No. 607,468. Patented July 19, 1898.

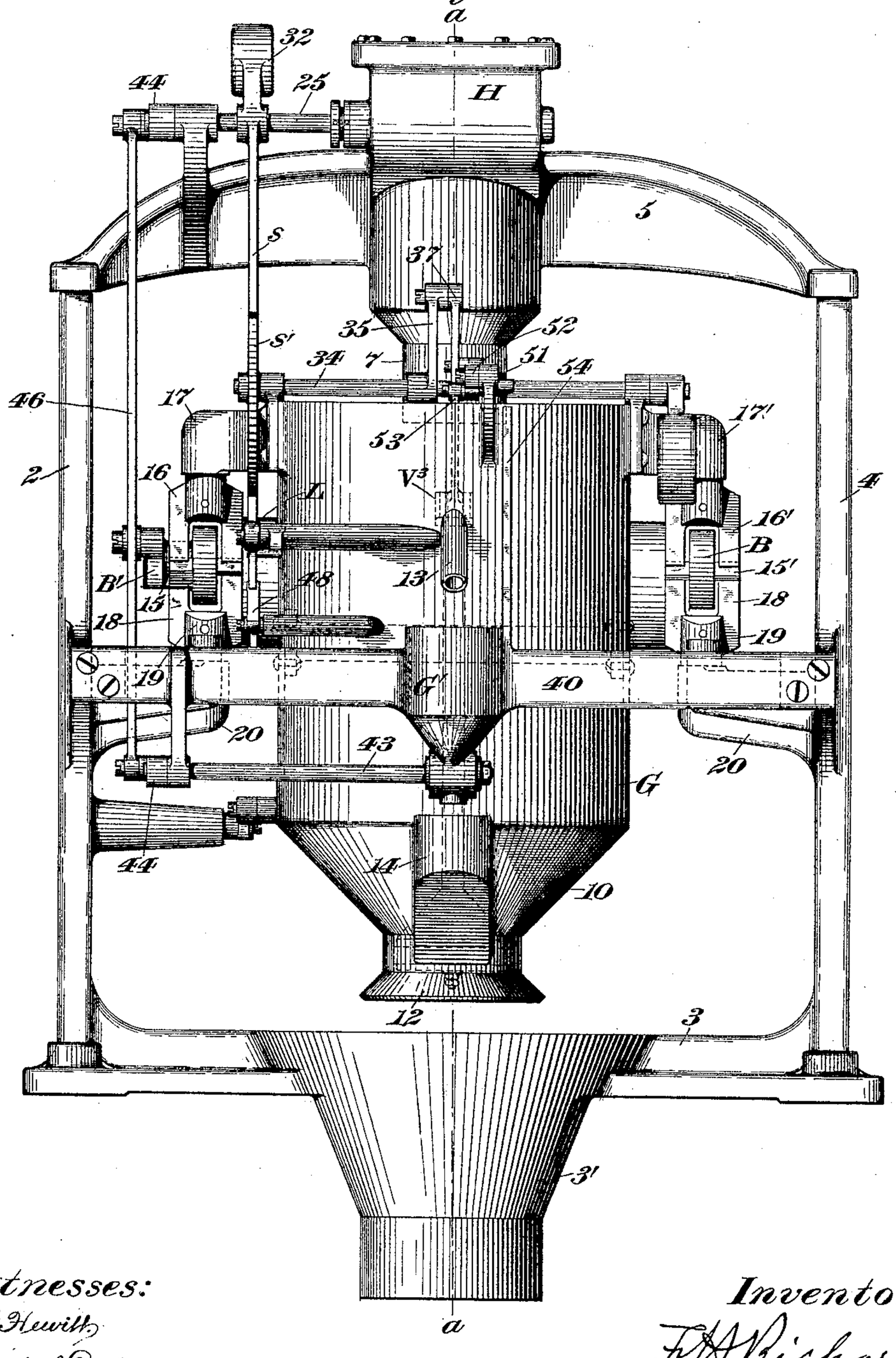
F. H. RICHARDS.

AUTOMATIC WEIGHING MACHINE.

(Application filed Nov. 17, 1897.)

(No Model.) 8 Sheets—Sheet 1.

Fig. 1.



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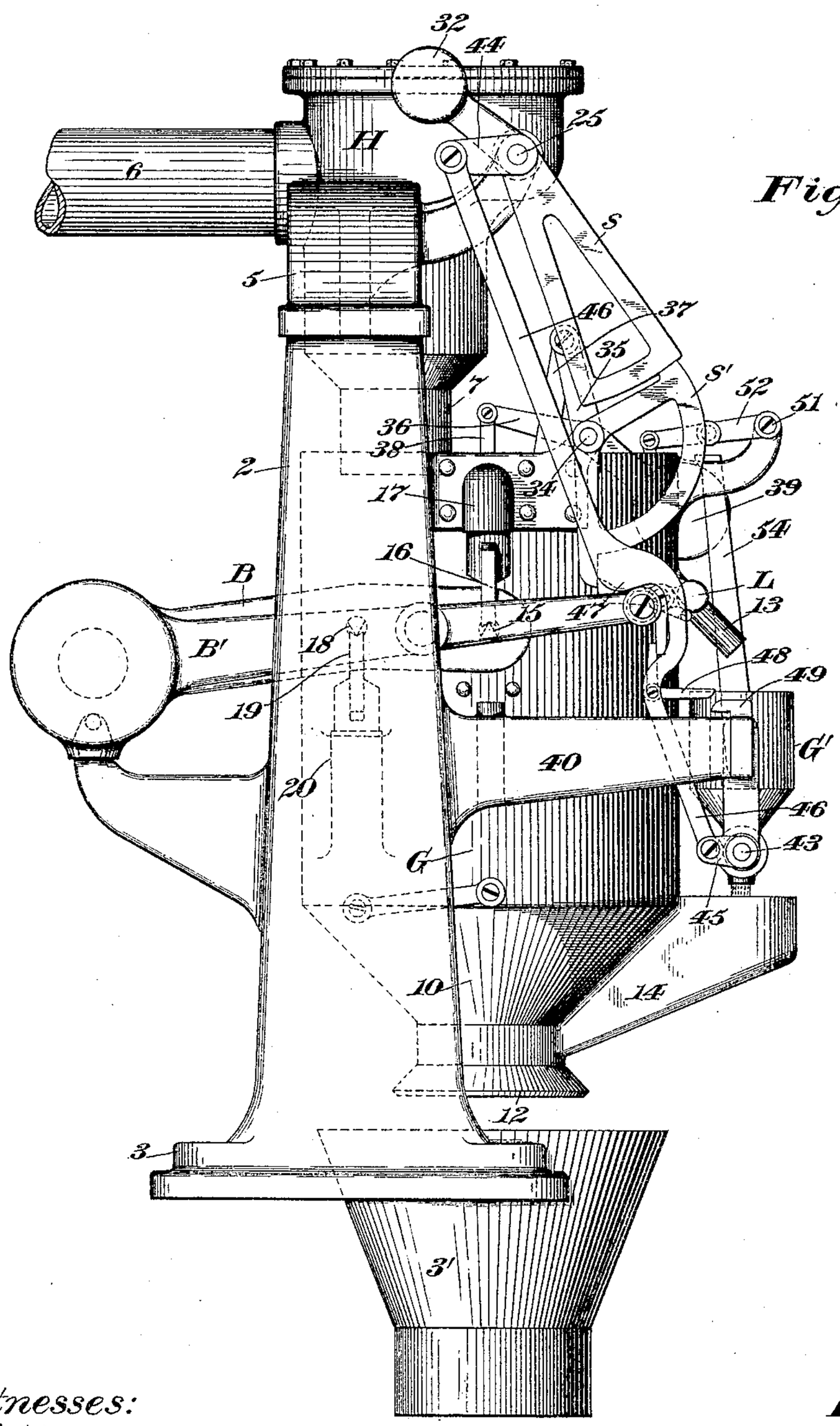
(No Model.) 8 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 8 Sheets—Sheet 3.

