No. 788,308. PATENTED APR. 25, 1905.

F. C. EMRICK.

STEAM HAMMER.

APPLICATION FILED DEC. 12, 1903.

6 SHEETS—SHEET 1.

Fig. 1.

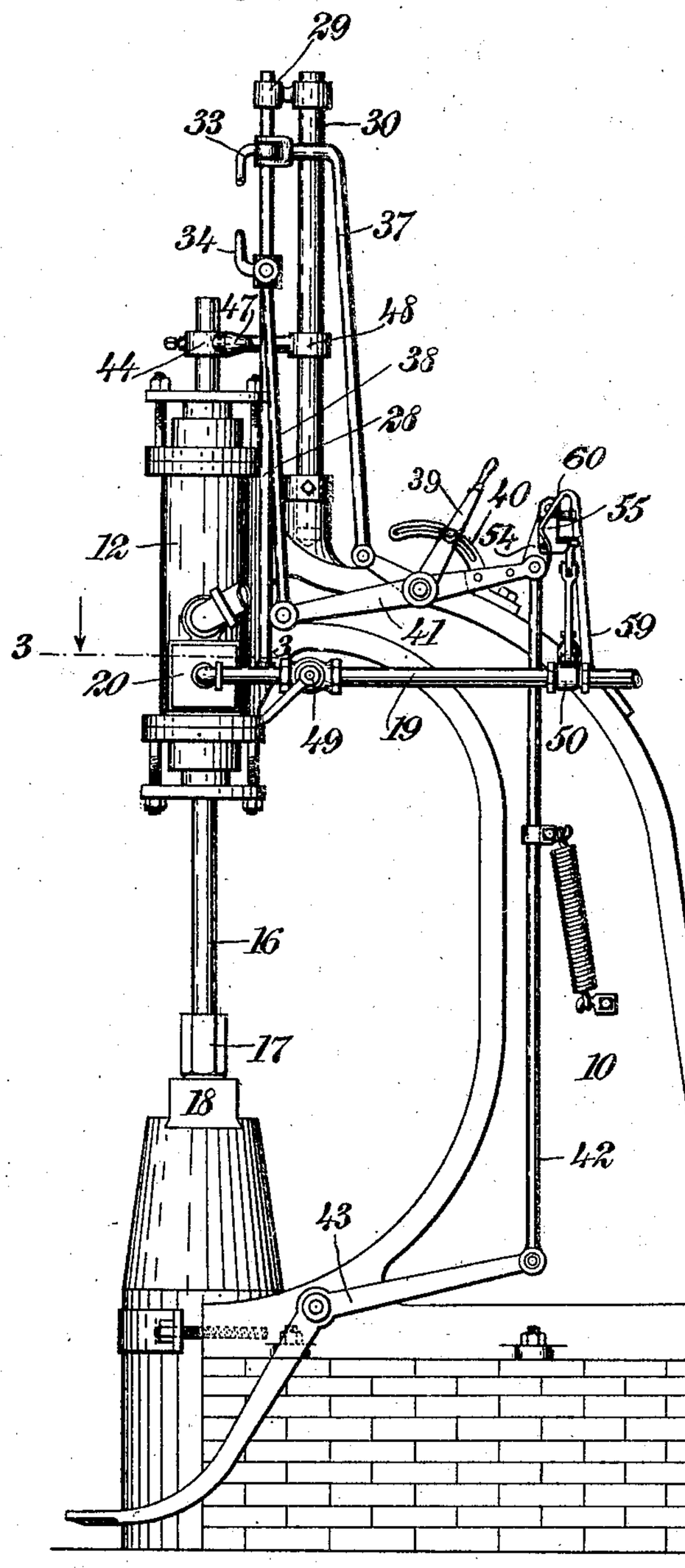
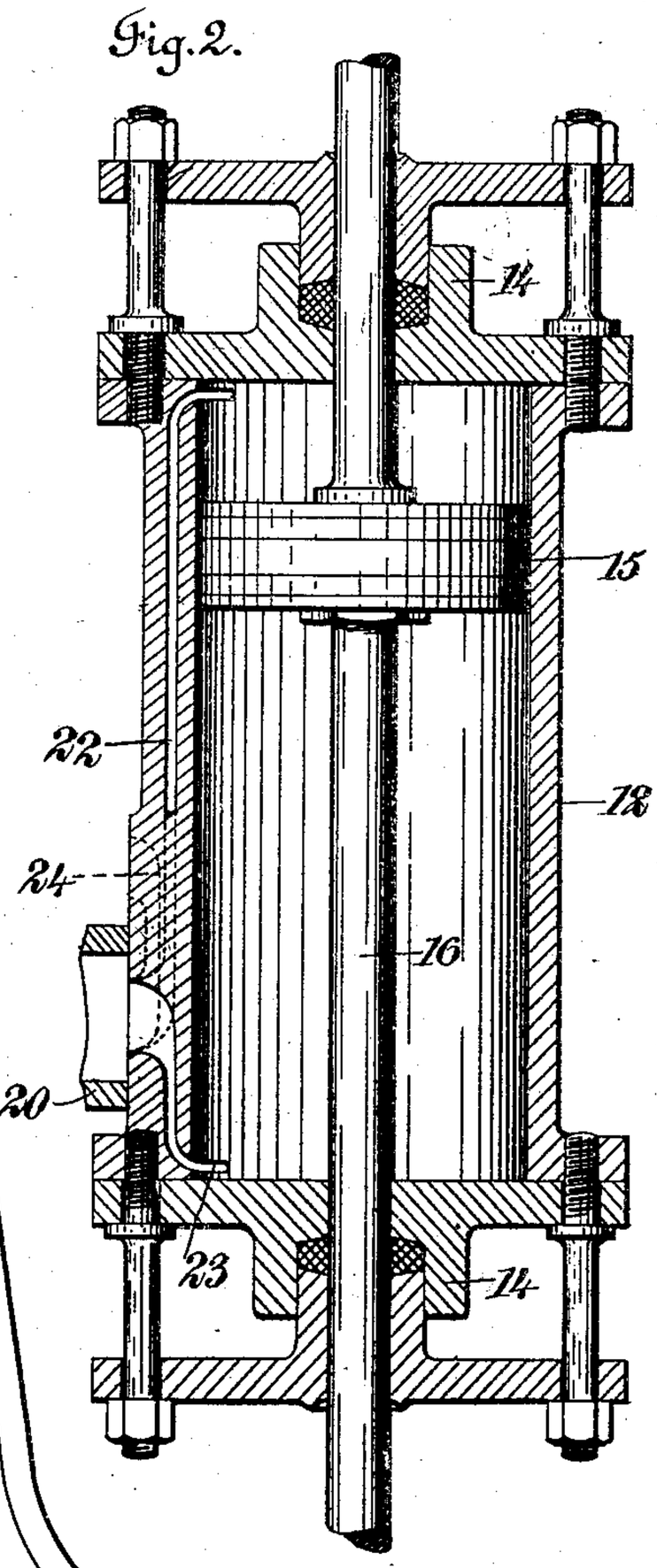


Fig. 2.



