(No Model.) 3 Sheets—Sheet 1.

F. C. BILLINGS & F. LOMBARD.

DROP HAMMER.

No. 545,188. Patented Aug. 27, 1895.

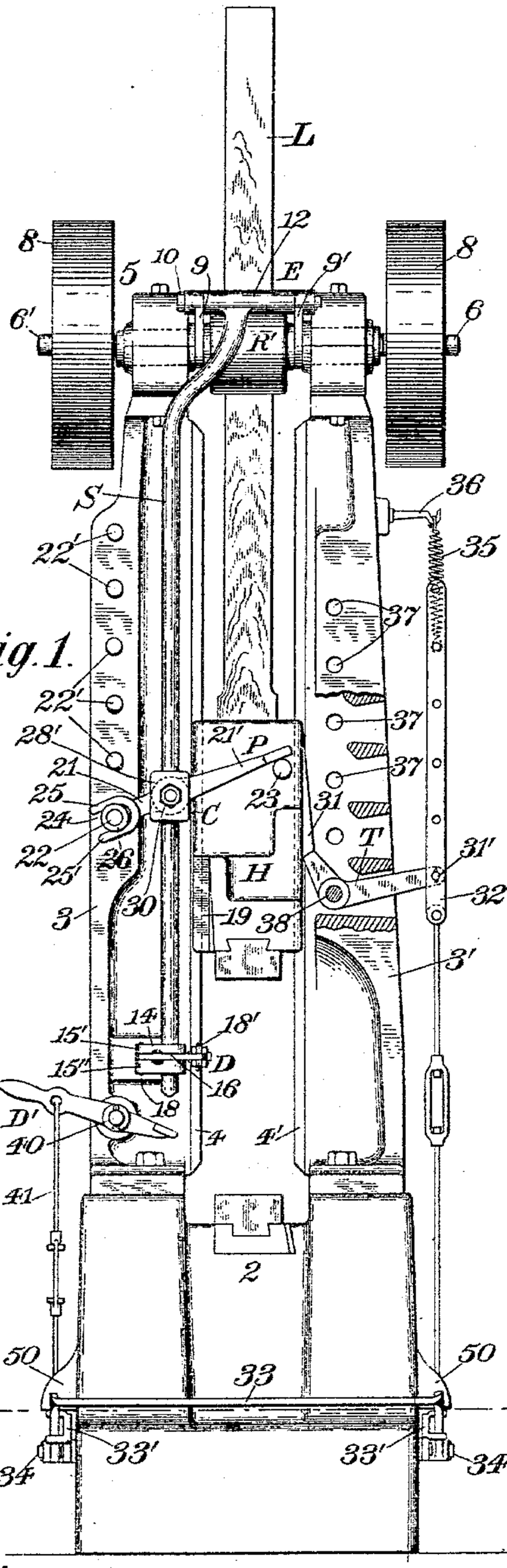


Fig. 1.

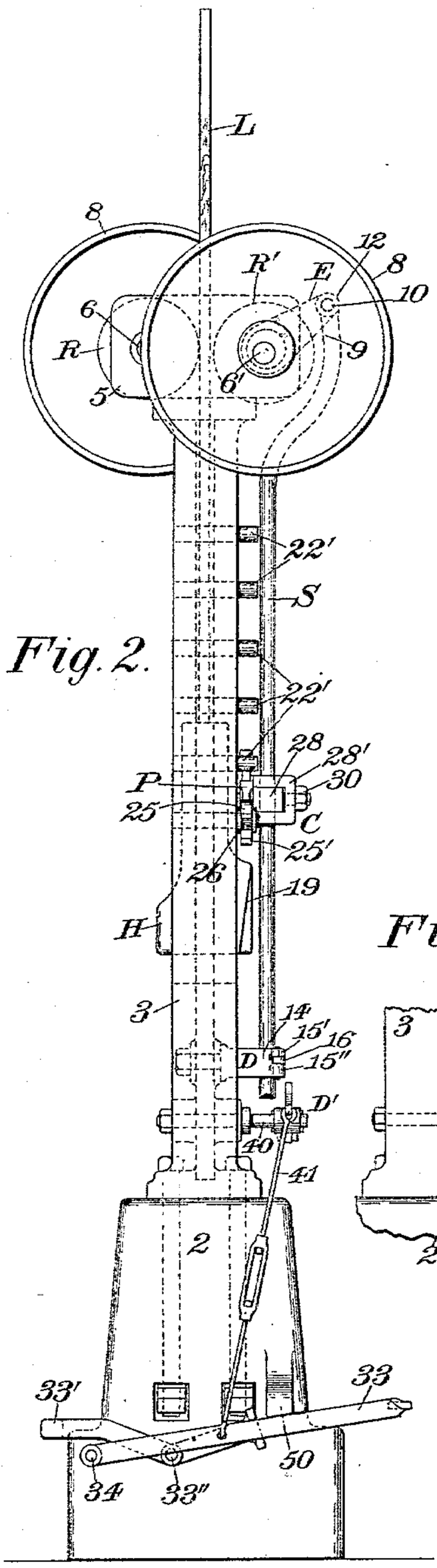
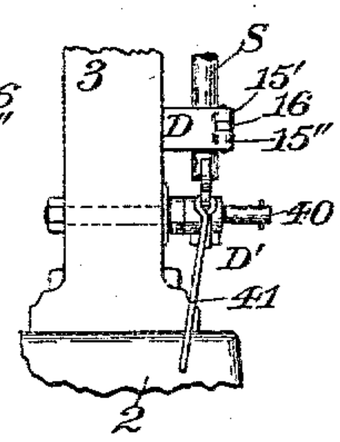


Fig. 2.

Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

F. C. BILLINGS & F. LOMBARD.

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Fig. 4.

