(No Model.) 4 Sheets—Sheet 1.

F. LOMBARD.

DROP HAMMER.

No. 563,603. Patented July 7, 1896.

Fig. 1

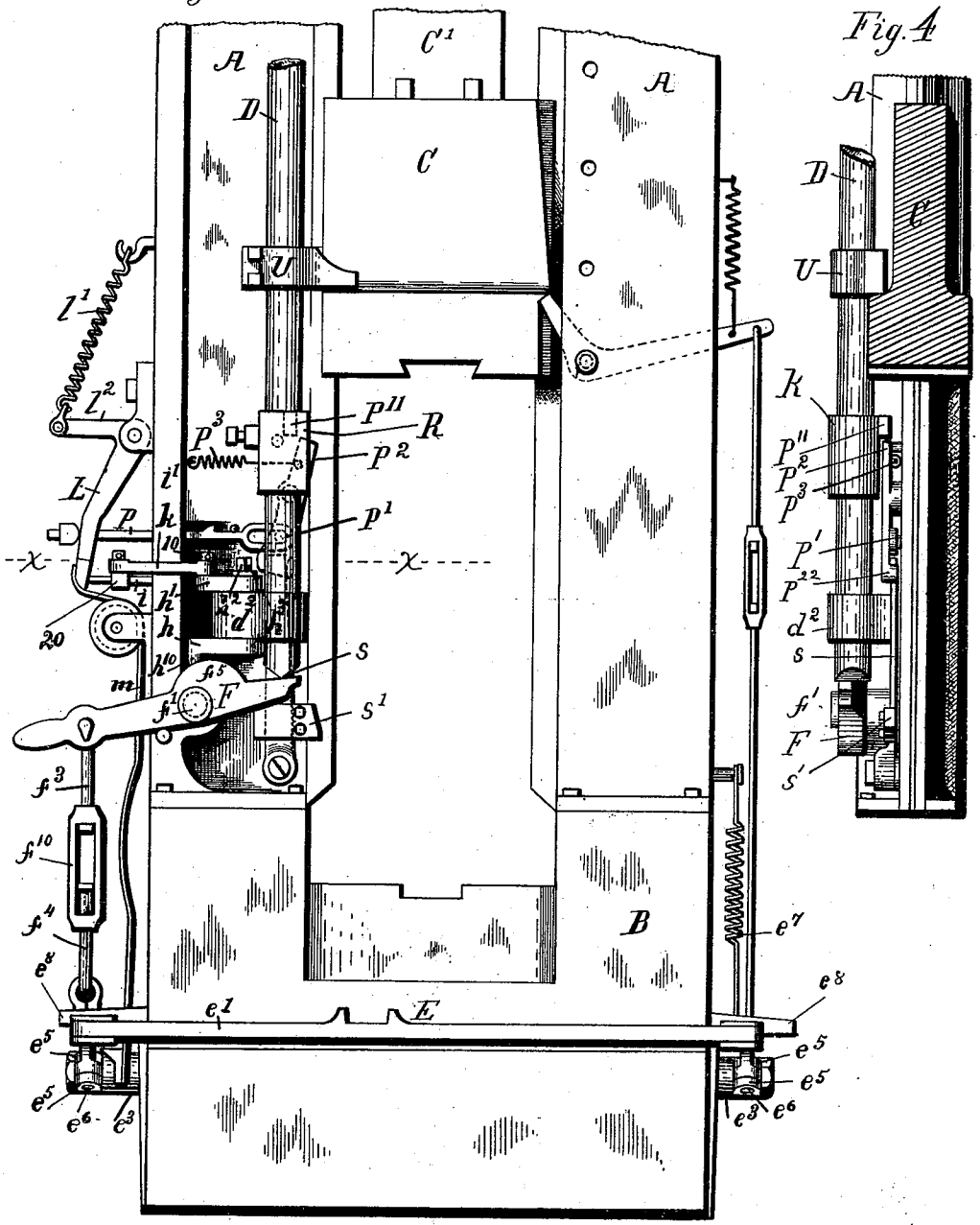


Fig. 4

Witnesses
Linus Barnes
Willis Barnes

Inventor
Frank Lombard
By George L. Barnes
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

F. LOMBARD.

DROP HAMMER.

No. 563,603. Patented July 7, 1896.