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5 SHEETS—SHEET 2.

Fig. 3.

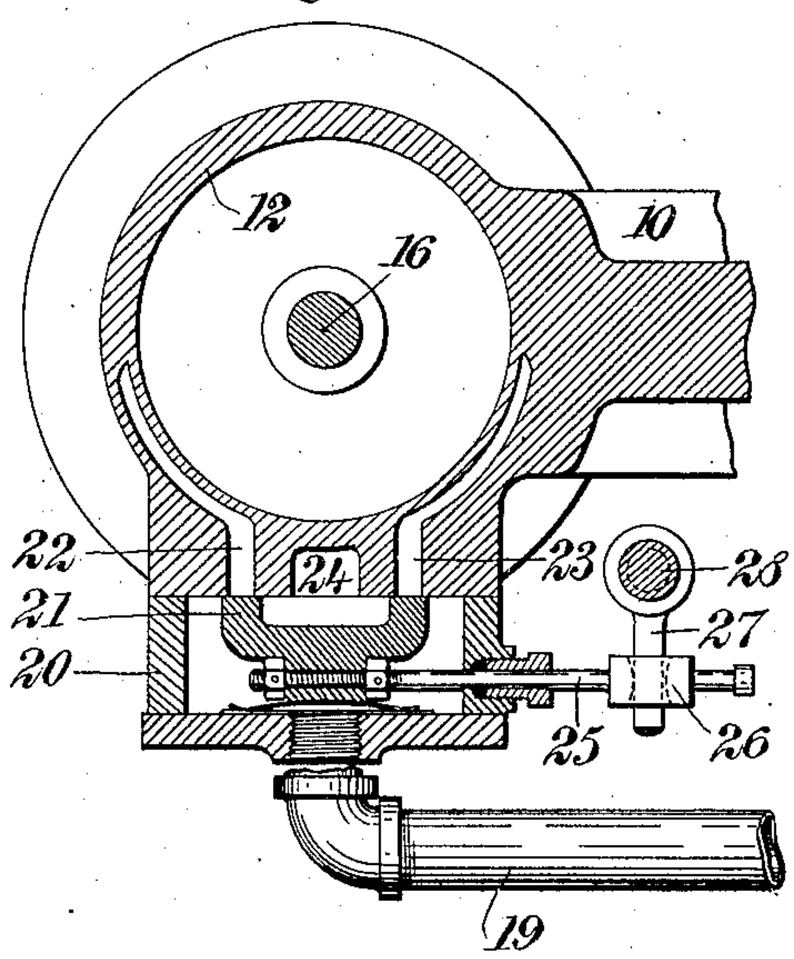


Fig. 4.

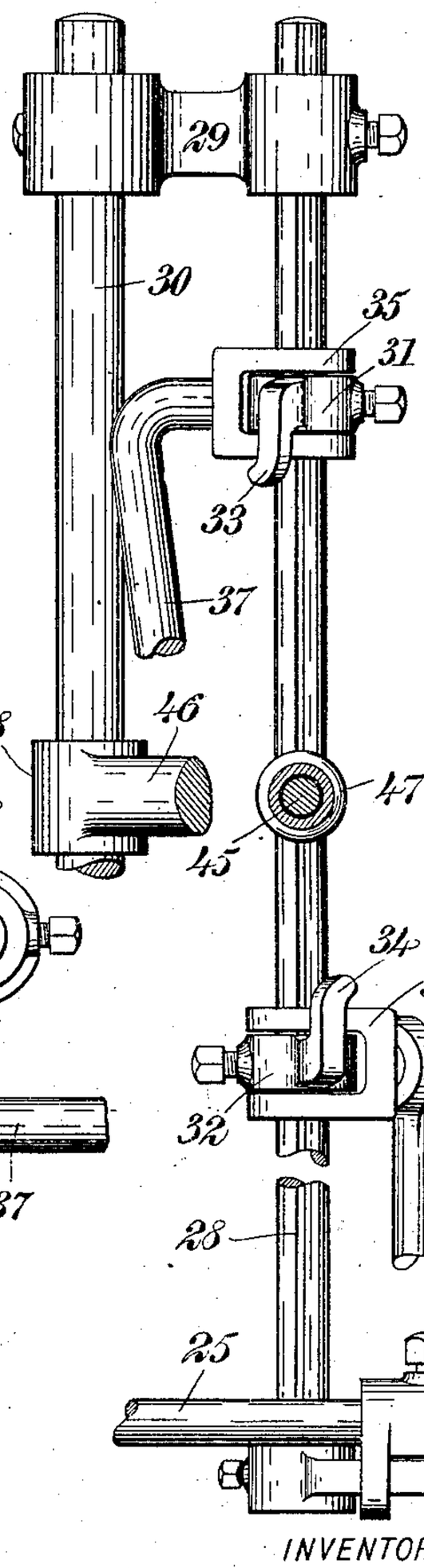
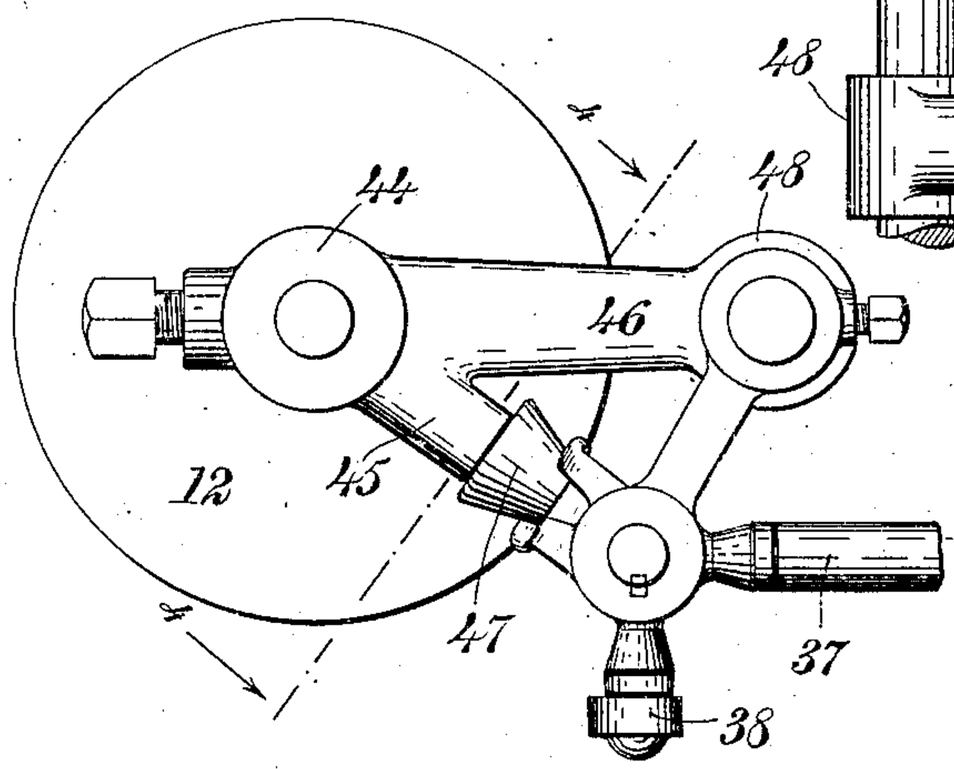


