(No Model.) 4 Sheets—Sheet 1.

G. W. KING.

EXCAVATOR.

No. 580,494. Patented Apr. 13, 1897.

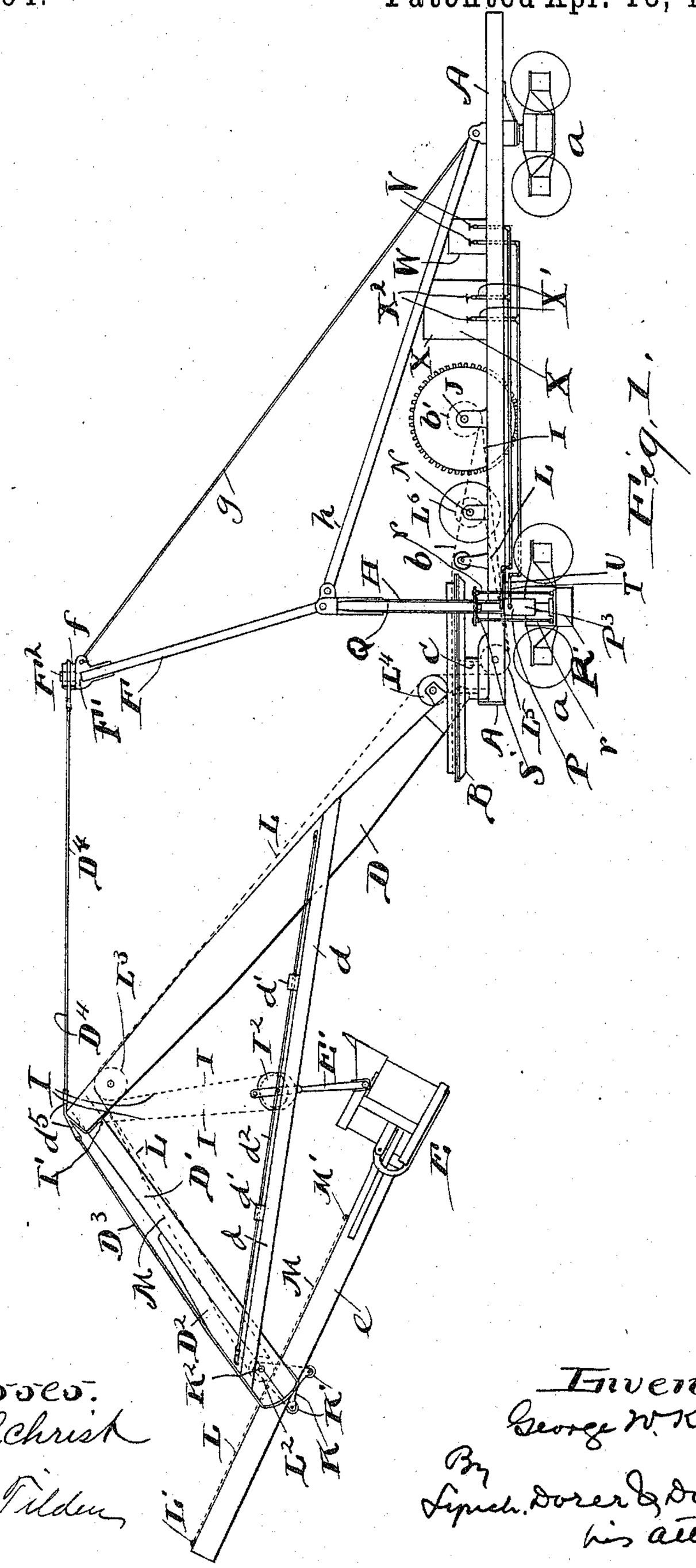

Fig. 1.

Witnesses:
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Ella E. Tilden

Inventor:
George W. King
By
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his attorneys

(No Model.)

4 Sheets—Sheet 2.

G. W. KING.

EXCAVATOR.

No. 580,494. Patented Apr. 13, 1897.

