(No Model.) 5 Sheets—Sheet 1.

J. A. HORTON.

DROP HAMMER.

No. 543,302. Patented July 23, 1895.

Fig. 1.

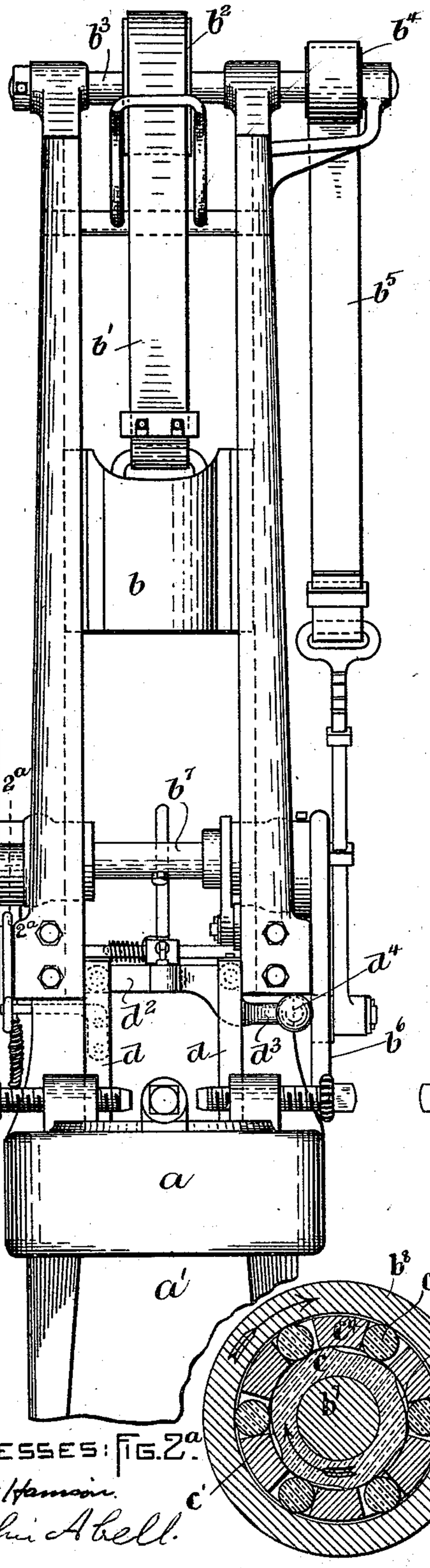

Fig. 2.

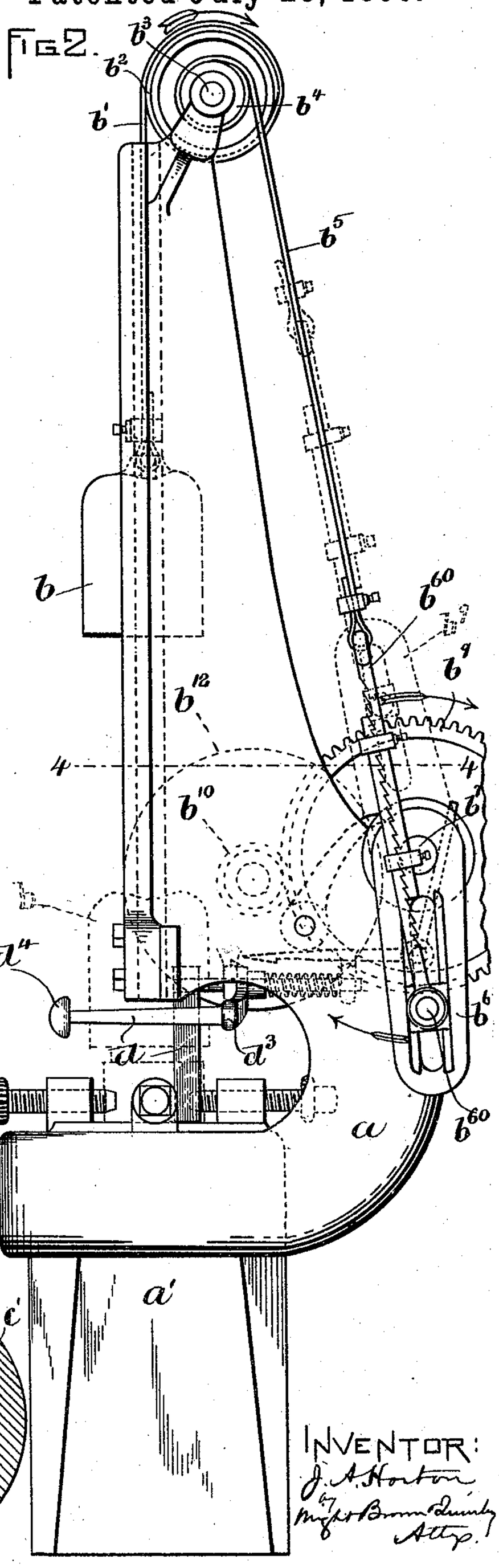

Fig. 2a.

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DROP HAMMER.

No. 543,302. Patented July 23, 1895.

FIG. 3.

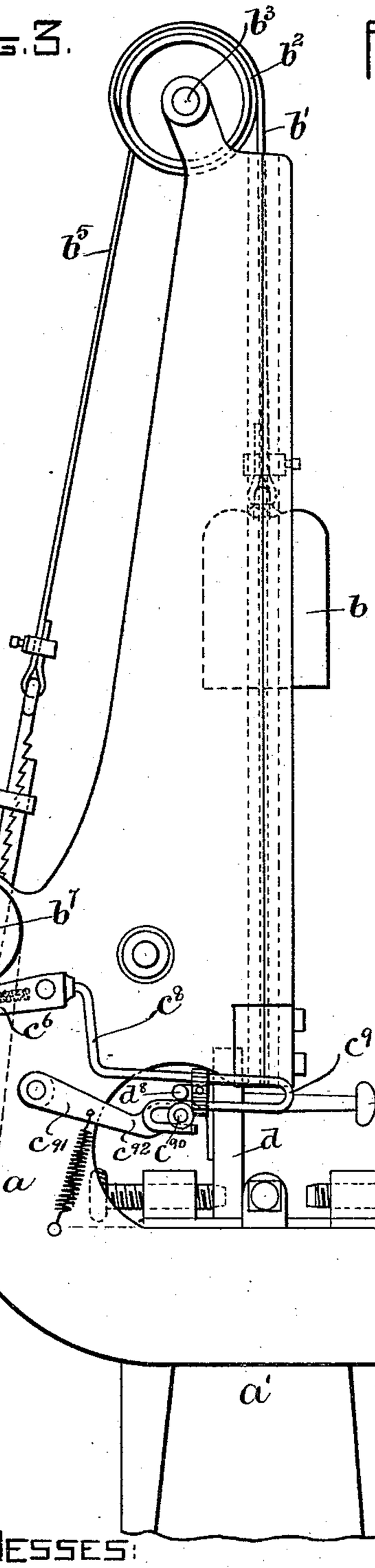

FIG. 4.