Fig. 2

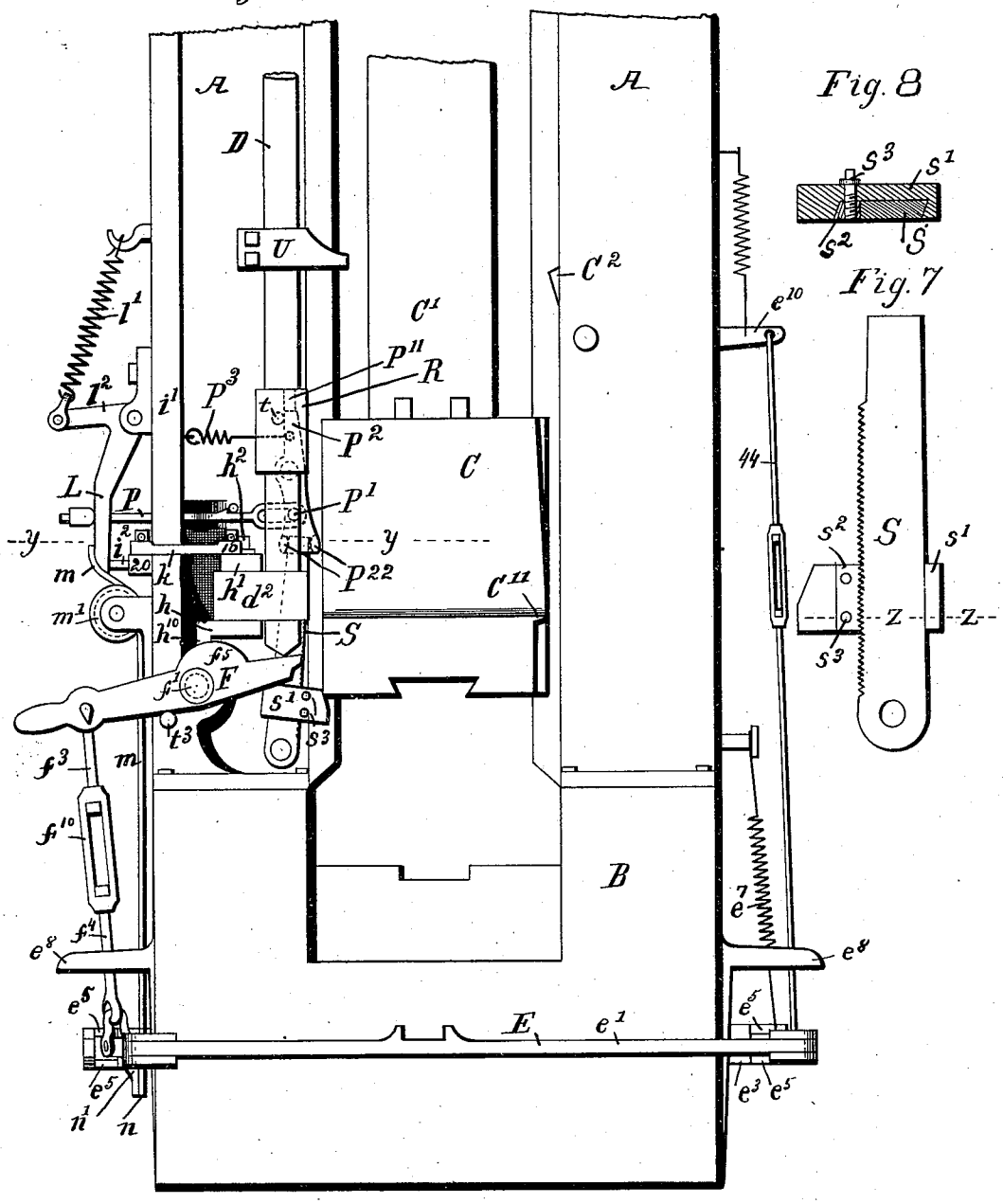


Fig. 8

Fig. 7

WITNESSES:

Linus Barnes

Willis Barnes

INVENTOR

Frank Lombard

BY George L. Barnes

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3.

F. LOMBARD.

DROP HAMMER.

No. 563,603. Patented July 7, 1896.

