

(No Model.)

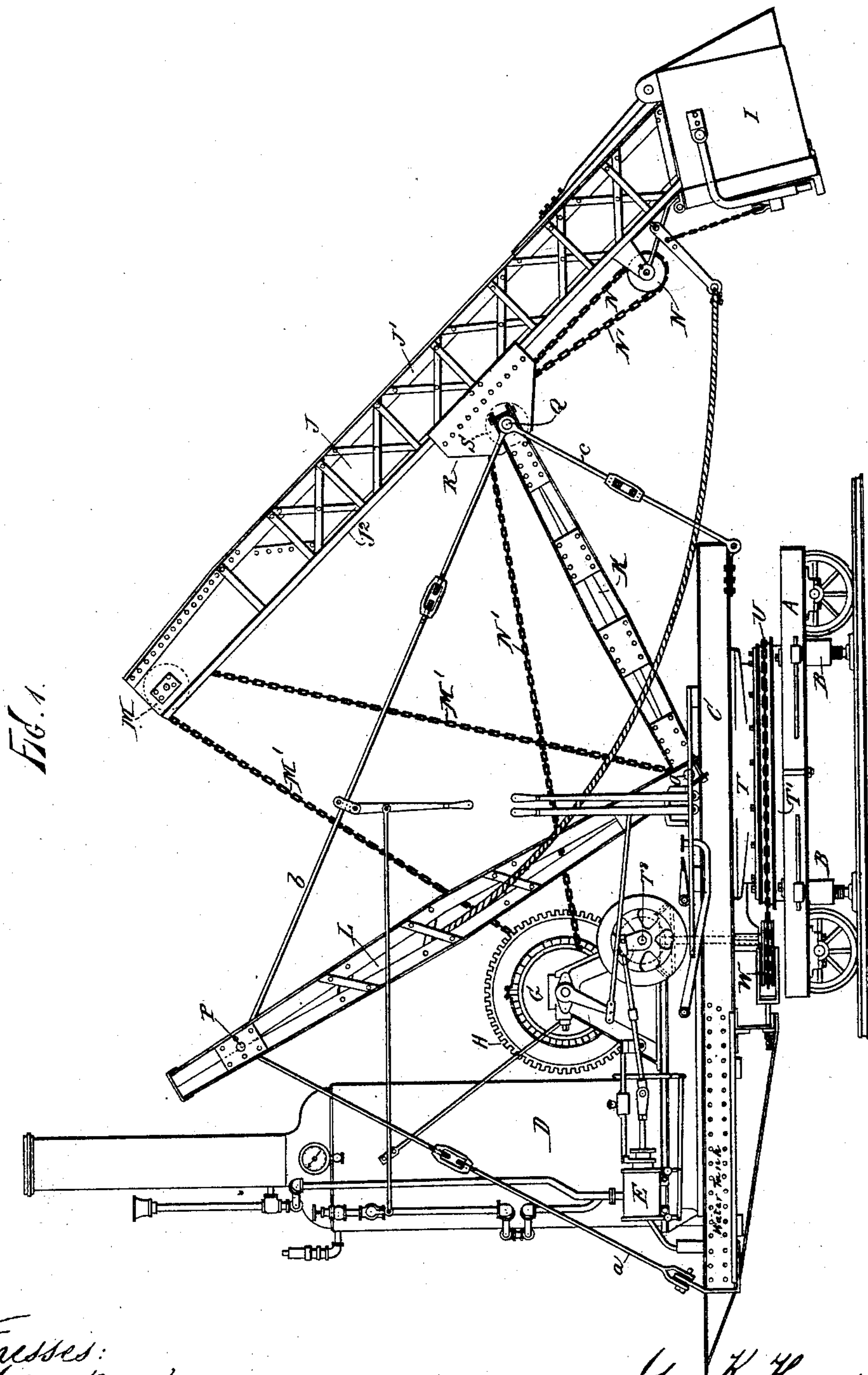
5 Sheets—Sheet 1.

J. K. HOWE.

EXCAVATOR.

No. 362,083.

Patented May 3, 1887.



Witnesses:  
John Buckler,  
L. H. Osgood,

John K. Howe,  
Inventor:  
By North Osgood,  
Attorney.

(No Model.)

