B. J. GRAHAM.

SAFETY DEVICE FOR PUNCH PRESSES.

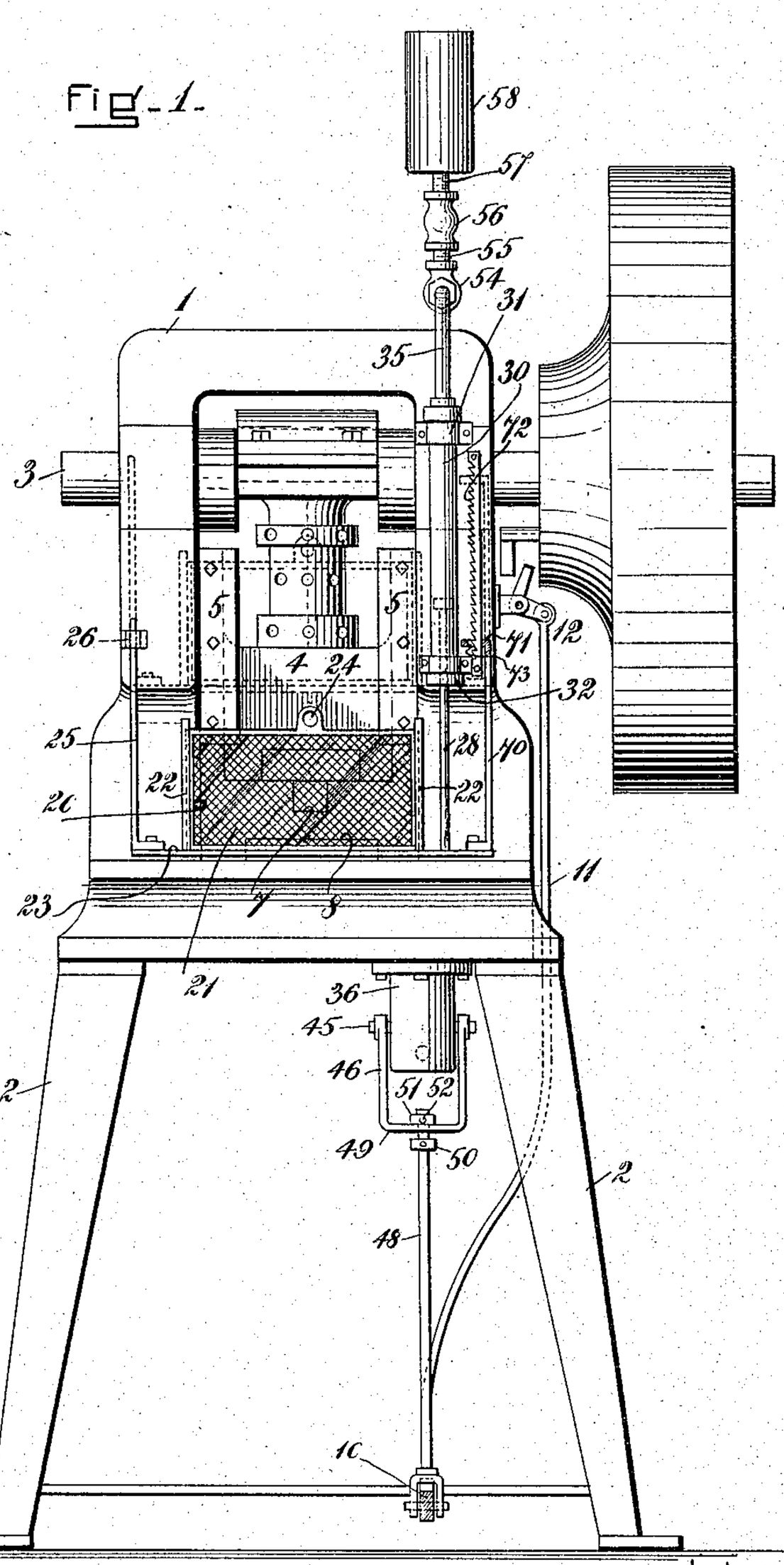
APPLICATION FILED JAN. 23, 1915.

1,166,981.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 1.

Fig. 1.