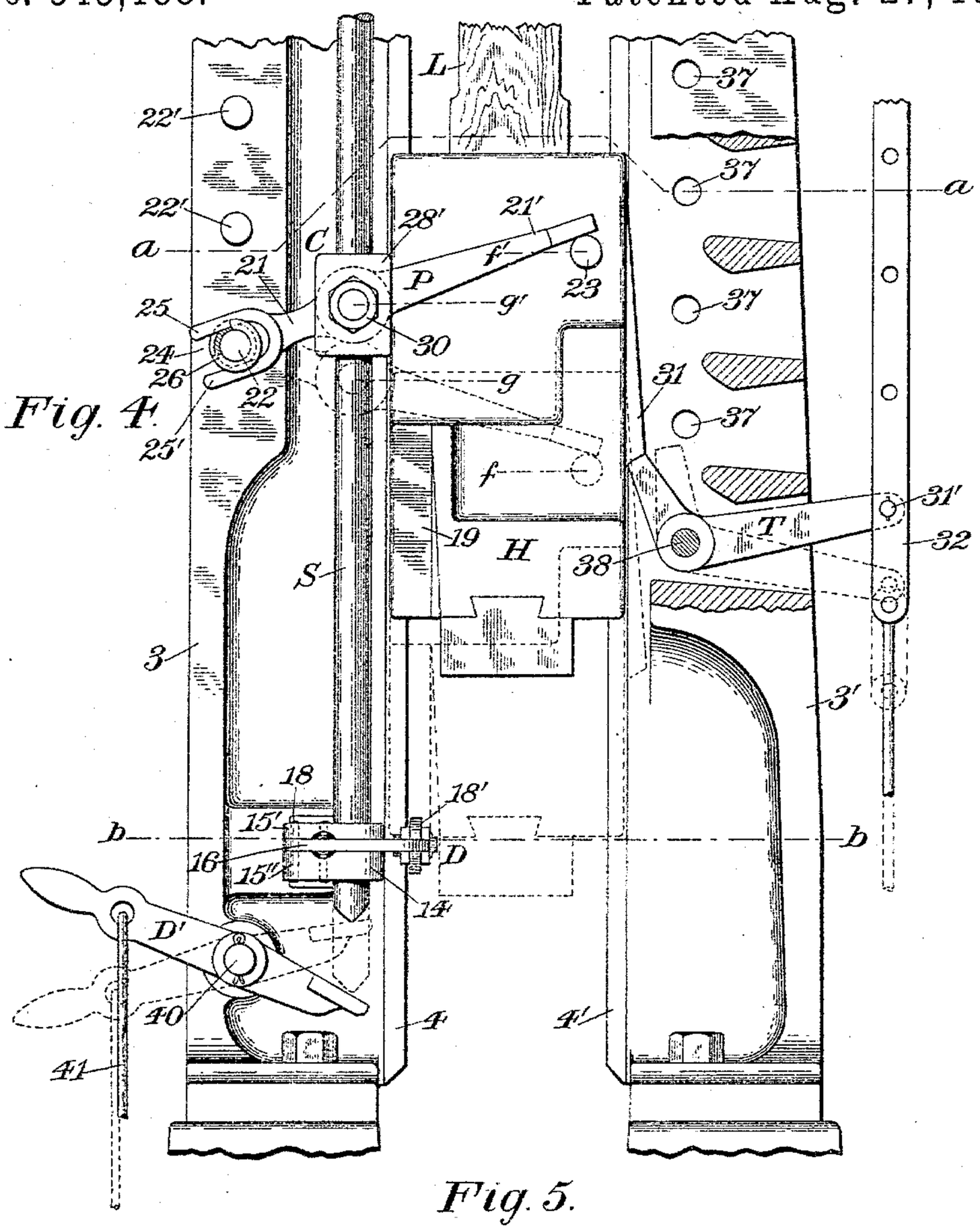

Fig. 5.

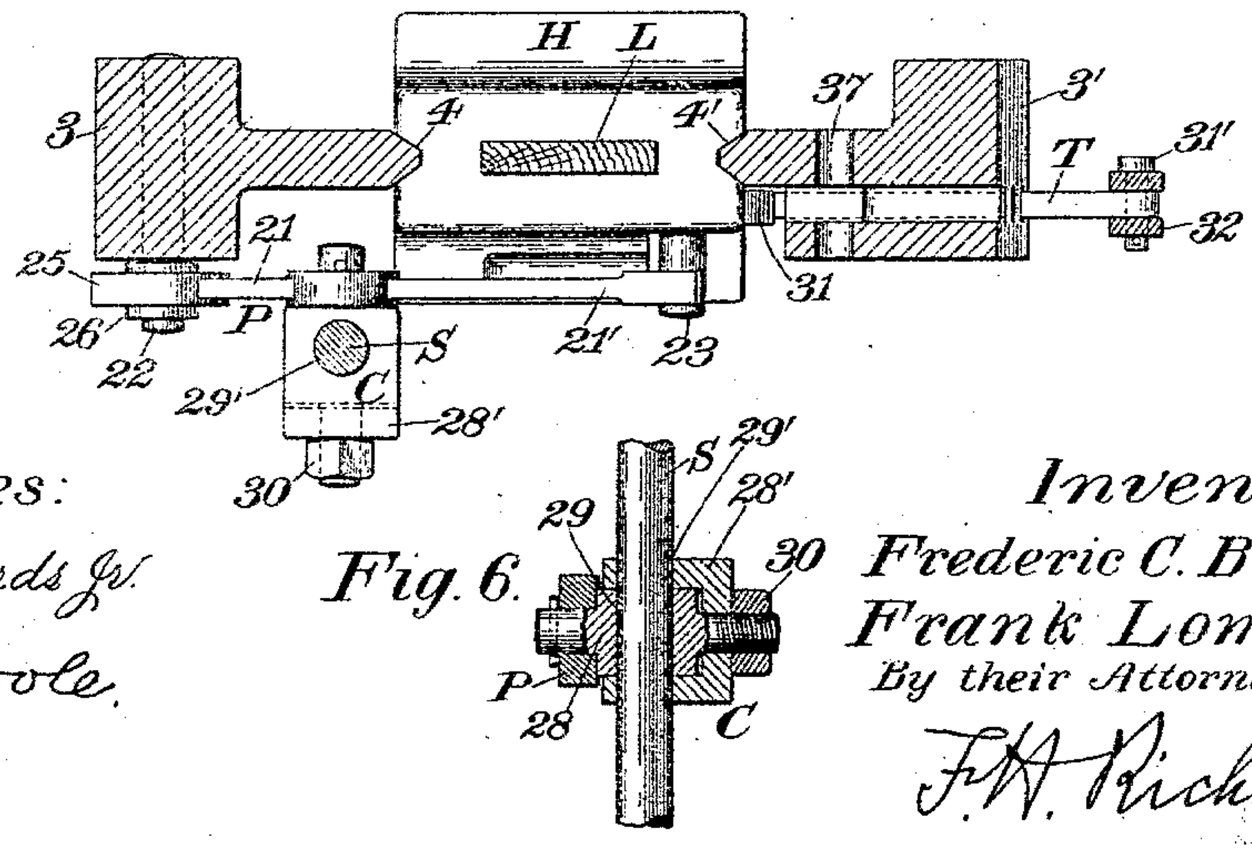

Fig. 6.

