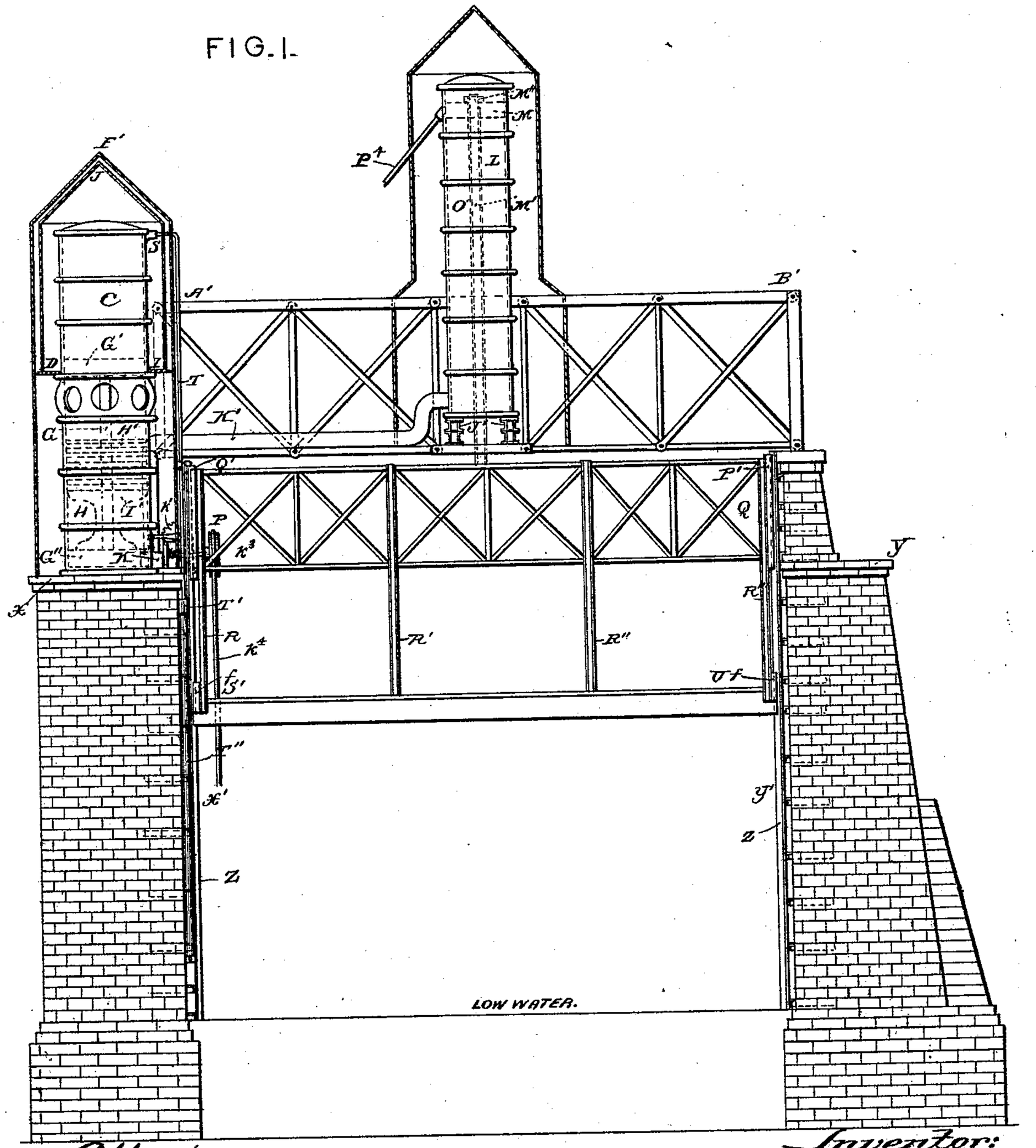
(No Model.) 9 Sheets—Sheet 1.

R. J. McCARTY

STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. 1.



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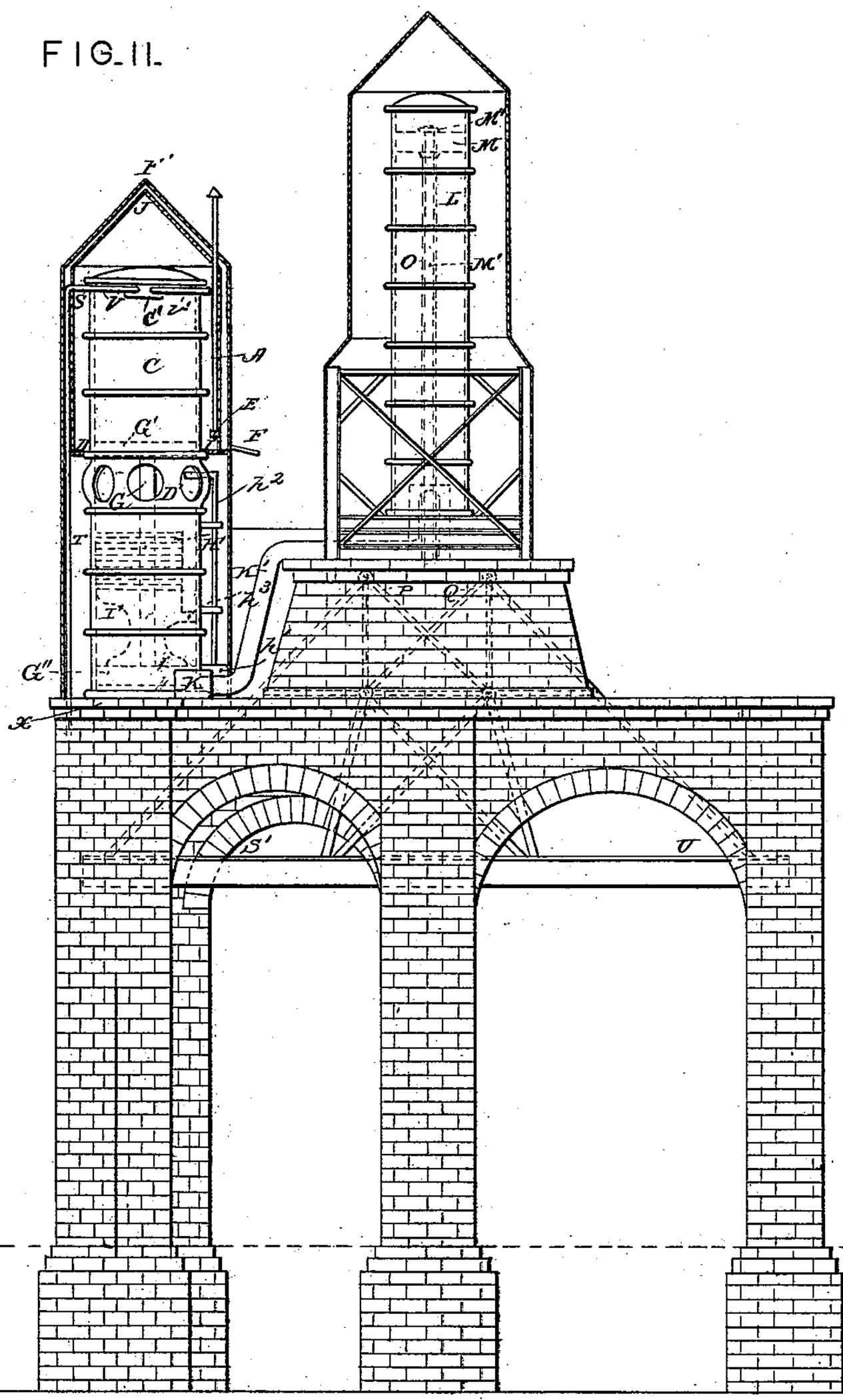
(No Model.) 9 Sheets—Sheet 2.

R. J. McCARTY.

STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. II.



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(No Model.) 9 Sheets—Sheet 3.