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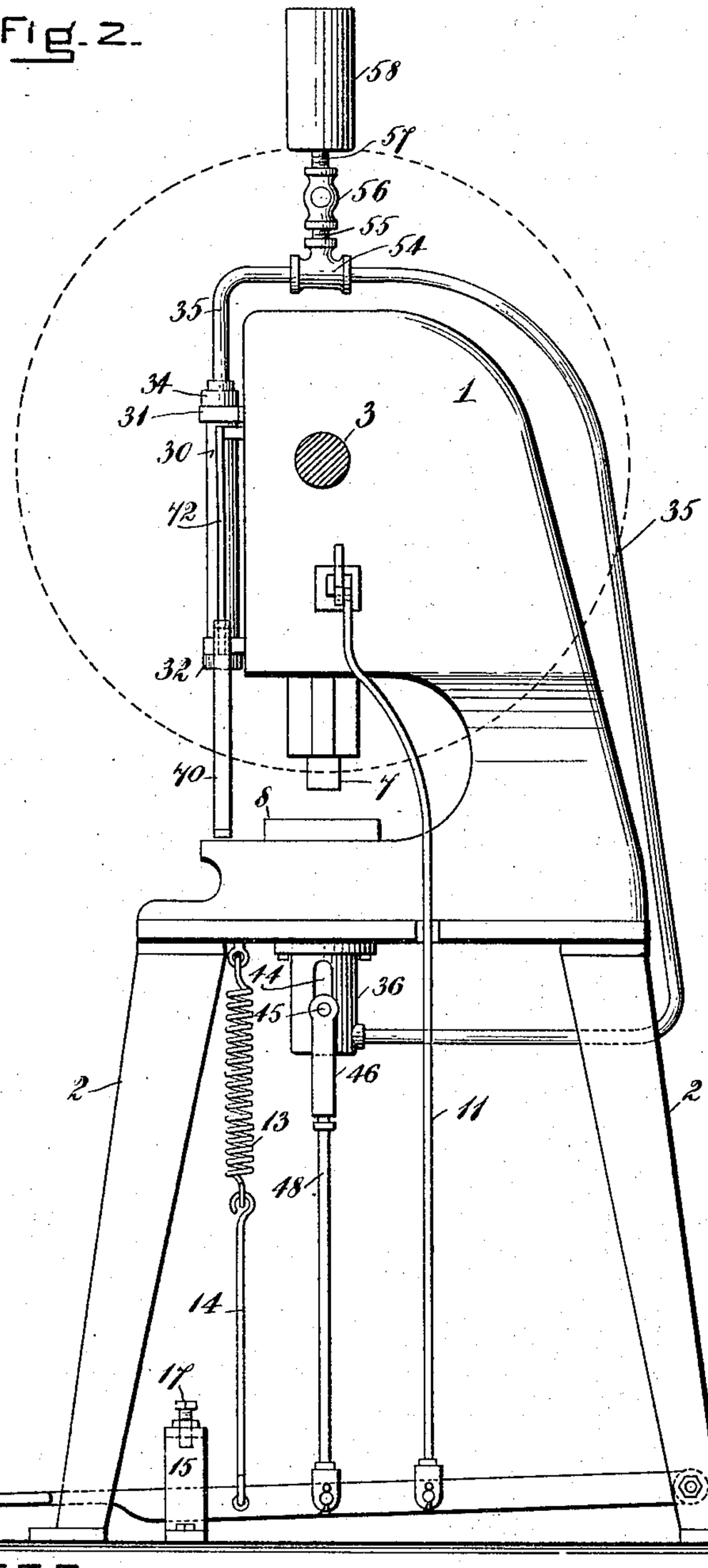
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

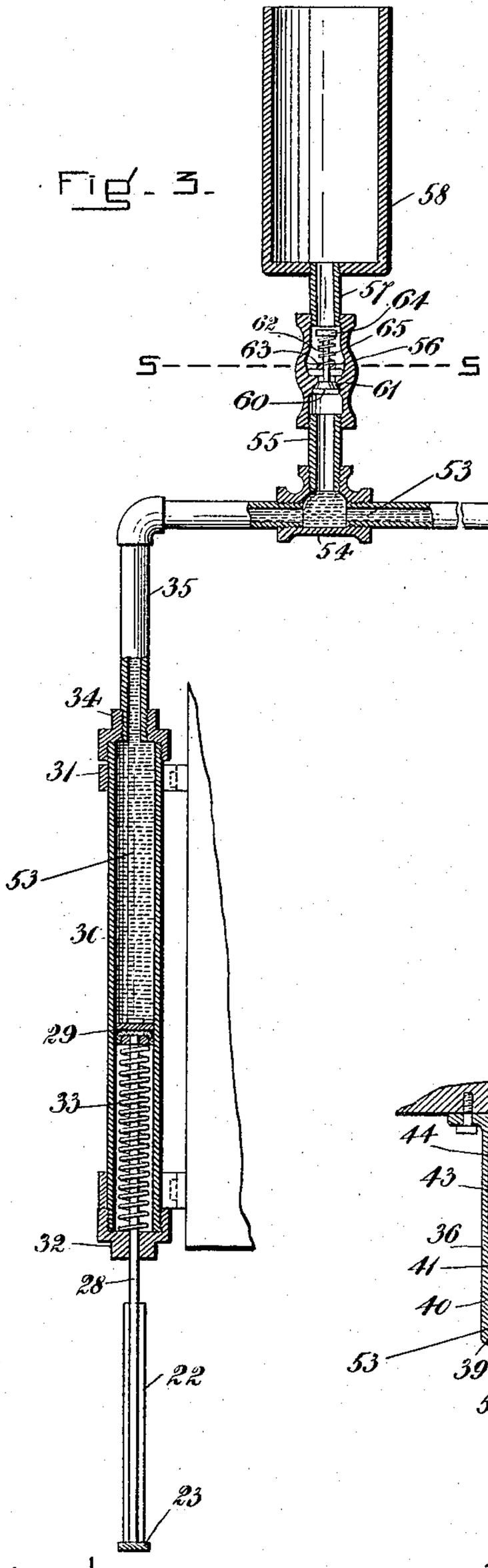


Fig. 4.