Fig. 5.



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5 SHEETS—SHEET 3.

Fig. 7.

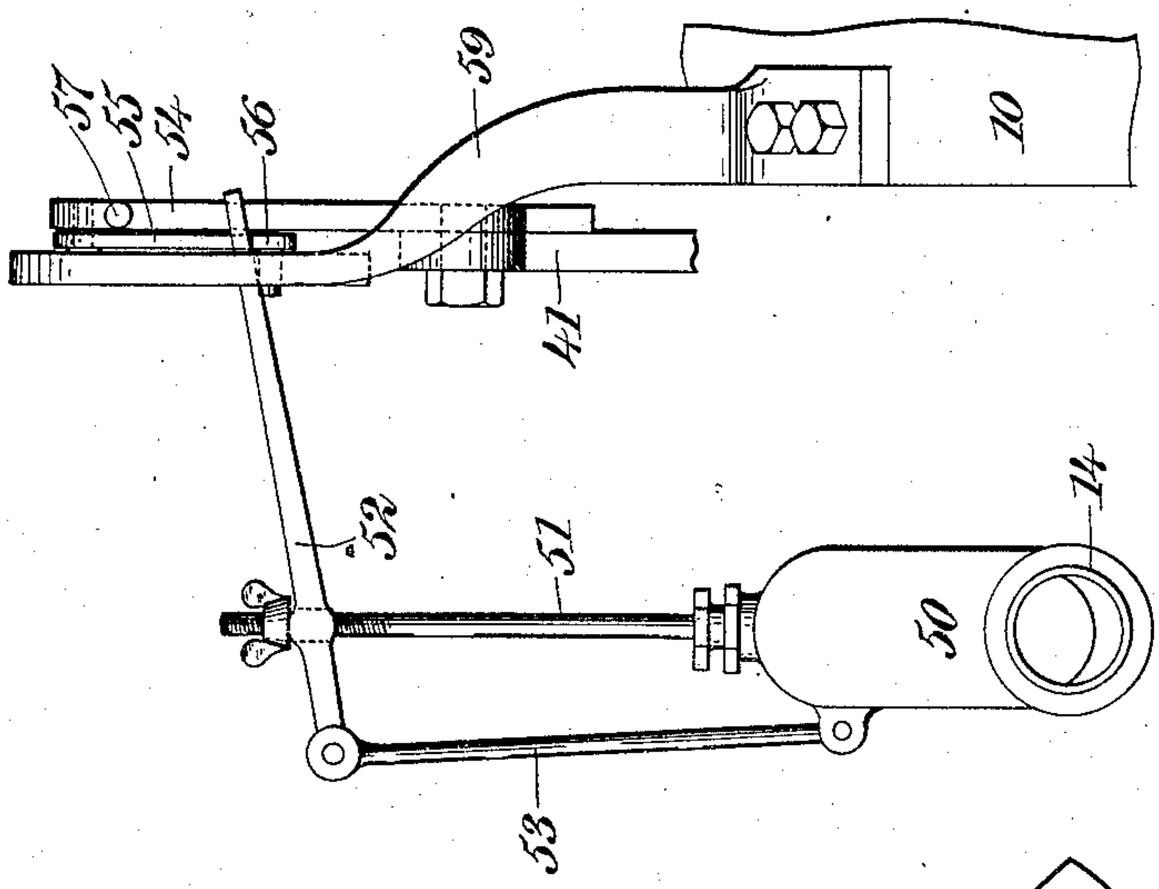
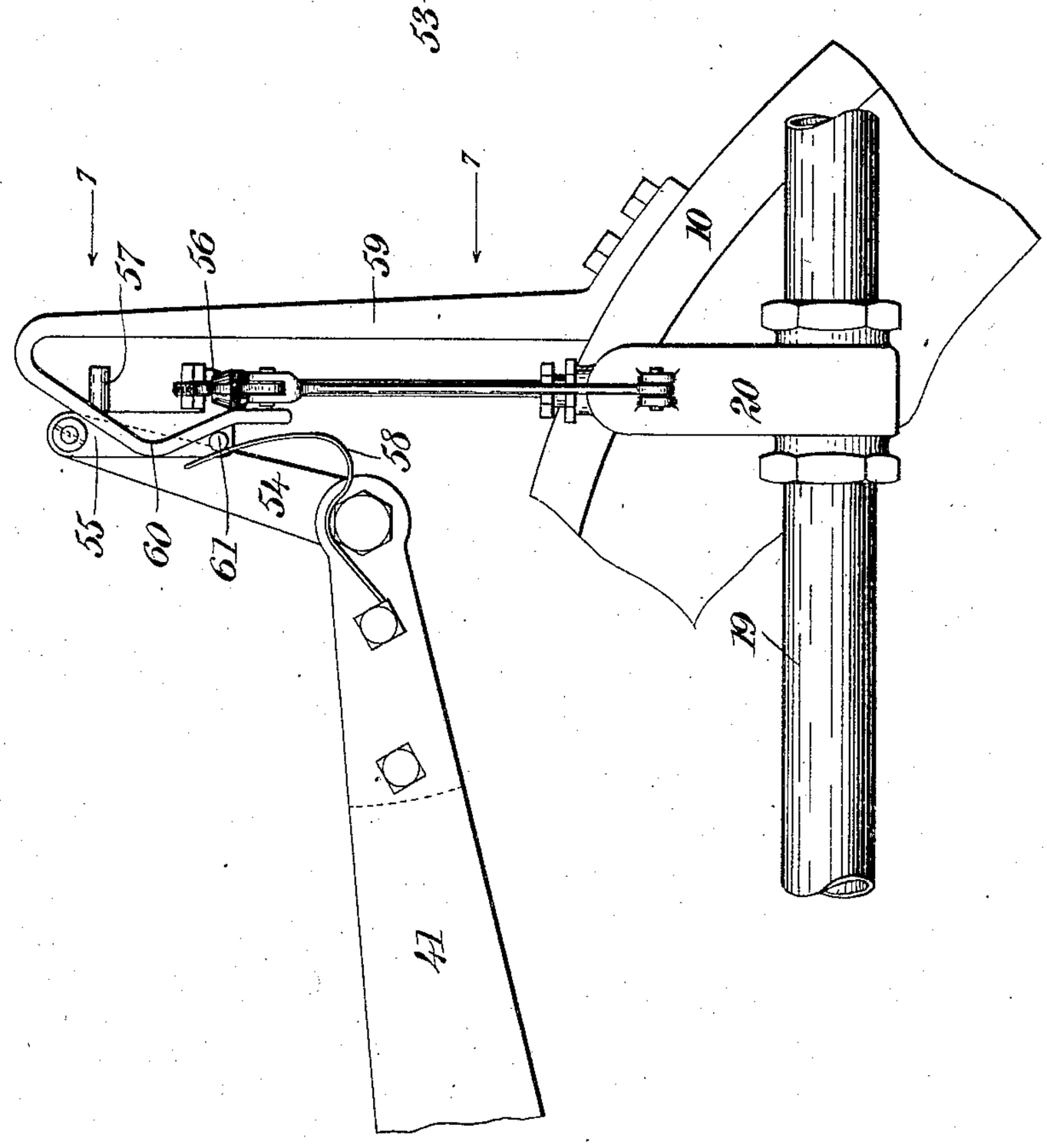