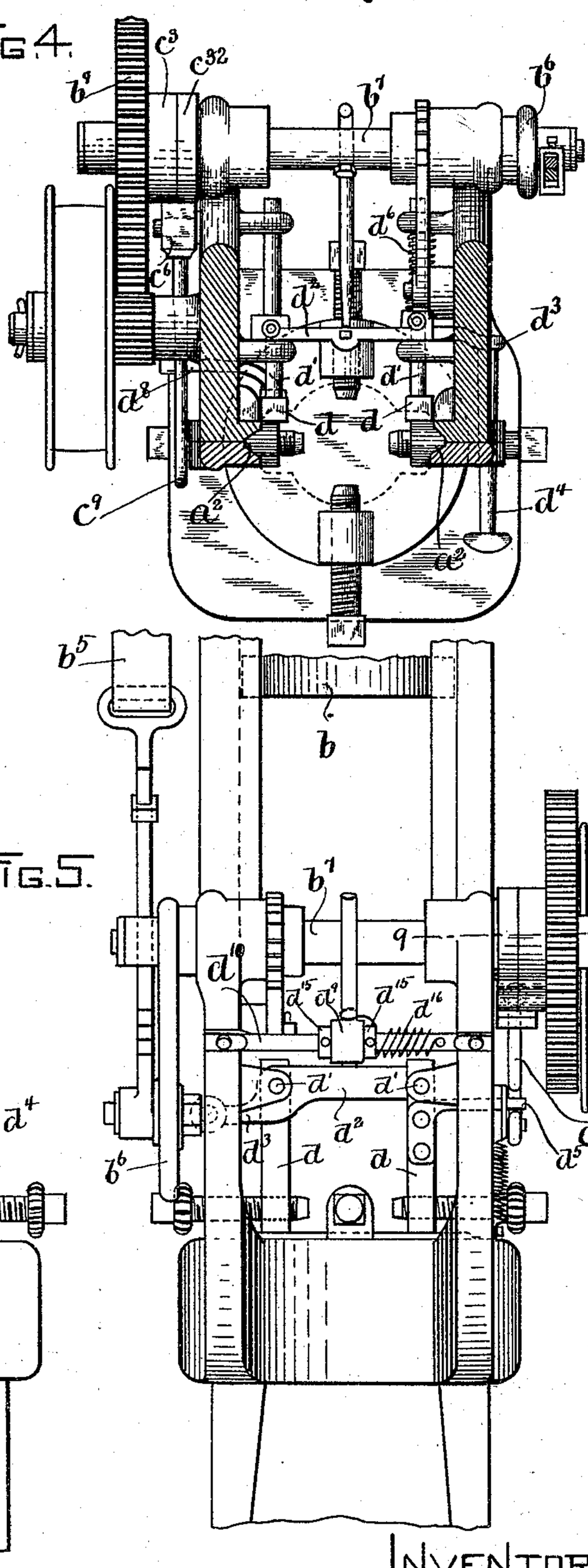

FIG. 5.

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(No Model.) 5 Sheets—Sheet 3.

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No. 543,302. Patented July 23, 1895.

FIG. 8.

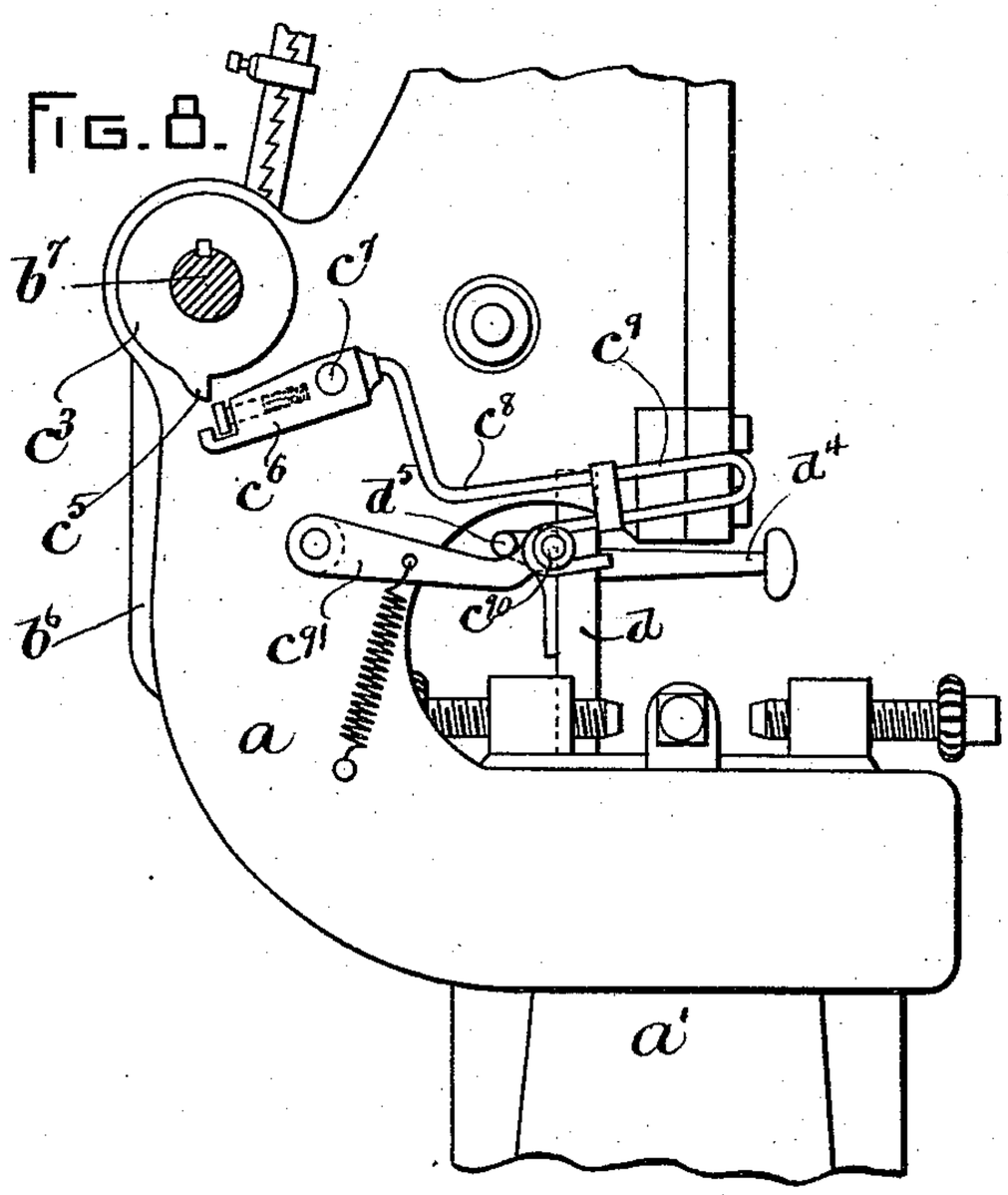

FIG. 6.