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(No Model.) 3 Sheets—Sheet 3.

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DROP HAMMER.

No. 545,188. Patented Aug. 27, 1895.

Fig. 7.

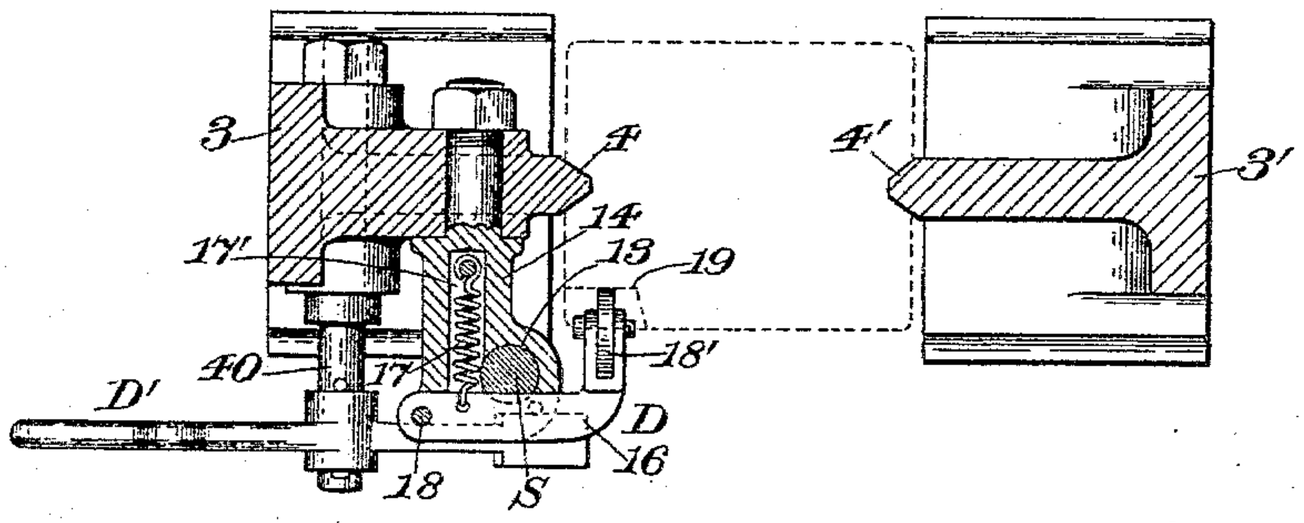


Fig. 8.

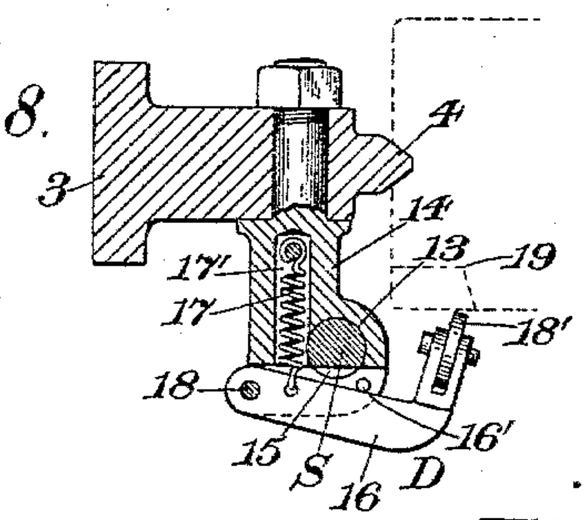


Fig. 9.