Fig. 3

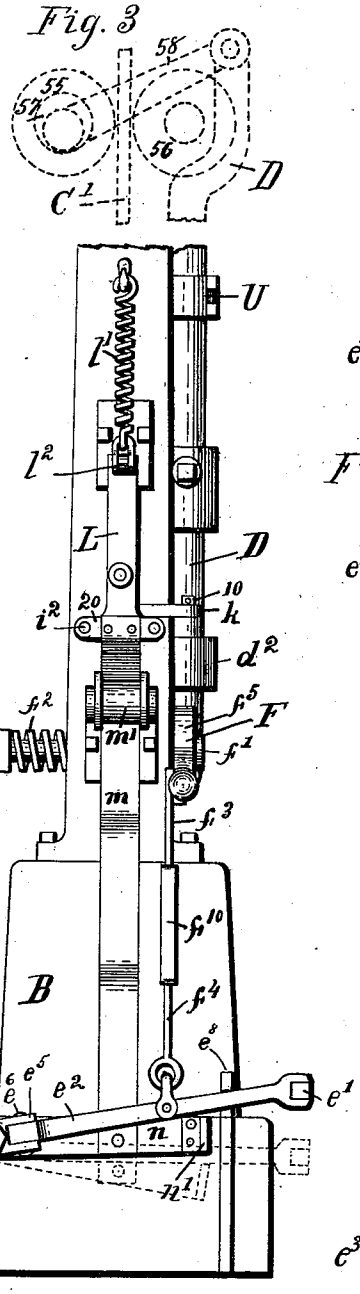


Fig. 6

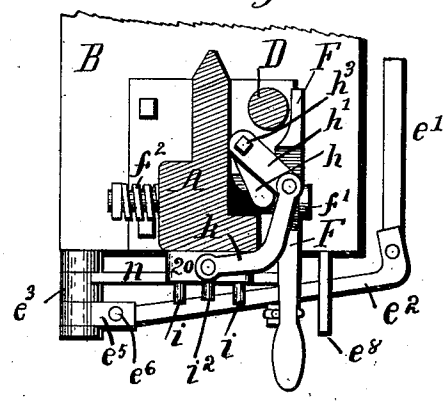
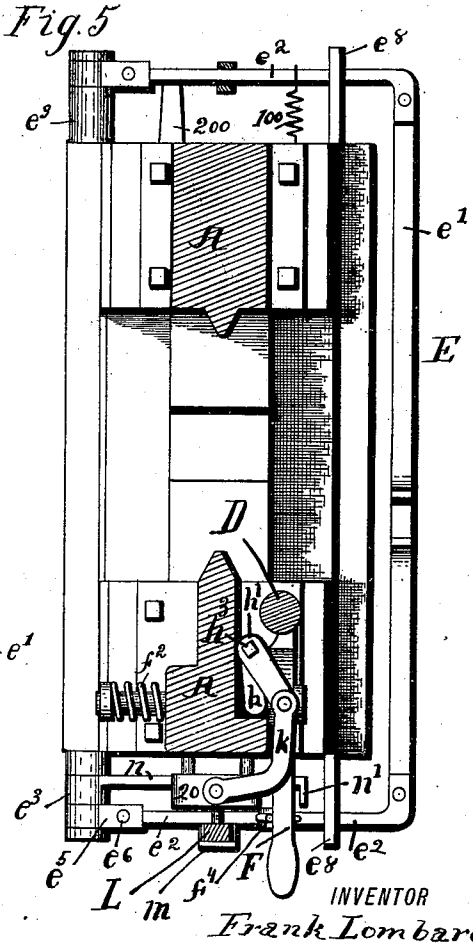


Fig. 5



WITNESSES:

Linus Barnes

Willis Barnes

INVENTOR

Frank Lombard

BY George L. Barnes

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

F. LOMBARD.

DROP HAMMER.

No. 563,603. Patented July 7, 1896.