Fig. 6.



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5 SHEETS—SHEET 4.

FIG. 9

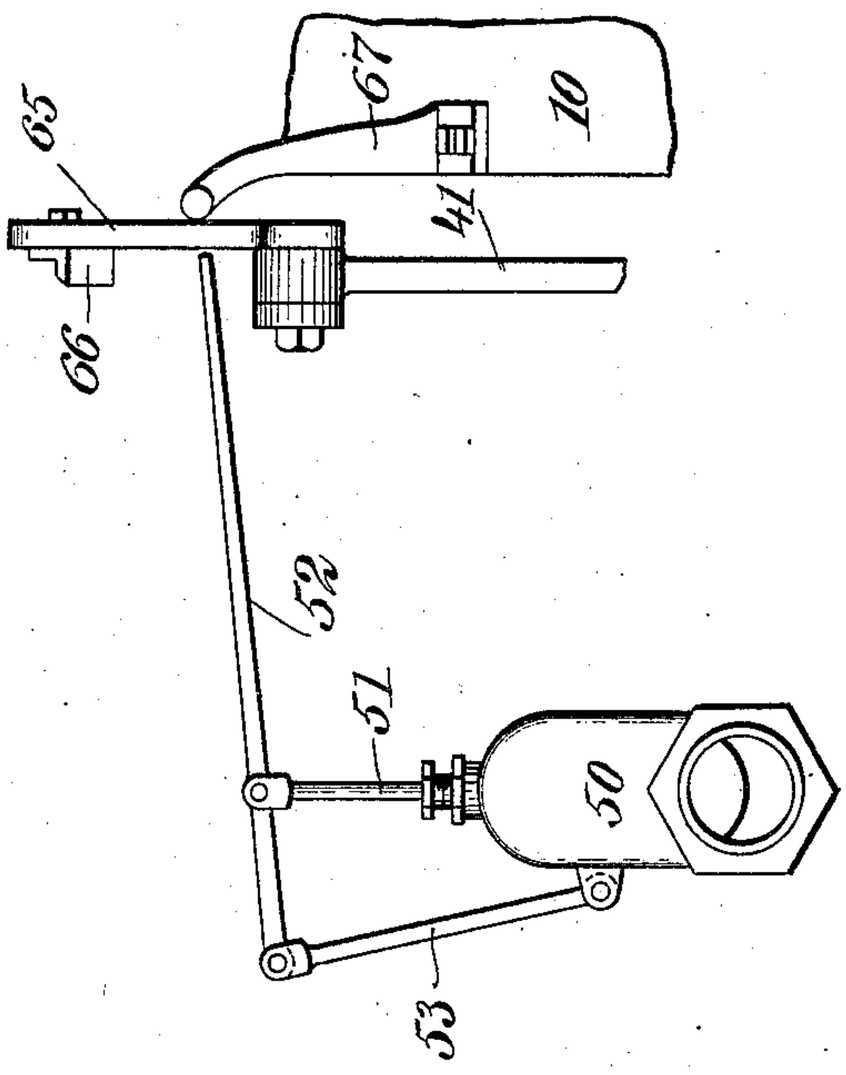
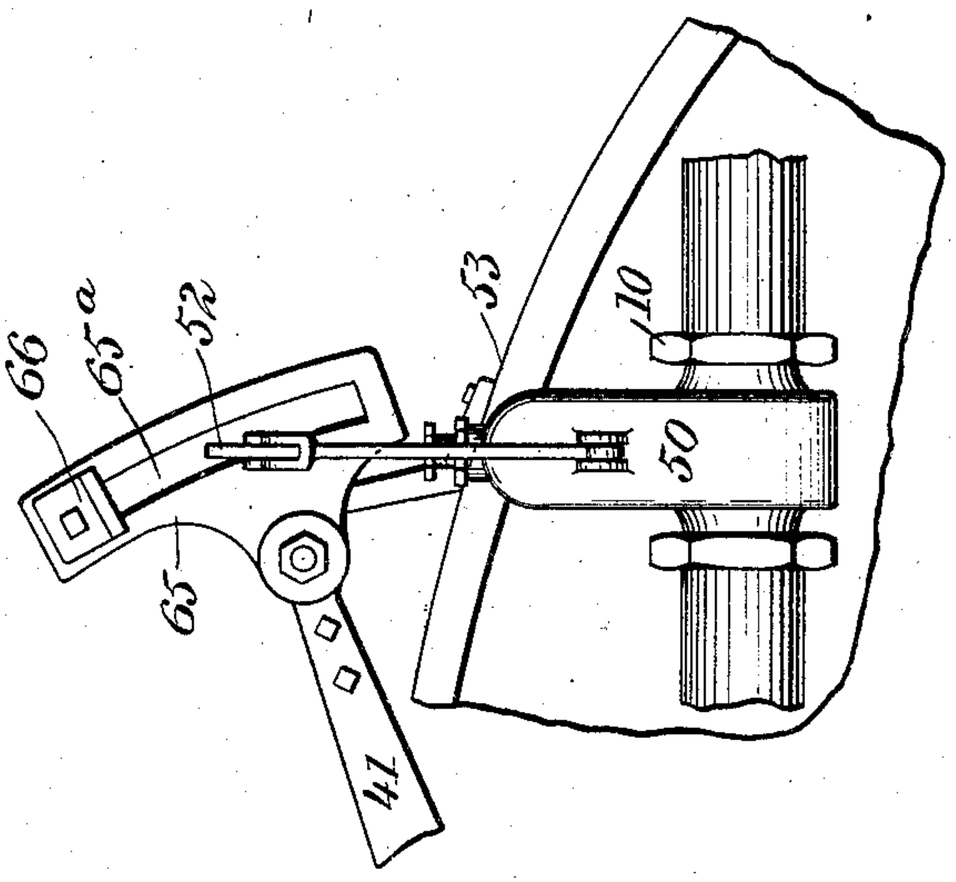