5 Sheets—Sheet 2.

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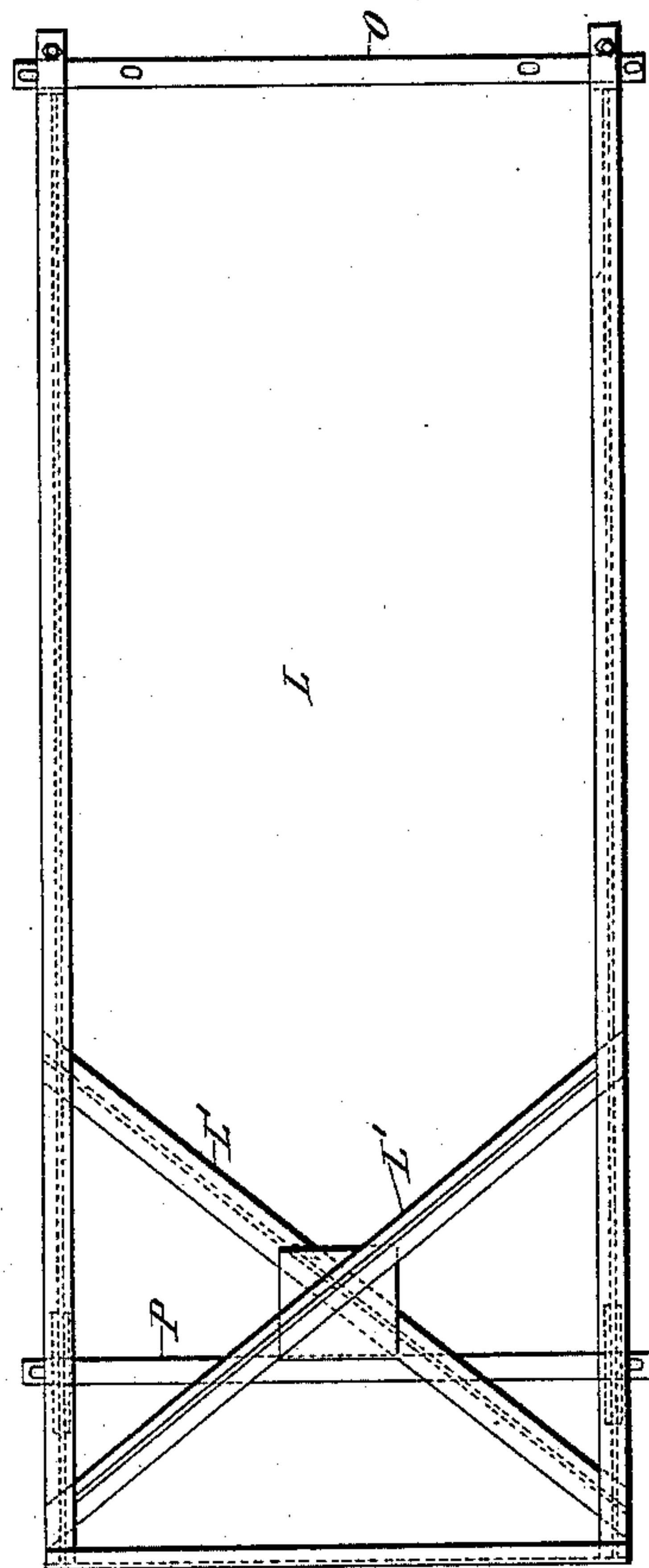


Fig. 3.



Fig. 4.

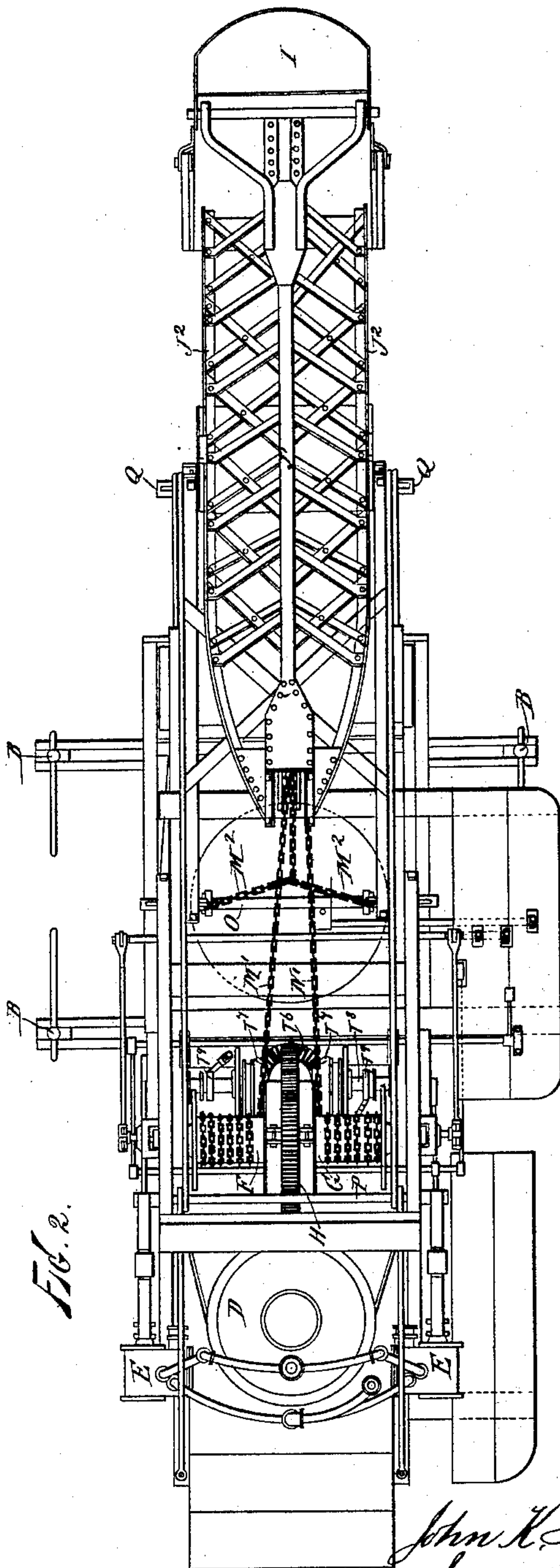


Fig. 2.