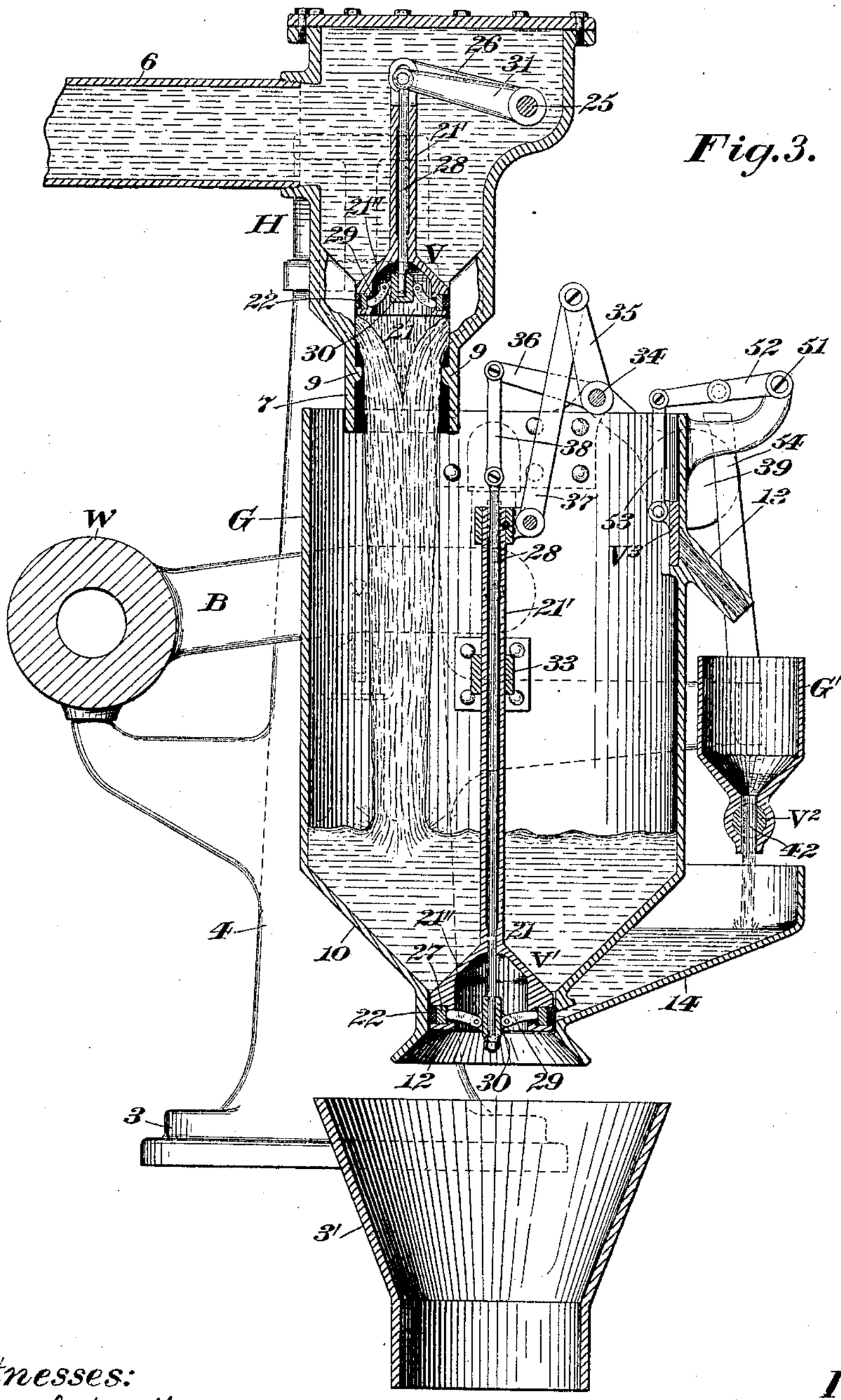

Fig. 3.

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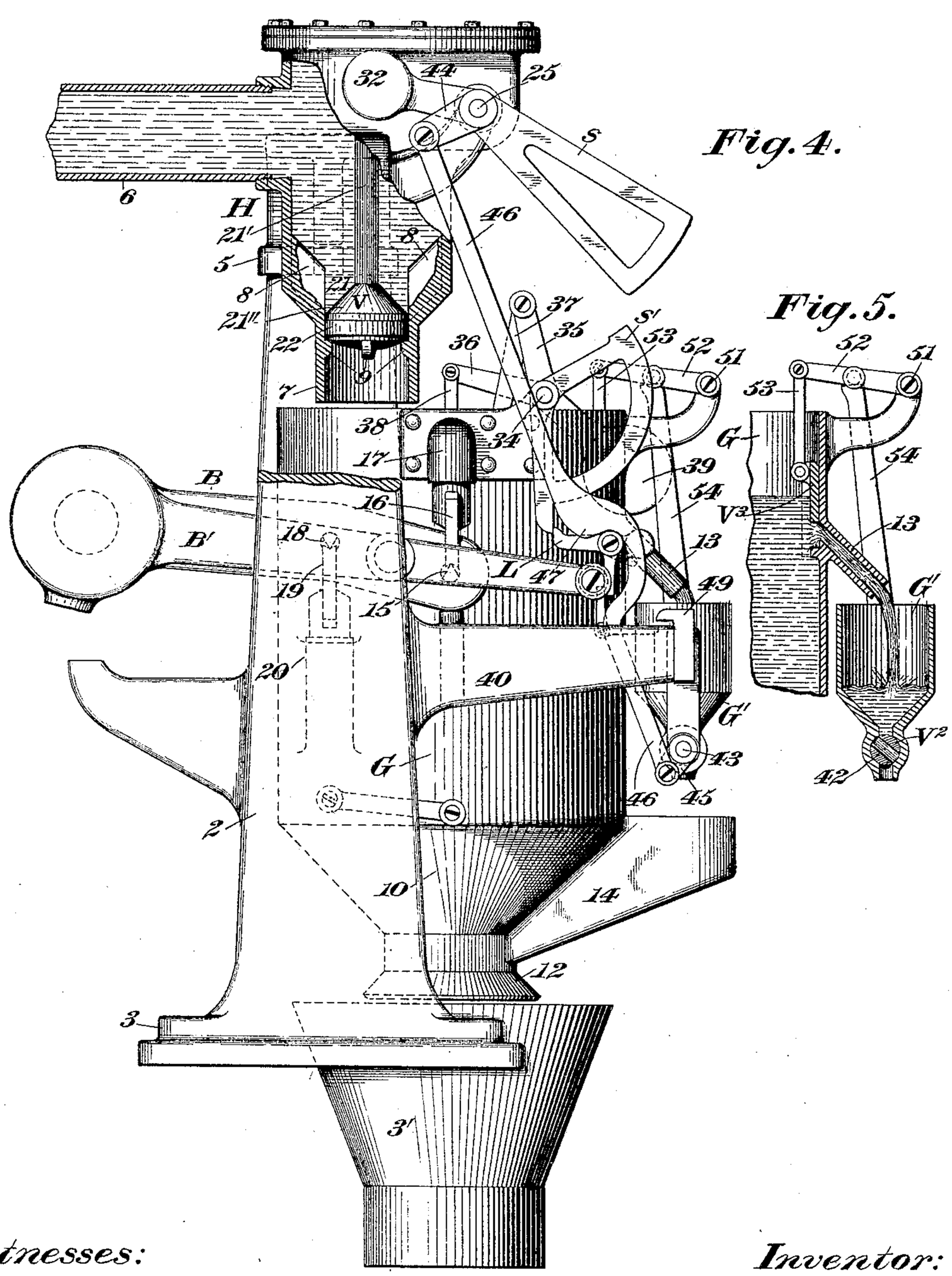
(No Model.) 8 Sheets—Sheet 4.