FIG. 8



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5 SHEETS—SHEET 5.

FIG. 11.

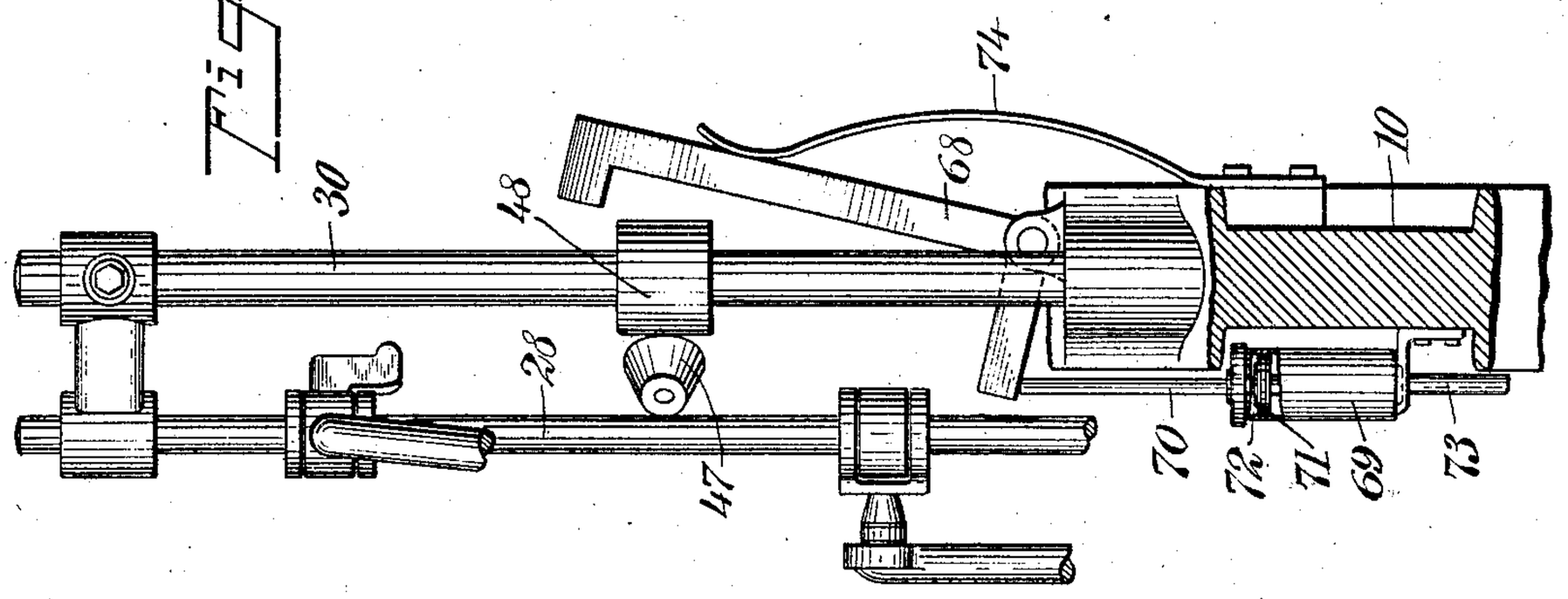
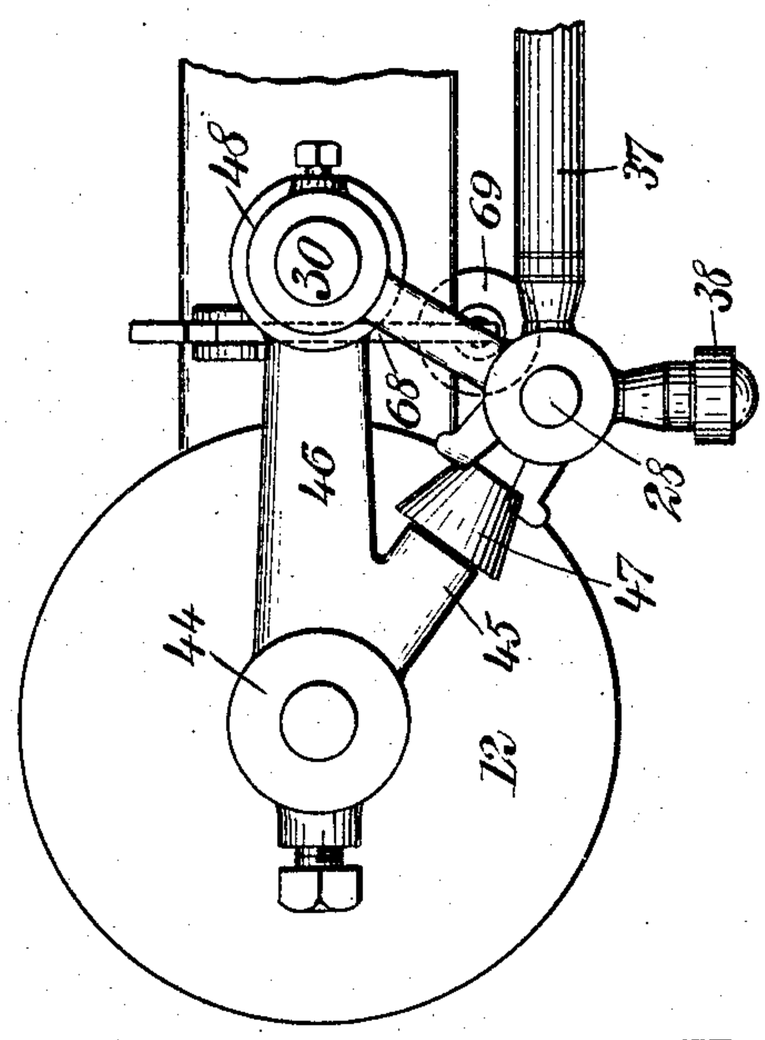