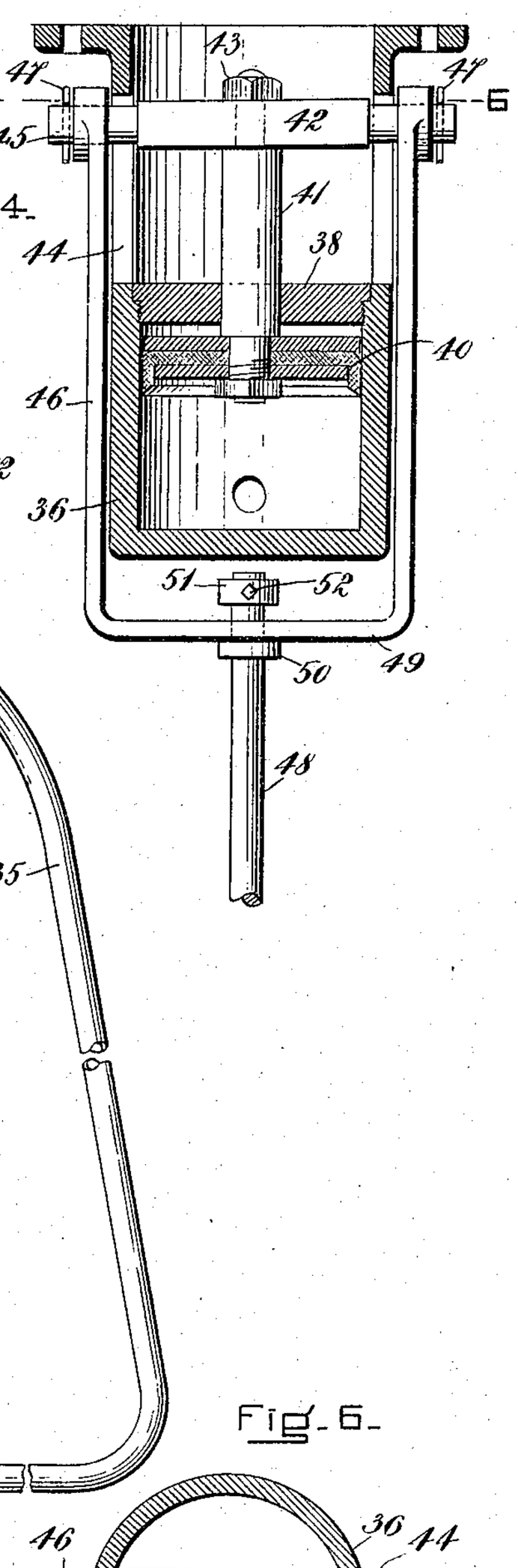
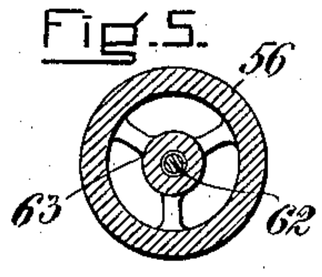


Fig. 5.