R. J. McCARTY.

STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

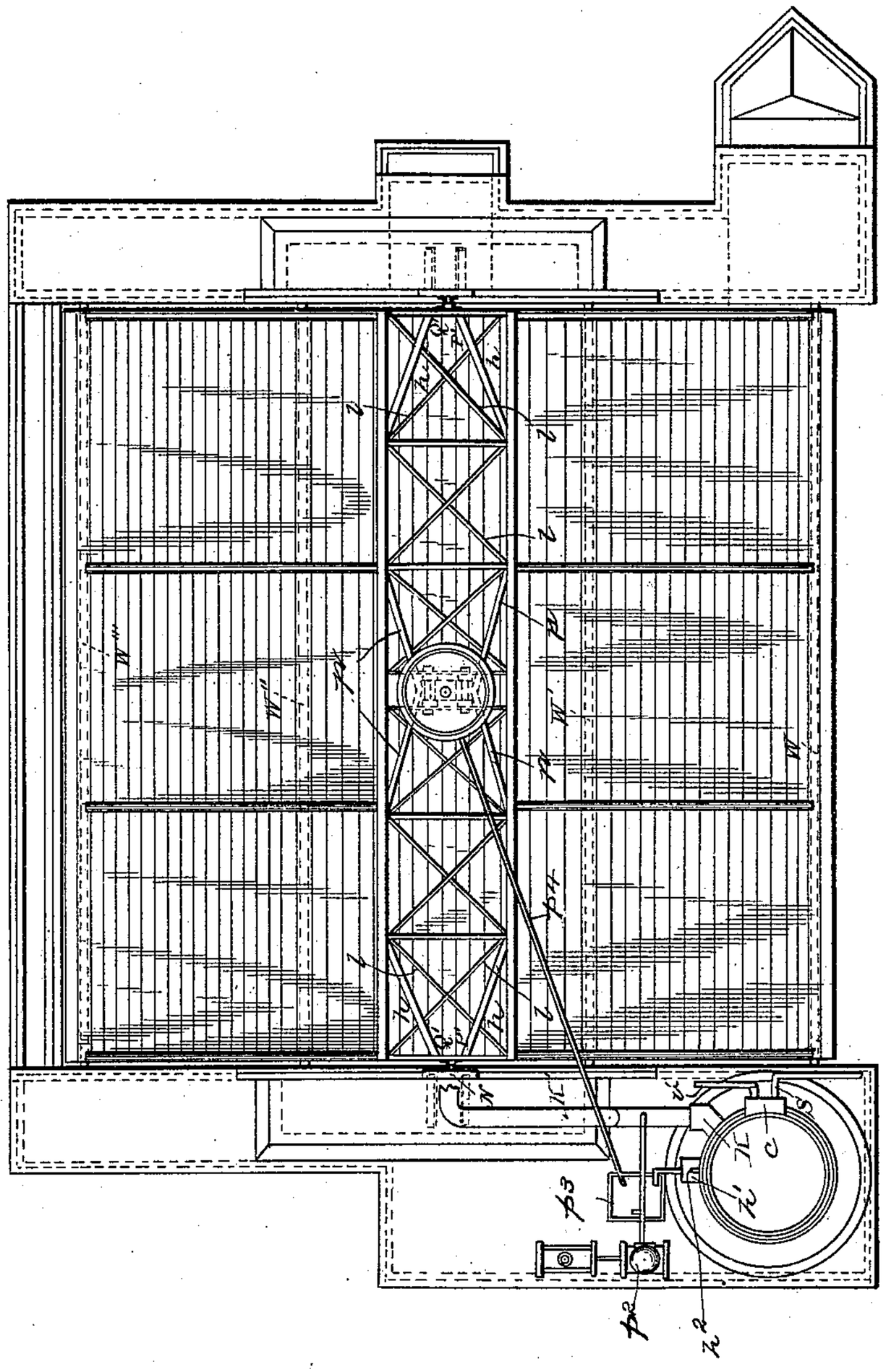

FIG. III.

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(No Model.) 9 Sheets—Sheet 4.

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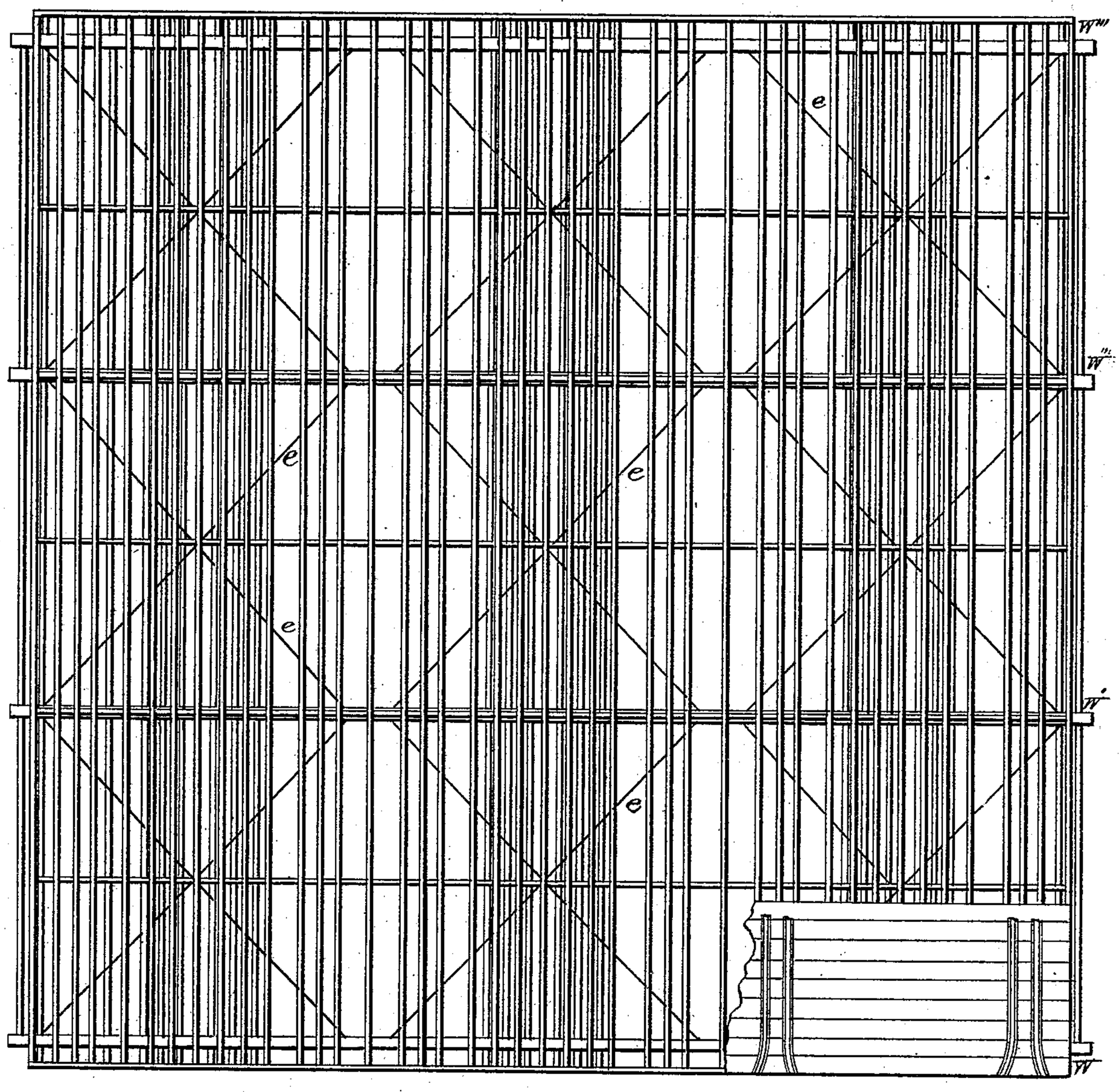
STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. IV.



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STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. V.