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(Application filed Nov. 17, 1897.)

(No Model.) 8 Sheets—Sheet 5.

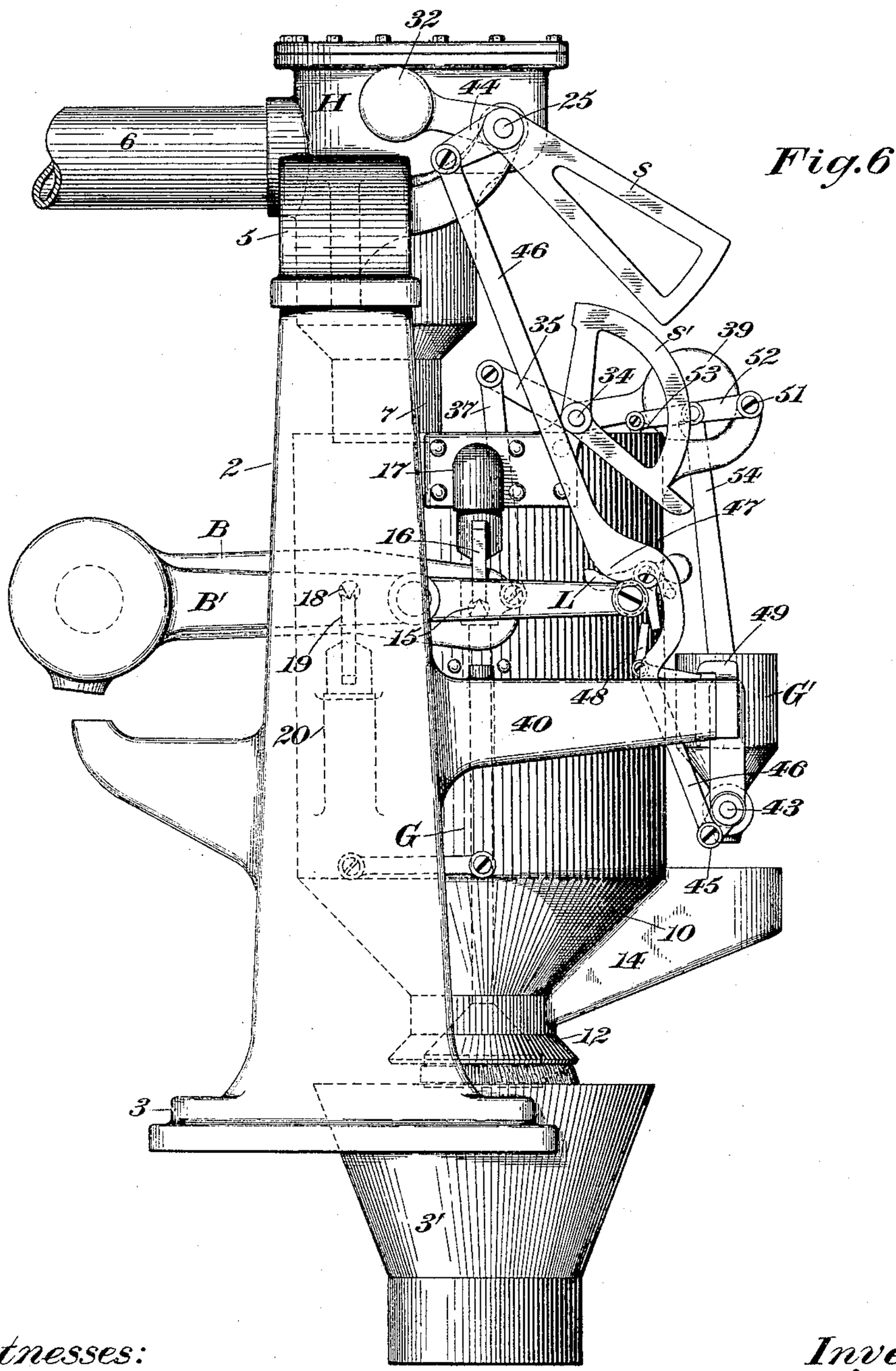

Fig. 6

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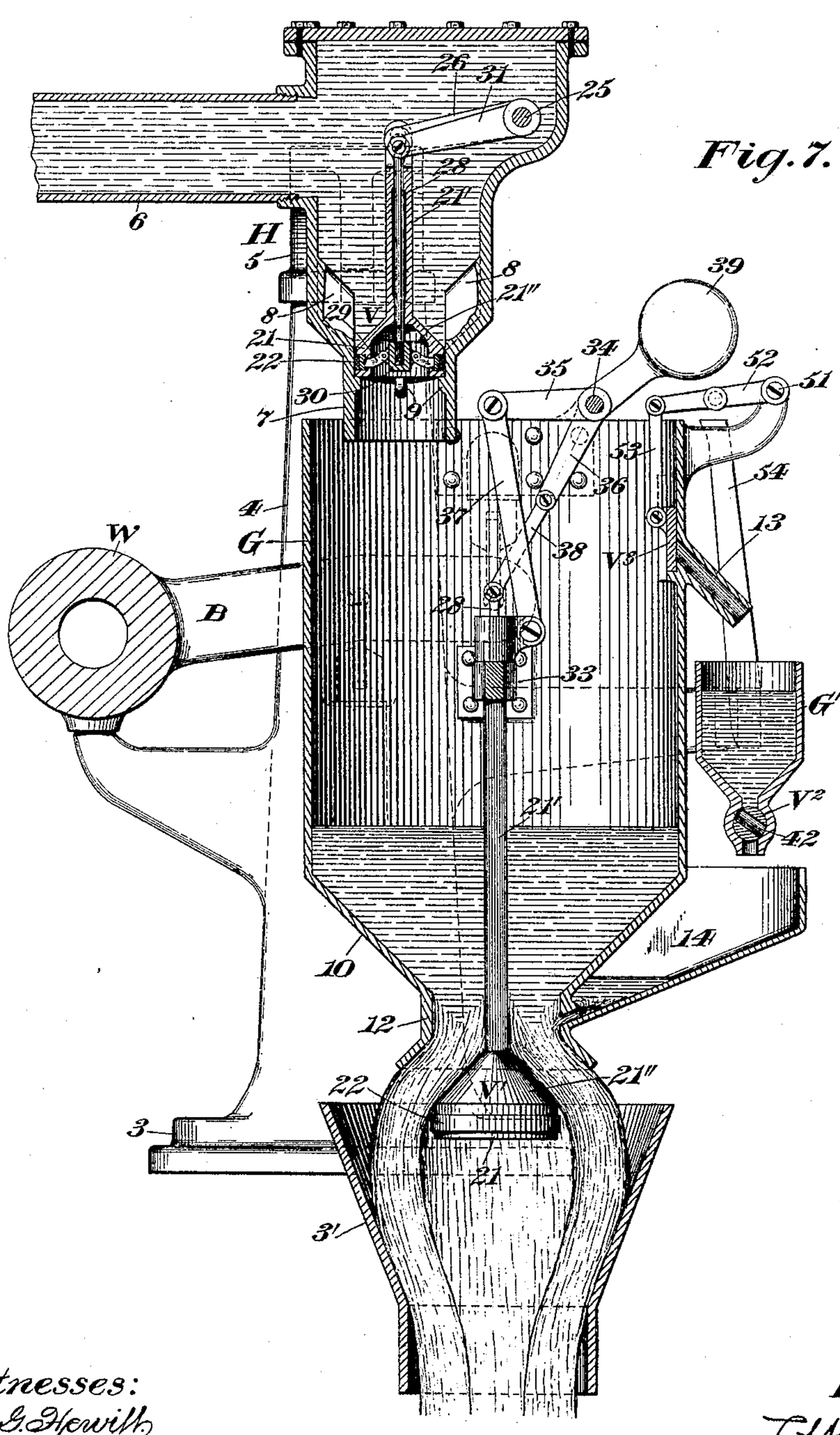
(Application filed Nov. 17, 1897.)