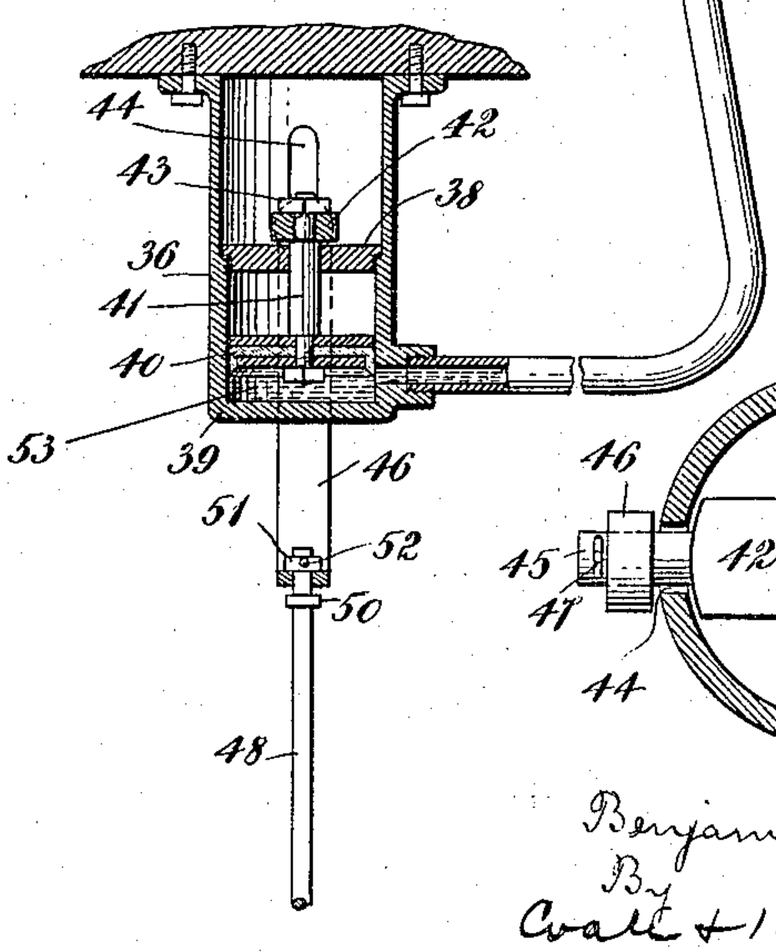
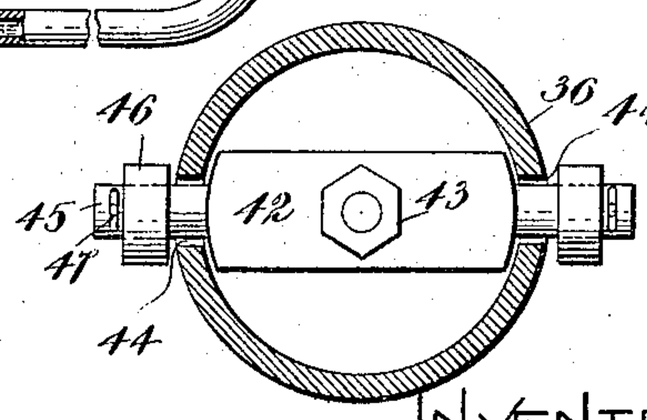


Fig. 6.



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UNITED STATES PATENT OFFICE.

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SAFETY DEVICE FOR PUNCH-PRESSES.

1,166,981. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed January 23, 1915. Serial No. 4,054.

To all whom it may concern:

Be it known that I, BENJAMIN J. GRAHAM, of Beverly, in the county of Essex and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Safety Devices for Punch-Presses and the like, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

The present invention relates to an attachment for punch presses or other machines which during their operation might injure the hands of an operator, and it consists of a movable guard and improved mechanism for controlling the guard for safeguarding the operator.

Among the essential objects of my invention is to provide such control for the guard as may have characteristics especially to be desired in a control of this kind, viz: positiveness and precision of operation with relation to the operation of the machine, the reduction of wear, adjustability, and also ease of attachment to any machine.

It is my further object to provide whereby the machine cannot be started until the guard is occupying a closed position.

The invention can best be seen and understood by reference to the drawings in which the attachment is shown applied to a punch press of common type and in which—

Figure 1 shows the parts in front elevation. Fig. 2 is a side elevation thereof. Fig. 3 shows various combined parts of the attachment mainly in vertical section but partly in side elevation. Fig. 4 is a view partly in front elevation and partly in vertical section of one of the operating parts of the device to which special reference will hereinafter be made. Fig. 5 is a section on the line 5—5 of Fig. 3. Fig. 6 is a section on the line 6—6 of Fig. 4.

Referring to the drawings, 1 represents the body or frame of the machine. 2 are the legs supporting the body.

3 is the usual eccentric shaft mounted upon the body and operating to reciprocate the holder or crosshead 4 working within guides 5 secured to the frame.

7 is the punch carried by the holder and movable therewith.

8 is the die with which the punch coöperates and which is mounted upon the table or base of the body of the machine.

10 is the treadle for starting and stopping the machine. This treadle is pivoted to the rear right-hand leg of the machine and operates through a connecting rod 11 pivoted to it to control a clutch arrangement 12 operable in the usual manner to connect the power with the eccentric shaft for operating the machine and for disconnecting the power from the eccentric shaft for stopping the machine as the clutch arrangement is reversely operated. The connection of the power with the eccentric shaft and the starting of the machine are accomplished by the depression of the treadle and are effected only when the treadle has been moved downward to the limit of its stroke. Reversely the raising of the treadle or the return thereof to its raised position operates to throw out the power and stop the machine. The treadle is maintained in a normal raised position, thereby disconnecting the power from the eccentric shaft, by means of a spring 13 secured to the under side of the body of the machine and connecting with the treadle through a link connection 14. The proper initial raised position of the treadle is defined by means of a bracket 15 secured to the floor or base upon which the machine is mounted and extending loosely around the treadle in the manner of a strap. Carried by this bracket is an adjusting screw 17 against which the treadle is adapted to contact when returned to a raised position by the spring, the end of the screw acting as an adjustable stop for defining the proper raised position of the treadle or that position to which it is returned for stopping the machine.