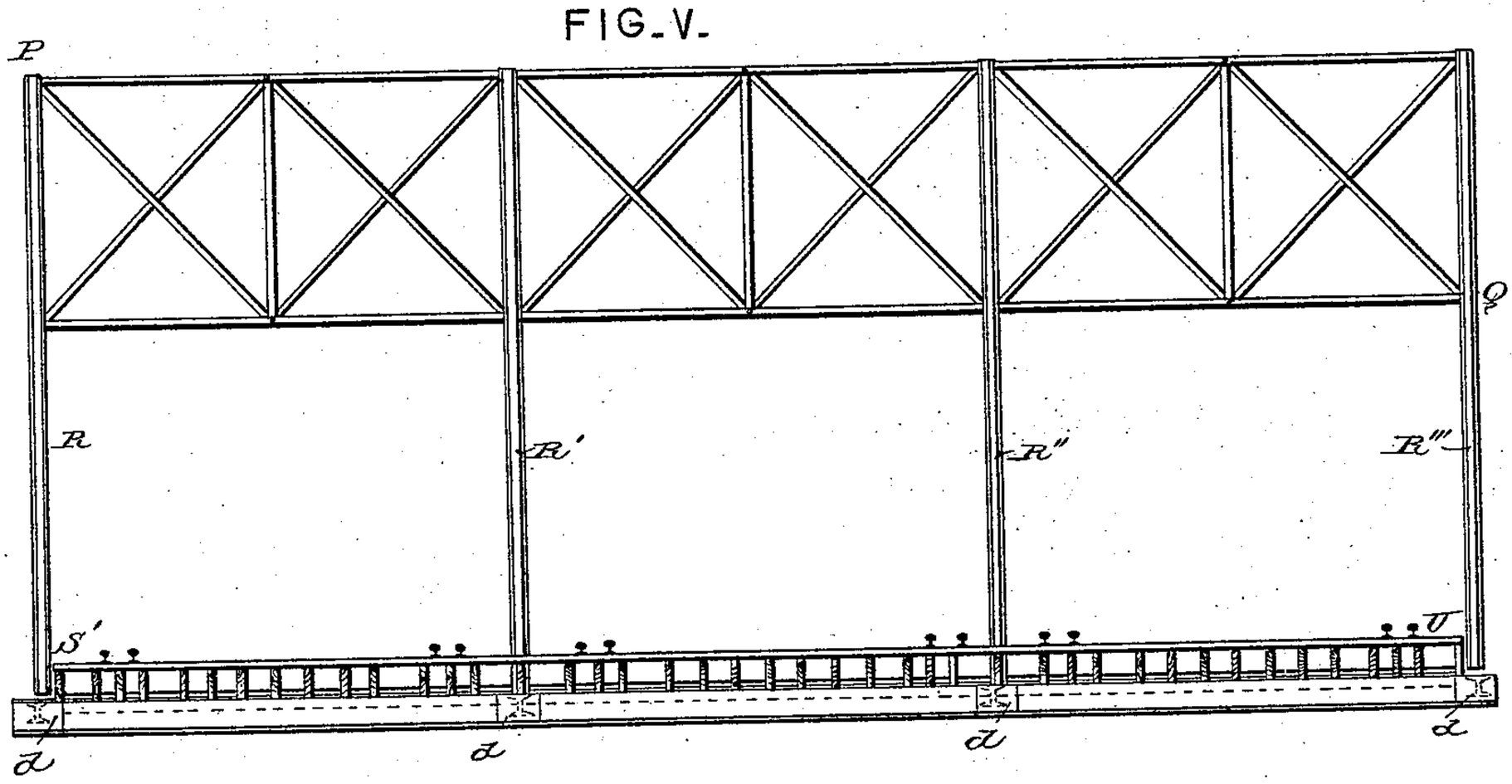
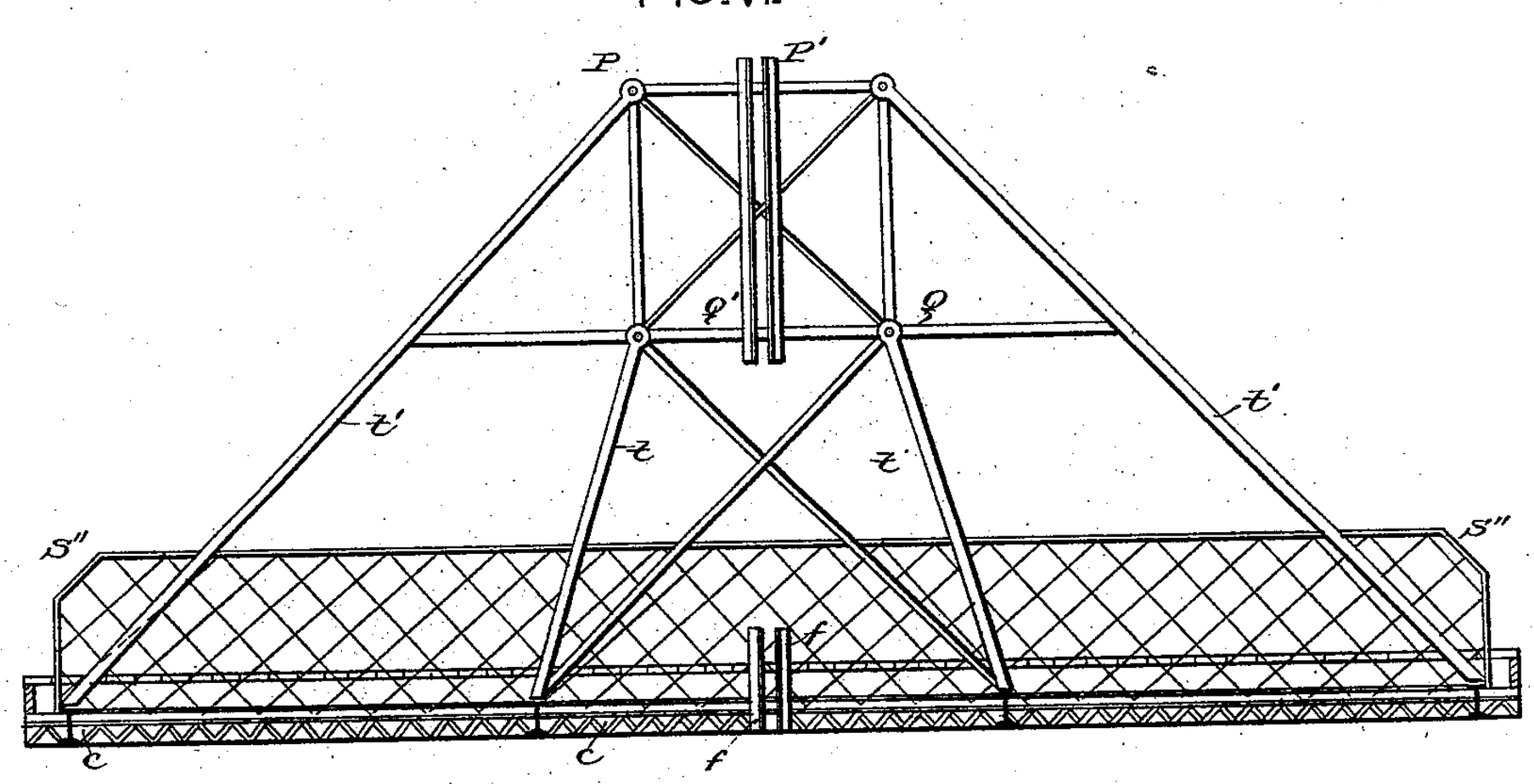


FIG. VI.



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R. J. McCARTY.

STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. VII.