(No Model.) 8 Sheets—Sheet 6.

Fig. 7.



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(No Model.) 8 Sheets—Sheet 7.

Fig. 9.

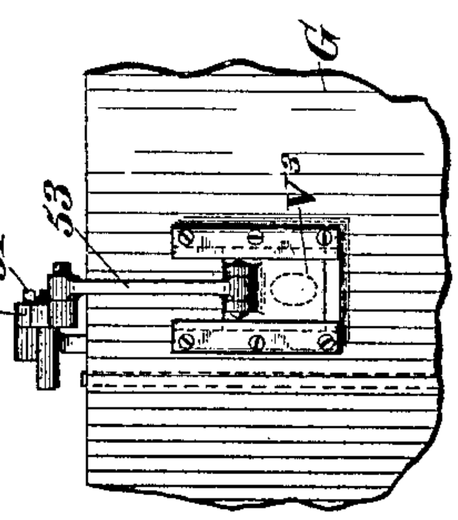


Fig. 10.

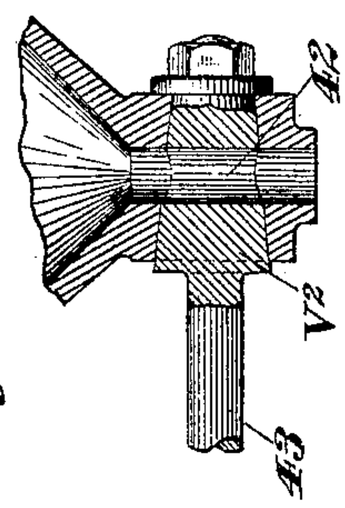
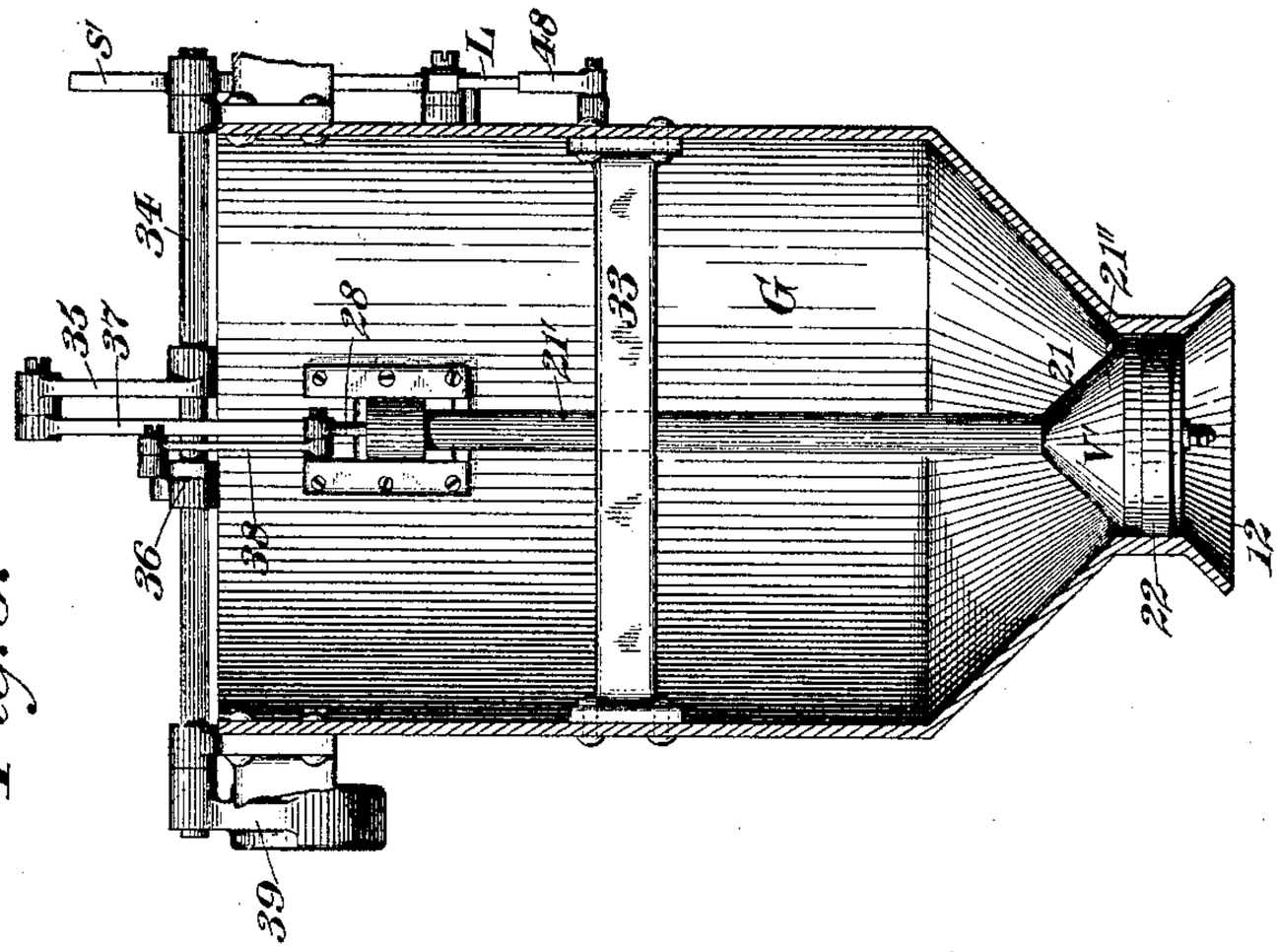


Fig. 8.