The parts above indicated comprise no part of my invention and are referred to merely for a proper understanding of the relative disposition, arrangement and operation of the parts comprising my invention to which attention will now be directed and which comprise the safety guard and means controlling it or otherwise pertaining thereto.

20 represents the guard. This consists of a rectangular plate of celluloid or other suitable material preferably reinforced with wire 21 embedded within it. The guard or plate is arranged at the front of the machine adjacent the entrance to the space or gap traversed by the punch or tool during its operation. The closed position of the guard is that shown in the full lines of the drawings where it entirely closes the gap or space leading to the tool and accordingly prevents the hands of the operator from entering this space. From this position the guard is moved vertically into a position indicated by the dotted lines in Fig. 1 where it will be seen that the space leading to the tool and die is left entirely clear for the insertion or removal of the work.

The guard is mounted within a frame consisting of vertical side bars 22 and a bottom horizontally-extending bar 23 to which the side bars are secured. The bars 22 are grooved along their inner sides or faces to receive the side edges of the guard which is inserted from above and is accordingly removable, the guard being provided with a tab 24 to assist in its application to or removal from the frame.

The bottom horizontally-extending frame bar 23 of the guard projects laterally at either side beyond the respective side bars 22. On the left side of the machine the projecting end of this bar is provided with an upwardly-extending rod 25 fixed to it. This rod extends through a guide 26 fastened to the frame or body of the machine. The rod 25 and guide therefor assist in preventing displacement of the guard or plate during its vertical up and down movement.

The right laterally-projecting end of the crossbar 23 of the guard frame has fixed to it a piston rod 28. This rod has an upward vertical extension and is secured to a piston 29 contained within a cylinder 30. This cylinder is vertically arranged and secured to the right face of the frame of the machine by any suitable attaching brackets 31.

Coiled around the piston rod 28 between the piston 29 and the bottom end 32 of the cylinder 30 is a spring 33. This spring, as will later be more fully explained, operates through its bearing against the piston 29, thence through the piston rod 28 and guard frame to normally hold the guard in its out-of-the-way or open position. In this connection it is to be observed that the location of the cylinder 30 on the frame is such as not to interfere with the raising and lowering of the guard.

Connecting with the top end 34 of the cylinder 29 and leading into the chamber thereof is a pipe 35 which extends up and over the frame of the machine and thence down over the rear side thereof, thence forward beneath the body of the machine to connect with a cylinder 36 which is bolted to the under side of the frame or body of the machine at a point above and in substantial vertical alinement with the treadle 10. The cylinder 36 has within it a diaphragm 38, the cylinder chamber into which the pipe 35 enters being formed between this diaphragm and the bottom end 39 of the cylinder. Contained within this chamber above the point where the pipe 35 enters the same is a piston 40. Secured to this piston is a short piston rod 41 which extends upward through the diaphragm 38 into the chamber of the cylinder above the diaphragm where the diameter of the piston rod is contracted to receive a crossbar 42, which is otherwise secured to the end of the piston rod by a nut 43 threaded on the end of the rod. The crossbar 42 is horizontally arranged and projects laterally at either end through slots 44 formed in the wall of the cylinder (see Fig. 4), the projecting ends 45 of the rod being rounded to receive the arms of a stirrup 46 loosely mounted thereon and held against lateral displacement by pins 47 passed through the ends of the bar 42 beyond the arms of the stirrup. The stirrup 46 extends downward and around the body of the cylinder 36 whereby it may turn freely with relation thereto. Connecting with the stirrup is a link 48 which extends downwardly therefrom and is pivotally connected to the treadle at about the center of its extension.

For a special purpose, as will later be explained, the link 48 is adjustably secured to the stirrup in the following manner: As will be observed by reference to Fig. 4, the link passes upwardly through the crossbar 49 of the stirrup, lying beneath the cylinder 36. Fixed to the link on the under side of the stirrup is a collar 50. This collar is adapted to bear against the bar 49 of the stirrup as the link is lifted. Above the bar 49 of the stirrup there is secured to the projecting end of the link 48 an adjustable collar 51. This collar is loosely mounted upon the link and bound thereto at any desired point within the limits of its adjustment by a binding screw 52. The collar 51 is adapted to bear against the stirrup as the link is moved downwardly. Owing to the adjustability of the collar 51 upon the link it will be observed that a space greater than the thickness of the bar 49 of the stirrup through which the link extends, will separate the respective collars, thereby providing for a certain amount of lost motion between the link and the stirrup, which is availed of as will later be explained.