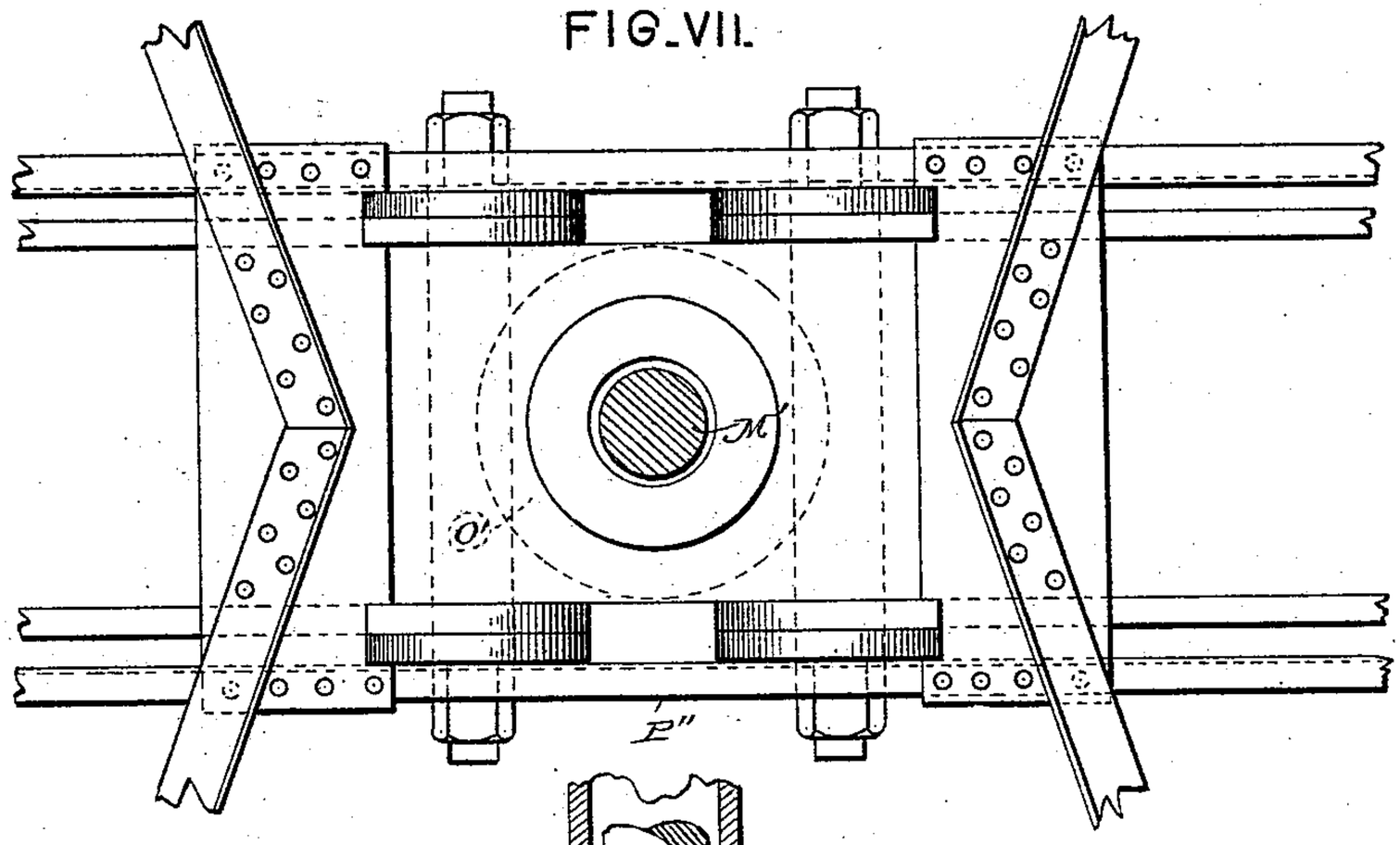
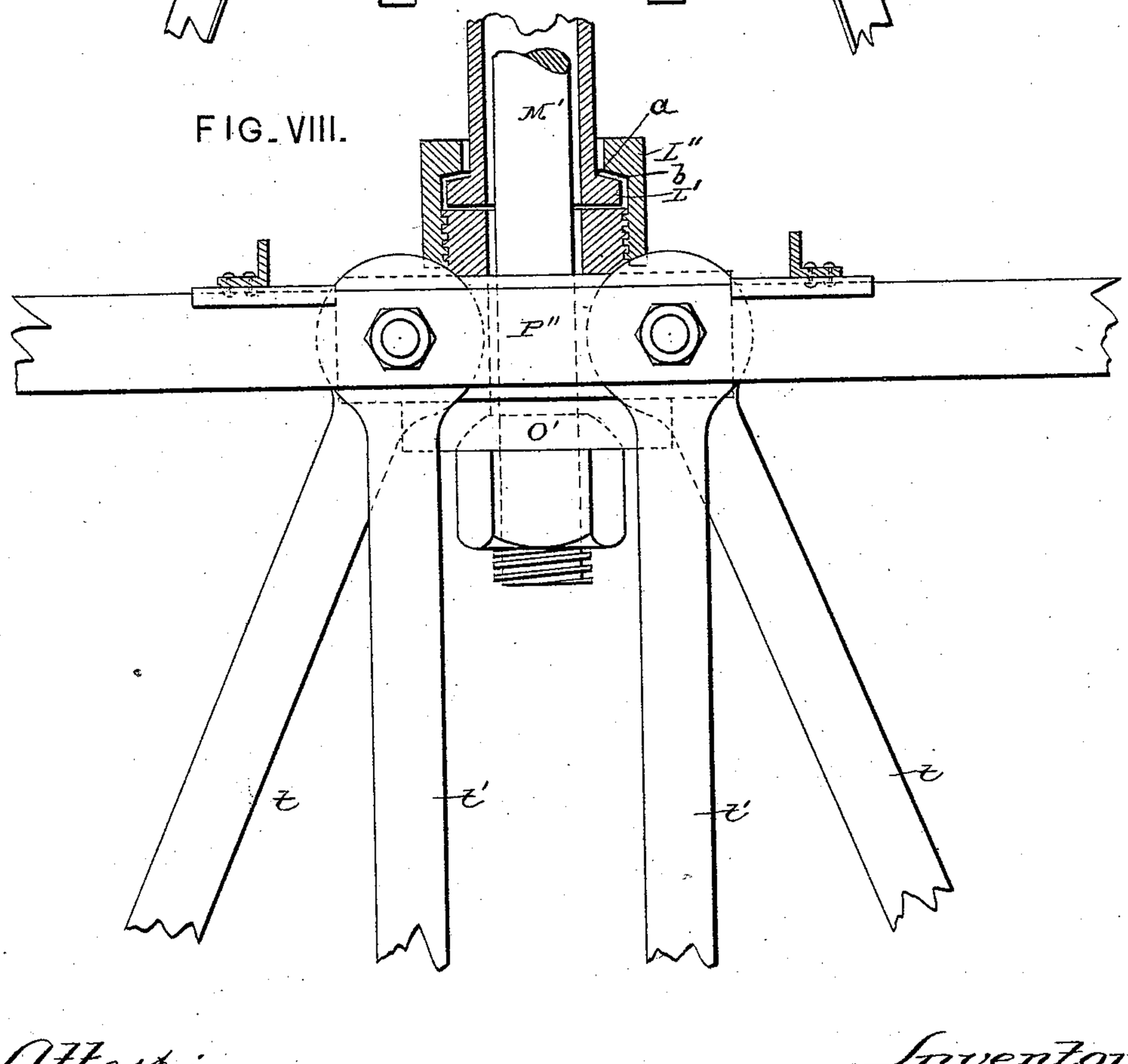


FIG. VIII.



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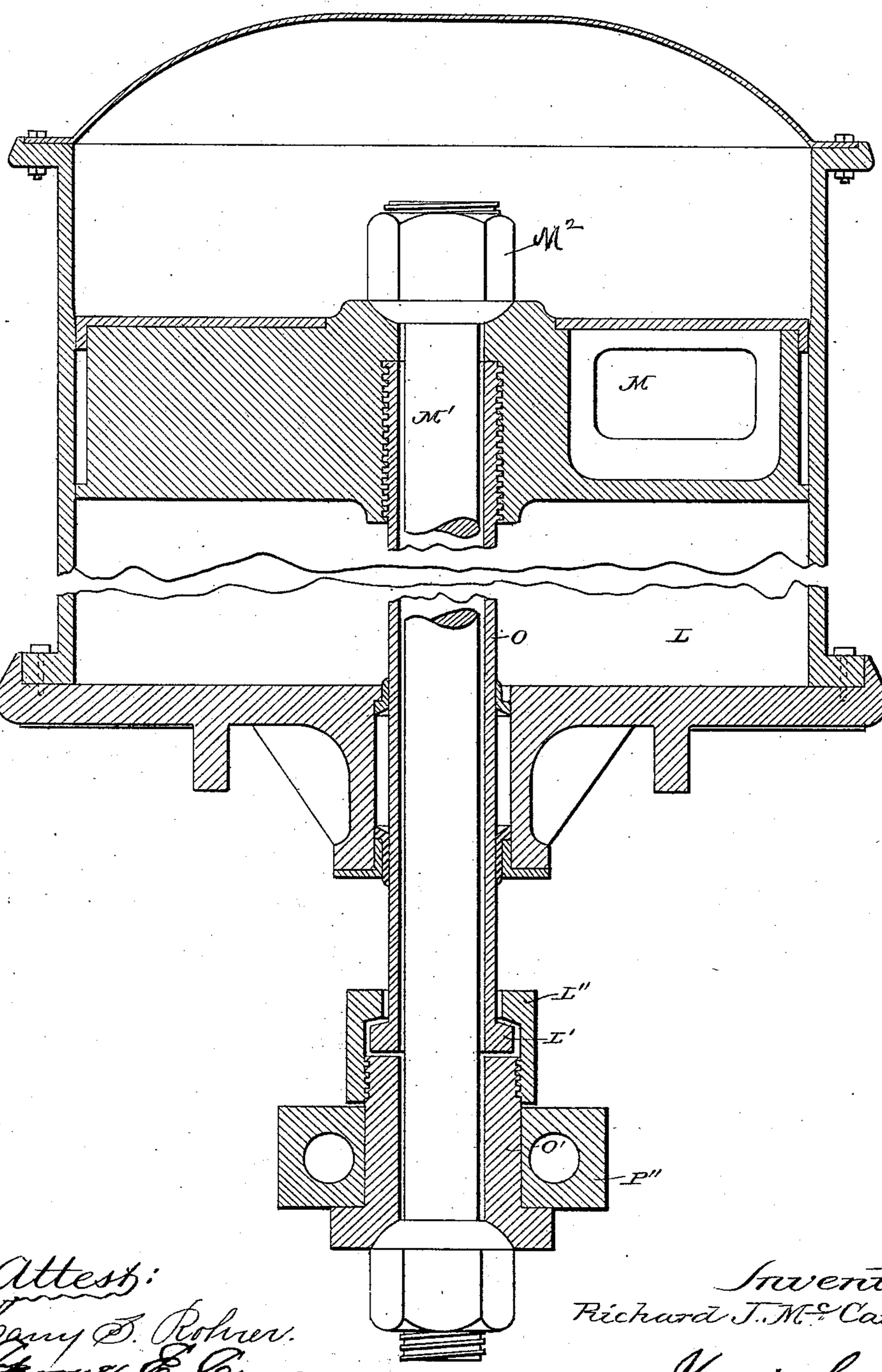
R. J. McCARTY.

STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. IX.



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R. J. McCARTY.

STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. X.

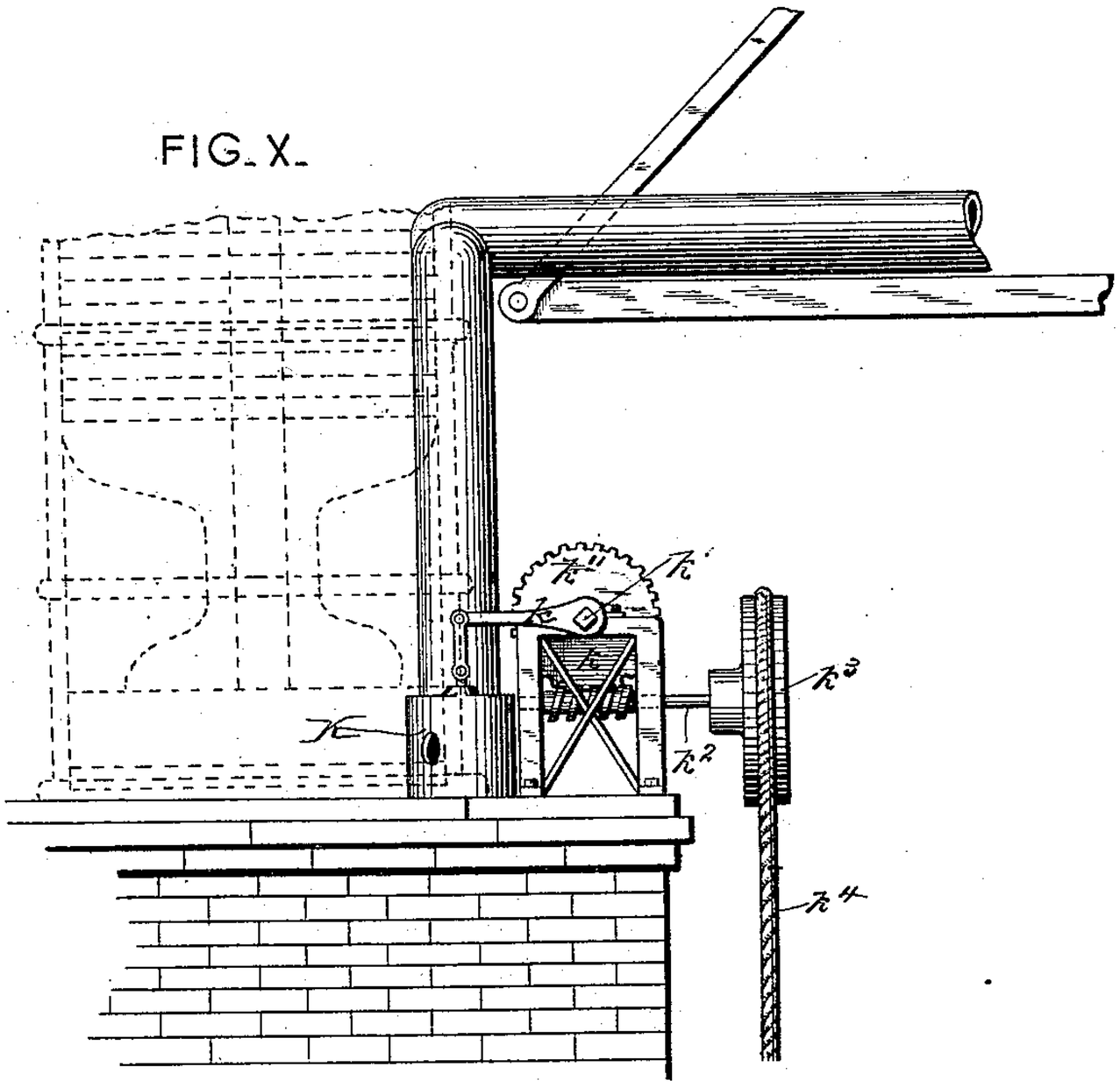
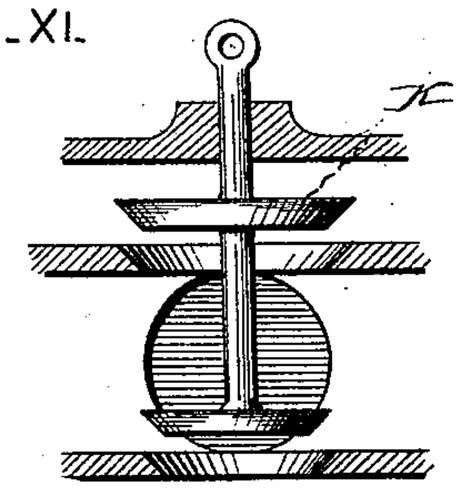


FIG. XI.



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(No Model.) 9 Sheets—Sheet 9.

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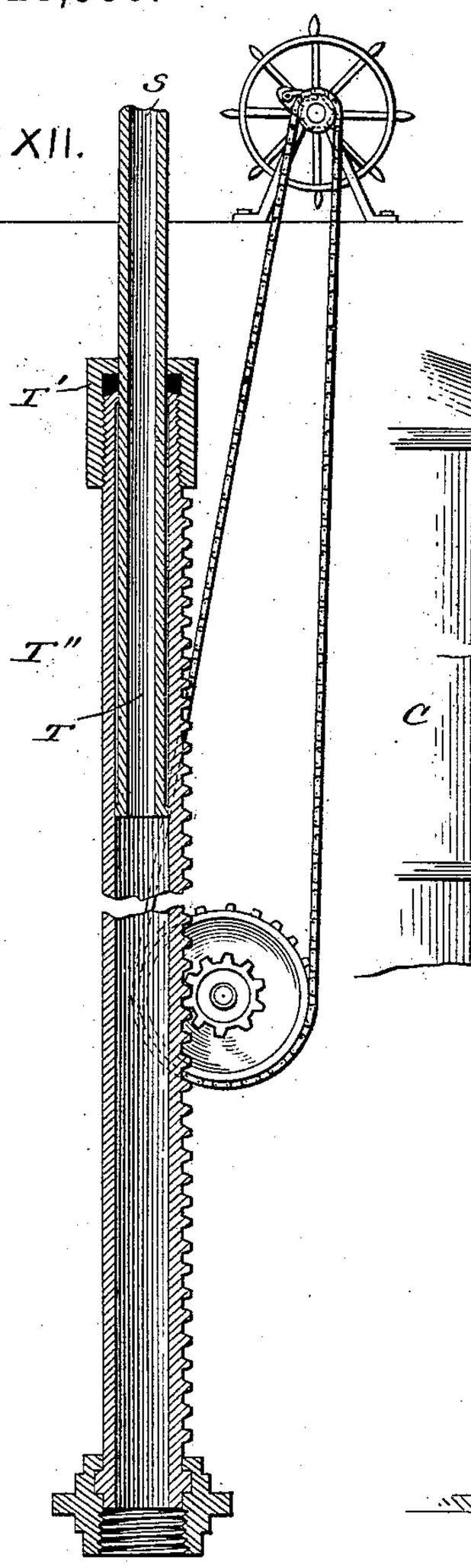
STEAM ELEVATOR.

No. 528,966. Patented Nov. 13, 1894.

FIG. XII.