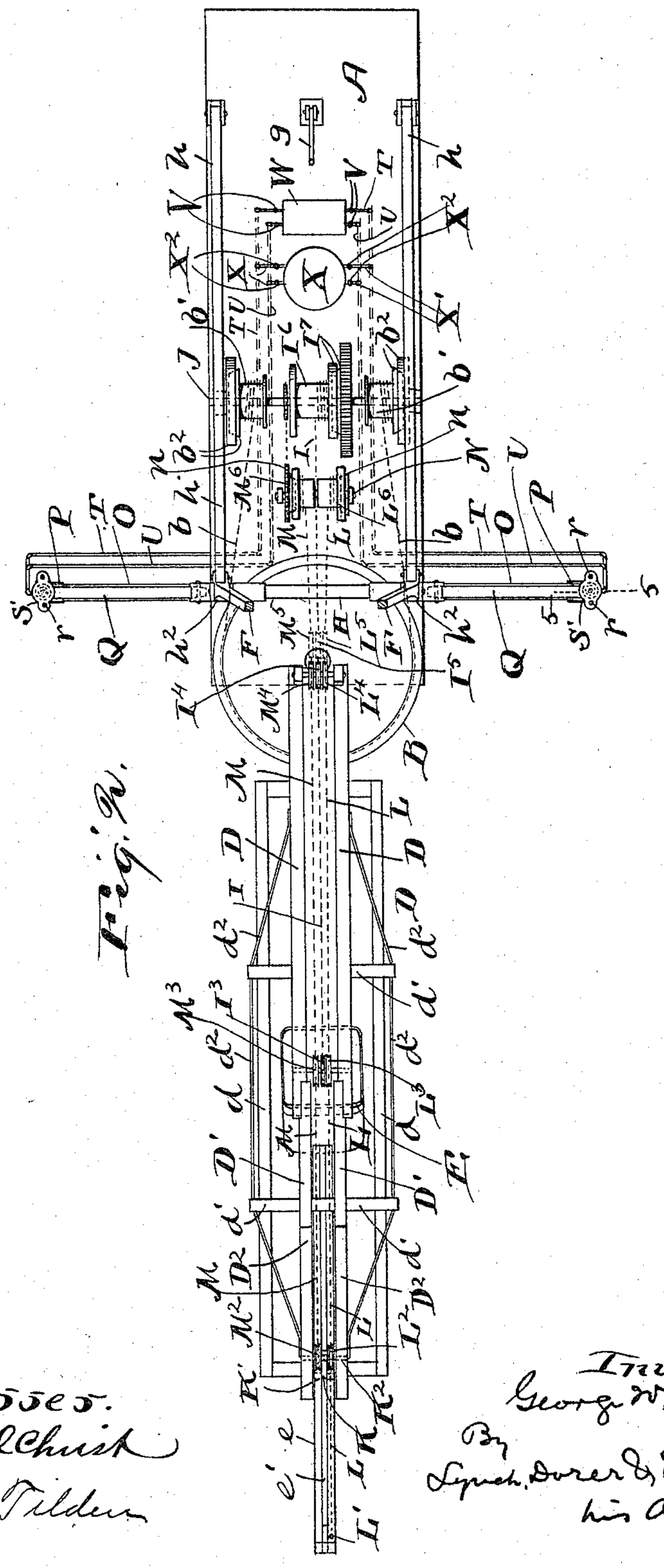

Fig. 2.

Witnesses.
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(No Model.) 4 Sheets—Sheet 3.

G. W. KING.

EXCAVATOR.