FIG. 10.



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No. 788,308. Patented April 25, 1905.

UNITED STATES PATENT OFFICE.

FRANK C. EMRICK, OF BLUEHILL, NEBRASKA.

STEAM-HAMMER.

SPECIFICATION forming part of Letters Patent No. 788,308, dated April 25, 1905.

Application filed December 12, 1903. Serial No. 184,954.

To all whom it may concern:

Be it known that I, FRANK C. EMRICK, a citizen of the United States, and a resident of Bluehill, in the county of Webster and State of Nebraska, have invented a new and Improved Steam-Hammer, of which the following is a full, clear, and exact description.

This invention relates to a hammer of that class in which power is applied through the medium of a cylinder and piston acted on by steam or other fluid under pressure.

One of the leading features of the invention resides in the arrangement of the cylinder and piston-rod, the latter passing through stuffing-boxes in both of the cylinder-heads, thus dispensing with the necessity for additional guides for the piston-rod.

A further feature of the invention lies in the location of the valve-chest near the lower end of the cylinder and in operating the valve by means of a peculiar gear actuated from the upper end of the piston-rod.

A further feature of the invention resides in mechanism for automatically operating the throttle and for controlling the movements of the valve mechanism.

The invention further resides in an automatic hold-up device for the hammer which, as the steam is shut off, automatically moves under the hammer or a part connected thereto, whereby to support the hammer clear of the anvil, and which automatically moves out of action as the steam is turned on.

A still further feature resides in a peculiar manner of mounting the anvil, so that it can be adjusted readily to suit the nature of the work being executed; and the invention involves various other novel features of major or minor importance, all of which will be fully set forth hereinafter.

This specification is an exact description of one example of my invention, while the claims define the actual scope thereof.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the invention. Fig. 2 is an enlarged section through the cylinder. Fig. 3 is a cross-section on the line 3 3 of Fig. 1. Fig. 4 is an elevation of the valve-operating mechanism with parts in section on the line 4 4 of Fig. 5. Fig. 5 is a plan view of the same. Fig. 6 is a side elevation of the throttle-operating mechanism. Fig. 7 is an end elevation thereof looking in the direction indicated by the arrows 7 7 in Fig. 6. Fig. 8 is a side view of a modification of the throttle-actuating mechanism. Fig. 9 is an end view of the same. Fig. 10 is a plan view of the automatic stop for holding the hammer elevated, and Fig. 11 is a side view of the same.

I shall first describe the concrete embodiment of my invention shown in Figs. 1 to 7. In these views the frame 10 of the apparatus is mounted on a suitable foundation, as shown in Fig. 1, and curves forwardly to support at its upper end the vertically-disposed cylinder 12. Said cylinder has stuffing-boxes 14 in its respective heads and carries the piston 15 and rod 16, the latter passing through both stuffing-boxes and projecting above and below the piston. 17 indicates the hammer proper, which is attached to the lower end of the rod 16, and 18 indicates any suitable anvil wherewith the hammer operates. It will be observed that by reason of this construction the piston-rod is securely guided and steadied in its reciprocal movement without necessitating the use of a special guiding device below the cylinder. 19 indicates the supply-pipe for the steam or other motive fluid, which pipe passes through the valve-chest 20. (See Fig. 3.) In said chest is a slide or other suitable valve 21, commanding the feed-ports 22 and 23 and the exhaust-port 24. Of these ports the port 22 passes to the upper end of the cylinder and the port 23 to the lower end, and the operation of the valve 21 serves, as will be understood, to admit the motive fluid to the cylinder in such manner as to impart a reciprocating movement to the piston and the rod. The valve-chest 20 is located at the lower portion of the cylinder, and the port 22 is therefore of sufficient length to reach to the upper end of the same. This arrangement serves to economize the steam necessary to operate the hammer, and when it is not at work the hammer may be held in a higher