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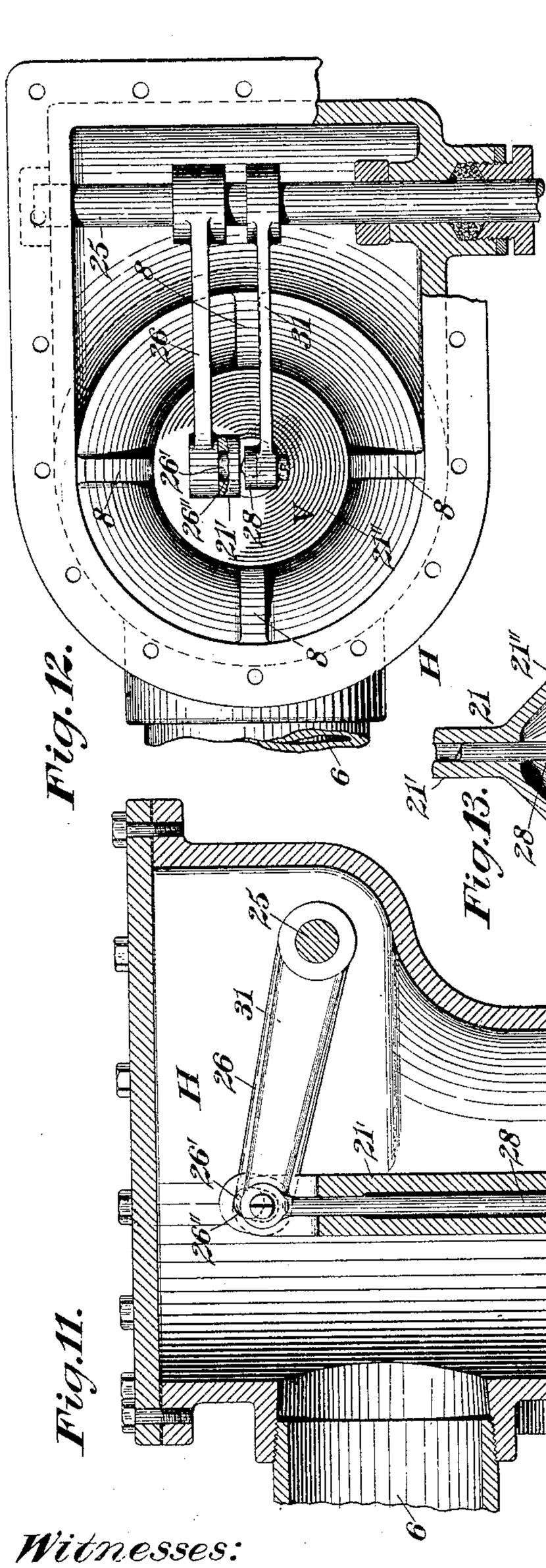

Fig. 12.

Fig. 11.

Fig. 16.

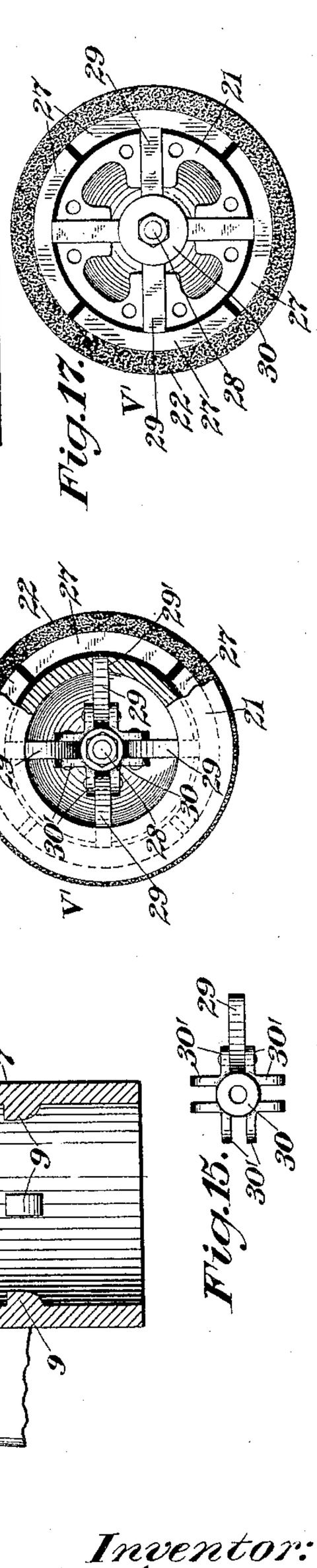

Fig. 17.

Fig. 13.

Fig. 14.

Fig. 15.

Witnesses:

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Fred. J. Dole.

Inventor:

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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

AUTOMATIC WEIGHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 607,468, dated July 19, 1898.

Application filed November 17, 1897. Serial No. 658,848. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, 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 Automatic Weighing-Machines, of which the following is a specification.

This invention relates to automatic weighing-machines, one object of the invention being to furnish an improved weighing-machine especially adapted for automatically weighing and delivering predetermined loads of freely-running fluids—such as sugar-syrup, coal-oil, benzene, &c.—and comprehending overload-supplying and load reducing and resupplying means constructed, organized, and operative whereby large loads of accurate predetermined weights may be made up and weighed by first delivering into the load-receiver an overload somewhat in excess of the proper amount to be weighed, then reducing the weight of the overload by discharging or removing the excess or surplus, and subsequently returning said surplus to form a portion of the next succeeding load.

A further object of the invention is to provide, in an automatic weighing-machine, two independent but coöperative valve mechanisms for controlling the supply of material to the load-receiver and for controlling the discharged material therefrom, respectively, and each of which mechanisms includes an expansile valve and actuating instrumentalities controlled by the weighing mechanism for first effecting a closing movement of said valve and then expanding the same within the valve-chamber positively to prevent the accidental escape of material from said valve.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation of an automatic rising-poise weighing-machine embodying my present improvements. Fig. 2 is a side elevation of the weighing-machine as seen from the left in Fig. 1, the parts of the machine being shown in the positions they occupy when the load-receiver is in its normal load-receiving position and the supply-valve is in its open position, the load-discharge valve being in this position of the parts blocked against opening movement. Fig. 3 is a central vertical section of the weighing-machine, taken on a line corresponding with the dotted line *a a*, Fig. 1, and shows the parts at the right of said line and in positions corresponding to the positions of like parts shown in Fig. 2. Fig. 4 is a side elevation, partially in section, of the weighing-machine as seen from the left in Fig. 1, the parts thereof being shown in the positions they occupy when the load-receiver has descended below its poising-line and the load-reducing means is effective for discharging the surplus, the supply-valve being in its closed position and the load-reducing valve being in its open position. Fig. 5 is a central vertical section, similar to Fig. 3, of that portion of the machine including the load reducing and resupplying means and illustrates the operation of the load-reducing means. Fig. 6 is a side elevation, similar to Fig. 2, of the machine, showing the parts in the positions they occupy when the load-receiver is in its truly-poised position and is discharging the weighed load. Fig. 7 is a central vertical section, similar to Fig. 3, showing the supply-valve in its closed position and the load-discharging valve in its open position. Fig. 8 is a vertical cross-section of the load-receiver, showing the discharge-valve and its actuating mechanism in elevation. Fig. 9 is an interior detail view of a portion of the load-receiver, showing the load-reducing valve and a portion of its actuating device. Fig. 10 is a cross-sectional view, on a large scale, of a portion of the surplus-receiver, showing the plug-valve in connection therewith. Fig. 11 is an enlarged central vertical section of the supply-hopper and supply-valve, showing said valve in its elevated position. Fig. 12 is a plan view, partially in section, of the parts shown in Fig. 11. Fig. 13 is an enlarged central vertical section of a portion of the discharge-valve shown in Fig. 2. Fig. 14 is an under side view, partially in section, of the valve shown in Fig. 13. Fig. 15 is a plan view of one of the thrust members for the expanding ring of the valve and the carrier therefor. Fig. 16 is an enlarged central vertical section of a portion of a

slightly-modified form of the expansile valve, and Fig. 17 is an under side view of the same with the bottom plate removed.