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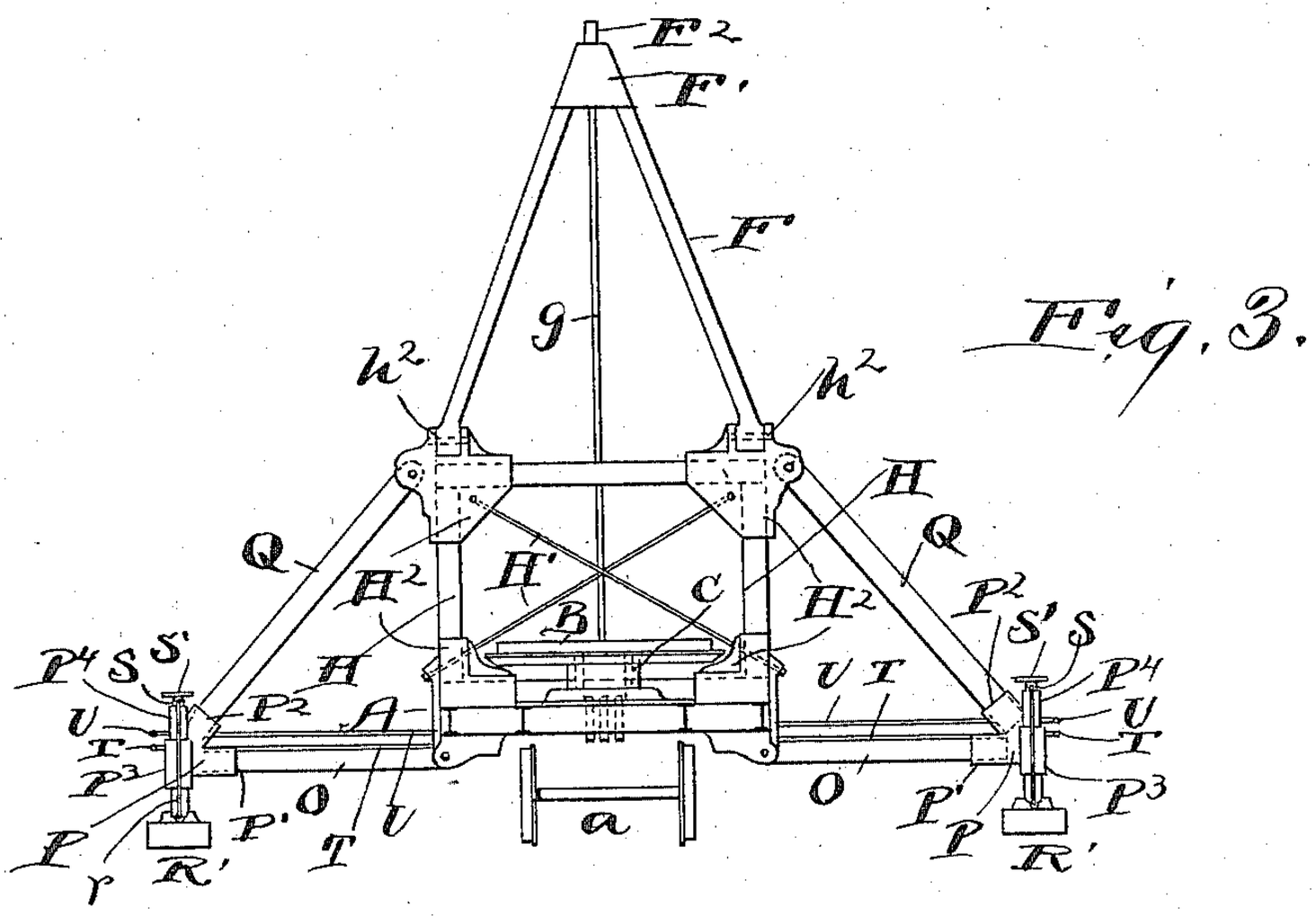

Fig. 3.