Fig. 9

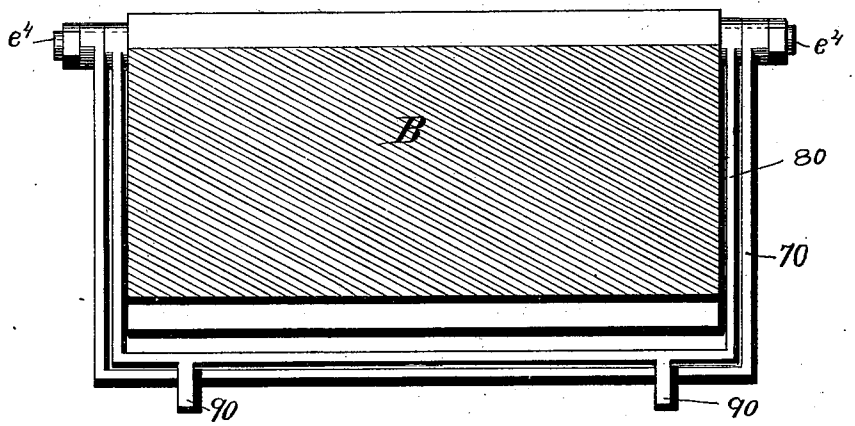


Fig. 10

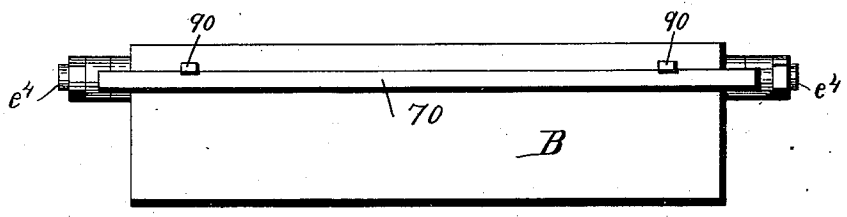
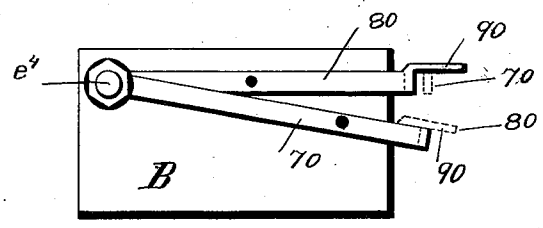


Fig. 11



WITNESSES:

Linus Barnes

Hallie Barnes

INVENTOR

Frank Lombard

BY George L. Barnes

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANK LOMBARD, OF HARTFORD, CONNECTICUT.

DROP-HAMMER.

SPECIFICATION forming part of Letters Patent No. 563,603, dated July 7, 1896.

Application filed March 20, 1896. Serial No. 584,049. (No model.)

To all whom it may concern:

Be it known that I, FRANK LOMBARD, a citizen 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.

My invention relates to improvements in drop-hammers, the object being to provide means whereby such machines may be thrown into or out of automatic operation while in use and without delay or cessation of the work.

As heretofore constructed, drop-hammers have been provided with automatic tripping mechanism in addition to the independent trip mechanism and the machine thereby adapted for both automatic and independent action of the hammer, the shifting or changing of the action being effected by suitable change, adjustment, removal, and substitution of parts of the mechanism, requiring considerable time and labor, and involving the disuse or idleness of the machine through such interval, and the further disadvantage of losing one or more "heats" of the material being worked, such cumbrous and complicated changes also rendering it both inexpedient and unprofitable to shift the mechanism for a small amount of work, thus prohibiting the desired despatch and economy in producing many of the smaller or lighter articles of trade.

My improvements contemplate improved means whereby the machine may be instantaneously shifted from independent to automatic action of the hammer and without removing the foot off the operating-treadle.

To this end the invention consists in the novel treadle action, tripping mechanism, and shifting means for performing the several functions recited, and in the arrangement, construction, and combination of parts, as hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a front elevation of the lower part of a drop-press fitted with my improvements, the head or upper part of the machine being no different from the ordinary construction, and therefore omitted from the drawings. In this view the trip mechanism is shown as arranged for independent operation of the hammer, while Fig. 2 is a similar view showing the trip mechanism set for automatic operation. Fig. 3 is a side view of Fig. 1, with dotted lines representing the treadle in the position shown in Fig. 2. Fig. 4 is a central vertical part section of Fig. 1, exposing the trip mechanism from the side opposite that shown in Fig. 3. Fig. 5 is a horizontal section on the line $x\ x$ of Fig. 1, and Fig. 6 is a similar part section through Fig. 2 on the line $y\ y$. Fig. 7 is an enlarged view of the lever and adjustable dog of the automatic trip mechanism, and Fig. 8 is a cross-section of same on the line $z\ z$. Figs. 9, 10, and 11 show modifications of the treadle mechanism.

Referring to the drawings, A designates the uprights or frame portions of the machine, which with the base B are of the ordinary construction. The head and the friction-rolls or motive mechanism are omitted from the drawings as forming no part of my present invention, and here requiring neither to be described nor shown, but a diagram thereof is appended to Fig. 3, designating the parts, and it will be understood that the hammer C, which is fitted to slide between the uprights A, is provided with the usual friction-board C', adapted to be gripped between suitable friction-rolls to lift the hammer in the ordinary and well-known manner, subject to engagement and release by the ordinary and well-known action of a trip-bar D, guided in a suitable bearing d^2 on the upright, and operated by the hammer, as hereinafter described.