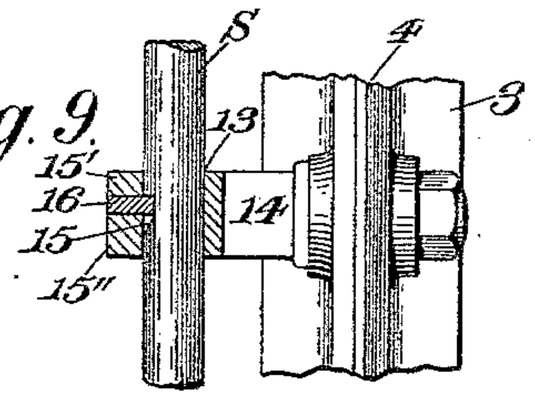
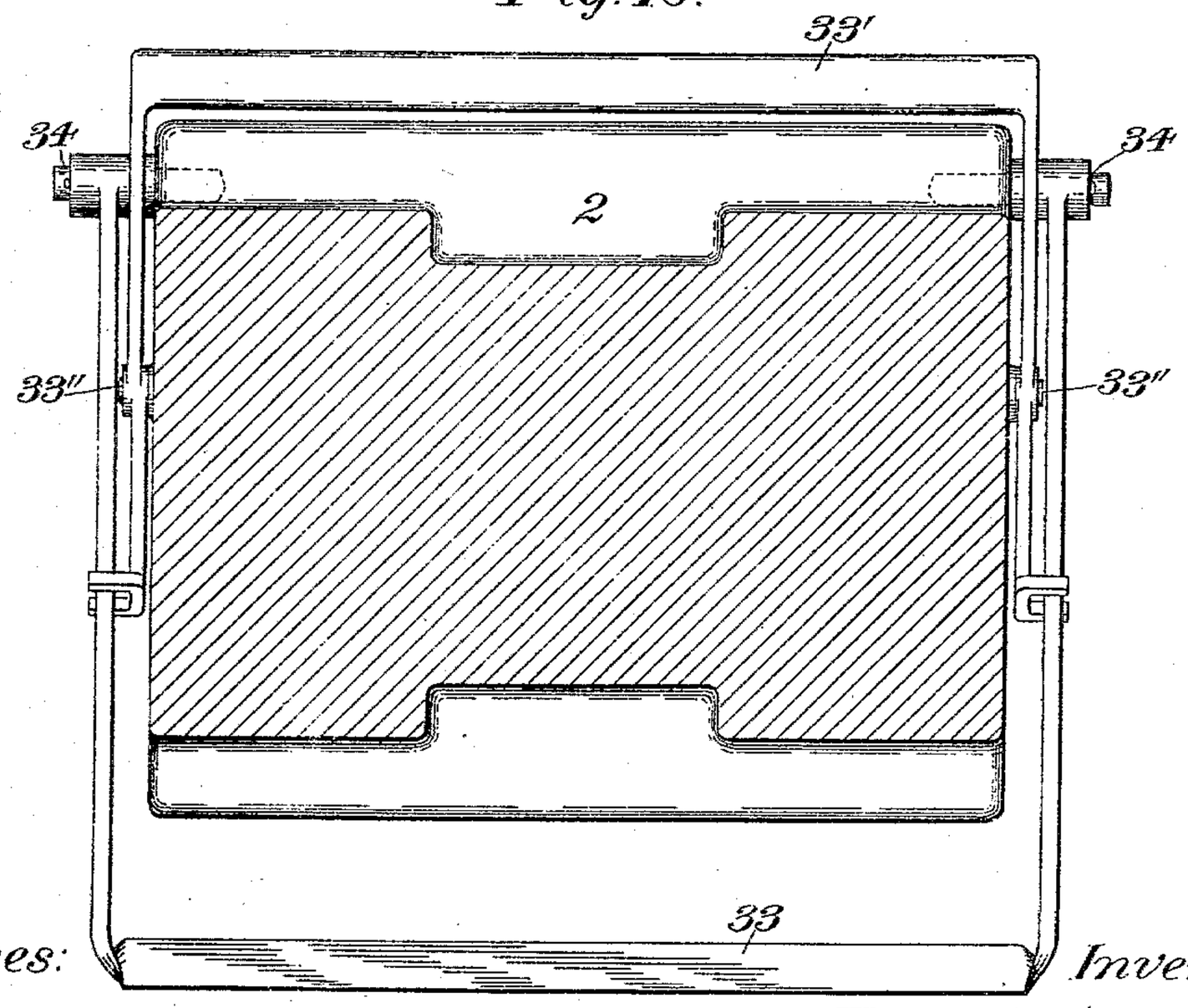


Fig. 10.



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UNITED STATES PATENT OFFICE.

FREDERIC C. BILLINGS AND FRANK LOMBARD, OF HARTFORD, CONNECTICUT, ASSIGNORS TO THE BILLINGS & SPENCER COMPANY, OF SAME PLACE.

DROP-HAMMER.

SPECIFICATION forming part of Letters Patent No. 545,188, dated August 27, 1895.

Application filed February 15, 1895. Serial No. 538,544. (No model.)

To all whom it may concern:

Be it known that we, FREDERIC C. BILLINGS and FRANK LOMBARD, citizens of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Drop-Hammers, of which the following is a specification.

This invention relates to drop-hammers, the object of the invention being, primarily, to provide a simple and effective automatically-operable drop-hammer, having hammer-actuating mechanism of a construction and organization adapted for imparting a return or lifting movement to the hammer or ram of relatively high velocity and without liability of straining the working parts of, or breaking, the machine, and also to provide means in connection with said machine whereby the hammer may be continuously or intermittently actuated, as may be required.

Another object of the invention is to provide, in connection with a machine of the class specified having suitable hammer-lifting rolls, roll-shifting mechanism in position and adapted to be automatically operated by the hammer or ram of the machine, and adapted, in connection with said hammer or ram, for automatically shifting the hammer-lifting rolls, the one relatively to the other, to effect at a predetermined point in the ascending movement of the hammer a relatively slow or gradual release of said rolls from the hammer-lifting bar or "board," and also to effect at a predetermined point in the descending movement of the hammer a gradual but positive engagement of said rolls with the hammer-lifting board; also to provide, in connection with said lifting-roll shifting mechanism, improved adjusting means whereby the effective stroke of the hammer may be regulated as required for different kinds of work.

Another object of the invention is to provide, in connection with the roll-shifting mechanism, an automatically-operable holding or latch device in position and adapted for automatically engaging a member of and for holding the roll-shifting mechanism in its normal "roll-opening" position, and in position and adapted to be actuated by the hammer, during the descending movement thereof, to automatically disengage said member and to release the roll-shifting mechanism to shift the rolls, the one relatively to the other, and effect an engagement between the lifting-rolls and the lifting-board of the hammer, all of which will be hereinafter fully described.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation, on a relatively small scale, of a drop-hammer embodying our present improvement, said figure showing the hammer or ram elevated and held in elevated position by a pawl or tripping-lever carried by one of the side frames of the machine. Fig. 2 is a side elevation of the drop-hammer, showing the main or automatically-operable holding device for the roll-shifting rod in its operative position and the auxiliary treadle-operated holding device for said shifting-rod in its operative position. Fig. 3 is a side elevation of a portion of the machine, showing the auxiliary holding device in operative position relatively to the roll-shifting rod. Fig. 4 is a front elevation, on a relatively large scale, of a portion of the drop-hammer, showing various working parts thereof in two positions in full and dotted lines. Fig. 5 is a horizontal cross-section of that portion of the drop-hammer illustrated in Fig. 4 and taken in dotted line *a a* in said figure. Fig. 6 is a detail, in elevation, of a portion of the eccentric-actuating rod or shifting member, showing in cross-section the speed-reducing device or controlling-actuator in connection with said member. Fig. 7 is a horizontal cross-sectional view of that part of the drop-hammer shown in Fig. 4, said Fig. 7 being taken in dotted line *b b*, Fig. 4, and clearly showing the construction and organization of the main or automatically-operable holding device for the roll-shifting mechanism, said figure showing the latch or detent in locked engagement with the eccentric-actuating rod and in position to be shifted out of engagement with said rod by means of a hammer, which is shown in dotted lines in said figure. Fig. 8 is a similar cross-sectional view of a portion of said parts, showing the latch thrown out of engagement with the eccentric-actuating rod by means of the hammer, which hammer in this instance