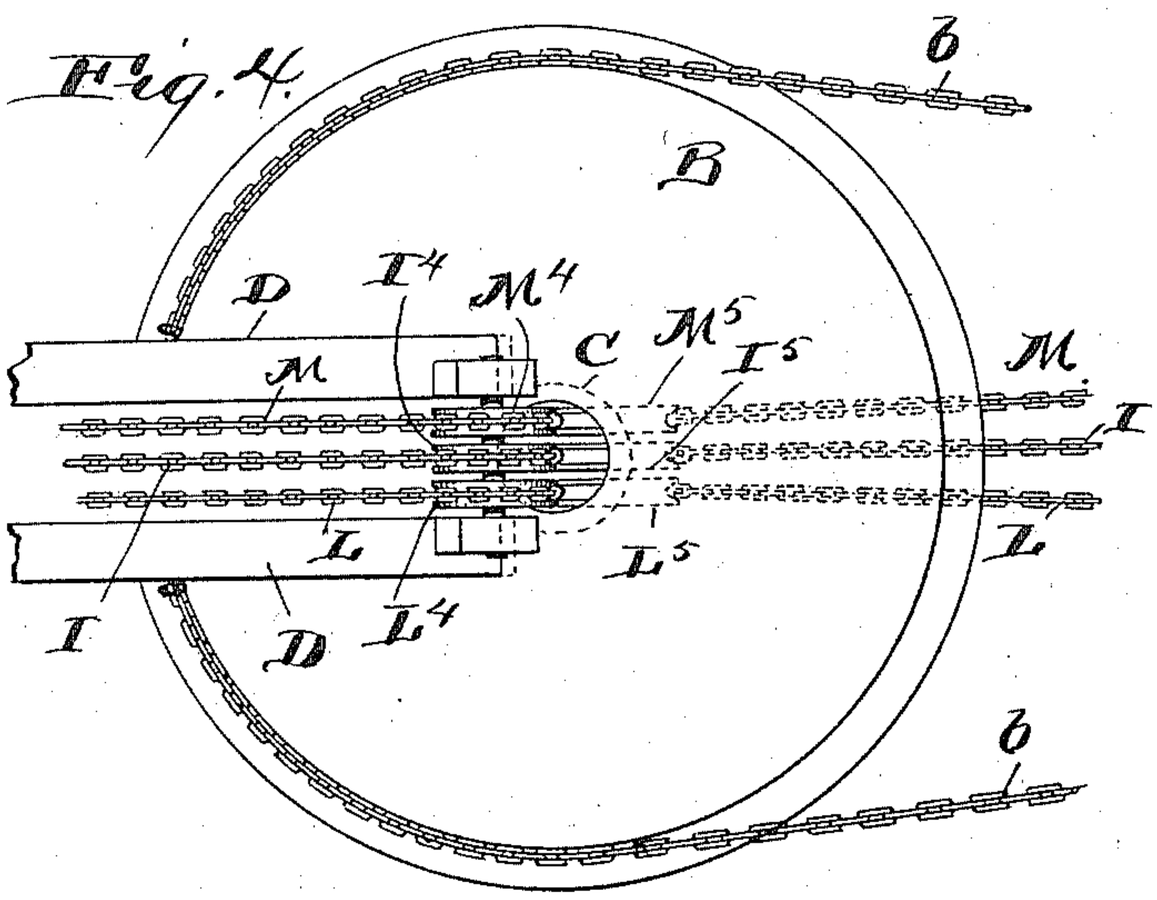

Fig. 4.

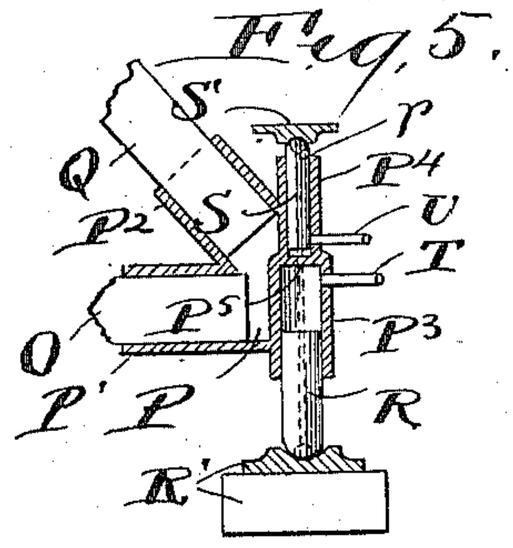

Fig. 5.

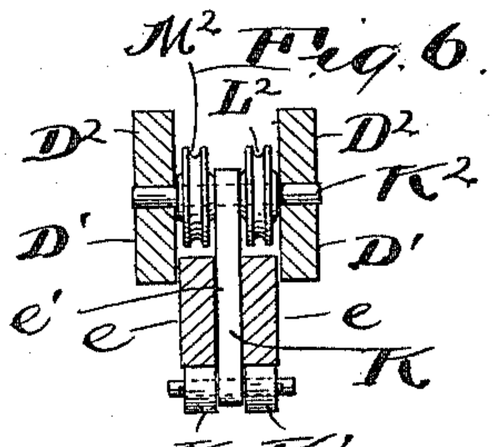

Fig. 6.

Witnesses.
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(No Model.) 4 Sheets—Sheet 4.

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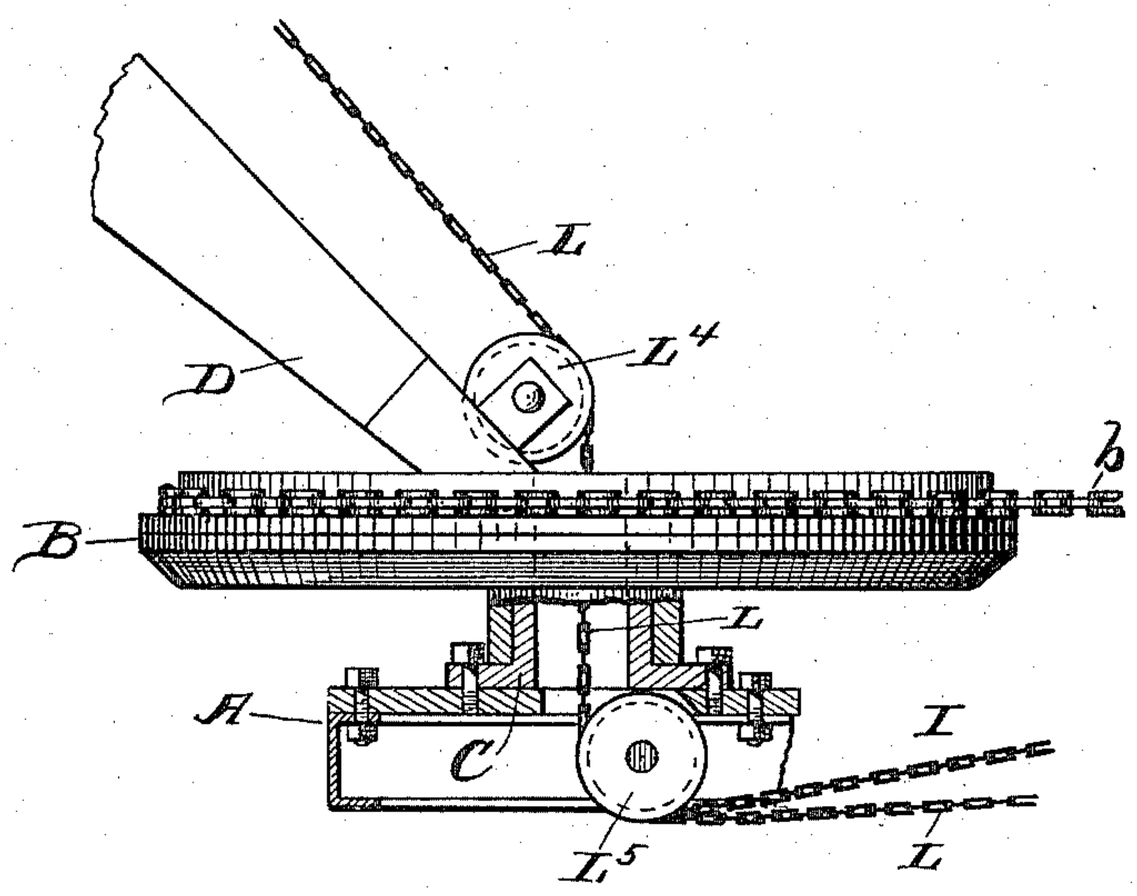
EXCAVATOR.