position than ordinarily. The slide-valve 21 carries on its stem 25 a fork 26, with which is engaged an arm 27, fastened to the rocking valve-operating shaft 28. This shaft is mounted suitably in an arm 29, fastened to the upper end of a standard 30, which is erected on top of the frame 10, as best shown in Fig. 1. Splined on the valve-operating shaft 28 are two collars 31 and 32, provided, respectively, with oppositely-disposed cam-shaped tappets 33 and 34. These collars are free to slide on the shaft, but are forced by the spline and key to turn therewith, and they are held at the desired elevation on the shaft by means of forks 35 and 36, attached, respectively, to arms 37 and 38. The arm 37 is connected with an elbow-lever 39, fulcrumed on the frame 10 and coöperating with a quadrant 40, by means of which the elbow-lever may be held securely at any desired adjustment. The arm 38 is connected to a lever 41, which is also fulcrumed on the frame 10 and has its opposite end joined to an arm 42, which extends downward into connection with a treadle-lever 43. By means of these levers 39 and 43 the collars 31 and 32 and their corresponding tappet-fingers may be adjusted vertically on the shaft 28, so as to time the operation, as will be hereinafter fully set forth. On the upper end of the piston-rod 16 is fastened a collar 44, which has two arms 45 and 46, the former carrying a tapered roller 47 and the latter having a collar 48 at its free end, which slides loosely on the stanchion 30 and serves to guide the upper end of the piston-rod and the parts attached thereto. The parts 44 and 48 move with the piston-rod, and the roller 47 alternately strikes the tappets 33 and 34, thus imparting a turning movement thereto at each operation. This gives the shaft 28 a regular rocking movement, and through the action of the parts 27, 26, and 25 the slide-valve 21 is operated. It is clear that this operation may be timed and controlled to produce blows of any duration and rapidity desired by adjusting the collars 31 and 32 on the shaft 28, as before described. The feed-pipe 19 is provided with a hand-valve 49 and a throttle 50 outward from the hand-valve. Said throttle may be of any desired construction, and its stem 51 is operated by a lever 52, fulcrumed on a link 53, attached to the throttle-valve. The lever 52 projects laterally over the frame 10, as indicated best in Fig. 7, and so as to reach the throttle-valve-operating devices. These devices are carried partly on the frame 10 and partly on the before-described lever 41. Said devices comprise the upwardly and rearwardly extending arm 54, rigidly attached to the outer lever 41 and carrying a pivoted dog 55, at the lower end of which is a hook or bill 56 and at the upper portion of which is a pin 57. 58 indicates a spring attached to the arm 41 and bearing on the dog 55 to throw the same rightward in Fig. 6. A bracket 59 is attached to the frame 10 and projects upward therefrom, its upper extremity carrying a forwardly and rearwardly extending cam 60, adapted to coact with a pin 61 on the dog 55, and by means of these parts and the spring 58 as the lever 41 moves vertically the dog is caused to swing toward and from the valve-operating lever 52. As the lever 41 rises from the position shown in Fig. 6 the bill 56 of the dog 55 engages the lever 52 and moves the same upward, thus opening the throttle-valve. This operation continues until the pin 61 runs up to the highest point on the cam 60, and then the bill of the dog is disengaged from the lever 52. The throttle-valve then stays open until the lever 41 is thrown back to its lowermost position, whereupon the pin 57 strikes the top of the lever 52 and throws the same downward, thus closing the throttle. 62 indicates a retractile spring connected with the link 42 and serves automatically to return the lever 41 to its lowermost or inactive position.

The general operation of the machine may be traced as follows: Assuming that the parts are in the position shown in Fig. 1, the hammer 17 being in contact with the anvil, the lower feed-port 23 will be open. The valve 49 being open, upon throwing down the treadle-lever 43 the throttle will be opened by the action of the dog 55, as before described. The movement of the lever 41, following the treadle 43, will also move down the lower tappet-finger 34. The fluid being thus admitted to the under side of the piston will raise the same and the roller 47 will move idly past the lower tappet-finger 34, the adjustment of the parts being such that the operation of said finger 34 causes the steam to be cut off from the top feed-port and turned on through the lower feed-port and the operation of the tappet-finger 33 to be reversed. This upward movement of the piston continues until the roller 47 strikes the tappet-finger 33, whereupon the steam is cut off from the port 23 and the port 22 is opened. The piston then begins its downward movement, and this operation will be kept up until the treadle 43 is released, whereupon the spring 62 returns the lever 41, and by the action of the pin 57, before described, the throttle will be closed. After the lever 41 has been raised at its outer end to open the throttle the free movement of the lever will be allowed without interfering with the throttle, by which to regulate the position of the tappet-finger 34. Therefore during the operation of the machine the operator keeps the treadle 43 under control, and by adjusting the same the length of the piston-stroke, and consequently the force of the blow, may be varied at will. This adjusting operation does not affect the throttle, it being necessary to close the throttle to bring down the outer end of the lever 41 to its lowermost position—that is to say, a position somewhat lower than that illus-

trated in Fig. 6. The elbow-lever 39 is intended to be set at the adjustment desired; but of course it may be moved from one position to another at will. This lever controlling the tappet-finger 33 also enables the movement of the piston to be controlled to the utmost nicety.

Figs. 8 and 9 show a simplified form of the throttle-actuating mechanism, in which the arm 41 is provided with an adjustably-attached plate 65, having a slot 65[a] therein, curved on the arc through which the plate 65 moves with the arm 41. Attached to the plate 65 at the upper end of the slot 65[a] is a stud 66. The frame 10 carries an arm 67, which bears loosely against the rear side of the plate 65 to brace the same. In said slot 65[a] the end of the lever 52 bears loosely. Therefore the arm 41 is free to be adjusted to regulate the position of the cam 34 without affecting the throttle; but upon moving the arm 41 and plate 65 to either of their extreme positions the lever 52 is engaged in one instance by the lower end of the slot and in the other instance by the stud 66, and in this manner the throttle may be opened or closed.

In Figs. 10 and 11 I have illustrated an arrangement for holding the hammer raised from the anvil when the apparatus is at rest. According to the arrangement shown in these views an elbow-lever stop 68 is suitably fulcrumed on the frame 10. Said lever is shown in inactive position in Fig. 11, which position it assumes when the hammer is at work, and it is held in this position by the rod 70 of a piston 71, which operates in a small cylinder 69, mounted on the frame 10, as shown. 73 indicates a steam or air pipe adapted to be connected with the steam-pipe 19, so as to be controlled by the throttle 50. When the steam is on and the hammer operating, the steam enters the cylinder 69 and raises the piston 71, thus throwing the stop 68 out of action. 72 indicates a packing-ring on top of the piston 71, which is adapted when the piston is raised to engage the upper head of the cylinder 69 and prevent the leakage of steam. Pressing against the stop 68 is a spring 74, which acts to throw the stop 68 leftward, Fig. 11, so as to lie in the path of the cross-head 46 and collar 48 when the steam-pressure in the cylinder 69 is relaxed. Therefore when the hammer is operating the stop is held by the steam-pressure out of active position; but the instant the steam is turned off to stop the hammer the spring 74 throws the stop into active position and the cross-head 46 and collar 48 fall on the stop, thus holding the hammer elevated clear of the anvil. In bringing about this operation the steam should be cut off when the hammer and the cross-head are raised, so that the latter will then be in position to engage the stop. The instant that steam is again turned on to start the hammer the stop will be again moved back out of action.