is supposed to be at the end, or approximately at the end, of its downward stroke. Fig. 9 is a sectional side elevation of the parts shown in Fig. 8, as seen from the right hand in said figure, the latch, however, being shown in the position illustrated in Fig. 7; and Fig. 10 is a cross-sectional view of the bed of the machine as taken in line *c c*, Fig. 1, but on a relatively large scale, and showing the construction and arrangement of the treadle mechanism for actuating the auxiliary holding device for the roll-shifting mechanism and also the click or pawl for holding the hammer in its normal elevated position.

Similar characters designate like parts in all the figures of the drawings.

The framework of our improved drop-hammer, which may, in a general way, be of any general or usual construction adapted for carrying the operative parts, consists, in the form thereof herein shown, of the anvil or base portion 2, the two uprights or side frames 3 and 3′, separately bolted to said base at opposite sides thereof, as most clearly shown in Figs. 1 and 2, and having guides 4 and 4′, respectively, at adjacent sides thereof, and a top frame or head 5, bolted to the upper ends of the uprights or side frames 3 and 3′, which head may be of any suitable construction and adapted for carrying the hammer-lifting rolls and their accessories, as clearly shown in said Figs. 1 and 2.

In the organization thereof herein shown the hammer-lifting rolls, which are carried by the head 5 at the upper end of the machine, and which are designated by R and R′, respectively, are shiftable, the one toward and from the other, as in friction drop-hammers of ordinary construction, one of said rolls, as R, being fixed to a shaft 6, journaled in bearings in the head 5 of the machine, whereas the other roll, as R′, is fixed to a shaft 6′, revolubly carried in and at opposite ends thereof in a transversely-divided or two-part eccentric, designated in a general way by E, which eccentric is, in turn, journaled in bearings in the head 5, preferably in horizontal alignment with the bearings in which shaft 6 is journaled, each of said shafts 6 and 6′ being preferably provided at one end thereof with a driving-pulley 8, by means of which pulleys said shafts, together with their respective hammer-lifting rolls, may be independently rotated simultaneously in opposite directions, respectively, from any suitable source of power. (Not shown.)

As shown most clearly in Fig. 1, the two parts of the eccentric or eccentric-sleeve E in which the shaft 6′ of the lifting-roll R′ is journaled are provided at their inner ends (which inner ends preferably abut, respectively, against opposite ends of the hub of the roll R′) with outwardly-projecting rocker-arms 9 and 9′, respectively, which arms are preferably connected together at their free ends by a tie rod or bolt 10.

The hammer or ram, which may, in a general way, be of any usual or suitable construction, and which is designated, in a general way, by H, is supported for vertical movement between the guides 4 and 4′ of the two side frames 3 and 3′ and has the usual lifting-board L connected with the upper end thereof, which lifting-board extends between and is adapted to be engaged by the lifting-rolls R and R′.

As a convenient means for actuating the eccentric E, in which the shaft of the shiftable roll R′ is journaled, so as to shift said roll toward and from the adjacent roll R to engage and release the lifting-board L, we have provided an eccentric-actuating rod S, (which rod constitutes a shifting member for the roll-shifting mechanism,) which rod is pivotally connected at the upper end thereof with the rocker-arms of the eccentric E, said rod being shown with a transverse sleeve 12 at the upper end thereof, which engages the tie-bolt 10, which connects the two parts of the eccentric together, as shown most clearly in Fig. 1 of the drawings. This eccentric-actuating rod is located at one side of the path of movement of the hammer H and is supported at or near the lower end thereof for sliding movement in parallelism with the path of movement with the hammer in a bearing 13, formed in a bracket 14, which bracket, in this instance, is shown removably secured to the side frame 3 of the machine, as shown most clearly in Figs. 7, 8, and 9 of the drawings. This eccentric-actuating rod is also shown having a lock-notch 15 at one side near the lower end thereof, as shown in Fig. 9, adapted to be entered by a detent or holding device automatically operable, designated in a general way by D, which is adapted for normally holding the eccentric-actuating rod in an elevated or roll-opening position. This automatically-operable detent or holding device D, in the form thereof herein shown, consists of a latch or locking-arm 16 in position and adapted for engaging in the lock-notch 15 in the eccentric-actuating rod when said rod is in its elevated or roll-opening position, and a spring, as 17, adapted for normally holding said locking-arm 16 in bearing contact with said eccentric-actuating rod. In the organization thereof herein shown the locking-arm 16 is pivoted at one end, as shown at 18, between ears 15′ and 15″ of the bracket 14, and is shown carrying a roller 18′ at the inner or free end thereof, which free end normally projects into the path of movement of the hammer H and is held in its engaging position by the spring 17, which is seated in a recess 17′, formed in the bracket 14, and having the inner end thereof fixed to said bracket and having the outer end thereof secured to the locking-arm.

As a means for automatically operating the detent or holding device D to release the same from engagement with the eccentric-actuating rod S, the hammer H has at one side thereof a detent-actuating cam or cam-face

19 in position and adapted for engaging (during the downward movement of the hammer) the free end of the locking-arm 16 and for throwing said locking-arm laterally in and out of engagement with said eccentric-actuating rod, which allows the eccentric-actuating rod to drop by its own gravity, thus partially rotating the eccentric E and throwing the lifting-roll R′ toward the lifting-roll R and into positive engagement with the lifting-board L.

The automatically-operable detent or holding device D will usually be located near the extreme lower end of the path of movement of the hammer H or in position to be engaged by the hammer and thrown out of engagement with the eccentric-actuating rod when the hammer has practically completed its downward stroke, so that immediately upon the striking of a blow by the hammer the eccentric-actuating rod will be shifted and will, through the medium of the eccentric, throw the rolls R and R′, which are continuously rotated, into positive lifting engagement with the lifting-board and lift the hammer at a relatively high speed.