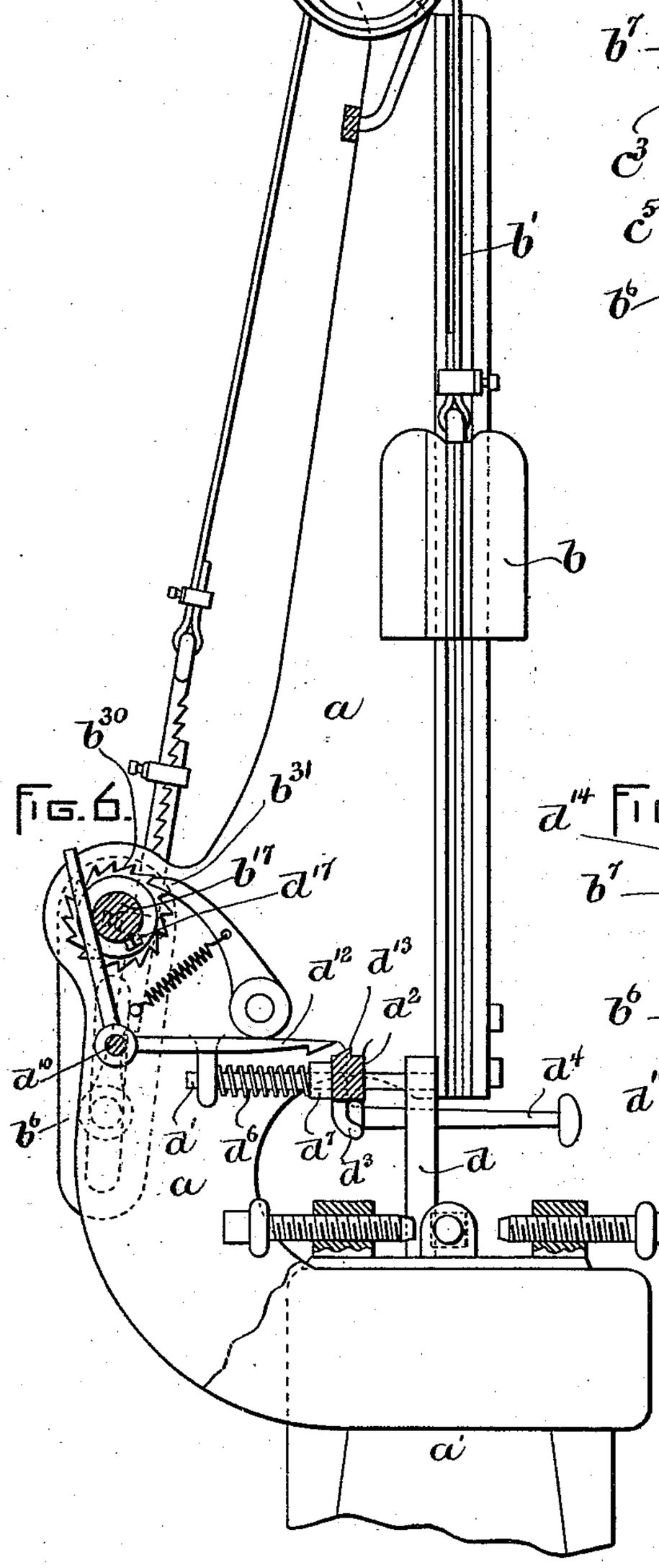

FIG. 7.

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(No Model.) 5 Sheets—Sheet 4.

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No. 543,302. Patented July 23, 1895.

FIG. 9.