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

My improvements being applicable to various types of automatic weighing-machines, it is distinctly to be understood that the invention is not confined to the particular form of weighing-machine illustrated in the accompanying drawings.

The framework for supporting the fixed and operative parts of the weighing-machine may be of any suitable general construction, and it is shown comprising two side frames or uprights 2 and 4, having a suitable base 3, which connects the lower ends of said frames and supports a conduit 3′, into which the successive loads may be discharged, said conduit being preferably formed integral with the base 3. The side frames 2 and 4 are shown connected at their upper ends by a top plate 5, which constitutes a support for the hopper or fluid-reservoir II, which may be cast integral therewith.

The fluid-reservoir or hopper II, which constitutes one element of the overload-supply means, is shown having at one side thereof a communicating supply-pipe 6 and is also shown having a vertically-disposed tubular discharge-conduit 7, which constitutes a chamber for the supply-valve, and said hopper also has a series of radially-disposed valve guides or wings 8, the inner ends of which terminate flush with the inner face of the valve-chamber, and supported for reciprocatory movements in the supply-hopper and between the inner ends of the radial guides is an expansile supply-valve, (designated in a general way by V,) the construction, organization, and operation of which will be hereinafter fully described.

For limiting the advancing or closing stroke of the valve V the valve-chamber preferably has upon the interior thereof a series of stop-abutments 9, preferably four in number, disposed equidistantly about the interior of the discharge-conduit 7, and which abutments, while constituting a support for the valve when in its closed position, allow a free discharge of the material between them when the valve is in its open position.

The bucket or load-receiver, which is designated in a general way by G, is shown of the "single-chambered" type, supported with its receiving end below and in position to receive material from the supply-hopper. Said load-receiver is shown cylindrical for a greater portion of its length and has a conical bottom portion 10, which terminates in a tubular discharge-conduit 12 of smaller diameter, which conduit has its extreme lower end flared, as shown in the accompanying drawings.

To facilitate the removal of the surplus from the load-receiver at one point in the length of said receiver and for resupplying the material to said receiver at another point in the length thereof, said receiver is furnished with two conduits 13 and 14, one of which, as 13, may be termed the "discharge-conduit" and constitutes one element of the load-reducing means, and the other of which, as 14, may be termed the "return-conduit" and constitutes one element of the resupply means. The discharge-conduit is shown tubular and communicates with the interior of the load-receiver near the upper end thereof, and the return-conduit 14 is shown somewhat in the nature of a hopper communicating with the valve-chamber 12 of the load-receiver.

For supporting the load-receiver any suitable type of beam mechanism may be employed, that shown in the drawings consisting of a scale-beam B of usual construction, including a pair of parallel beam-arms joined together at their outer ends by a tubular counterweight W, the said beam-arms being provided at their inner ends with knife-edges 15 and 15′, on which are supported knife-edge bearings 16 and 16′, secured to brackets 17 and 17′, fixed to opposite side walls, respectively, of the load-receiver, each beam-arm also having intermediate the poising and counterweighted ends thereof a knife-edge pivot 18, supported on a knife-edge bearing 19, carried by a bracket 20 on the side frame.

The closer for the load-receiver in the present instance is shown as a vertical reciprocatory expansile valve, (designated in a general way by V′,) which will for convenience be hereinafter referred to as the "discharge-valve."

The supply-valve for controlling the supply of material from the hopper or reservoir II to the load-receiver is shown consisting, essentially, of two valve members 21 and 22, one of which is carried by and is shiftable transversely of the plane of movement of the other. The member 21 of the valve consists of a tubular stem 21′, having at the lower end thereof a diametrically-enlarged axially-recessed valve body or head 21″, which is cylindrical and constitutes a housing for expanding devices hereinafter described. The other member 22, which constitutes the expansile member of the valve, is shown as a ring, which may be constructed of rubber or other flexible material, supported in a circumferential groove in the valve-body 21″ near the lower end thereof. This valve V is shown supported for reciprocatory movement in the supply-hopper discharge-conduit or valve-chamber 7 and is intended to be opened by an upward movement thereof against the pressure of the fluid contained in the supply hopper or reservoir and to be closed by a downward movement by its own gravity and the weight of material resting on the main body of the valve.

As a means for elevating the valve V, I have provided a valve-actuator, which, in the form thereof shown in the accompanying drawings,

comprises a rock-shaft 25, journaled in suitable bearings in the side walls of the hopper H and having one end thereof extended beyond one side wall, and a rocker-arm 26, fixed at one end to the rock-shaft and having a shiftable connection at its opposite end with the valve-stem 21′, and as a convenient means for expanding the valve member 22 concurrently with the arrival of said valve at its fully-closed position, to thereby produce a tight joint between the valve and valve-chamber and preclude the possibility of accidental escape of fluid from the supply-hopper through the discharge conduit or spout 7, I have provided in operative connection with the expansile ring 22 an expanding device which, in the preferred form thereof shown in Figs. 3, 11, and 12, comprises a radially-divided expanding ring 27, disposed within and bearing against the inner face of the expansile ring 22, an expander-rod or thrust-rod 28, extending through and supported for reciprocatory movement in the valve-stem 21′, a series of radially-disposed thrust members 29, extending through guideways 29′, formed in the side wall of the valve-body and bearing at their outer ends against the expanding-ring segments 27, and a thrust-member actuator 30, fixed to the lower end of the expanding-rod 28 and operable on one movement of said rod for imparting a ring-expanding movement to said thrust members 29.

In the construction and organization thereof shown in Figs. 3, 11, and 12 the thrust-member actuator is shown having radially-disposed arms 30′, to which the inner ends of the thrust members 29 are pivotally connected, whereas in Figs. 16 and 17 the thrust-member actuator is shown as a conical member or wedge, against which the inner ends of the thrust members bear and which on a movement of the expanding-rod forces the thrust members outward radially to expand the expanding ring 22.

I do not desire to limit myself to the particular construction and organization of valve nor to the particular construction and organization of expanding instrumentalities illustrated in the drawings, as these may be variously modified without departure from this invention.

As a convenient means for actuating the expanding device the rock-shaft 25 is shown furnished with a rocker-arm 31, which is fixedly connected at one end of said shaft and is pivotally secured at its opposite end to the upper end of the expander-rod 28, as shown most clearly in Fig. 11 of the drawings, and for the purpose of facilitating a retractive movement of the expanding device slightly in advance of the retractive movement of the valve V the rocker-arm 26 has at the inner end thereof a stud 26′, which extends into an elongated slot 26″ in the upper end of the valve-stem 21′, the slot being of sufficient length to permit the expander-rod to be elevated by the rocker-arm 31 a short distance before the crank-arm becomes effective for elevating the valve V.

By the construction and organization of valve and expanding instrumentalities hereinbefore described it will be seen that on the gravitative or closing movement of the valve the expanding device will remain in its ring-retracting position and be carried downward with the valve until said valve is arrested in its closing movement by the stop-abutments 9, after which a continued movement of the rocker-arm 31, in connection with the expander-rod 28, will impart a further descending movement to said rod and through the medium of the thrust members 29, in connection therewith, expand the ring 22, bringing the outer face thereof into tight engagement with the inner face of the discharge-conduit 7, as will be readily apparent by a comparison of Figs. 3 and 7 of the accompanying drawings.