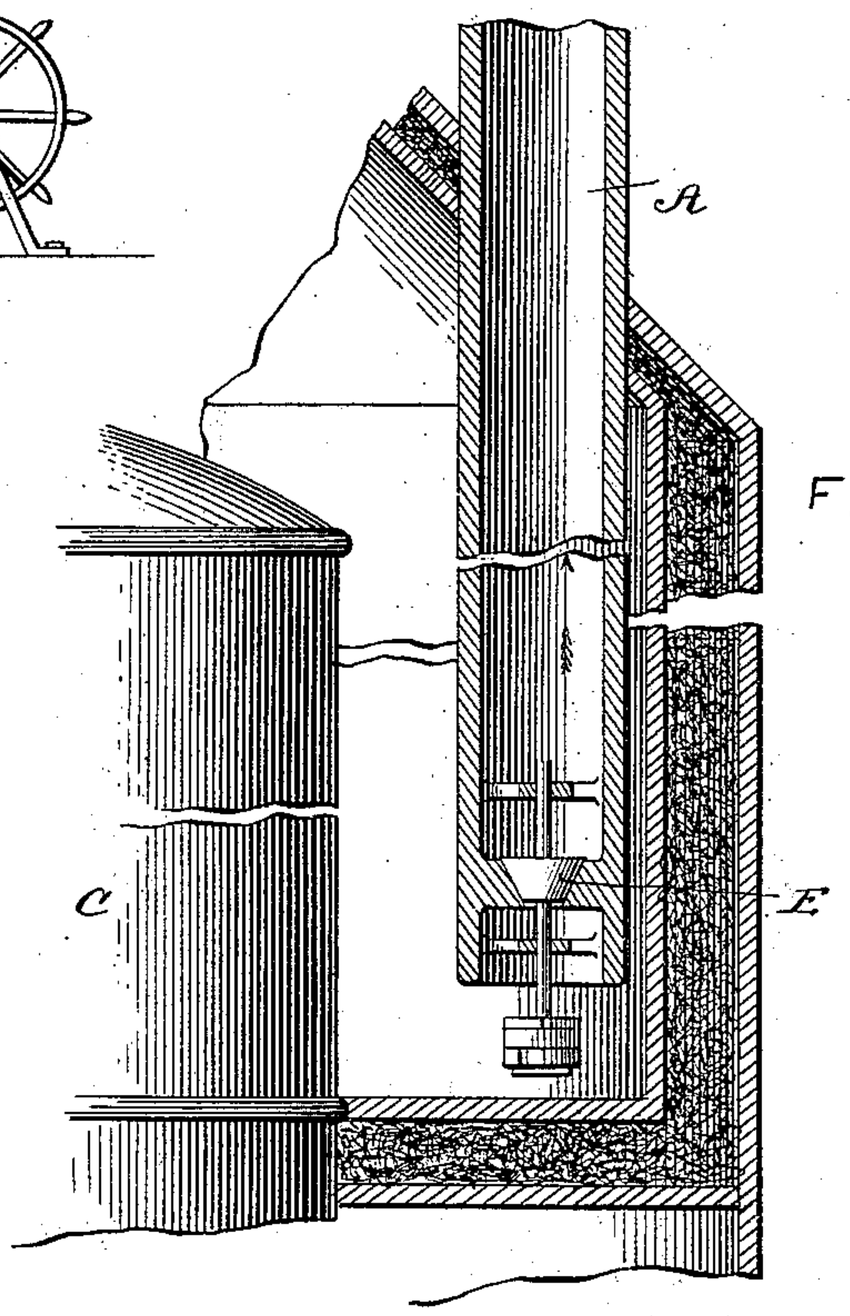


FIG. XIII

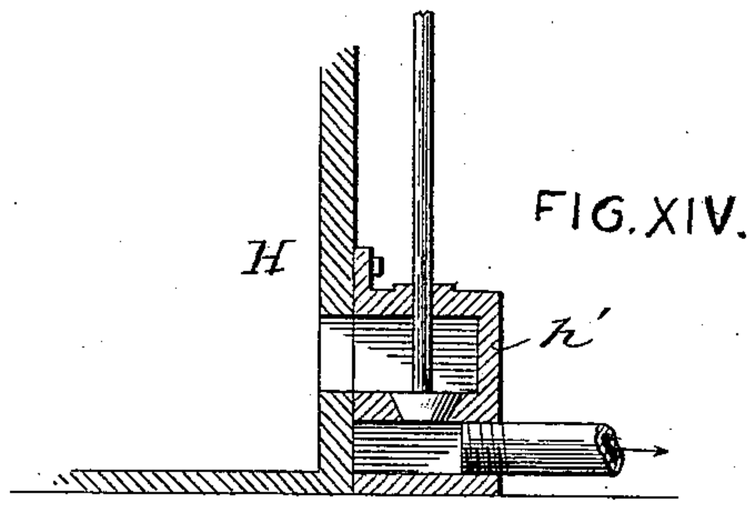


FIG. XIV.

Witnesses:
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Attys.

UNITED STATES PATENT OFFICE.

RICHARD J. McCARTY, OF KANSAS CITY, MISSOURI.

STEAM-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 528,966, dated November 13, 1894.

Application filed June 11, 1892. Serial No. 436,370. (No model.)

To all whom it may concern:

Be it known that I, RICHARD J. McCARTY, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Steam-Elevators, of which the following is a specification.

My steam elevator is designed for heavy operations such as raising and lowering loaded teams and heavy merchandise in unloading and loading steamboats or other boats or vessels, at points where rivers and other waters are subject to variations in height or where a great difference in level exists between a navigable river or other water and the approach thereto by rail or other road.

The invention is equally applicable to overcoming street grades and for other operations where heavy loads are to be transferred from one level to another.

To this end I construct a pair of power cylinders connected together in line so that a piston rod common to both may carry a piston at each end working in the respective cylinders one of the said cylinders receiving steam for motive power and other containing water or other liquid by which the power is transmitted to a third cylinder containing a lifting piston connected, preferably by concentric solid and hollow piston rods, to an elevator car or cage consisting of strong trusses carrying a platform and guided within the masonry or foundation frame of the structure.

My improvements embrace various other details of construction hereinafter explained.

In the accompanying drawings:—Figure I is a front elevation of the elevator. Fig. II is a side elevation of the same. Fig. III is a plan of the structure showing the masonry and the elevator in top view. Fig. IV is a plan view of the cage platform and accessories. Fig. V is an end elevation of the same. Fig. VI is a side elevation thereof. Fig. VII is a plan view of the cage connections on a larger scale. Fig. VIII is an elevation of the same, showing, in section, the safety piston-rod attachments hereinafter described. Fig. IX is a vertical section of the lifting cylinder and piston and cage connections. Fig. X is a detail elevation, on a larger scale of a suitable device for operating the water valve. Fig. XI is a detail sectional elevation of a suitable water valve of double puppet form. Figs. XII, XIII, and XIV are detail vertical sections on a larger scale. Fig. XII represents apparatus for raising and lowering the extensible steam supply pipe. Fig. XIII represents a portion of a projecting jacket surrounding the steam cylinder, the escape pipe through which exhaust steam is discharged therefrom and a loaded valve in said pipe for maintaining a moderate pressure of steam within the jacket. Fig. XIV represents a relief valve for discharging surplus water from the space and connections between the lifting piston and the power piston when the latter reaches the limit of its return stroke.

Power is communicated through a steam pipe S connected to the boilers by ordinary means should the boilers be fixed and by means of steam hose and a telescope joint T, T″, should the boilers be movable as, for example, in using the elevator for lowering and elevating teams, freight, &c., to and from ferries or other steamboats and using the steamboat boilers as the source of power.

The steam cylinder C takes steam from the pipe S through a steam valve V and discharges through an exhaust pipe V′, into a jacket I, J, D, surrounding the steam cylinder, from whence it is discharged through a loaded valve E Fig. XIII and an exhaust pipe A, a drip pipe F being provided to carry off water of condensation. Beneath the steam cylinder C is a water cylinder H.

G is a piston rod common to both the cylinders C and H, carrying a steam piston G′ on its upper end and a water piston G″ on its lower.

The cylinders are separated to a sufficient distance to prevent conduction of heat from the steam cylinder C to the water cylinder H and this affords room for a counterbalance H′ between the pistons G′ and G.″

A water valve K, and water pipe K′ conduct water from the cylinder H to a lifting cylinder L in which are a lifting piston M having a solid piston rod M′, connected to it by a socket nut M″, and a hollow piston rod O rigidly connected to the piston M.

Transverse trusses P, Q, are attached to the piston rod M′, and longitudinal trusses R, R′, R″, R‴, are attached to the trans-

verse trusses P, G. A platform S′, U, is carried by the longitudinal trusses R, R′, R″, R‴. Slides P′, Q′, attached to the transverse trusses and slides *f*, *f*, attached to the platform S′, U, work on vertical guides X′, Y′, attached to the masonry.

Trusses A′, B′, resting on the masonry, support massive girders J′, J′, on which the lifting cylinder L, is sustained. Suitable housings are provided for the cylinders and water pipe.