The hammer is provided with the usual detent or shoulder C^{11}, which, when at the upper limit of the stroke, is adapted to be engaged and supported by the usual spring-actuated pawl or latch C^2, pivoted to the upright, and having an arm e^{10}, which is connected by rod 44 to the treadle E, hinged on the base B. Said treadle is not of the usual construction, but embodies an important feature of my invention. It comprises the treadle-bar e' in front of the machine and the side bars e^2, to the front ends of which the front bar e' is hinged or pivoted, as shown. The side bars are hinged to the rear side of the base by means of a universal joint, which permits the swinging of the treadle-bar both in vertical and horizontal or lengthwise

planes. Any suitable form of joint permitting such universal motion may be employed, that shown consisting of the parts e^3, secured and adapted to oscillate upon studs e^4, secured in the base, said parts e^3 having the flanges e^5, between which the rear ends of the side bars are inserted and hinged on the pivots e^6. The treadle is held in the normal elevated position by the spring e^7, and suitable stops e^8 are arranged to prevent excessive upward rebound of the treadle by the force of the spring.

On the front of the frame is pivoted the usual lever F for holding or hoisting the tripping-bar in its elevated position, to permit the descent of the hammer by disengagement of the friction-roll from the friction-board. The lever F swings upon a stud f', fitted through a suitable hole or bearing in the frame and projecting on the rear side thereof, to receive a coiled spring f^2, adapted to act between the frame and a nut on the end of the stud, to draw the stud rearward and normally hold the lever against the face of the frame and in position to support the trip-bar D in the elevated position by depression of the treadle, which is connected to the lever by a connecting-rod f^3 of the ordinary "turnbuckle" construction, which is adapted to permit upward movement of the treadle while the lever is depressed, the lower portion f^4 of the rod in such case sliding up through the turnbuckle-loop f^{10}, as shown in Fig. 1, the connecting-rod being loosely and suitably jointed both to the treadle and the lever to permit the lateral motion of the treadle, hereinbefore referred to. The lever F has a flange or rim f^5 over its bearing on the stud f', and an arm h, journaled or hinged in the bearing d^2, is adapted to swing horizontally over the lever, and is provided with a depending part or projection h^{10}, engaging the rear side of said rim f^5, and adapted, by means hereinafter to be described, to force the lever F and its stud forwardly against the force of the spring f^2, to carry the lever out of the plane of the trip-bar, when it is desired to operate the mechanism automatically. To said arm h is secured a similar arm h' by any suitable and well-known means, both arms being thus adapted to swing together as a single piece. The arm h' is here shown as being fitted upon the upper squared end of the arbor or journal h^2 of the arm h, and held by a pin h^3 through the arbor.

The arm h' has a vertical pin or journal 10 at the end, which receives one end of a horizontal link k, and the opposite end of the link is attached to a yoke or head 20, fitted and adapted to slide upon guide-rods i, fastened in the flange or side i' of the machine, the link being suitably curved, as shown in Figs. 5 and 6, to clear the said flange of the frame. The yoke or head is provided with a projecting stud i^2, which is engaged by a depending lever L, hinged on the side of the frame and normally held outward therefrom by a spring l', attached to the frame and a short horizontal arm l^2 of the lever, as shown in Fig. 1. A strip of leather m is attached to said depending lever, and, passing inward and then downward over a roll m', is attached at its lower end to an arm or lever n, hinged on the stud e^4. The object of the roll is to change the plane of motion of the leather strip from horizontal to vertical, but the strip or a rod might be attached directly to the horizontal arm l^2 of the lever. The lever n is provided with a spur n', which projects laterally therefrom in position to be free and clear of the adjacent side bar of the treadle when the treadle is depressed from a central position, or with its side bars parallel with the sides of the base, as shown in Fig. 5; but if the treadle is moved laterally in the direction to throw said side bar toward the machine the side bar will be brought immediately over the spur of the lever n, as shown in Fig. 6, and if the treadle then be depressed the lever n will be carried down with it by engagement of the lever n with the spur n', thereby swinging the lever L inward, and by means of the link k and arms h and h', throwing the lever F outward or forward from the face of the frame and out of the plane of the trip-bar D for automatic operation of the mechanism, as hereinafter described. The aforesaid movement of the depending lever L also permits the inward travel of a rod P, connected thereto, passing through the flange i' of the frame and connected at its inner end to a pin P' on a lever or pawl P^2, pivoted to the frame back of the trip-bar, said inward motion of the rod P being accomplished by a spring P^3, attached to the flange i' and the upper end of the pawl P^2, or on the opposite side of the pivot from the pin P'. The pawl P^2 when in such position is adapted to swing beneath and engage a lug P^{11} on a collar R, clamped upon the trip-bar, whereby the pawl serves to hold the trip-bar in the elevated position when the lever F is moved out of operative connection with the bar.