Before referring to the operation of the parts thus far described, reference will be made to their normal relationship to those of the machine, that is, from an operative

standpoint. It should first be understood, however, that the portion of the chamber of the cylinder 30 lying above the piston 29, including also the pipe 35 and that portion of the chamber of the cylinder 36 lying below the piston 40, is filled with oil or other substantially non-compressible fluid 53. This fluid forms practically one of the working elements of the combination inasmuch as it is the instrument by which motion is transmitted from one piston to the other. With the punching machine at rest the treadle 10 will have been raised to an elevated position by the spring 13. The elevated position of the treadle as above explained is defined by the stop 17 and is commensurate with the disengagement or throwing out of the clutch mechanism which controls the operation of the machine. The guard 20 will then be occupying its elevated or out-of-the-way position as shown in the dotted lines of Fig. 1. This position is defined by the engagement of that portion of the guard frame to which the piston rod 28 is secured, with the bottom end 32 of the cylinder 30, and is effected by the tensional bearing of the spring 33 against the piston 29. With the guard 20 occupying its elevated position the piston 29 will then occupy a position within the cylinder 30 commensurate with the elevated position of the guard or as indicated in the dotted lines of Fig. 1. At the same time the piston 40 within the cylinder 36 will have been raised by the treadle through the link 48, collar 50, stirrup 46 and other connections into an elevated position substantially as shown in Fig. 4.

Assuming now that the treadle is depressed for starting the machine, the effect upon the control of the guard is as follows: As the treadle is moved downwardly by the foot of the operator it will operate through the link 48, collar 51 and stirrup 46, cross-bar 42 and piston rod 41 to draw down the piston 40 in the chamber of the cylinder 36, thereby moving or displacing the fluid which lies between the piston 40 and the piston 29. In other words, the fluid is forced out of the chamber of the cylinder 36 into the chamber of the cylinder 30 where it operates to force down the piston 29 and this through the piston rod 28 and guard frame operates to close the guard. Of course the movement of the fluid for operating the guard will continue until the treadle is fully depressed. Inasmuch as the treadle must be fully depressed in order to start the machine, it is evident that the guard will have become fully closed before the machine is started. The guard will remain closed as long as the treadle is held depressed and the machine in operation. When the treadle is released from the pressure operating to depress it, it will immediately be returned to its normal elevated position by the spring 13 and the machine stopped. As the treadle is returned to its elevated position by the spring 13 it operates through the link 48, collar 50 thereon, stirrup 46 and other connecting parts above referred to, to raise the piston 40 within the chamber of the cylinder 36, producing therein a vacuum tending to draw back the fluid into this cylinder through the pipe 35 from out of the cylinder 30, thereby allowing the spring 33, which has been contracted by the previous operation, to expand against the piston 29 and open the guard, which assumes its normal out-of-the-way position as above defined.

In order that the fluid may properly operate to move the guard, it is necessary that certain relative proportions be maintained between the cylinder chamber containing the piston 29 and that containing the piston 40. Any necessity for exactness or refinement in such proportions I have eliminated by the adjustment to which I shall presently refer. By this same adjustment provision is made whereby the attachment may be easily applied to any machine and compensation be made also in different machines for the relative height and amount of travel of the punch with relation to the die. The adjustment for attaining these ends consists simply in providing the rod 48 which connects the treadle with the stirrup with the adjustable collar 51 as above referred to. To understand the applicability of this adjustment reference must again be made to certain phases of the operation of the attachment as a whole. As before described the full open and closed positions of the guard are commensurate in time with the full raised and depressed positions of the treadle, which in turn determine, respectively, the starting and stopping of the machine. Reference has also been made to the fact that the treadle when moved into its elevated position for stopping the machine, operates through the link 48 and collar 50 thereon to lift the stirrup 46 by the bearing of this collar against the stirrup, the raising of the stirrup through the other connecting means operating to lift the piston 40 and thereby relieve the fluid from the cylinder 30, permitting the spring 33 to raise the guard into its full open position. On the other hand, as the treadle is depressed for closing the guard it will operate through the link 48 and collar 51 thereon, which bears against the upper side of the stirrup, to draw down the stirrup, thereby operating the piston 40 to force the fluid into the chamber of the cylinder 30 and force down the piston therein closing the guard. In the initial attachment to any machine the parts are so set that when the treadle is occupying its full raised position it will then

operate through the bearing of the collar 50 against the stirrup (which in fact may be a fixed collar) to lift the piston 40 to a position where the fluid will be sufficiently withdrawn from the chamber of the cylinder 30 to permit the spring 33 to raise the guard to its full maximum open position, and this may be determined by the location on the frame of the machine of the cylinder 30, the bottom end of which acts as a stop for defining the full open position of the guard. From this maximum open position practically any desired amount of travel may be imparted to the guard for closing it and the guard become fully closed at a period coincident with the full depression of the treadle preliminary to starting the machine, simply by the adjustable location of the collar 51 with relation to the stirrup. In other words, the amount of travel imparted to the guard will depend upon the space which separates the collar from the bar 41 of the stirrup. That is, the treadle will operate to move the piston 40 for displacing the fluid only when this collar 51 engages the stirrup. Accordingly any amount of lost motion may be provided for in the operation of the treadle as will permit it moving the piston 40 just so far that the fluid displaced by it will have operated to close the guard only when the treadle has become fully depressed just preliminary to the starting of the machine.