The device operates as follows:—A body of water or other suitable liquid is maintained between the pistons G″ and M. When the cage is down, steam entering the valve V forces down the piston G′. This force is transmitted to the piston G″ and drives the water through the pipe K′ thus lifting the piston M and raising the cage and load. The desired height having been reached the steam valve V and the water valve K are closed, the exhaust valve V′ is opened and the elevator becomes stationary. The elevator is made to descend by opening the water valve K. The motion of the elevator can be controlled perfectly by the operation of the water valve K. The steam valve V may be so connected with the moving parts that it will close automatically at any point necessary to give the proper terminal pressure in case the steam can be worked expansively, or so that it will close when the elevator reaches its highest point. The steam valve may then be allowed to remain closed until the elevator has descended and is ready to make another ascent, when it may be opened by the operator in the cage. The exhaust valve V′ may be so connected to the moving parts of the elevator that it will open automatically when the elevator has reached its highest point and it may be closed by the operator when the steam valve is opened. The water valve K may be so connected that it will close automatically when the elevator has reached its highest point, but as this valve must furnish the means of controlling the motion of the elevator and hence must be under full control of the operator it will probably be found best not to make it automatic in any respect.

There are so many suitable kinds of valves and so many practical ways of arranging and operating them, that it is not necessary to go further into detail regarding them especially since the party who would be responsible for the operation of the elevator would naturally wish to arrange these details to suit himself.

The following is a general description of the parts of my improved elevator:

Boilers.—When the elevator is used in direct connection with ferry or other steam boats and when the boilers on the boats are of sufficient capacity, the steam pipe S may be connected therewith by a telescope joint T, T″ and a flexible hose and coupling. This connection can be easily made while the elevator is being loaded. Should the capacity of the boilers of the boats be not sufficient the steam space may be increased in perhaps nearly all cases, to such an extent as to store up sufficient power for the elevator during each trip and as the expense of changing the boat boilers would probably not exceed the cost of separate boilers in many cases and since no additional firemen would be necessary and the cost of fuel reduced to a minimum, the boilers may be left out of consideration when the elevator is to be used in direct connection with boats. In the event, however, that stationary boilers should be necessary, this would not change any part of the device except the telescope joint and the hose and coupling.

The hose and coupling, may be connected after the manner of couplings for air-brakes and special arrangements may be necessary to effect the coupling with dispatch, but this can be done in several ways and needs no demonstration to prove its practicability.

The telescope joint T T″ is a simple affair having a stuffing-box T′ attached to the upper end of the female T″. The male T which is a continuation of the steam-pipe S fits into the female T″ and the stuffing-box prevents the escape of the steam. The lower end of the female T″ carries the coupling whereby the connection is made with the boilers. This female also carries a rack which works in a pinion attached to a wheel and axle above whereby the length of the pipe may be quickly adjusted to suit the level of the water in the river.

The steam cylinder C is provided with a steam chest C′, Fig. II, to accommodate the steam and exhaust valves V and V′. It is supported upon a casting D′, which is in turn supported by the water cylinder H. The two cylinders are kept sufficiently far apart to prevent the cooling of the steam cylinder by the water in the water cylinder and the heating of the water cylinder by the steam in the other. At the same time that this is accomplished, a space is made accessible for workmen when the water piston needs packing and a place is provided for the counterbalance H′. In order to keep the steam cylinder as hot as possible at all times and prevent the undue condensation of steam as it enters from the boilers it is surrounded with a jacket I. J. D. which is made as large as possible. Into the space between this jacket and the cylinder the steam is exhausted through the pipe V′. This space communicates with the outside air by means of an exhaust pipe A which is provided with a check valve E. This check valve is weighted so as to confine within the steam jacket, steam at a few pounds pressure which will keep the cylinder hot until the steam is again introduced from the boiler. This jacket is intended to be large enough to allow a man to pass between it and the cylinder. As it is necessary to protect the water cylinder H from the cold, both cylinders are surrounded with a housing of sheet iron F′ and the upper portion of this contains the

jacket I J D. Between this jacket and the housing F′ the space is filled with mineral wool or some other equally good non-conductor of heat. The water cylinder and connections are thus protected against freezing in cold weather.

The water cylinder H is of the same length as the steam cylinder and its diameter is determined by the volume of the lifting cylinder L. It is provided at the bottom with a suitable vent for water into the water pipe K′. The bottom is placed somewhat lower than the bottom of the vent so that a few inches of water will remain in case the piston G should pass the vent. The capacity of the water cylinder H is sufficient to fill the lifting cylinder L at full stroke and as it is not desirable to make the steam cylinder C together with the water cylinder H and the space between the two of greater height than that of the lifting cylinder L it is necessary that the water cylinder H should be of larger diameter than the lifting cylinder L.

The steam piston G′ is rigidly attached to the piston rod G and has a stroke determined by the ratio existing between the diameter of the water cylinder H and the dimensions of the lifting cylinder L. The piston rod G carries at its lower end the piston G″ fixed rigidly thereto.

The counterbalance H′ occupies a portion of the space between the pistons G′ and G″ and is kept above the top of the piston G″ so as to leave space for workmen. It is supported by a casting I′ that surrounds the piston rod G and rests on the piston G″. The counterbalance is composed of cast iron disks made in pieces so that its weight can be increased or diminished as occasion may require. These disks are annular and in pieces which when bolted together form rings which surround the rod G and are thus kept in place.

The water pipe K′ connects with the water cylinder H at one end and with the lifting cylinder L at the other. It is covered with a housing to protect it from cold. Its size is determined by the maximum velocity with which it is desired to move the elevator.

The water valve K is preferably of the kind known as the "double beat puppet" illustrated in Fig. XI and can be preferably controlled by mechanism such as shown in Fig. X consisting of the arm k attached to a shaft k' carrying a worm wheel k'' in which works a worm on a shaft k^2 carrying a pulley k^3 which latter is turned by a rope k^4 in the hands of the operator in the cage. By this arrangement the valve will remain in any position in which it may be placed, and this valve and the water pipe can be made of such dimensions that the velocity of the elevator can be confined within fixed limits. This valve mechanism is supported on an iron frame which rests on the masonry near the valve and has four legs joined together at the top by horizontal pieces which carry bearings for the shaft k' and by horizontal pieces which carry bearings for the shaft k^2. The whole frame is strongly braced within itself, and anchored firmly to the masonry. It will be seen that by this arrangement the valve K is caused to work by lifting it from the top, which is the most practical way of operating such valves. It will also be seen that the arrangement shown brings the ropes by which the valve is controlled near the corner of the elevator; a proper place for the operator as there he is most out of the way.

The lifting cylinder L has a length equal to the extreme lift over and above clearances and the space occupied by the piston M. Its size is determined by the pressure to be employed and the load to be lifted. It is provided at the bottom with a suitable vent for the water and its bottom is somewhat lower than that of the vent. This bottom is designed with reference to avoiding unequal strains resulting from the deflection of the girders J′ upon which it rests. The top of this cylinder may either be left entirely open or it may be covered in any manner which may be desired. The whole cylinder is inclosed in a sheet iron housing to protect it from the cold.

The lifting piston M carries a solid rod M′ attached by a socket nut M″ as shown. It also carries rigidly attached to it a hollow rod O surrounding the solid rod M′. This piston must be made more than usually strong.

The solid rod M′ is attached at its lower end to a socket block as shown by a socket nut similar to the one above. The rod M′ is thus allowed to swing freely within certain limits. The reason for this is that the horizontal motion of the cage cannot be entirely prevented on account of its size and of the fact that while the girders are attached to the masonry and are a fixed distance apart, the slides change as the cage trusses expand and contract under changes of temperature. This would if the solid rod should fit tightly in the stuffing box bring a transverse strain upon it which it is necessary to avoid.

The safety piston rod O serves two purposes.

First. It acts as a piston rod around which the packing is placed in the stuffing boxes o' to prevent the cylinder from leaking and thus leaves the solid rod free to swing through certain limit.

Second. It is made of the same sectional area as the solid rod, is made of the same or equally strong material and hence has the same tensile strength. This together with the attachment below enables it to sustain the whole load in case the solid rod should break and thus serves the purpose of a safety appliance. The distance between the top of its lower flange L′ and the bottom of the flange of the safety collar L″ is the distance through which the solid rod M′ will stretch before it reaches its elastic limit, so that before the solid rod can break, it must stretch until the hollow

rod relieves it of part of the strain. This will not only prevent accident from the fracture of the solid rod but will give notice of any signs of weakness in the solid rod. The hollow rod O is screwed into the piston M in order to accommodate the safety collar below, which must slip over the hollow rod.

The safety collar L″ is constructed with an inwardly projecting flange engaging over the flange L′ at the lower end of the hollow piston rod O, forming a gland connection and permitting some movement between the attachments and the piston rod. The gland collar L″ screws on the socket piece O′ confining the socket block P″ whereby the solid rod M′, the socket O′ and the safety collar L″ are attached to the transverse cage trusses P Q.