As a means for automatically lifting the eccentric-actuating rod S at a predetermined point in the ascending movement of the hammer and with a relatively slow movement, as compared with the movement of the hammer, to thereby shift the lifting-roll R′ away from the lifting-roll R and out from engagement with the lifting-board with a gradual or a relatively slow movement, we have provided in connection with said eccentric-actuating rod a speed-reducing actuator, designated in a general way by P, and which, in the preferred form thereof herein shown, consists of a lever adjustably secured by means of a clamping device, designated in a general way by C, to the eccentric-actuating rod at a point intermediate to the two ends thereof and having one end—an arm, as 21—fulcrumed at 22 at one side of said rod upon the frame of the machine and having the opposite end or arm, as 21, thereof projected inward into the path of movement of an abutment or pin 23, carried by the hammer H, by means of which abutment or pin 23 said lever is actuated during the ascending movement of the hammer.

In practice the short end 21 of the speed-reducing lever or actuator P will, for convenience in assembling said actuator in operative relation with the eccentric-actuating rod, be bifurcated, as shown at 24, to form pin-engaging arms 25 and 25′, which, as shown in Figs. 4 and 5 of the drawings, are in movable engagement with a sleeve or collar 26 upon the fulcrum-pin 22 upon the side frame 3 of the machine.

As a convenient means for adjustably securing the speed-reducing actuator or lever P to the eccentric-actuating rod S, said lever is carried by one member of a frictional clamping device C, which clamping device, in the form thereof herein shown, consists of the two members at 28 and 28′, transversely bored, as shown at 29 and 29′, to receive the eccentric-actuating rod, which extends through both members and shiftably secured together and moved in opposite directions, relatively to each other, by means of a nut 30, screwed upon one of said members and bearing against the other of said members, as will be readily understood by reference to Fig. 6 of the drawings.

By reference to Fig. 4 of the drawings it will be seen that the eccentric-actuating rod is carried at a relatively short distance from the fulcrum-point of the actuator and at a relatively long distance from that point of the actuator where the lifting-force is applied, so that the abutment or pin 23 upon the hammer comes in contact with the free end of the lever or actuator during the relatively rapid ascending movement, and, as a result, the effective movement of the eccentric-actuating rod is relatively short, as compared with the movement of the hammer when in operative engagement with the actuator; or, in other words, the hammer H traverses a distance equal to the space between the horizontal lines *f* and *f′* (see Fig. 4) while the eccentric-actuating rod traverses a distance equal to the space between dotted lines *g* and *g′* in said figure. Thus it will be seen that the eccentric-actuating rod S and hammer H will, in the organization of speed-reducing mechanism herein shown and described, have comparative movements of relatively varying velocities of a predetermined ratio, the ratio in the present instance being substantially or approximately as one is to three, as will be understood by reference to said Fig. 4.

As a means for effecting an opening movement or lifting movement of the eccentric-actuating rod at various points in the length of the upward stroke of the hammer H, so that said hammer may be raised to different heights to increase or decrease the downward stroke of said hammer, as may be required for different kinds of work, we have provided the frame of the machine with a series of fulcrum pins or studs 22′, which are set a suitable distance apart in vertical alignment and in parallelism with, but at one side of, the path of movement of the eccentric-actuating rod and in position to be engaged, one or the other of them, as may be desired, by the arm 21 of the speed-reducing actuator or lever P, said actuator being, of course, adjusted upon the rod as required for engagement with said fulcrum-pin.

As a means for automatically engaging and holding the hammer, when desired, when the same is at the end of its upward stroke, we have provided a pawl or trip-lever T, which is removably pivoted to the side frame of the machine at one side of the hammer H, and have provided the hammer with a cam-face stop-abutment 31 at one side thereof in posi-

tion and adapted to be engaged by the inner end of the trip-lever, which inner end of the trip-lever normally projects into the path of movement of said stop-abutment 31, and as a means for actuating said trip-lever to release the same from engagement with said hammer the outer end of said trip-lever is connected, as shown at 31′, with a connecting-rod 32, which in turn is connected at the lower end thereof with a treadle 33, pivoted to the base 2 of the machine, as shown at 34, the upper end of said connecting-rod being preferably carried by a spring 35, secured to a bracket 36, fixed to the side frame near the upper end thereof, as shown in Fig. 1 of the drawings. This side frame has a series of pivot-holes 37 at different points in the height thereof adapted for receiving the pin or pivot 38 of the trip-lever T to provide for the adjustment of said trip-lever to adapt the same to engage the hammer H at different points in the length of the upward stroke thereof, as may be required, the connecting-rod 32 also having a series of pivot-holes therein to provide for the connection of the trip-lever therewith when adjusted to the different positions along the side frame, as will be readily understood by reference to Figs. 1 and 4 of the drawings.

In some cases it is desirable that the opening movement of the eccentric-actuating rod be controlled by a treadle, instead of having the same automatically controlled by the hammer, (this being the case when it is desired to intermittently operate said hammer.) For this purpose we have provided an auxiliary or treadle-operated holding device for the eccentric-actuating rod, which holding device (designated in a general way by D′) is in the nature of a lever pivotally carried upon a stud 40, secured to the side frame of the machine at one side of and below the lower end of the eccentric-actuating rod when said rod is in its elevated position, as shown in Fig. 4, the opposite end of said lever being connected by means of a connecting-rod 41 to the treadle 33, by means of which treadle said lever or holding device D′ is actuated to engage or release the eccentric-actuating rod S. This holding device D′ is movably carried upon the stud 40, so that the working end thereof may be thrown out of the path of movement of the eccentric-actuating rod, as shown in Fig. 2, or may be thrown into opposite positions relatively to said rod, as illustrated in Fig. 3.