The shaft 25 of the valve-actuator is furnished with a counterweighted arm 32 for normally exerting a downward stress upon the valve V and the expanding device.

The closer or discharge-valve V′ is shown substantially of the same general construction as the valve V, hereinbefore described, and therefore a detailed description of this valve is deemed unnecessary. This valve V′ is mounted for vertical reciprocatory movements in the discharge-conduit 12 on the load-receiver, the valve-stem thereof being supported near its upper end in a bearing 33 on a cross-piece secured to the load-receiver on the interior thereof. This valve, in contradistinction to the valve V, hereinbefore described, is opened on the descending movement thereof and is closed on the ascending movement thereof.

As a convenient means for actuating the valve V and its expanding device I have provided, in operative connection therewith, a valve-closing actuator, which, in the preferred form thereof shown most clearly in Figs. 1, 3, and 7 of the drawings, comprises a rock-shaft 34, journaled in bearings at the upper end of the load-receiver, two rocker-arms 35 and 36, fixed to said rock-shaft, and two links 37 and 38, one of which, as 37, is of greater length than the other and is pivotally connected at one end to the rocker-arm 35 and is pivotally connected at its opposite end to the valve-stem, and the other link 38 of which is pivotally connected at one end to the expander-rod of the valve V′ and is pivotally connected at its opposite end to the rocker-arm 36, said shaft 34 having a weighted arm 39 fixed thereto for normally exerting a valve-closing stress upon the actuator.

The construction and organization of the discharge-valve-closing actuator and its connections with the valve and expanding device thereof are such that an ascending or closing movement will be first imparted to the valve

and then the expansible ring will be expanded, and on the opening movement of said valve the expansion thereof will take place in advance of the descending or opening movement of said valve.

Fixedly supported on a suitable bracket 40 of the framework between the discharge-conduit 13 and the return-conduit 14 of said receiver is a surplus-receiver G′, which surplus-receiver is shown smaller than, but similar in general construction to, the load-receiver G. This surplus-receiver is shown having a transverse valve-seat in the discharge end thereof, in which is seated an oscillatory plug-valve V^2, having a duct 42 for facilitating the discharge of material from said receiver into the return-conduit 14, said receiver constituting another element of the resupplying means.

As a convenient means for simultaneously actuating the supply-valve V and the plug-valve V^2 and for controlling the operations of these valves by the weighing mechanism I have provided in connection with the shaft 25 of the supply-valve actuator and the shaft 43 of the plug-valve V^2 crank-arms 44 and 45, respectively, which arms are operatively connected by an actuator 46, said actuator being pivotally connected at its upper end to the crank-arm 44 and at its lower end to the crank-arm 45 and having intermediate the ends thereof an offset portion 47, constituting an abutment, which is disposed in the path of movement of a valve-actuating lever or auxiliary beam B′, carried by the beam B in the usual manner, the construction and organization of the actuator or actuating-connector 46 and the beam B′ being such that when the supply-valve is in its open position (shown in Fig. 3) and the load-receiver is in its elevated load-receiving position the offset portion 47 of the actuator 46 will rest upon the poising end of the counterweighted actuating-beam B′, and will, on the descending movement of the load-receiver, descend with the poising end of the beam, permitting the weighted lever of the supply-valve actuator to impart a closing movement to the supply-valve and simultaneously a closing movement to the plug-valve V^2 of the surplus-receiver G′.

As a means for blocking the opening movement of the supply-valve V when the discharge-valve V′ is in its open position and for also blocking the valve-opening movement of the beam B′, I have provided in operative connection with the supply-valve actuator and discharge-valve actuator two reciprocally-effective stop members *s* and *s′*, respectively, the one *s* of which is carried by the rock-shaft 25 and is located in position to engage the stop member *s′* when the supply-valve is closed and the discharge-valve is opened and is adapted to prevent an opening movement of said valve until the load in the load-receiver G is completely discharged and the discharge-valve has returned to its normal closed position, the stop member *s′* being carried by the rock-shaft 34 of the discharge-valve actuator.

As a means for normally locking the discharge-valve against opening movement I have provided a counterweighted latch L, which is pivotally supported on the load-receiver and normally engages a projection on the stop member *s′*, and as a convenient means for actuating the closer-latch at a predetermined point in the movement of the load-receiver to facilitate an opening movement of the discharge-valve I have provided a latch-tripper 48, pivotally supported on the load-receiver, and a latch-tripper actuator 49, fixed to a part of the framework of the machine in position for actuating the latch-tripper at a predetermined point in the ascending movement of the load-receiver. This latch-tripper 48 is shown as an angle-lever, one arm of which is in position to engage an arm on and trip the latch and the other arm of which is in position to strike the tripper-actuator 49 on the arrival of the load-receiver in its ascending movement at its truly-poised position.

As a convenient means for controlling the discharge of the surplus from the load-receiver I have provided a load-reducing valve V^3, (shown as a reciprocatory valve,) supported in a guideway 50 on the inner face of the front wall of the load-receiver and in juxtaposition to the entrant end of the surplus-discharge conduit 13, said valve being shiftable across and being adapted for covering the entrant end of said conduit. I have also provided, in connection with said valve V^3, an actuator operative at a predetermined point in the descending movement of the load-receiver for elevating the valve V^3 to allow the surplus material to flow through the conduit 13 into the surplus-receiver G′. This actuator is shown comprising a rock-shaft 51, supported in suitable bearings on brackets on the load-receiver, a crank-arm 52, fixed at its outer end to said rock-shaft, and a link 53, pivotally connected at its upper end to the inner end of said crank-arm 52 and pivotally connected at its lower end to the valve V^3. A valve-opening movement is imparted to the actuator of the valve V^3 by means of a fixture 54 on the framework, disposed in position to engage and lift said valve-actuator at a predetermined point in the descending movement of the load-receiver, said valve being preferably closed by gravity.

The discharge-valve V′ is so disposed within the load-receiver that when the load-receiver is in its closed position the expanding ring will cover the discharge-opening of the return-conduit 14.

Having described my invention, I claim—

1. The combination, with weighing mechanism including a reciprocatory load-receiver, of stream-supplying means including an expansile valve, and valve closing and expanding means automatically controlled by the weighing mechanism and effective at prede-

termined definite points in the movements of the load-receiver for first closing and then expanding said valve.

2. The combination, with weighing mechanism including a reciprocatory load-receiver, of a piston-valve embodying a divided expanding ring, and independent instrumentalities automatically controlled by the weighing mechanism and effective one for closing the valve at one point in the movement of the load-receiver, and the other for expanding the ring at another point in the movement of the load-receiver.

3. The combination, with weighing mechanism including a reciprocatory load-receiver having a discharge-valve and a discharge-valve-shutting actuator, of stream-supplying means embodying a reciprocatory valve having a diametrically-expansible ring; automatically-operable means controlled by the weighing mechanism for first closing the valve and then expanding the ring; and means operated by the closer, on the closing movement thereof, for controlling the contraction of the expanding ring and the opening movement of the valve.

4. The combination, with weighing mechanism including a reciprocatory load-receiver and with a supply-hopper having a valve-chamber, of an expansile piston-valve supported for reciprocatory movements in said chamber, and two successively-effective devices automatically operative at predetermined points in the reciprocatory movements of the load-receiver for first advancing and subsequently expanding, and next contracting and subsequently retracting, said valve.