No. 580,494. Patented Apr. 13, 1897.

FIG. 7.



WITNESSES:
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UNITED STATES PATENT OFFICE.

GEORGE W. KING, OF MARION, OHIO.

EXCAVATOR.

SPECIFICATION forming part of Letters Patent No. 580,494, dated April 13, 1897.

Application filed March 30, 1896. Serial No. 585,366. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. KING, of Marion, Marion county, State of Ohio, have invented certain new and useful Improvements in Excavators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in excavators; and it consists, among other things, in a novel and meritorious arrangement of the hoisting chain or cable and the chains or cables employed in effecting the excavating stroke and return stroke of the excavating dipper or shovel.

My invention consists in improvements in bracing the excavator laterally and externally.

My invention consists, moreover, in certain novel and meritorious features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a steam shovel or excavator embodying my invention. Fig. 2 is a top plan of the same. Portions are broken away or removed in Fig. 2 to more clearly show certain features in the construction. Fig. 3 is a front end elevation showing the turn-table, the so-called "A-frame" or mast, the upright braced frame bearing said mast or A-frame, and the braces employed in bracing said mast-bearing frame and the machine's body portion laterally and externally. Fig. 4 is a top plan of the turn-table and connected end of the boom and adjacent portions of the hoisting-cable and shovel-feed cables. Fig. 5 is a vertical section on line 5 5, Fig. 2. Fig. 6 is a transverse section of a portion of the boom and shows the shovel-arm-bearing vertically-swinging frame. Fig. 7 is a side elevation, partly in central vertical section, showing the forward end of the excavator's car or body portion, the hollow box that forms the lower pivotal center of the boom, the turn-table mounted upon the box, and the chains passing through the box.

Referring to the drawings, A designates the car or body portion of the excavator, that is provided with two-wheeled trucks *a a*, arranged at opposite ends, respectively, of the car. The turn-table B is supported from the forward end of the car and is mounted upon a vertical cylindrical hollow box or bearing C, rigidly secured to the car. An A-shaped boom is operatively connected at its lower and inner end with the turn-table, and the latter's axis constitutes the lower pivotal center of the boom. The boom comprises, preferably, first, two parallel bars or beams D D, projecting upwardly and outwardly from the turn-table and located a suitable distance apart; secondly, two parallel bars or beams D′ D′, extending downwardly and forwardly from and rigidly secured to the upper and forward ends of bars or beams D D, respectively, and located a distance apart sufficient to accommodate the movement of the handle or arm *e* of the excavating dipper or shovel E between them; thirdly, two timbers or bars *d d*, connecting together and bracing apart timbers or beams D D′ and located a distance apart sufficient to accommodate the hoisting or elevation of the dipper or shovel between them, and, fourthly, other members, such, for instance, as cross-bars *d′ d′*, connecting together members *d d*, and tie-rods d^2, all located and arranged so as not to interfere with the operation of the shovel.