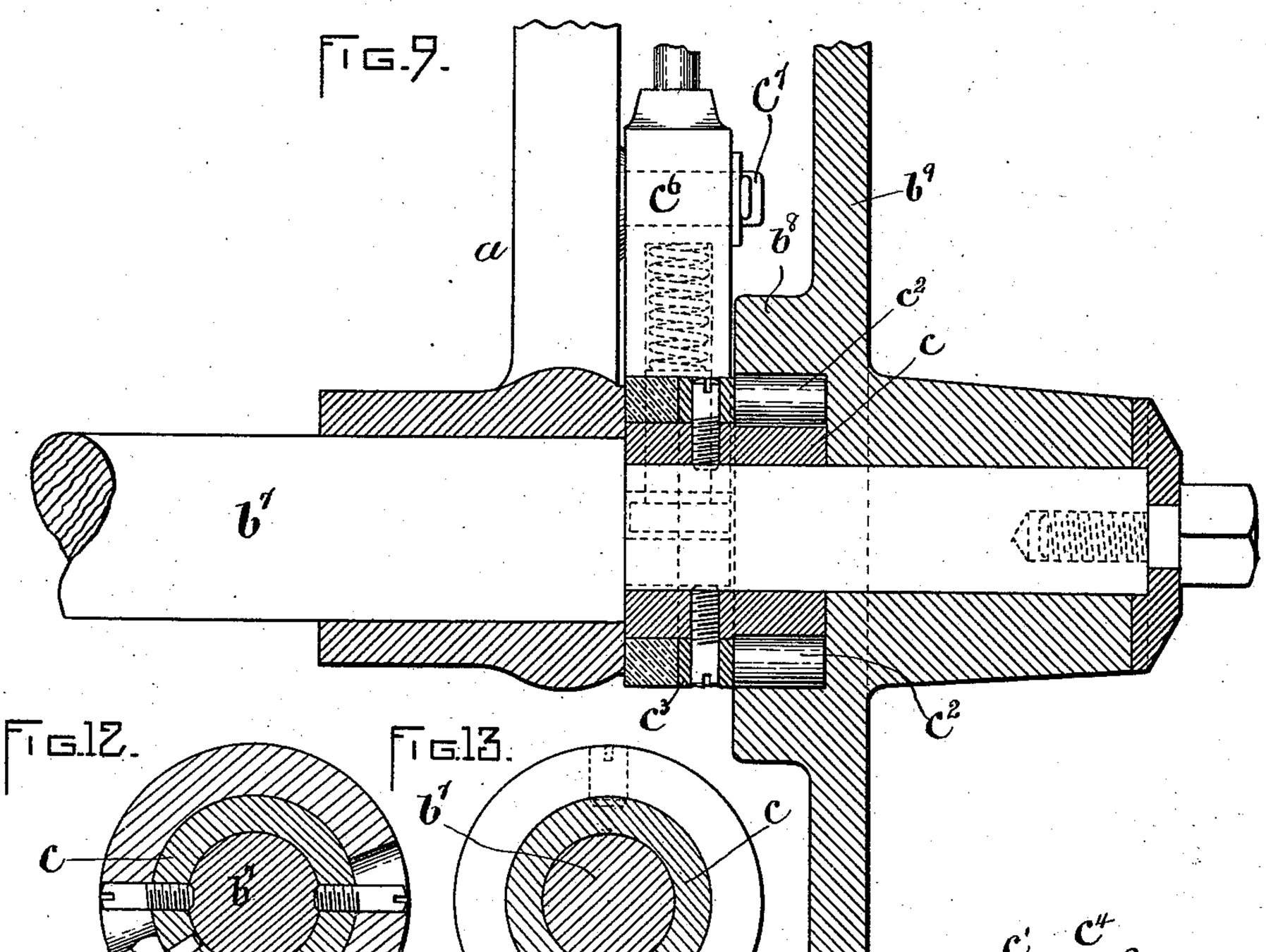


FIG. 12.

FIG. 13.

FIG. 10.

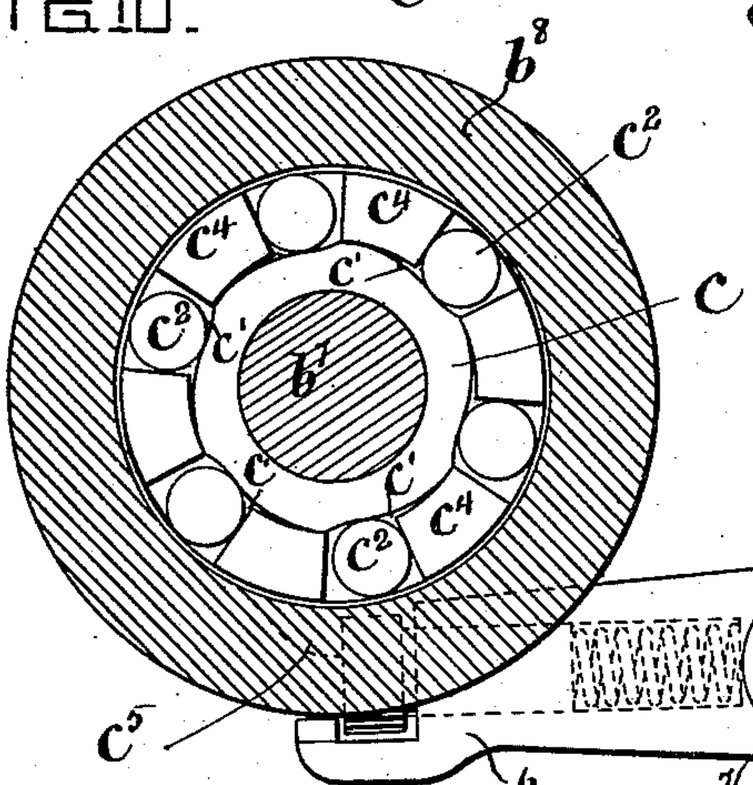
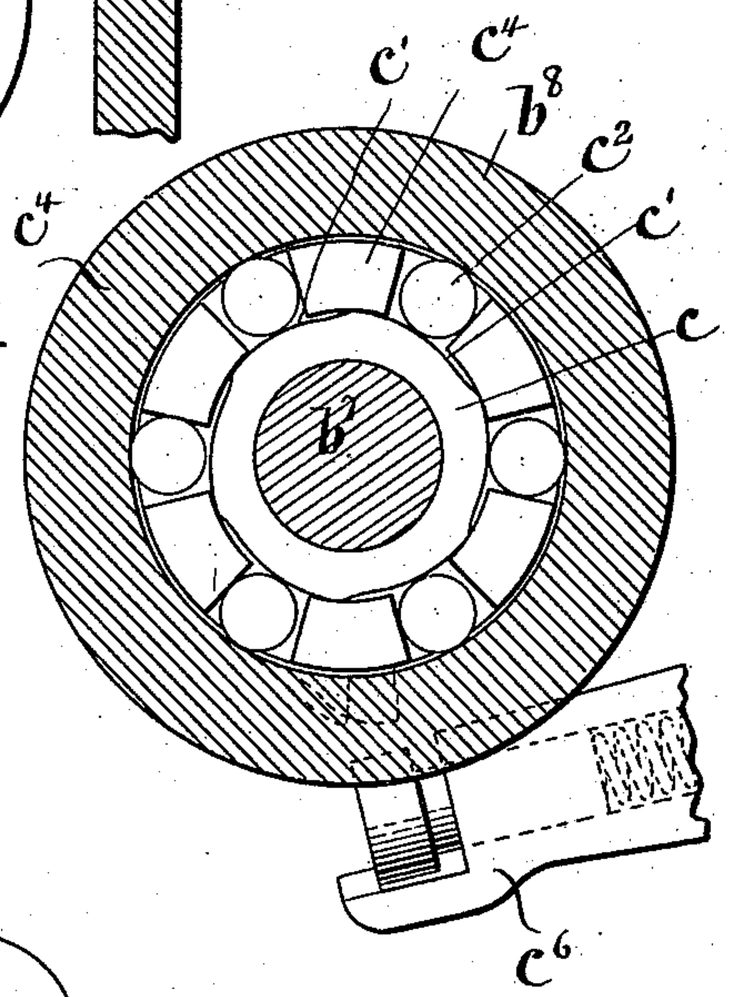


FIG. 11.



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DROP HAMMER.

No. 543,302. Patented July 23, 1895.

Fig. 15.