The pawl P^2 comprises part of a compound lever, its lower end being provided with lugs or projections P^{22}, which span the upper end of a lever S, pivoted to the frame. On the lever S a dog s' is clamped, projecting into the path of the hammer C. The construction of said dog is shown in Figs. 7 and 8, the dog being grooved to fit the lever and receive a clamp s^2 alongside the lever, into which suitable clamping-screws s^3 are screwed, with their heads on the opposite side of the lever, and thus adapted to bind the clamp firmly to its seat. The slot in the dog has parallel beveled sides, as shown, the side having the dovetailed form being placed against the lever, and the opposite side fitting the clamp, whereby the binding action of the screws wedges the clamp against the bar and correspondingly draws the dovetailed side of the dog against the lever, thus securing the dog in place. The engaging edges of the bar and

clamp may be serrated, as shown, to further secure the parts against slipping. Thus constructed, the dog may be adjusted in any required position on the lever to regulate the force of the blow of the hammer, as hereinafter described in the operation of the mechanism. The edge of the dog is beveled, as shown, for engagement by the hammer, and a stop t in the frame is provided to limit the movement of the pawl P^2 by spring P^3. A stop t^3 is provided to limit the movement of the lever F by the weight of its outer end.

U designates the ordinary dog clamped on the trip-bar for lifting the same to disengage the friction-rolls and friction-board by means of the hammer at the upper limit of its throw.

The friction-rolls are designated as 55 and 56, the former being mounted on eccentric 57, connected by lever 58 to trip-rod D, to clamp the rolls against the board by weight of the trip-rod.

Constructed as described and shown the operation of my improved drop-hammer is as follows: Considering the hammer as having reached its highest position, as shown in Fig. 1, the trip-bar will have been lifted by engagement of the hammer with the dog U, thus releasing the friction-rolls from the friction-board, but the hammer will be prevented from dropping by engagement of the holding-pawl c^2 with the detent or shoulder c' on the hammer. If then the treadle be depressed in its normal position shown in Fig. 5 and without being carried laterally to engage the spur n', the pawl c^2 will be tripped, thus releasing the hammer, and as the trip-bar will be prevented from falling by the lever F, which is held in the position shown in Fig. 1 by means of its connection with the treadle, thereby maintaining the friction-rolls free of the friction-board, the hammer will drop and deliver its blow, remaining down until the release of the treadle permits the descent of the trip-bar and successive lifting of the hammer by the friction-rolls and its arrest at the upper limit of its stroke, which cycle of operations will be repeated at each depression of the treadle, each blow of the hammer being determined successively by the operator; but if it is desired to operate the machine automatically it is only necessary to first move the treadle laterally into the position shown in Fig. 6, when its subsequent depression will carry down the lever n and by means of strip m, lever L, head 20, link k, and arms h and h' move the lever F out of the plane of the lifting-bar, as shown in Fig. 6, simultaneously letting the pawl P^2 in underneath the lug P^{11} on the collar R of the trip-bar, and correspondingly projecting the dog s' on the lever S into the path of the hammer, which, as it falls after being released from the pawl C^2 by the aforesaid depression of the treadle, will encounter the said dog and thus throw the pawl p^2 out from under the lug P^{11} and allow the trip-bar to fall and clutch the friction-rolls upon the friction-bar to raise the hammer again, and said cycle of operations will be automatically repeated as long as the treadle is held depressed in the position shown in Fig. 6. The force of the blow of the hammer may be regulated by vertical adjustment of the dog s' on the lever S, correspondingly affecting the time of clutching the friction-board by the rolls.

To shift the mechanism back to secure independent action, it is only necessary to raise the treadle and move it laterally back to normal position, or a spring 100 may be arranged to return the treadle laterally against stop 200 on the frame, the simple removal of the foot from the treadle in such case accomplishing the said result. The height of the hammer stroke is regulated in the ordinary well-known manner by adjustment of the dog U on the trip-bar and correspondingly changing the position of the pawl C^2 on the frame.

