attached to the bar 61. This gear meshes with a second segmental gear 64, se-
115 cured to the rock shaft or valve rod 65, operatively connected to the cross-head by means of a lever 66 and link 67. Thus the range of oscillation or swinging of the hand 62 over the face of the dial 60 will be a
120 clear indication of the length of the piston stroke; and, by observing such movement of the hand, the speed of feeding the cylinder may be properly regulated as already explained. With respect to this it will be un-
125 derstood that the speed of reciprocation of the engine will be so controlled that the range of movement of the hand will be clearly visible.

As indicated in the drawings, the machine 130

is provided with a protecting hood 68. As seen in Fig. 3, the dial and hand are placed outside of the hood, which is suitably constructed for this purpose. To indicate, during the progress of a tapping operation, the extent of the movement of the cylinder 6, a gage 69 is attached to the frame 1 and a pointer 70 to the cylinder, as shown in Figs. 2 and 4.

10 In operation, the rear portion of the machine may, as indicated in Figs. 1 and 7, be suspended from a suitable crane 71, a hanger 72 being attached to the frame 1 for this purpose, and the front being supported by
15 legs 73 detachably connected to the frame and provided with a plurality of connecting holes 74 so that the elevation of the machine may be varied. To the end that the machine may be properly anchored against displacement due to the impact of operation, means
20 are provided for pivotally connecting the legs 73 to the trough 75 leading from the tapping hole 76 of the furnace 77. Preferably the trough is provided with a pair of
25 lugs 78, having at their upper ends trunnion bearings for pins 79 which are secured to and project laterally from the legs 73. The sides of the bearings are provided with inclined dove-tail key ways 80 adapted to receive correspondingly shaped blocks 81, secured to the ends of rod 82, and forming the
30 upper halves of the trunnion bearings for the pins 79. As will be seen, these rods may be readily manipulated at a distance from the furnace, both for effecting or breaking the connection of the legs to the trough. The front of the machine being thus pivotally supported, the rear end may be adjusted to various levels by varying the effective
40 length of the rod 83, as by turning the nut 84.

I claim:

1. In a machine for tapping blast furnaces, the combination of an elongate frame,
45 a fluid pressure cylinder mounted for longitudinal movement upon the rear portion of said frame and provided with a reciprocatory piston, means for moving said cylinder forwardly and rearwardly upon the
50 frame, a motive fluid supply conduit secured to the frame and extending from the rear to the front thereof and thence rearwardly parallel to the line of advance of the cylinder, and a second conduit secured to said
55 cylinder and telescoping with said rearwardly extending portion of the first named conduit.

2. In a machine for tapping blast furnaces, the combination of an elongate frame
60 provided with a pair of oppositely disposed guides for a motive fluid cylinder, and further provided with an intermediate and end yokes, a fluid pressure cylinder slidably mounted on said guides and provided with
65 a reciprocatory piston, means for moving

said cylinder forwardly and rearwardly upon said guides, a motive fluid supply conduit fixedly secured to the upper portions of said yoke and extending from the rear end yoke to the forward end yoke and thence
70 rearwardly to the intermediate yoke, and a second conduit secured to said cylinder and telescoping with said rearwardly extending portion of the first named conduit.

3. In a machine for tapping blast furnaces, the combination of a frame, a fluid pressure cylinder mounted for longitudinal movement upon said frame and provided with a reciprocatory piston, a cross-head secured to said piston, a tool-holding chuck
80 attached to said cross-head, and a combined drawing bar and tool support secured to the cross-head.

4. In a machine for tapping blast furnaces, the combination of a frame, a fluid
85 pressure cylinder mounted for longitudinal movement upon said frame and provided with a reciprocatory piston, a cross-head secured to said piston, a tool holding chuck rotatably attached to said cross-head, means
90 coördinated with the reciprocation of the piston for rotating the chuck, and a U-shaped drawing bar and tool support attached to the cross-head and projecting forwardly thereof.
95

5. In a machine for tapping blast furnaces, the combination of a frame, a fluid pressure cylinder mounted for longitudinal movement upon said frame and provided with a reciprocatory piston, means for moving
100 said cylinder, and mechanism for indicating the length of the piston rod strokes.

6. In a machine for tapping blast furnaces, the combination of a frame, a fluid pressure cylinder mounted for longitudinal
105 movement upon said frame and provided with a reciprocatory piston, an indicator for showing the length of the piston stroke attached to and movable with said cylinder, and means controlled independently of the
110 reciprocation of the piston for moving said cylinder.

7. In a machine for tapping blast furnaces, the combination of a frame, a fluid pressure cylinder mounted for longitudinal
115 movement upon said frame and provided with a reciprocatory piston, a dial and hand for indicating the stroke of the piston attached to and movable with said cylinder, operative connection between said piston
120 and hand for moving the latter in coördination with the former, and means controlled independently of the reciprocation of the piston for moving said cylinder longitudinally of said frame.
125

8. In a machine for tapping blast furnaces, the combination of a frame, a fluid pressure cylinder mounted for longitudinal movement upon said frame and provided with a reciprocatory piston, a feed screw
130

rotatably mounted in said frame and operatively engaging said cylinder, a motor, and driving connections including a yielding clutch between said motor and screw.

- 5 9. In a machine for tapping blast furnaces, the combination of a frame, a fluid pressure cylinder mounted for longitudinal movement upon said frame and provided with a reciprocatory piston, a feed screw
10 rotatably mounted in said frame and operatively engaging said cylinder, a motor, and double driving connections between said motor and screw, each of said connections including a yielding clutch.
- 15 10. In a machine for tapping blast furnaces, the combination of a frame, a fluid

pressure cylinder mounted for longitudinal movement upon said frame and provided with a reciprocatory piston, means for attaching a tapping tool to said piston, a feed screw rotatably mounted in said frame, and operatively engaging said cylinder, a motor, and double driving connections between said motor and screw, each of said connections including a magnetic clutch. 20

In testimony whereof I have hereunto set my hand. 25

BENJAMIN J. MULLEN.

Witnesses:

PAUL N. CRITCHLOW,
FRANCIS J. TOMASSON.