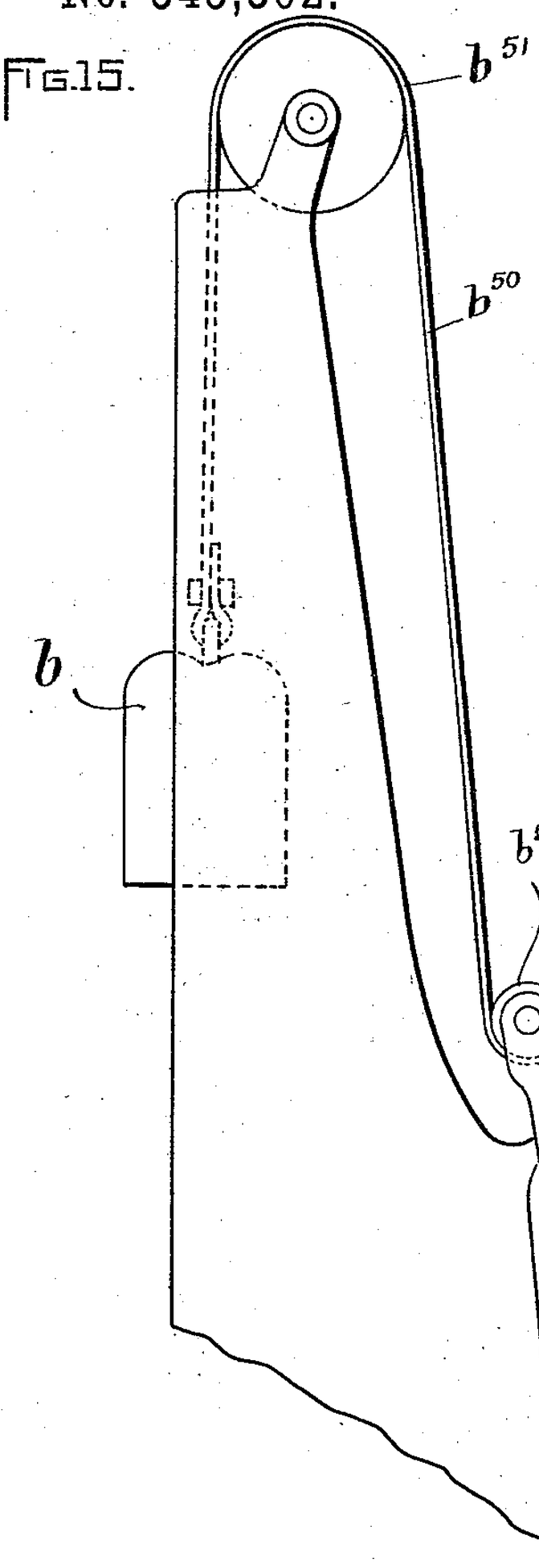
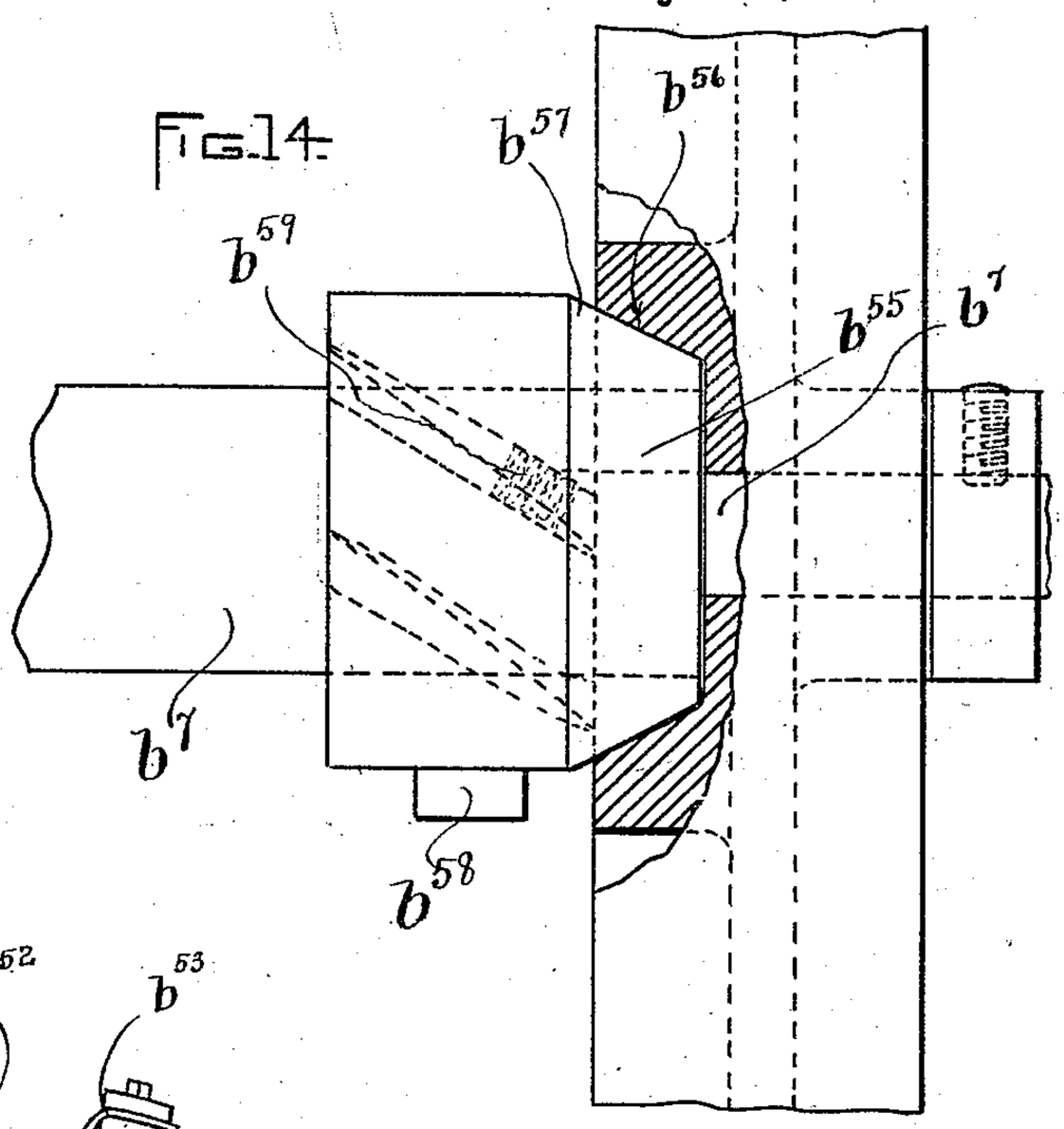


Fig. 14.



WITNESSES:
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Rollin A. Bell.

INVENTOR:
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UNITED STATES PATENT OFFICE.

JAMES A. HORTON, OF READING, ASSIGNOR TO THE MOSSBERG MANUFACTURING COMPANY, OF ATTLEBOROUGH, MASSACHUSETTS.

DROP-HAMMER.