Figs. 9, 10, and 11 represent a construction in which the treadle is not adapted to be moved laterally, but two separate treadles are provided. A main treadle 70 is connected with the latch C^2 and with the trip-bar lever F substantially in the manner hereinbefore described and here requiring no repetition, and an auxiliary treadle 80, which is equivalent to the lever n of the mechanism hereinbefore described, and like that lever is connected to the automatic pawl-releasing mechanism before described, the auxiliary treadle being arranged interior to the main treadle and provided with projecting arms or foot-levers 90, overhanging and adapted to engage the main treadle, whereby the main treadle may at any time be depressed independently of the auxiliary treadle, but if pressure be applied to the arms 90 or to any portion of the auxiliary treadle the consequent depression of the auxiliary treadle will carry the main treadle downward by engagement of the arms 90 therewith, and thus operate the various mechanisms of the machine to effect the same result accomplished by the laterally-movable treadle of Figs. 1 to 8, inclusive. The treadles of the modification are simply hinged or pivoted upon the studs e^4, inserted in base of the machine, as shown.

I claim as my invention—

1. In drop-hammers the combination of the hammer provided with a friction-board, friction-rolls for lifting the hammer by engagement with the board, a trip-bar and connections for clutching and releasing the rolls and friction-board, a self-latching pawl for holding the hammer in elevated position, a main operating-treadle, an auxiliary treadle or part normally independent of the main treadle but adapted to be operated in conjunction therewith, means for disengaging the self-latching pawl by action of the main treadle, means for lifting the trip-bar by the hammer to release the rolls from the friction-board, mechanism for lifting the trip-bar by action of the main treadle, means for throwing said mechanism out of operative relation with the trip-bar by

action of the auxiliary treadle, an automatic pawl for holding the trip-bar elevated, means for holding said pawl normally disengaged from the trip-bar, subject to operative release by action of the auxiliary treadle, and means for tripping said automatic pawl by the working stroke of the hammer, substantially as and for the purpose specified.

2. In drop-hammers, the combination of the hammer provided with a friction-board, friction-rolls for lifting the hammer by engagement with the board, a trip-bar and connections for clutching and releasing the rolls and friction-board, a self-latching pawl for holding the hammer in elevated position, a main operating-treadle, an auxiliary treadle or part normally independent of the main treadle but adapted to be operated in conjunction therewith, means for disengaging the pawl by action of the main treadle, means for lifting the trip-bar by the hammer to release the rolls from the friction-board, mechanism for lifting the trip-bar by action of the main treadle, means for throwing said mechanism out of operative relation with the trip-bar by action of the auxiliary treadle, an automatic pawl for holding the trip-bar elevated, means for holding said pawl normally disengaged from the trip-bar, subject to operative release by action of the auxiliary treadle, means for tripping said automatic pawl by movement of the hammer, and means whereby the main treadle may be operated independently of the auxiliary treadle, or in connection with the auxiliary treadle to provide for independent and automatic action of the hammer, substantially as and for the purpose specified.

3. In drop-hammers of the class operated by friction driving-rolls and friction lifting-board, the combination of a trip-bar adapted to actuate the friction-rolls into clutching engagement with the friction-board, an adjustable dog carried by the trip-bar and adapted to be engaged by the hammer on its upward travel to unclutch the driving mechanism, a trip-bar lever or part for lifting or holding the trip-bar in elevated position independently of the hammer, said lever being movable into and out of operative relation with the trip-bar, an operating-treadle or foot-bar mounted on the frame, a connecting rod or mechanism for operating the trip-bar lever by said treadle action, means for normally retaining said lever in operative relation with the trip-bar, connecting mechanism for throwing said lever out of operative engagement with the trip-bar by action of the treadle, automatic pawl or holding mechanism for supporting the trip-bar independently of the trip-bar lever, means for retaining said automatic holding mechanism normally inoperative, mechanism for throwing said holding mechanism into operation by action of the treadle, means for tripping said holding mechanism by movement of the hammer, and means for coupling the trip-bar-lever-disengaging mechanism and the mechanism for throwing said holding mechanism into operation, upon, or subject to the action of the treadle, substantially as and for the purpose specified.