Various changes in the form, proportions, and minor details of my invention may be resorted to at will without departing from the spirit and scope thereof. Hence I consider myself entitled to all such variations as may lie within the intent of my claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of a cylinder, a piston therein, a rod attached to the piston, projecting members attached to the rod outside of the cylinder, a support upon which one of the said members has guided movement, a valve for controlling the movement of the motive fluid in the cylinder, a rock-shaft, means for operating the valve from the rock-shaft, tappet-fingers mounted to slide on the shaft but to turn therewith and adapted to be engaged by the other projecting member of the piston-rod, and independent means for sliding each of the tappet-fingers on the rock-shaft.

2. In a power-hammer, the combination of a cylinder, a piston therein, projecting members on the piston-rod, a support adjacent to and projecting above the cylinder, and upon which one of the members of the piston-rod has sliding movement, a rock-shaft mounted in the support, tappets mounted to slide on the rock-shaft but to turn therewith, said tappets being adapted to be engaged by the other projecting member of the piston-rod, separate and independent means for sliding each tappet, a valve for controlling the motive agent to the cylinder, and a connection between the rock-shaft and the stem of the said valve.

3. The combination of a cylinder, a piston therein, a rod attached to the piston, means for controlling the movement of the motive fluid in the cylinder, a rocking shaft in connection with said means, tappet-fingers longitudinally adjustable on the shaft, a member mounted to move in time with the piston-rod and coacting with the tappet-fingers, a hand-lever having connection with one of the tappet-fingers to facilitate its adjustment, and a treadle-lever having connection with the other tappet-finger to facilitate its adjustment.

4. In a power-hammer, the combination of a cylinder, a piston therein and carrying a projection on its piston-rod outside of the cylinder, a valve for controlling the motive agent to the cylinder, a rock-shaft connected with the valve, tappets on the rock-shaft and adapted to be engaged by the projection of the piston-rod, one of the tappets being adjustable on said shaft, means for adjusting said tappet, a throttle and means for operating the throttle from the tappet-operating means.

5. In a power-hammer, the combination of a cylinder, a piston therein and provided with

a projection on its piston-rod outside of the cylinder, a valve for controlling the admission of the motive agent to the cylinder, a rock-shaft connected with the valve, tappets on the rock-shaft and adapted to be engaged by the projection of the piston-rod, one of the tappets being mounted to slide on the said shaft, a lever mechanism for operating the tappet, a throttle, and means for operating the throttle from the said lever mechanism.

6. In a power-hammer, the combination of a cylinder, a piston therein, a valve for controlling the admission of the motive agent to the cylinder, mechanism for operating the valve from the piston, said mechanism including tappets one of which is adjustable, a lever connected with said adjustable tappet, means for operating the lever, a throttle, and mechanism for operating the throttle from said lever.

7. In a power-hammer, the combination of a cylinder, a piston therein, a valve for controlling the admission of the motive agent to the cylinder, mechanism for operating the valve from the piston, said mechanism including tappets, one of which is adjustable, a lever connected with the adjustable tappet, means for operating said lever, a throttle-valve, a lever connected with the throttle-valve, and means for operating the throttle-valve lever from the tappet-operating lever.

8. In a power-hammer, the combination of a cylinder, a piston thereon, a valve for controlling the admission of the motive agent to the cylinder, mechanism for operating the valve from the piston, said mechanism including tappets, one of which is adjustable, a lever connected with the adjustable tappet, means for operating the lever, a throttle-valve, a lever connected with the throttle-valve, and a pivoted dog carried by the tappet-operating lever and engaging the throttle-lever to swing said lever to open and close said valve.

9. In a steam-hammer, the combination with the throttle-valve, of a lever, a dog movably mounted thereon, a relatively stationary cam coacting with the dog, and a member in connection with the throttle-valve and adapted to be operated by the dog.

10. In a steam-hammer, the combination with the throttle-valve, of a movably-mounted member, a dog movable thereon, and having two projecting portions, a stationary cam coacting with the dog, and a member in connection with the throttle-valve and adapted to be actuated from the dog, to operate the throttle.

11. In a power-hammer, the combination with a throttle, and a lever connected therewith, of a second lever, a pivoted and spring-pressed dog carried by the second lever and provided with a bill at its lower end and with a projection at its upper end, and a stationary cam with which the dog engages.

12. In a power-hammer, the combination of a cylinder, a valve for controlling the motive agent to the cylinder, mechanism for operating the valve from the piston, said mechanism including tappets, one of which is adjustable, a lever connected with the adjustable tappet, a throttle-valve, a lever connected with the throttle-valve, and means carried by the tappet-operating lever and engaging the throttle-lever to swing said lever to open and close said valve.

13. In a power-hammer, a cylinder, a valve for controlling the motive agent to the cylinder, a piston in the cylinder and provided with a projection on its piston-rod, a rock-shaft, means for operating the valve from the said shaft, tappets on the rock-shaft, and adapted to be engaged by the projection of the piston-rod, one of the tappets being adjustable, a lever having one end connected with the adjustable tappet, a treadle connected with the other end of said lever, a throttle-valve, and means for operating the throttle-valve from said lever.

14. A power-hammer comprising a cylinder, a valve for controlling the motive agent to the cylinder, a piston in the cylinder and provided with a projection on its piston-rod, a rock-shaft, means for operating the valve from the rock-shaft, tappets mounted to slide on the rock-shaft but to turn therewith, said tappets being adapted to be engaged by the projection of the piston-rod, a handle-lever connected with one tappet, a lever having one end connected with the other tappet, a treadle connected with the other end of said lever, a throttle-valve, and means for operating the throttle-valve from the lever connected with the treadle.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK C. EMRICK.

Witnesses:

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