5. The combination, with weighing mechanism including a reciprocatory load-receiver and with a supply-hopper, of two expansile valves in coöperative relation with, and effective for closing the outlets of, the hopper and receiver, respectively, and one of which is controlled in one of its movements by the other, and automatically-operative means controlled by the weighing mechanism at predetermined points in the movements thereof for effecting a closing and expanding movement of one valve and a contracting and opening movement of the other valve in successive order.

6. The combination, with weighing mechanism including a reciprocatory load-receiver and with a supply-hopper, of a piston-valve supported in said hopper and having a divided expanding ring for closing the outlet of said hopper; a counterweighted valve-advancing actuator including means for operating the valve and ring, one slightly in advance of the other; means operative at a predetermined point in the movement of the load-receiver for effecting a movement of said valve-advancing actuator; and a seat for arresting the advancing movement of said valve.

7. The combination, with weighing mechanism including beam mechanism, a load-receiver, and a supply-hopper, of an expansile valve comprising a carrier and an expanding device movable in relatively-transverse planes; means controlled by the weighing mechanism for operating the carrier and expanding device one in advance of the other, and comprising a rock-shaft journaled in the hopper and having two rocker-arms movably connected with the carrier and expanding device, respectively; and an actuator operatively connecting the rock-shaft and a member of the beam mechanism.

8. The combination, with weighing mechanism including a load-receiver, of overload-supplying means including a reciprocatory expansile valve; load-reducing means including a surplus-receiver having an oscillatory plug-valve; an actuator in direct connection with the expansile valve and plug-valve and operative, at a predetermined point in the movement of the weighing mechanism, for effecting opening and closing movements of said valves concurrently; and means effective, on the closure of the expansile valve, for expanding said valve.

9. The combination, with oscillatory beam mechanism and with a load-receiver supported thereon, of stream-supplying means including a valve; valve-reducing means in connection with the load-receiver; a surplus-receiver fixedly supported at one side the load-receiver in operative relation with the load-reducing means, and embodying a valve; and a valve-actuator directly connecting the two valves and having an offset portion disposed in the path of movement of one member of the beam mechanism, whereby the two valves will be operated concurrently.

10. A weighing-machine comprehending oscillatory beam mechanism; two receivers set side by side and one of which is carried by the beam mechanism and the other of which is fixedly supported; a vertically-reciprocatory expansile valve disposed to close the discharge-opening of one of said receivers; a plug-valve seated for oscillatory movement in the discharge end of the other receiver and having its axis in a horizontal plane; means controlled by the weighing mechanism and effective for first reciprocating the expansile valve and for expanding and contracting the same intermediate the closing and opening movements thereof; overload-supplying means including a supply-controlling valve; and means operatively connecting the supply-controlling valve and plug-valve, and effective, on the closing movement of the expansile valve, for imparting opening movements to the stream-controlling valve and plug-valve.

11. The combination, with weighing mechanism including a load-receiver having a discharge-opening and a supply-hopper having a discharge-opening, of two expansile piston-valves for closing the discharge-openings of the load-receiver and supply-hopper, respectively, and each comprising an axially-

recessed carrier and a radially-divided expanding ring; a flexible ring surrounding the expanding ring; an expander-rod extending through each carrier; a series of radially-disposed thrust members operatively connecting the lower end of each carrier and each divided expanding ring, and so disposed that on one movement of the expander-rod an expanding movement will be imparted to said expanding ring; independent valve-actuators controlled by the weighing mechanism and each including a rock-shaft having two rocker-arms in operative connection with the carrier and expander-rod, respectively, and effective for operating one in advance of the other; and interlocking instrumentalities between said actuators and effective for alternately blocking the valve-opening movements of each other alternately.

12. The combination, with weighing mechanism including a reciprocatory load-receiver, of overload-supplying means including a supply-hopper having a vertically-reciprocatory piston-valve adapted for closing the outlet of said hopper; load-reducing means including a fixedly-supported surplus-receiver having an oscillatory valve; a valve-actuator directly connecting said two valves and actuated by a member of the weighing mechanism at predetermined points in the movements of the load-receiver for imparting a reciprocatory movement to one valve and an oscillatory movement to the other valve concurrently.

13. The combination, with a supply-hopper having a vertically-disposed tubular valve-chamber and also having internal radially-disposed valve-guides, of a tubular valve supported between the inner ends of said guides for reciprocatory movement, and having a circumferential groove; an expansile ring seated in said groove; a radially-divided expanding ring bearing against the inner face of said expansile ring; an expander-rod supported for reciprocatory movement in the valve-stem; radially-disposed thrust members in operative connection with the expander-rod and expanding ring and effective, on the movements of the expander-rod, for actuating the expanding ring to expand or contract the expansile ring; and oscillatory actuating means in operative connection with the expander-rod and valve and effective for imparting to one a movement slightly in advance of the other.

14. The combination, with weighing mechanism including a load-receiver and with a supply-hopper having a vertically-disposed valve-chamber, of an axially-recessed cylindrical valve-body having a circumferentially-disposed ring-receiving groove and an axially-recessed stem; an expansile ring seated in said groove; a divided expanding ring in operative engagement with the inner face of the expansile ring; radially-disposed thrust-rods bearing at their outer ends against the inner face of the expanding ring; an expander or thrust rod supported for reciprocatory movement in the valve and embodying means for actuating the radial thrust members to expand, and permit the contraction of, the expansile ring; and means controlled by the weighing mechanism for effecting opening and closing movements of the valve, and for imparting reciprocatory movements to the expanding-rod.

15. The combination, with a load-receiver having a discharge-opening, of an axially-recessed cylindrical valve-body having a circumferential ring-receiving groove; an axially-recessed stem; a flexible ring seated in said circumferential groove; a divided expanding ring bearing against the inner face of the flexible ring; radially-disposed thrust members bearing at their outer ends against the inner face of the expanding ring; an expander-rod extending through, and supported for reciprocatory movement in, the valve-stem and embodying means for actuating the radial thrust members to force the parts of the expanding ring inward and outward to expand and contract the flexible ring; and means in connection with, and effective for imparting reciprocatory movements to, the valve and expander-rod, one slightly in advance of the other.

16. The combination, with weighing mechanism including a reciprocatory load-receiver having a discharge-opening and with a supply-hopper having a discharge-opening, of two expansile valves supported for reciprocatory movements in parallel planes and in operative relation, respectively, with the discharge ends of the load-receiver and supply-hopper; means controlled by the weighing mechanism for effecting opening and closing movements of the two valves in alternating order, and comprehending instrumentalities for expanding said valves on the closing movements thereof; a discharge-conduit and a return-conduit located the former above the latter and communicating with the interior of the load-receiver; a gravitative reciprocatory valve in operative relation with, and effective for closing the opening of, the discharge-chute; a surplus-receiver fixedly supported at one side of the load-receiver between the discharge and return conduits, and having an oscillatory plug-valve journaled therein; an actuating-connector between the plug-valve of the surplus-receiver and the expansile valve of the supply-hopper, and operable on the opening and closing movements of said hopper-valve for imparting simultaneously opening and closing movements to the surplus-receiver valve; and means controlled by the load-receiver, on its descending movement, for imparting an opening movement to the valve of the discharge-chute.

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Witnesses:
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