SPECIFICATION forming part of Letters Patent No. 543,302, dated July 23, 1895.

Application filed January 28, 1895. Serial No. 536,457. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. HORTON, of Reading, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Drop-Hammers, of which the following is a specification.

This invention has for its object to provide improved means for operating a drop-hammer in such manner that while the hammer is permitted to fall freely by gravitation, downward movement of the hammer after its rebound or at any point during its ascent will be prevented under ordinary conditions.

The invention also has for its object to provide safety devices to prevent liability of injury to the work and to the operator's hands should the hammer be released under extraordinary conditions.

To these ends the invention consists in the improvements which I will now proceed to describe and claim.

Of the drawings accompanying this specification and forming a part thereof, Figure 1 represents a front elevation of a hammer embodying my improvements. Fig. 2 represents a side elevation of the same looking from the right of Fig. 1. Fig. 2^a represents a section on line 2^a 2^a of Fig. 1. Fig. 3 represents a side elevation looking from the left of Fig. 1. Fig. 4 represents a section on line 4 4 of Fig. 2 looking downwardly. Fig. 5 represents a rear elevation of the lower portion of the machine. Fig. 6 represents a partial longitudinal central section of the machine. Figs. 7 and 8 represent detail views hereinafter described. Figs. 9, 10, 11, 12, and 13 represent details of the preferred form of clutch mechanism employed. Fig. 14 represents a modified form of clutch. Fig. 15 represents a side view of a modified construction of the machine.

The same letters indicate the same parts in all the figures.

In the drawings, *a* represents a supporting-frame, which is provided with suitable vertical guides in which the slug or hammer *b* is adapted to move. Said hammer is supported by a flexible strap b', one end of which is affixed to a pulley b^2 on a shaft b^3, which is journaled in bearings in the frame *a*.

b^7 represents a crank-shaft which is journaled in bearings in the supporting-frame and has a crank b^6 affixed to one of its ends. Said crank is provided with an adjustable wrist-pin b^{60}, which is connected with a flexible strap b^5, one end of which is affixed to a pulley b^4, which is affixed to the shaft b^3. The strap b^5 is preferably connected with the wrist-pin b^{60}, through an adjustable connecting device or coupling b^{61}, the construction of which is clearly shown in Fig. 2.

b^9 represents a driving gear or wheel which is loosely mounted upon the crank-shaft b^7, and is connected with said shaft by a clutch which is constructed to impart rotary movement from the driving-wheel to the shaft when the wheel is rotated forward or in the direction indicated by the arrow in Fig. 2, and to prevent backward rotation of said shaft, the clutch being also of such construction that it will permit the shaft to rotate forward more rapidly than the driving-wheel, so that while said wheel is constantly rotated by suitable connection with a prime motor the shaft, when engaged with the wheel, may be given an accelerated forward movement by the weight of the hammer, as hereinafter described, without disturbing the operative connection between the driving-wheel and the shaft.

The preferred construction of the clutch is shown in Figs. 9, 10, 11, and 12, said construction comprising a collar *c* affixed to the crank-shaft and provided on its perimeter with a series of faces which are somewhat eccentric to the axis of the shaft, a series of loose friction-rolls c^2 interposed between the collar *c*, and an internal annular face constituting the inner surface of a flange b^8 on the hub of the gear b^9, and a series of fingers or projections c^4, interposed between said rolls and formed on a collar c^3, which has a limited independent rotary movement upon the shaft and is normally pressed by a spring c^{30}, Fig. 12, in the direction required to cause the fingers c^4 to force the rolls c^2 into the narrower portions of the irregular space between the collar *c* and the flange b^8, thus causing the rolls to bind upon the said flange and collar, as shown in Fig. 11. A detent c^6 is pivoted at c^7 to the frame of the machine and is normally in position, as shown in Figs. 3 and 10, to bear upon the shoulder c^5 on the collar c^3, and

thus hold said collar back from the position into which it is normally forced by the spring c^{30}, so that the rolls c^2 are normally loose between the collar c and flange b^8, as shown in Fig. 10. A detent ear or lug c^{31}, formed on a collar c^{32}, affixed rigidly to the crank-shaft b^7, is located in close proximity to the projection c^5, and the stop c^6 is arranged to co-operate with said lug or projection c^{31} and lock or arrest the shaft b^7 at the same time that the clutch is drawn out of connection with said shaft, so that the shaft is released from the driving-wheel and at the same time stopped by the detent c^6.

The clutch above described is of substantially the construction shown in Letters Patent No. 260,394, granted to me July 4, 1882.

The stop c^6 is arranged to arrest the rotation of the shaft, as above described, when the crank b^6 is substantially at the lowest point in its movement, as shown in Fig. 2, the wrist-pin being then carried slightly beyond the center of the shaft b^7, so that a line drawn from said wrist-pin to the periphery of the pulley b^4 will be slightly at the left of the center of said shaft, as viewed in Fig. 2, the straps, pulleys, and crank being relatively arranged, so that when the crank occupies this position the hammer is raised. The described position of the crank relatively to the shaft enables the detent c^6 to support the weight of the hammer with the minimum degree of resistance, the pull due to the weight of the hammer being exerted nearly lengthwise of the crank b^6, so that only the minimum strain is exerted upon the detent c^6 and the lug or projection c^{31} on the crank-shaft, the position of the crank being such, however, that the weight of the hammer will instantly cause it to descend and rotate the crank in the direction indicated by the arrows in Fig. 2 when the stop c^6 is displaced.

By reference to Fig. 2^a it will be seen that when the parts are in the position shown in Fig. 2, the hammer being raised, the pull of the hammer tends to rotate the crank-shaft, through the pulleys and straps, in the direction indicated by the arrow in Fig. 2^a. It will also be seen that if the rotary movement of the crank-shaft and its collar c is more rapid than the movement of the driving-wheel, which is continuously rotated in the same direction, the clutch-rollers will be loosened so that the shaft can have an accelerated forward rotation, and can rotate as much faster than the driving-wheel as the rate of downward movement of the hammer, due to its weight, will require. It will be seen, therefore, that when the detent c^6 is displaced and the crank-shaft released, the clutch, although released and made operative to connect the driving-wheel and the shaft, will not in fact do so, owing to the fact that the weight of the hammer causes it to descend and impart an accelerated forward rotation to the crank-shaft, the latter being thus rotated much more rapidly than the driving-wheel, until the hammer reaches the lower end of its movement. The parts are arranged so that the crank is raised to the dotted-line position shown in Fig. 2 when the hammer reaches the lower end of its movement, so that during the remainder of a complete rotation of the shaft back to the full-line position shown in Fig. 2, the pull caused by the weight of the hammer on the shaft will be in a direction opposite to that indicated by the arrow in Fig. 2^a, and will therefore engage the clutch-rolls with the collar c and the flange of the driving-wheel, so that the driving-wheel is operatively engaged with the crank-shaft and positively rotates the latter from the dotted-line position to the full-line position shown in Fig. 2, thus causing the strap b^5 to unwind from the pulley b^4 and raise the hammer. It will also be seen that the described positive action of the clutch enables the crank-shaft to arrest the hammer after its rebound from the hammer-bed, thus preventing it from again striking the work after its rebound. When the crank-shaft reaches the position shown in full lines in Fig. 2, the shaft is arrested and the clutch made inoperative by the action of the detent c^6, as already described.