To the upper side of each member D′ of the boom is secured a bar D^2. A rod D^3 extends between the outer or lower ends of members D′ and outer or upper ends of members D and is suitably secured to said members D D′, (see Fig. 1,) and another rod D^4 extends rearwardly from and is suitably secured to the upper ends of members D. Rod D^4 is arranged horizontally or approximately so and has its rear end attached to a sleeve or collar *f*, that rests upon a metallic cap or head F′, that embraces the upper end of the A-frame or mast F and is mounted upon a vertical cylindrical lug or bearing F^2, formed upon said head or cap. Mast F is suitably connected at its upper end by a rod *g* with the rear portion of the car or body portion of the machine. Said mast is mounted upon an upright braced frame H, that is built over the rear portion of the turn-table and extends a desirable distance above said table. Frame H is braced in a rearward direction by two bars or braces *h*, arranged at the rear of opposite ends, respectively, of the frame. Braces *h* are connected at their for-

ward ends to a top portion of frame H and thence extend downwardly and rearwardly and are made fast at their rear and lower ends to the car or body portion of the machine. Frame H is preferably quadrangular and suitably braced internally by two crossed braces H'. (See Fig. 3.)

It is obvious that braces H', in order to most effectually brace the upright quadrangular frame, should connect diagonally opposite corners of said frame, but such an arrangement, notwithstanding its desirability, would be impossible in the case illustrated without interfering with the location and operation of the turn-table. I therefore furthermore brace frame H at the corners by metallic corner blocks or plates H^2 and provide the blocks or plates H^2, that brace said frame at its upper corners, with pockets h^2 for the reception of the feet of the A-frame or mast F. (See Fig. 3.)

I designates the hoisting chain or cable, (see Fig. 1,) that is fastened at one end at I' to the boom at or near the apex of the latter, thence leads downwardly to and over a sheave I^2, suitably supported from the shovel-bail E', thence leads upwardly to and over a sheave I^3, (see Fig. 2,) supported from and centrally between the two timbers or beams D D of the boom, thence leads downwardly and rearwardly along and centrally of the boom to and over a vertically-arranged sheave I^4, (see Fig. 4,) suitably supported from the boom forward of the axis of the turn-table, thence leads downwardly through the hollow box or bearing C to and in under a vertical sheave I^5, suitably supported from car A and arranged just rearward of the turn-table's axis, and thence leads to and in under and operatively engages the winding-drum I^6, (see Fig. 2,) called the "hoisting-drum." The hoisting-drum is loosely mounted upon a suitably-driven shaft J, arranged transversely of and suitably supported from the machine's body portion, and a suitably-operated clutch I^7 controls operative connection between said drum and shaft.

It is obvious that the excavating-shovel is hoisted upon establishing operative connection between said shaft and drum and lowers by gravity when the cable is free to be paid out by the drum upon interrupting operative connection between the drum and shaft.

The machine illustrated is what is known in the trade as a "back-acting" machine; that is, the machine's excavating-shovel during its excavating stroke moves rearwardly or excavates in the direction of the car or body portion of the machine, and consequently the shovel-arm extends between members D' D' of the outer portion of the boom and rests or has bearing, preferably, upon any suitable number of rollers K' of a saddle or frame K, capable of swinging vertically and longitudinally of the boom and extending through a longitudinal slot *e'* in the shovel-arm. Saddle or frame K at its upper end has bearing upon a pin K^2, supported from the boom. Frame K is provided, preferably, with two pairs of rollers K'. The pairs of rollers are arranged a suitable distance apart, (see Fig. 1,) and the rollers of each pair of rollers afford bearing for the different timbers or bars, respectively, of the shovel-arm. (See Fig. 6.)

L and M designate the two shovel-feed chains, respectively. Chain L is instrumental in effecting the excavating stroke of the shovel and is suitably secured at one end to and at or near the free end of a shovel-arm at L' (see Figs. 1 and 2) and thence leads inwardly along the shovel-arm to and in under a vertically-arranged sheave L^2, suitably supported from the outer end of the boom and mounted upon pin K^2 at one side of frame K. Shovel-feed chain M is instrumental in effecting the shovel's return stroke after excavating and is fastened at one end to and at or near the load-bearing end of the shovel-arm (see Fig. 2) and thence leads along said arm in the direction of the arm's free end to and over a vertically-arranged sheave M^2, suitably supported from the outer end of the boom and mounted upon pin K^2 at the other side of frame K. The axes of sheaves L^2 and M^2 and saddle or frame K are therefore coincident. From sheaves L^2 M^2 chains or cables L and M lead upwardly and inwardly and side by side, but a suitable distance apart, to and over two different sheaves L^3 M^3, respectively, located at or near the apex of, and supported from, the boom. Sheaves L^3 and M^3 and the hoisting-cable-engaging sheave I^3 have their axes coincident, and sheaves L^3 and M^3 are located, preferably, at opposite sides, respectively, of sheave I^3. From sheaves L^3 and M^3 the shovel-feed chains or cables lead at opposite sides, respectively, of the hoisting-cable downwardly and rearwardly between and along members D D of the boom to and over two different sheaves L^4 and M^4, respectively, suitably supported from the lower and inner end of the boom and forward of the turn-table's axis.