When it is desired that the hammer shall have a continuous movement, the auxiliary holding device will be shifted into its inoperative position, as shown in Fig. 2, and the main automatically-operable holding device or detent D will be adjusted into operative position to control the lifting movement of said hammer, as will be understood by a comparison of Figs. 1, 4, 7, and 8 of the drawings; but when it is desired to intermittently actuate the hammer the auxiliary holding device will be shifted into operative position, as shown in Fig. 3, and the locking-arm 16 of the holding device D will be thrown into the inoperative position shown in Fig. 8, where it will be held in such position by means of a pin extended into the pin-hole 16′ in the bracket 14. The auxiliary holding device may then be shifted into the dotted-line position shown in Fig. 4 or in position to hold the eccentric-actuating rod in its roll-opening position, or it may be shifted into the full-line position in said figure or in position to allow said rod to drop to close the rolls upon the lifting-board of the hammer, this shifting of the auxiliary holding device being effected by the depression and elevation of the treadle 33, as will be clearly apparent by reference to Figs. 1, 2, and 4 of the drawings.

When it is desired to continuously reciprocate the hammer of the machine automatically, the treadle 33 will, of course, be depressed to shift the trip-lever T into inoperative position with relation to the hammer and to prevent said trip-lever from engaging said hammer at the end of the upward stroke thereof. In this case the automatically-operable holding device D will, upon each descent of the hammer, be actuated by said hammer to release the eccentric-actuating rod, which immediately drops and causes the rolls R and R′ to engage the lifting-board and raise the hammer, which hammer, when it reaches a predetermined point in its ascending movement, lifts, through the medium of the speed-reducing lever P, the rod S with a relatively slow movement, causing the same to open the lifting-rolls, which allows the hammer to drop, and these operations are repeated until the trip-lever is thrown into position to engage the hammer, which is accomplished by releasing the treadle.

The operation of the machine when controlled by the treadle-actuated auxiliary holding device will be readily understood by reference to Figs. 1, 2, 3, and 4 of the drawings. It will be observed in this connection that the holding device D′ and the tripping lever or pawl T for holding the hammer in its elevated position are so co-operatively organized that when the treadle is released to depress the working end of the holding device D′ to effect the engagement of the lifting-rolls with the hammer lifting-board the trip-lever is thrown into operative position, as shown in full lines in Fig. 4, and in position to engage the hammer at the completion of the upward stroke thereof. This organization insures the holding of the hammer in an elevated position until the auxiliary holding device is thrown into engagement with the eccentric-actuating rod, and also prevents the release of the hammer by the trip-lever T until the said auxiliary device is in position to prevent the descent of the eccentric-actuating rod, thus permitting the operator to have full control over the movements of the hammer.

As a means for simultaneously actuating

the auxilary holding device D′ and the trip-lever T, which devices are located at opposite sides of the machine, as shown most clearly in Figs. 1, 2, and 4 of the drawings, we have provided, in connection with said holding device D′ and trip-lever T, an improved treadle mechanism, which, in the form thereof herein shown, consists of two oppositely-disposed U-shaped frames 33 and 33′, the frame 33 constituting the treadle proper and the frame 33′ constituting a retracting device for said treadle. The treadle or frame 33 straddles the front part of the base of the machine and has its side arms pivoted at the extreme rear ends thereof, as shown at 34, to opposite sides, respectively, of said base and near the rear edge of said base, as clearly shown in Fig. 10 of the drawings, whereas the frame 33′, which is in the nature of a weighted lever, straddles the rear side of said base and has its side arms fulcrumed at a point approximately midway of their length, as shown at 33″, to opposite sides of said base, and has the forward end of said arm in shifting engagement with the side arms of the frame or treadle 33 and at points approximately midway of the length of said arms, as clearly shown in said Fig. 10. This frame 33′ will preferably be made of wrought-iron and will have the cross-bar thereof reinforced or made sufficiently heavy to constitute a weight adapted for lifting the treadle 33, as illustrated in Fig. 3 of the drawings.

In practice the base 2 of the machine will be provided with stop-abutments 50 at opposite sides thereof in position and adapted for limiting the retractive movement of the lever-actuated treadle 33.

Having thus described our invention, we claim—

1. In a drop-hammer of the class specified, the combination with a frame; of a reciprocatory-hammer; lifting-rolls, one of which is shiftable toward and from the other; an actuating-rod in operative connection with said shiftable roll, and adapted for shifting said roll toward and from the other roll; a speed-reducing device comprising a lever connected to said actuating-rod, and having one end thereof fulcrumed to the frame, and having its other end in the path of movement of the hammer, whereby it will be operated by the hammer at a predetermined point in the ascending movement of said hammer to lift the actuating-rod with a relatively-low velocity as compared with the velocity of said hammer; and means co-operating with the hammer and adapted for controlling the closing movement of the shiftable roll, substantially as described.

2. In a drop-hammer of the class specified, the combination with a frame; of a reciprocatory-hammer; lifting-rolls, one of which is shiftable toward and from the other; an actuating-rod in operative connection with said shiftable roll, and adapted for shifting said roll toward and from the other roll; a speed-reducing device comprising a lever connected to said actuating-rod, and having one end thereof fulcrumed to the frame, and having its other end in the path of movement of the hammer, whereby it will be operated by the hammer at a predetermined point in the ascending movement of said hammer to lift the actuating-rod with a relatively-low velocity as compared with the velocity of said hammer; means co-operating with the hammer, and adapted for controlling the closing movement of the shiftable roll; a holding device in position and adapted for holding the actuating-rod in an elevated or roll-open position; and means for actuating said holding device, substantially as described.

3. In a drop-hammer of the class specified, the combination with a frame; of shiftable lifting-rolls, one of which is shiftable toward and from the other; a hammer; an actuating-rod for said rolls; and a speed-reducing device comprising a lever adjustably connected to said rod, and having one end thereof adjustably fulcrumed to the frame, whereby the height of movement of said hammer can be regulated, and the opposite end of said lever projecting into the path of movement of the hammer, whereby said actuating-rod and hammer have comparative movements of relatively-varying velocities, substantially as described.

4. In a drop-hammer, the combination with a frame; of an actuating roll-shifting rod; a reciprocatory-hammer; and a speed-reducing device consisting of a lever having its inner end fulcrumed to the frame and pivotally connected, intermediate of its ends to the roll-shifting rod and adapted to lift said rod, and having its opposite end thereof projected into the path of movement of the hammer, whereby at a predetermined point in the ascending movement of the hammer, a comparative movement is imparted to the shifting-rod at a relatively-low velocity, substantially as described.