The described action of the driving-wheel and clutch in arresting the hammer after its rebound is very advantageous in a machine of this class, said driving-wheel and clutch constituting a safety device preventing undesirable contact between the hammer and the work, and also sustaining the weight of the hammer during its upward movement. To guard, however, against an accident which might arise in case the driving-belt or other power-transmitting means which operates the driving-wheel fails to operate properly and releases the driving-wheel, I provide an auxiliary safety device, which is preferably a ratchet b^{30} affixed to the crank-shaft, and a pawl b^{31} pivoted to the frame of the machine and engaging said ratchet, said pawl and ratchet being arranged to prevent backward rotation of the crank-shaft.

The detent c^6 is provided with an operating device whereby it may be conveniently displaced by the operator to release the crank-shaft and clutch. Said operating device, as here shown, is a curved rod or handle c^8, having a loop c^9 constituting a handle which is in position to be conveniently moved by the operator. Said loop c^9 is engaged with an arm d^5, which is formed on a safety device hereinafter described that is normally located under the hammer and prevents contact between the hammer and the hammer-bed in case the hammer descends at the wrong time, the said safety device and its arm preventing the handle or loop c^9 from being raised to release the shaft and clutch when the safety device is in its normal position. The said safety device, as here shown, comprises two vertical standards d d, which are affixed to horizontal rods d' d' fitted to slide in guides on the frame of the machine. To the rods d' d' is affixed a cross-

bar d^2, upon one end of which is formed an arm d^3, having a forwardly-projecting handle d^4, arranged to be grasped by the operator for the purpose of displacing the safety device or pushing it back out of the path of the hammer. The arm d^5 above mentioned is affixed to one of the standards d and is moved back with said standards out of the loop or handle c^9 when the safety device is displaced. When the safety device is moved back, as above described, it is held in a displaced position out of the path of the hammer by a detent d^{12}, which engages a tooth d^{13} on the cross-bar d^2 and holds the safety device in the displaced position shown in Fig. 7. The detent d^{12} is affixed to a rock-shaft d^{10}, having an arm d^{14}, which projects upwardly behind the crank-shaft b^7 and is arranged to be displaced by a projection d^{17} on said crank-shaft at a given point in the rotation of the latter, the arrangement being such that said projection displaces the arm d^{14} and detent d^{12}, and thus releases the safety device during the upward movement of the hammer, so that the safety device is automatically restored to place to prevent the descent of the hammer upon the hammer-bed, the safety device being impelled forward to its operative position after it is released by a spring d^6, located upon one of the rods d' and bearing against a collar d^7 interposed between the spring and the cross-bar d^2.

The loop or handle c^9 is connected at its lower portion with a stud c^{90} on an arm c^{91}, which is pivoted to the frame of the machine and has a recess c^{92} in its upper edge which co-operates with the arm d^5 in permitting the upward movement of the handle or loop c^9 indicated in Fig. 8 when the safety device is pushed backwardly, said upward movement permitting the detent to swing downwardly on its pivot c^7 out of engagement with the crank-shaft and clutch. When the safety device is moved forward the curved upper edge of the arm c^{91}, bearing on the arm d^5, causes the loop or handle c^9 and stop c^6 to move back to their operative position, as shown in Fig. 3.

The operation is as follows: The hammer being raised and the work in place upon the hammer-bed, the operator first pushes in the handle d^4, thus removing the safety device from the path of the hammer and releasing or unlocking the detent c^6. He then displaces the detent c^6 by means of the handle c^9, whereupon the crank-shaft is released and the hammer immediately drops, the crank-shaft being carried by the downward motion of the hammer to the position shown in dotted lines in Fig. 2. After this the clutch continues the rotation of the crank-shaft from the said dotted-line position to the full-line position shown in Fig. 2, at which point the detent acts to arrest the rotation of the shaft, the hammer being again supported in a raised position.

I do not limit myself to the two straps b' and b^5 and the corresponding pulleys as the connection between the hammer and the crank-shaft.

In Fig. 15, I have shown a modification in which the hammer is suppended by a single-strap b^{50} passing over a single pulley b^{51}, which is journaled in fixed bearings on the supporting-frame of the machine and under a movable pulley b^{52} to a fixed support at b^{53} on the frame of the machine. The pulley b^{52} is connected by a rod or link b^{54} with the crank b^6. In this modification only one strap is employed, the pulley b^{52} being raised and lowered by the rotation of the crank-shaft, and holding a portion of the strap in the form of a bight or loop, which varies in depth with the position of the crank-shaft, and thus raises and lowers the hammer.

I may employ any suitably-constructed clutch adapted to connect the crank-shaft with the driving-wheel in such manner as to prevent backward movement of the crank-shaft and permit an accelerated forward movement of the same, my invention not being limited to the clutch mechanism above described.

In Fig. 14, I show a modification in which the driving-wheel is provided with a beveled flange b^{56}, which is formed to fit the conical end of a clutch-sleeve b^{57}, which is movable into and out of said flange and is provided with a projection b^{58}, which corresponds with the projection c^5 of the clutch-collar c^3 and engages the detent c^6. The clutch-sleeve b^{57} is provided with spirally-arranged grooves b^{59}, which engage fixed ribs on the crank-shaft b^7, the arrangement being such that when the projection b^{58} is arrested by the detent a partial rotation of the sleeve b^{57} ensues, which removes it from engagement with the flange of the disk b^{55}. When the projection b^{58} is released by the detent, it is moved into engagement with said flange by springs suitably arranged within the said sleeve.

The clutch device shown in Fig. 14 was not invented by me.