The cage is composed of the floor and sub-structure S′ U, the balusters S″, S″, the longitudinal cage trusses R, R′ R″, R‴ and the transverse cage trusses P Q which latter attach to the socket block P″ which is attached to the solid piston rod M′ in the manner already explained.

The floor and substructure.—In case the water valve K should leak or in case for any reason it should be impossible to stop the cage in its descent, it and its load might sink into the water unless some means were provided to prevent this. So that where the elevator is to be used over water the sub-structure of the floor, bottom and sides, is enveloped with a sheet iron hull strongly stayed by the small trusses *c*, *c*, so that this hull will have sufficient strength and displacement to float the entire cage and its load. Next to the bottom are iron **I**-beams W W′ W″, W‴ to which the bottom is attached. These **I**-beams run transversely of the cage and are held in proper position by smaller **I**-beams *d d d d* running lengthwise, and by the diagonal tie rods *e e e*, &c. Resting upon the heavy **I**-beams W W′ W″ W‴ are the floor stringers and upon these the floor. Upon the floor are securely fastened the railroad irons as shown, to guide the wheels of wagons and prevent injury to the trusses.

The balusters S″ rest and are fastened to the smaller **I**-beams *d d* at the bottom and are supported at the top by the longitudinal cage trusses R R‴.

The lower slides *f f* are fastened to the two small longitudinal **I**-beams *d d* which are braced by struts supported by the enlarged diagonal tie rods *e e*, and which also constitute the bottom chords of the longitudinal cage trusses P Q.

The longitudinal cage trusses R R′ R″ R‴,—four in number,—support the large **I**-beams W W′ W″ W‴, as shown and hence the whole floor and substructure as shown. The middle trusses R′ R″ manifestly carry twice the load carried by the outer trusses R R‴. As these trusses cannot be rigidly braced transversely of the cage, to the transverse trusses without interfering with the drive way, they are allowed to swing freely between the girders X′ Y′; and since in case the cage and load should float these trusses would have to resist an upward thrust and hence strains of compression and buckling strains the principal elements should be given at least double the strength necessary to resist the tensile strains which ordinarily they would only be required to stand. These elements should also be made stiff laterally to prevent their being injured by wagons. They should therefore, be double elements stiffened by channel iron riveted between them in the ordinary way.

The transverse trusses P Q support the longitudinal cages trusses as shown. There are two of these trusses placed parallel to each other and at a distance apart equal to their depth. They are strongly braced and bound together laterally above and below and tied diagonally as shown. They should stand a reversal of all the forces usually acting upon them, for these forces would be reversed in case the heavily loaded cage should float. Where these trusses attach to the socket block P″ which accommodates the piston rod M′ these trusses should be made with double members so that if one should break the others would sustain the load. These transverse trusses carry at their ends the slides P′ Q′ which work on the girders X′ Y′. Braces *h h* are placed above and below to take the strains resulting from unequal loading. The braces *p p* are for the purpose of bracing the socket block P′.

The upper truss A′ B′ support the lifting cylinder L, its attachment and housings; and the cage and load. There are two of these trusses placed a distance apart equal to their height or depth. These trusses are strongly braced together laterally at the top and bottom and are braced and tied diagonally as shown. These bracings should be amply strong to prevent deflections from the wind strains.

The girders J′ J′ are carried by the bottom chords of the upper trusses A′ B′ as shown. These girders should be at least twice the usual strength in order to reduce deflection.

The masonry may be built to suit local conditions, the preferred form, however, being that shown, where the elevator is built over water, the arches and openings serving the double purpose of reducing the cost and preventing accumulation of sediment. Heavy anchors should be built in just above the arches to resist the horizontal thrust.

The guides Z Z are strongly anchored to the masonry and should be so built as to be adjustable. They should have broad bases to resist canting and have sufficient bearing against the face of the masonry to resist shocks incident to unequal loading.

It will be observed that in case of high wa-

ter the piston G′ will not move back to the top of the cylinder when the elevator is down as low as the water will allow. This will sometimes make a large clearance space to be filled. This space can in good part be filled by keeping the exhaust valve under control and causing the elevator to produce compression in its descent in much the same manner that the clearances are filled in steam engine cylinders.

The following is a more complete and effective mode of filling the clearance space above the steam piston or almost entirely avoiding any vacant space which would otherwise result in case high water makes it impossible as well as unnecessary for the cage to descend to the lowest point to which it might otherwise reach.

Suppose that the case should descend only part of the way down. Let the volume of water between the water pistons G″ and M be increased so that when the cage has reached the required lower level (in which case the piston M would be at some intermediate point of the lifting cylinder L) the piston G′ will be as close as practicable to the upper end of the steam cylinder C. This sometimes makes it necessary to increase or diminish the volume of water used according as this travel of the cage changes. With this increased volume of water careless handling might knock out the head of the steam cylinder on the one hand, and cause the cage to strike the lifting cylinder or its supports on the other. To prevent this a valve h' is placed near the bottom of the large water cylinder H. This valve may be similar to the valve K and situated alongside of it. Attached to the stem of this valve is a rod h^2 extending upward to the space D′ between the cylinders and there operated by a lug h^3 so that the piston G″ and hence G′ cannot pass beyond a given height without opening the valve. When the valve is thus opened the water will run out into a vessel p^3 provided for that purpose, and thus cause the pistons G′ and G″ to drop back a little distance and close the valve. To stop the upward motion before the cage strikes the lifting cylinder or its supports a vent is made in the lifting cylinder near the top, out of which, the water will flow through a pipe p^4 when the piston M passes said vent. This water is led to the same vessel p^3 provided for the cylinder H. The water may then be pumped back into the cylinders when it is required. A suitable pump p^2 is employed as a part of the device as it is necessary to prime the elevator and to supply loss from leakage as well as for the purpose mentioned above.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The motor cylinder C, jacket I surmounting the same, exhaust pipe V′ discharging steam from the engine within the jacket I, discharge pipe A and loaded valve E maintaining a regulated pressure of exhaust steam in the jacket substantially as and for the purposes set forth.

2. The combination of the motor cylinder C jacket I surrounding the same, exhaust pipe V′ delivering steam within the jacket, discharge pipe A extending downward within the jacket, loaded valve E for escape steam and drip pipe F for water of condensation, as explained.

3. In a hydraulic elevator, the combination of a power piston for applying water pressure, a lifting piston for receiving such pressure, a cage connected to said lifting piston, and a relief valve h' connected with the water space between the power piston and water piston and a connection between the power piston and said valve to open it automatically near the termination of the return movement of the piston as explained.

4. The combination of the steam cylinder "C," the water cylinder "H," connected therewith and containing a pump piston actuated from the steam cylinder "C," the lifting cylinder "L," having a piston "M," the water pipe "K′" connecting the water cylinders "H" and "L" to transmit pressure from one to the other, the valve "K" to control passage of water in said pipe, the relief valve "h'" discharging water from the pipe and the tappet "h^3" carried by the power piston and opening said relief valve at the proper point to arrest the motion of said piston, as explained.

5. The combination of the pressure cylinder H piston G″ lifting cylinder L, piston M connecting pipe K′ between the cylinders H and L, the relief valve h' opening out of the water space between pistons G″ and M to discharge any excess of water therefrom, the tank p^3 connected with the relief valve to receive such excess of water, and the priming pump p^2 connecting with the water space to supply water to the latter as explained.

6. The combination of the cylinders H and L, lifting piston M, vent p^4 in the cylinder L uncovered at the termination of the stroke of the said piston, to discharge surplus water, the tank p^3 receiving such discharged water, and the priming pump p^2 connected with the water space to supply water to the cylinders substantially as set forth.

7. The combination of the lifting piston M the solid piston rod M′, connected thereto and to the cage truss, and the hollow safety piston rod O connected at its upper end to the lifting piston and at its lower end adjustably to the cage truss substantially as and for the purpose explained.

8. The combination of the lifting piston M, the piston rod M′ attached thereto and to the cage-truss, the hollow safety rod O attached at its upper end to the lifting piston and the flange and gland coupling L′, L″, between

the lower end of said safety rod and the cage-truss, affording relative movement, as explained.

9. The combination of the concentric lifting rods M′, O, the flanged socket piece O′ resting on the rod M′ the flanged collar L″ connecting the rod O and socket O′, and the annular block P″ confined between the socket O′ and collar L″ and adapted for attachment of the cage-truss as explained.

RICHARD J. McCARTY.

Witnesses:
HECTOR LITHGOW,
F. M. BERNARDIN.