5. In a drop-hammer of the class specified, the combination with a frame; of a reciprocatory-hammer; lifting-rolls; one of which is shiftable toward and from the other; an actuating-rod in operative connection with said shiftable-roll, and adapted for shifting said roll toward and from the other roll; a speed-reducing device comprising a lever connected to said actuating-rod, and having one end thereof fulcrumed to the frame, and its other end in the path of movement of the hammer, whereby it will be operated by the hammer at a predetermined point in the ascending movement of said hammer to lift the actuating-rod with a relatively-low velocity as compared with the velocity of said hammer; a holding device in position and adapted for holding the actuating-rod in an elevated or roll-open position; and means for actuating said holding device, substantially as described, and for the purpose set forth.

6. In a drop-hammer of the class specified,

the combination with the side-frames, one of said side-frames having a series of openings therein; of lifting-rolls, one of said rolls shiftable into and out from engagement with the other of said rolls; a hammer; an actuating-rod operatively connected with one of said rolls for shifting said roll; and a speed-reducing device comprising a lever connected to said actuating-rod, and having one end thereof adapted to be fulcrumed in any one of said openings, and having its opposite end projecting into the path of the hammer, whereby the actuating-rod and hammer co-operate and have comparative movements of relatively-varying velocities, substantially as described.

7. In a drop-hammer, the combination with a suitable framework carrying a reciprocatory-hammer, of two continuously rotatable hammer-lifting rolls, one of which is carried by an eccentric and is adapted for movement toward and from the other, an eccentric-actuating rod supported for longitudinal movement at one side of the path of movement of the hammer; a speed-reducing lever adjustably carried by the eccentric-actuating rod and having one end thereof fulcrumed upon the framework, and having the opposite end thereof projected into the path of movement of the hammer or into the path of movement of an abutment upon said hammer, and adapted to be operated by said hammer at a predetermined point in the ascending movement thereof, to impart longitudinal movement to the actuating-rod and reduce the velocity of said rod relatively to the velocity of the hammer, substantially as described, and for the purpose set forth.

8. In a drop-hammer, the combination with a frame; of hammer-lifting rolls, one of which is shiftable toward and from the other; a hammer; an actuating-rod for said shiftable-roll; a speed-reducing device operatively connected to said actuating-rod and operated by the hammer; and a holding device for holding said shiftable-roll in roll-opening position comprising a bracket secured to the frame and having a recess therein; a right-angled lever pivoted to said bracket and having its bent, free end projecting into the path of the hammer; and a spring secured in the recess of the bracket, and connected to said angled-lever, to hold the same in engagement with the actuating-rod, substantially as described.

9. In a drop-hammer of the class specified having a reciprocatory-hammer or ram, a pair of lifting rolls, one of which is shiftable toward and from the other, and an actuating-rod in connection with said roll, the combination therewith, and with the frame of the machine, of a speed-reducing lever in adjustable connection with the actuating-rod, and having a relatively short longitudinally-slotted arm fulcrumed upon a pin fixed to the framework of the machine, and having a relatively long arm projected into the path of movement of the drop-hammer, and adapted to be engaged and operated by said drop-hammer, to impart a relatively slow lifting movement to the actuating-rod at a predetermined point in the ascending movement of said hammer, substantially as described, and for the purpose set forth.

10. In a drop-hammer, the combination with the vertically reciprocating roll-shifting rod and with the reciprocatory-hammer, of a speed-reducing device consisting of a lever pivotally and adjustably connected intermediate to the ends thereof, to the roll-shifting rod, and having one end thereof movably-fulcrumed at one side of said rod, and having the opposite end thereof projected into the path of movement of an actuating-abutment upon the hammer; whereby, at a predetermined point in the ascending movement of the hammer, a comparative movement is imparted to the shifting-rod, at a relatively slow velocity, substantially as described, and for the purpose set forth.

11. In a drop-hammer, in combination, a pair of lifting-rolls shiftable, the one toward and from the other, an actuating-rod in connection with the shifting-roll and adapted for longitudinal movement, to effect an opening or closing of said rolls; a speed-reducing lever pivotally-carried by said actuating-rod, having one end thereof fulcrumed at one side of said rod, and having the opposite end thereof projected into the path of movement of the hammer and adapted to be actuated by said hammer; a reciprocatory-hammer in position, and adapted for actuating said speed-reducing lever, at a predetermined point in the ascending movement of said hammer; and an auxiliary-holding device and a trip-lever, co-operating with each other and adapted, the holding-device for engaging and holding the actuating-rod in an elevated position, and the trip-lever for automatically-engaging and holding the hammer in its elevated position, and means in connection with, and adapted for, simultaneously actuating said auxiliary-holding device and trip-lever, and to throw them into engaging or disengaging positions, respectively and alternately, substantially as described, and for the purpose set forth.

12. In a drop-hammer, the combination with the vertically reciprocatory roll-actuating rod and with the vertically-reciprocatory hammer, in co-operative connection with said roll-actuating rod, of an auxiliary-holding device in position and adapted to engage, and hold the actuating-rod in an elevated position; a trip-lever in position and adapted for normally-engaging and holding the hammer in an elevated position; and a treadle mechanism in connection with, and adapted for, simultaneously operating the auxiliary-holding device and trip-lever, to simultaneously throw the auxiliary-holding device into engagement with the actuating-rod, and to throw the trip-lever out of engagement with the hammer, or vice versa, substantially as described, and for the purpose set forth.

13. In a drop-hammer, the combination with

the holding-device for the roll-actuating rod, and with the triping-lever for the hammer, of a treadle-mechanism in operative connection therewith and comprising a U-shaped treadle having the two side arms thereof pivotally-connected to opposite sides of the base or frame of the machine, and a U-shaped weighted-lever, having its side arms fulcrumed upon opposite sides of said frame, approximately midway of the length of said arms, and having their outer ends in sliding engagement with the side arms of the treadle, and adapted for normally-elevating said treadle, substantially as described, and for the purpose set forth.

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