Sheaves L^4 and M^4 and sheave I^4 have their axes coincident, and said sheaves L^4 and M^4 are arranged, preferably, parallel with and at opposite sides, respectively, of sheave I^4. From sheaves L^4 and M^4 the shovel-feed chains lead downwardly through the hollow bearing of the turn-table, preferably at opposite sides, respectively, of and parallel with the hoisting chain or cable to and over two different vertically-arranged sheaves L^5 and M^5, respectively, that are supported from the machine's body portion. Sheaves L^5 and M^5 have their axes coincident with the hoisting-cable-engaging sheave I^5 and are arranged at opposite sides, respectively, of said sheave I^5. From sheaves L^5 and M^5 shovel-feed chains L and M lead rearwardly to and in under two different winding-drums L^6 and M^6, respectively, mounted upon a suitably-driven shaft N, that is arranged transversely of and suitably supported from the machine's body por-

tion and is preferably operatively connected in any approved manner with shaft J. A suitably-operated clutch *n* is provided for each drum L^6 and M^6 for controlling operative connection between the respective drum and the drum-supporting shaft. It will therefore be observed that shovel-feed chain L or shovel-feed chain M is wound upon the engaging drum, according as drum L^6 or drum M^6 is operatively connected with their supporting-shaft, and that the excavating-shovel is fed in the direction required to excavate or is returned after excavation, according as chain L or chain M is wound upon the engaging drum.

I would also remark that the upper portion of frame H and the body portion of the excavator at a point below said frame should be braced laterally and externally during the operation of the machine, and two braces for the purpose indicated are provided at opposite sides, respectively, of the excavator and respectively comprise, preferably, the following elements: a horizontally-arranged or approximately horizontally-arranged bar or beam O, (see Fig. 3,) secured at its inner end to the body portion of the machine below frame H and projecting outwardly from and laterally of the machine and secured at its outer end, preferably by means of a metallic cap P, to the lower and outer end of the diagonally-arranged bar Q, that at its upper and inner end is suitably secured to the adjacent upper corner-brace of frame H. Cap P consists, preferably, of a casting provided with two pockets P′ and P^2, engaged by the connected ends of members O and Q, respectively, and is furthermore provided with two upright cylinders P^3 P^4 integral with said casting. Cylinders P^3 and P^4 are preferably arranged in line vertically and have a head P^5 (see Fig. 5) in common at their meeting ends and are open at their opposite ends. The upper cylinder P^4 is diametrically smaller than the lower cylinder P^3. The cylinder P^3 is engaged internally by a piston or plunger R, that at its lower end engages and is adapted to bear upon the base or foot R′ of the brace. The upper cylinder P^4 is engaged internally by a piston or plunger S, that at its upper end engages the under side of a cap-plate or head S′, that rests upon said plunger and is operatively connected with the base or foot of the brace in any approved manner, so that said foot or base shall be elevated or lowered, according as the actuating fluid is admitted into the lower end of the upper cylinder below piston or plunger S or is conducted into the upper end of the lower cylinder above plunger or piston R. The connection of head S′ with the base or foot of the brace consists, preferably, of two upright rods *r r*, arranged at opposite sides, respectively, of the cylinders and suitably secured to the head and foot.

T and U designate the two pipes for supplying the fluid under pressure to cylinders P^3 and P^4, respectively. Pipe T communicates with the upper end of cylinder P^3 and pipe U communicates with the lower end of cylinder P^4, and both of said pipes lead from the compressed-fluid reservoir W, supported at any suitable point from the machine's body portion. Each pipe T and U (see Fig. 2) is provided with a valve V for controlling the supply of fluid from reservoir W, and a valved branch pipe X′ leads from each pipe T and U to the exhaust-tank X, located, preferably, in suitable proximity to the supply-reservoir. Fluid passes into the one or the other cylinder of the brace according as the valve of the supply-pipe leading to the one or the other of said cylinders is opened. The valve X^2 in the exhaust-pipe X′, connected with the operating supply-pipe, is of course kept closed during the supply of fluid to the brace's cylinder connected with said supply-pipe, but is opened preparatory to the exhaustion of said cylinder during the supply of fluid to the other cylinder.

The operation of my improved brace will be readily understood without further description.

The apparatus employed for actuating the turn-table is the same as heretofore and comprises two chains or cables *b b*, (see Fig. 2,) suitably attached to the table at opposite sides, respectively, of the boom, and thence leading rearwardly to and operatively engage different winding-drums *b′*, loosely mounted upon shaft J, and a clutch b^2 is provided for each of said drums for controlling operative connection between the respective drum and the shaft, and it is obvious that the table is turned in the one direction or the other according as the one or the other of said winding-drums is operatively connected with the shaft.