I claim—

1. The combination, in a machine of the character described, of the following elements, namely, first, a driving-wheel; secondly, a drop-hammer; thirdly, intermediate wheel and hammer connecting mechanism comprising a shaft on which the driving-wheel is loosely mounted, a wheel and shaft connecting clutch organized to prevent a backward rotation of the shaft and to permit a free or accelerated forward rotation thereof, a crank affixed to said shaft, and a flexible connection between the crank and hammer, said mechanism positively connecting the driving-wheel with the hammer to raise the latter during a part of a rotation of the crank-shaft and releasing the hammer during the remainder of said rotation; and fourthly, a stop which arrests the crank-shaft and makes the clutch inoperative when the crank is in its depressed position and the hammer raised.

2. The combination of a crank-shaft having a detent or projection, a driving-wheel or gear mounted loosely on said shaft, a clutch comprising members affixed respectively to the said wheel and shaft and organized substantially as described to prevent backward rotation of the shaft and to permit the shaft to rotate forward more rapidly than the wheel, a stop arranged to simultaneously engage the detent or projection on the shaft and a projecting portion of the clutch and thereby make the clutch inoperative and lock the shaft when the crank thereof is in its lowest position, a drop-hammer movable in suitable guides, a shaft having a pulley connected by a strap with the hammer, the arrangement being such that the hammer is held in its raised position by the said detent through the crank-shaft, straps, and pulleys when the crank-shaft is locked by the detent, and when the detent is displaced the crank-shaft, clutch, and hammer are released, the clutch permitting the crank-shaft to rotate more rapidly than the driving-wheel while the hammer is descending and then acting to automatically arrest the hammer at the end of its rebound and to cause the rotation of the crank-shaft to its hammer-raising position.

3. The combination of a crank-shaft having a detent or projection, a driving-wheel or gear mounted loosely on said shaft, a clutch comprising members affixed respectively to the said wheel and shaft and organized substantially as described to prevent backward rotation of the shaft and to permit the shaft to rotate forward more rapidly than the wheel, a stop arranged to simultaneously engage the detent or projection on the shaft and a projecting portion of the clutch and thereby make the clutch inoperative and lock the shaft when the crank thereof is in its lowest position, a drop-hammer movable in suitable guides, a shaft having a pulley connected by a strap with the crank and another pulley connected by a strap with the hammer, the clutch and driving-wheel acting as a safety device to prevent backward movement of the crank-shaft and downward movement of the hammer when the latter is being raised by the rotation of the crank-shaft, and an auxiliary safety device such as a ratchet affixed to the crank-shaft and a dog on the supporting frame whereby backward rotation of the crank-shaft and downward movement of the hammer are prevented in case of accident to the driving-wheel or clutch.

4. The combination, in a machine of the character described, of the following elements: namely, first, a driving-wheel; secondly, a drop-hammer; thirdly, intermediate wheel and hammer connecting mechanism comprising a shaft on which the driving-wheel is loosely mounted, a wheel and shaft connecting clutch organized to prevent a backward rotation of the shaft and to permit a free or accelerated forward rotation thereof, a crank affixed to said shaft, an intermediate shaft having a larger pulley connected by a strap with the hammer and a smaller pulley connected by a strap with the crank; and fourthly, a stop whereby the crank-shaft is arrested and the clutch made inoperative when the crank is in its depressed position and the hammer is raised.

5. The combination of a crank-shaft having a detent or projection, a driving-wheel loosely mounted on the shaft, a clutch composed of a member affixed to the shaft, a member affixed to the wheel, and an intermediate member which normally co-operates with the other members in preventing backward rotation of the shaft and is provided with an external operating device, said clutch being organized to permit an independent forward rotation of the shaft, a drop-hammer movable in suitable guides, two connected pulleys, straps connecting said pulleys respectively with the hammer and with the crank, and a stop adapted to co-operate simultaneously with the said operating device and with the detent on the crank-shaft when the hammer is raised.

6. The combination of a drop-hammer, a driving-wheel, a crank-shaft, a clutch comprising members affixed respectively to the said wheel and shaft and organized substantially as described to prevent backward rotation of the shaft and to permit the shaft to rotate forward more rapidly than the wheel, connections such as a crank and a flexible strap between the crank-shaft and hammer, said connections, clutch- and crank-shaft acting to raise the hammer during a part of the rotation of said shaft and to release the hammer during another part of said rotation, a stop which automatically arrests the crank-shaft and makes the clutch inoperative when the hammer is raised, and a movable safety device which is normally interposed between the hammer and its bed to prevent the descent of the hammer upon the bed.

7. The combination of a drop-hammer, a driving-wheel, a crank-shaft, a clutch comprising members affixed respectively to the said wheel and shaft and organized substantially as described to prevent backward rotation of the shaft and to permit the shaft to rotate forward more rapidly than the wheel, connections such as a crank and a flexible strap between the crank-shaft and hammer said connections, clutch, and crank-shaft acting to raise the hammer during a part of the rotation of said shaft and to release the hammer during another part of said rotation, a stop which automatically arrests the crank-shaft and makes the clutch inoperative when the hammer is raised, a movable safety device which is normally interposed between the hammer and its bed to prevent the descent of the hammer upon the bed, and a detent which holds said guard out of the path of the hammer when the guard is displaced by the operator.

8. The combination of a drop-hammer, a driving-wheel, a crank-shaft, a clutch com-

prising members affixed respectively to the said wheel and shaft and organized substantially as described to prevent backward rotation of the shaft and to permit the shaft to rotate forward more rapidly than the wheel, connections such as a crank and a flexible strap between the crank-shaft and hammer said connections, clutch, and crank-shaft acting to raise the hammer during a part of the rotation of said shaft and to release the hammer during another part of said rotation, a safety device which is normally interposed between the hammer and its bed, a stop adapted to arrest the crank-shaft and make the clutch inoperative when the hammer is raised, and connections between said safety device and stop whereby the stop is locked when the safety device is in its operative position.

9. The combination of a drop-hammer, a driving-wheel, a crank-shaft, a clutch comprising members affixed respectively to the said wheel and shaft and organized substantially as described to prevent backward rotation of the shaft and to permit the shaft to rotate forward more rapidly than the wheel, connections such as a crank and a flexible strap between the crank-shaft and hammer said connections, clutch, and crank-shaft acting to raise the hammer during a part of the rotation of said shaft and to release the hammer during another part of said rotation, a safety device which is normally interposed between the hammer and its bed, a stop adapted to arrest the crank-shaft and make the clutch inoperative when the hammer is raised, connections between said safety device and stop whereby the stop is locked when the safety device is in its operative position, a detent which holds the safety device out of the path of the hammer when the safety device is displaced by the operator, and automatic means whereby the safety device is released and caused to lock the detent at a given point in the rotation of the crank-shaft.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 23d day of January, A. D. 1895.

JAMES A. HORTON.

Witnesses:
FRANK MOSSBERG,
A. D. HARRISON.