It is desirable in order to secure the exact and proper operation of the machine, that the chambered connections between the pistons 29 and 40 be kept full of fluid at all times and no partial vacuum occur therein as might otherwise occur owing to the fact that the raised position of the piston 29 is a limited one. I have therefore provided whereby the connections between the pistons may automatically be kept filled with fluid at all times and the possibility of a vacuum therein be eliminated. Located within that section of the pipe 35 which extends over and around the frame of the machine is a coupling 54 (see Fig. 3). Having threaded connection with this coupling and extending upwardly therefrom is a short pipe section 55 which has threaded connection with a valve casing 56. Having threaded connection with the upper end of this valve casing is a short pipe section 57 connecting with a tank or reservoir 58 which is kept filled with oil. Communication through the various connections between the chamber of the reservoir and the pipe 35 is controlled by an inwardly-opening valve 60 located within the valve casing and closing against a seat 61 formed therein. The valve 60 is provided with a stem 62 extending upwardly therefrom through the port controlled by the valve and thence through a fixed guide 63 for the stem, and bearing upon its upper end a stem piece or head 64. Coiled around the stem and located between the head 64 and the guide 63 is a spring 65 which operates to hold the valve in a normal closed position against any head of oil which may be contained in the reservoir 58. The guide 63 may consist simply of a crossbar fixed to the interior of the valve casing or of a grid substantially as shown in Fig. 5. In the event of the escape of oil from the connections between the two pistons 29 and 40 a partial vacuum will be formed therein with the effect that when the piston 40 is elevated for drawing back the fluid, sufficient suction will ensue, after the piston 29 has been raised to its full elevated position, to open the valve 60 and draw oil from the reservoir in sufficient amount to entirely fill the connections, after which the valve will again be returned to a closed position by the spring.

It is much to be desired in an attachment of the present kind that the machine should be incapable of being started in case the hands of the operator are in a position where they might be injured by the punch. By reference to Fig. 1 it will be observed that the right laterally-projecting end of the bottom frame bar 23 carrying the guard has attached to it outside the piston 28 an upright bar or rod 70 which extends upwardly and at the upper end thereof is provided with a finger 71 which turns inwardly and around a toothed bar 72 fastened to the frame of the machine just outside the cylinder 30. The bent finger 71 presents an edge 73 adapted to engage any of the teeth of the bar 72, and it is also to be observed that these teeth are set or inclined so that the finger or edge thereof will have engagement with the teeth only as the finger is drawn downwardly during the closure of the guard. The normal position of the finger is one such that the engaging edge 73 thereof will lie just out of contact with the teeth of the bar and accordingly will have no engagement therewith during the ordinary and proper opening and closure of the guard. In the event, however, that the hands of the operator are beneath the punch when the treadle is depressed for starting the machine, then as the guard is moved downwardly by the treadle it will be brought into engagement with the hands or arms of the operator. Such contact tends to cramp the guard and accordingly by the distortion thereof to draw the edge 73 of the finger into engagement with some one of the teeth on the bar 72. The rod 70 thereon will prevent further lowering of the guard which has the indirect effect of preventing further depression of the treadle and the starting of the machine, for as above explained the machine cannot be started until the treadle has been fully depressed and the full lowering of the guard

is at all times coincident with the full depression of the treadle.

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

1. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a movable fluid-operated piston connecting with said guard, a fluid-operating piston, connections within which said pistons operate and providing also a closed passage between said pistons adapted to contain a substantially non-compressible fluid column, and means for operating said fluid-operating piston.

2. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a movable fluid-operated piston connecting with said guard, a fluid-operating piston, connections within which said pistons operate and providing also a closed passage between said pistons, a column of substantially non-compressible fluid contained within and filling the passage between said pistons, and means for operating said fluid-operating piston.

3. In a safety device of the character specified, a movable guard and means for controlling the open and closed positions thereof, said means comprising a fluid-operated piston connecting with said guard, a fluid-operating piston, cylinders containing said pistons, a pipe connecting said cylinders, said cylinders and pipe in the space inclosed thereby lying between said pistons being adapted to contain a substantially non-compressible fluid, and means for operating said fluid-operating piston.

4. In a safety device of the character specified, a movable guard and means for controlling the open and closed positions thereof, said means comprising a fluid-operated piston connecting with said guard, a fluid-operating piston, cylinders containing said pistons, a pipe connecting said cylinders, a column of some substantially non-compressible fluid contained within the cylinders and pipe connection lying between said pistons and movable therewith, and means for operating said fluid-operating piston.

5. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a piston having a piston rod connecting with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, a cylinder containing said piston, means for holding said guard in a normally open position with said piston occupying a position commensurate therewith, and a fluid-actuating means operable from a distance for operating said piston.

6. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a piston having a piston rod connecting with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, a cylinder containing said piston, a stop defining the normal open position of said guard, and a fluid-actuating means operable from a distance for operating said piston and guard controlled by it.

7. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a piston having a piston rod connecting with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, a cylinder containing said piston, means for defining the open position of said piston, means for holding said guard in a normally open position with said piston occupying a position commensurate therewith, and a fluid-actuating means operable from a distance for operating said piston.

8. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a piston having a piston rod connecting with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, a cylinder containing said piston and through the bottom end of which said piston rod extends, said cylinder being located adjacent said guard, a spring contained within said cylinder between the bottom end thereof and said piston for normally maintaining said guard in an open position, and a fluid-actuating means operable from a distance for operating said piston.

9. In a safety device of the character specified, the combination comprising a movable guard having a bar projecting laterally therefrom, a piston having a piston rod connecting with said bar, a cylinder containing said piston, and a fluid-actuating means operable from a distance for operating said piston to move said guard through said piston rod and bar as aforesaid.

10. In a safety device of the character specified, the combination with a movable guard, of parts controlling the position of

said guard and comprising in part a fluid-actuated piston, connections through which a fluid column may be directed to said piston for operating the same from a distance, a fluid-actuating piston contained within said connections for moving the fluid column, a main operating lever, and connections interposed between said lever and said fluid-actuating piston whereby said fluid-actuating piston may be moved in reverse directions as said lever is operated.

11. In a safety device of the character specified, the combination with a movable guard, of a fluid-operated piston, means connecting said piston with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, means for maintaining said guard in a normally open position and said piston in a position commensurate therewith, connections through which a fluid column may be directed to said piston for operating it from a distance for closing said guard, a fluid-actuating piston for moving said column, a main operating lever connecting with said fluid-actuating piston, and means whereby said lever may actuate said piston to move said column during a determinate full or partial movement thereof.

12. In a safety device of the character specified, the combination with a movable guard, of a fluid-operated piston, means connecting said piston with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, means for maintaining said guard in a normally open position and said piston in a position commensurate therewith, connections through which a fluid column may be directed to said piston for operating it from a distance for closing said guard, a fluid-actuating piston for moving said column, a main operating lever, means connecting said lever with said fluid-actuating piston whereby it may be moved by said lever when moved in one direction to a position where the fluid column controlled by it will permit of the full opening of said guard and upon a reverse movement of said lever said piston and fluid column controlled by it will be moved just enough to close said guard.

13. In a safety device of the character specified, the combination with a movable guard, of a fluid-operated piston, means connecting said piston with said guard whereby said guard may be moved to occupy open and closed positions commensurate with positions occupied by said piston, means for maintaining said guard in a normally open position and said piston in a position commensurate therewith, connections through which a fluid column may be directed to said piston for operating it from a distance for closing said guard, a fluid-actuating piston for moving said column, a main operating lever, means controlling said lever to have a determinate movement in reverse directions, and an adjustable connection between said lever and said fluid-actuating piston whereby said lever may operate said piston and fluid column controlled by it as said lever is reversely moved with a determinate movement irrespective of the full reverse movement of said lever.

14. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising in part a fluid-actuated piston connecting with said guard, connections through which a fluid column may be directed to said piston for operating it from a distance, a fluid-operating piston, and means whereby the connection between said pistons may automatically be kept filled with fluid.

15. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising in part a fluid-actuated piston connecting with said guard, connections through which a fluid column may be directed to said piston for operating it from a distance, a fluid-operating piston, a receptacle for containing fluid with a connection leading therefrom and into the connection between said pistons by which fluid may be directed thereto from said receptacle, and a valvular device located within the passage of said connection out of said receptacle comprising a valve opening in the direction of the connection between the pistons and means for holding said valve in a normally closed position.

16. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a fluid-actuated piston connecting with said guard, a fluid-actuating means for operating said piston to close said guard, a fixture arranged adjacent said guard, and means carried by said guard and adapted to have engagement with said fixture for arresting the movement of said guard toward a closed position upon the torsional displacement of said guard.

17. In a safety device of the character specified, the combination with a movable guard having a lateral extension, of means for controlling the open and closed positions of said guard, the same comprising a fluid-actuated piston having a piston rod connecting with said lateral extension of the guard whereby said guard may be moved to a closed position by said piston, a fluid-actuating means for operating said piston to close said guard, a fixture arranged adja-

cent said guard, and means carried by the lateral extension of said guard and adapted to have engagement with said fixture for arresting the movement of said guard toward a closed position and also the movement of said piston for closing said guard upon the torsional displacement of said guard.

18. In a safety device of the character specified, the combination with a movable guard, of means for controlling the open and closed positions thereof, the same comprising a fluid-actuated piston connecting with said guard, a fluid-actuating means for operating said piston to close said guard, a fixture arranged adjacent said guard and presenting a toothed edge and an arm carried by said guard and presenting an edge out of contact with the toothed edge of said fixture during the normal operation of said guard but adapted to have engagement with the toothed edge of said fixture for arresting the movement of said guard toward a closed position upon a torsional displacement of said guard.

BENJAMIN J. GRAHAM.

Witnesses:
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