What I claim is—

1. The combination of the suitably-supported and suitably-actuated horizontally-arranged turn-table; the A-shaped boom operatively connected with said table; excavating-shovel and its arm; the suitably-actuated hoisting chain or cable operatively connected with the shovel; a bearing at the outer end of the boom for the shovel-arm; the shovel-feed chain or cable L attached to and at or near the free end of the shovel-arm; the shovel-feed chain or cable M attached to said arm nearer the load-bearing end of the arm; the sheaves L^2 M^2, L^3 M^3, L^4 M^4, and L^5 and M^5, and the two suitably-actuated winding-drums L^6 and M^6, all arranged and operating substantially as shown, for the purpose specified.

2. The combination of the boom; the hollow box or trunnion forming the lower pivotal center of the boom; the three vertical sheaves I^4, L^4 and M^4 suitably supported above and arranged just forward of said center; the three suitably-supported vertically-arranged sheaves I^5, L^5 and M^5 below and arranged just rearward of said center; the excavating-shovel; the suitably-actuated hoisting chain or cable operatively connected with the shovel

and thence suitably guided to and over the aforesaid sheave I^4 and thence to and in under sheave I^5, and the suitably guided and actuated chains or cables L and M for feeding the shovel in opposite directions, respectively, and passing over the aforesaid sheaves L^4 and M^4, respectively, and under the aforesaid sheaves L^5 and M^5, respectively, substantially as set forth.

3. A machine of the character indicated, comprising a suitably-supported and suitably-actuated horizontally-arranged turn-table; the vertically-perforated box or bearing C for said table; the boom operatively connected with the turn-table; the excavating-shovel; the hoisting-cable; the hoisting-cable-engaging sheaves I^3, I^4 and I^5; the two shovel-feed cables L and M, and the sheaves L^2, M^2, L^3, M^3, L^4, M^4, and L^5, M^5, all arranged and operating substantially as shown, for the purpose specified.

4. A machine of the character indicated, comprising an A-shaped boom capable of being swung laterally; the centrally and vertically perforated box or bearing C forming the boom's lower pivotal center; the armed excavating-shovel arranged to excavate in the direction of the inner end of the boom; a vertically-swinging saddle or frame K bearing the shovel-arm and suitably supported from the boom; the two sheaves L^2 and M^2 suitably supported from the outer end of the boom; the three sheaves I^3, L^3 and M^3 suitably supported from, and at or near the apex of, the boom; the three sheaves I^4, L^4 and M^4 suitably supported above and forward of and in close proximity to the aforesaid center; the three sheaves I^5, L^5 and M^5 suitably supported below and rearward of and in close proximity to said center; the suitably-operated hoisting-cable, and the two suitably-applied and suitably-operated chains or cables L and M for feeding the shovel in opposite directions, respectively, all arranged and operating substantially as shown, for the purpose specified.

5. The combination with the body portion or stationary part of the machine, of an external brace comprising a frame projecting laterally of and suitably connected to the machine's stationary part or body portion, an upper hollow cylinder and a lower hollow cylinder connected with the outer end of said frame, the base or foot, a piston or plunger extending into the lower cylinder from below and arranged to bear upon said foot or base, a piston or plunger extending into the upper cylinder from above, a cap-plate or head resting upon the upper plunger or piston, a suitable connection between the head and base or foot, a passage-way for conducting fluid under pressure into the lower end of the upper cylinder, and another passage-way for conducting fluid under pressure into the upper end of the lower cylinder, substantially as set forth.

6. The combination with the body portion or stationary part of the machine, of an external brace comprising a frame extending laterally of, and suitably connected with, the stationary part or body portion of the machine, an upper upright hollow cylinder closed at its lower end, and a lower upright hollow cylinder closed at its upper end, and both cylinders being rigid with the outer end of said frame, a piston or plunger extending into the upper cylinder from above, a cap-plate or head resting upon said plunger or piston, a piston or plunger extending into the lower cylinder from below, the foot or base arranged below and in position to be borne upon by the lower plunger or piston, and operatively connected with the aforesaid head, a compressed-fluid reservoir supported from the machine's body portion, a suitably-valved supply-pipe connecting said reservoir with the lower end of the upper cylinder, and another suitable valved supply-pipe connecting said reservoir with the upper end of the lower cylinder, an exhaust-tank, and two valved pipes connecting the different supply-pipes, respectively, with the exhaust-tank, substantially as set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 21st day of February, 1896.

GEORGE W. KING.

Witnesses:
FRANK A. HUBER,
S. C. BOWEN.