4. In drop-hammers of the class operated by friction driving-rolls and friction lifting-board, the combination of a trip-bar adapted to actuate the friction-rolls into clutching engagement with the friction-board, an adjustable dog carried upon the trip-bar, engageable by the hammer to unclutch the driving mechanism, a trip-bar lever for lifting or holding the trip-bar, the lever being laterally movable into and out of the plane of the trip-bar, a spring for retaining the lever normally in the plane of the trip-bar, an operating-treadle mounted on the frame and universally pivoted for both vertical and horizontal movement of the foot-bar, connections for operating the trip-bar lever by the normal movement of the treadle, an auxiliary treadle or part adapted to be coupled or engaged with the main treadle by the lateral or switching movement thereof, connections for throwing the trip-bar lever out of the plane of and operative relation with the trip-bar by the said auxiliary treadle, automatic pawl mechanism for holding the trip-bar in non-driving position independently of the trip-bar lever, means for normally holding said pawl mechanism inoperative, connections for throwing said pawl mechanism into operation by the auxiliary treadle, an adjustable dog for releasing said pawl mechanism by the fall of the hammer, and a pawl or latch for holding the hammer, connected to and releasable by the treadle, substantially in the manner and for the purpose specified.

5. In drop-hammers the combination of the hammer provided with a friction-board, friction-rolls for lifting the hammer by engagement with the board, a trip-bar and connections for clutching and releasing the rolls and friction-board, a self-latching pawl for holding the hammer in the elevated position, a main operating-treadle hinged to the frame by a universal joint or connections adapted to permit both vertical and lateral motion of the treadle, an auxiliary treadle or part adapted to be engaged by the main treadle by the lateral shift or switching action of the main treadle, connections between the main treadle and the self-latching pawl, a trip-bar lever, movable into and out of the plane of the trip-bar, connections between said lever and the main treadle, a crank or rock arm for moving the said lever bodily in one direction, a spring for moving the lever in the opposite direction, connections between the said crank and auxiliary treadle, a spring for returning said connections, lever, and treadle to normal position after operation, an automatic pawl for holding the trip-bar elevated, connections for normally holding said pawl inoperative by the said spring, and a dog and means for tripping said pawl by the fall of the hammer,

said dog being adjustably secured to regulate the force of the hammer blow, substantially as and for the purpose specified.

6. In drop-hammers the combination of the hammer provided with a friction-board, friction-rolls for lifting the hammer by engagement with the board, trip-bar and connections for clutching and releasing the rolls and friction-board, a self-latching pawl for holding the hammer in elevated position, a main operating-treadle, an auxiliary treadle or part normally independent of the main treadle but adapted to be operated in conjunction therewith, means for disengaging the self-latching pawl by action of the main treadle, means for lifting the trip-bar by the hammer to release the rolls from the friction-board, mechanism for lifting the trip-bar by action of the main treadle, means for throwing said mechanism out of operative relation with the trip-bar by action of the auxiliary treadle, an automatic pawl for holding the trip-bar elevated, means for holding said pawl normally disengaged from the trip-bar, subject to operative release by action of the auxiliary treadle, a vertical lever connected or engaged with said automatic pawl to form a compound lever therewith, and an adjustable dog secured on said vertical lever, engageable by the hammer to release the automatic pawl by the fall of the hammer, substantially as and for the purpose specified.

7. In drop-hammers the combination of the hammer provided with a friction-board, friction-rolls for lifting the hammer by engagement with the board, a trip-bar and connection for clutching and releasing the rolls and friction-board, a self-latching pawl for holding the hammer in the elevated position, a main operating-treadle hinged to the frame by a universal joint or connection adapted to permit both vertical and lateral motion of the treadle, an auxiliary treadle or part adapted to be engaged by the main treadle by the lateral shift or switching action of the main treadle, connections between the main treadle and the self-latching pawl, a trip-bar lever movable into and out of the plane of the trip-bar, connections between said lever and the main treadle, a crank or rock arm $h\ h'$ for moving the said lever bodily in one direction, a spring for moving the lever in the opposite direction, the link k, head 20, lever L l^2 and connection, m, connecting the said crank and auxiliary treadle, a spring for returning said connection, lever, and treadle to normal position after operation, an automatic pawl for holding the trip-bar elevated, the connecting-rod P for normally holding said pawl inoperative by the said spring, a vertical lever compounded with said pawl, a dog adjustably secured on said vertical lever and adapted to be engaged by the hammer in falling to release the trip-bar, substantially as and for the purpose specified.

FRANK LOMBARD.

Witnesses:
WM. L. MAYNARD,
CHAS. E. MAYNARD.