Witnesses:  
John Buckler,  
L. H. Orgood,

John K. Howe,  
Inventor:  
By North Orgood,  
Attorney.



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FIG. 5.

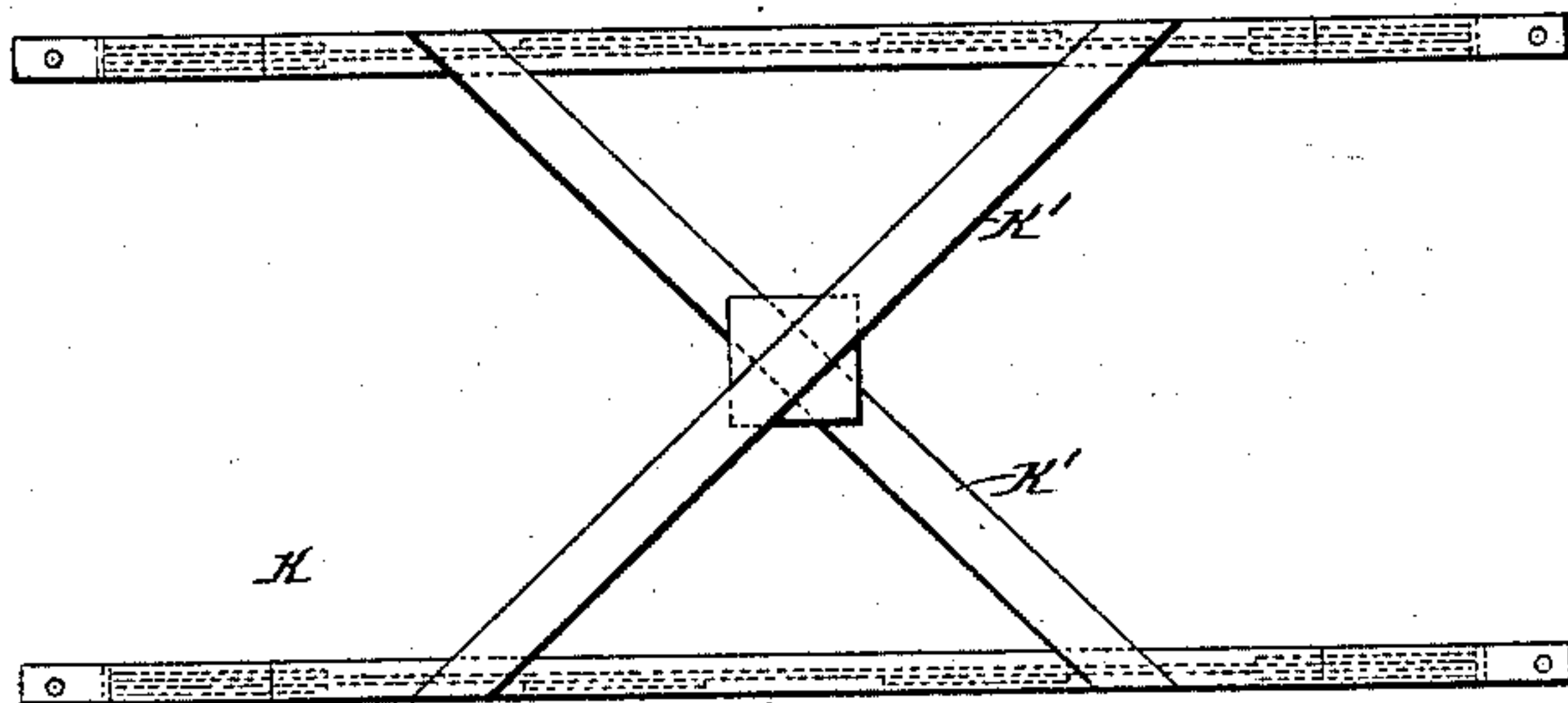


FIG. 6.

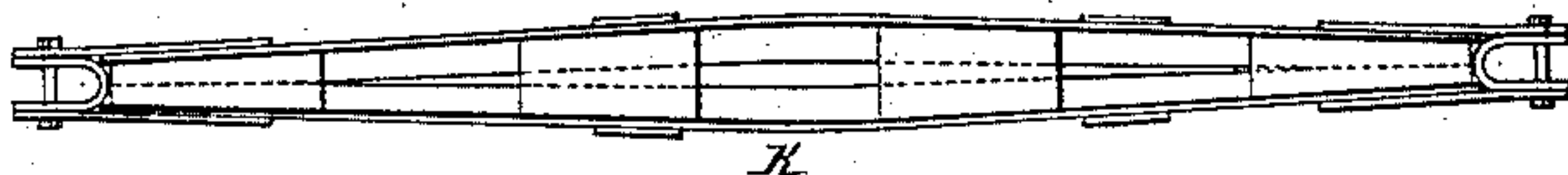


FIG. 7.

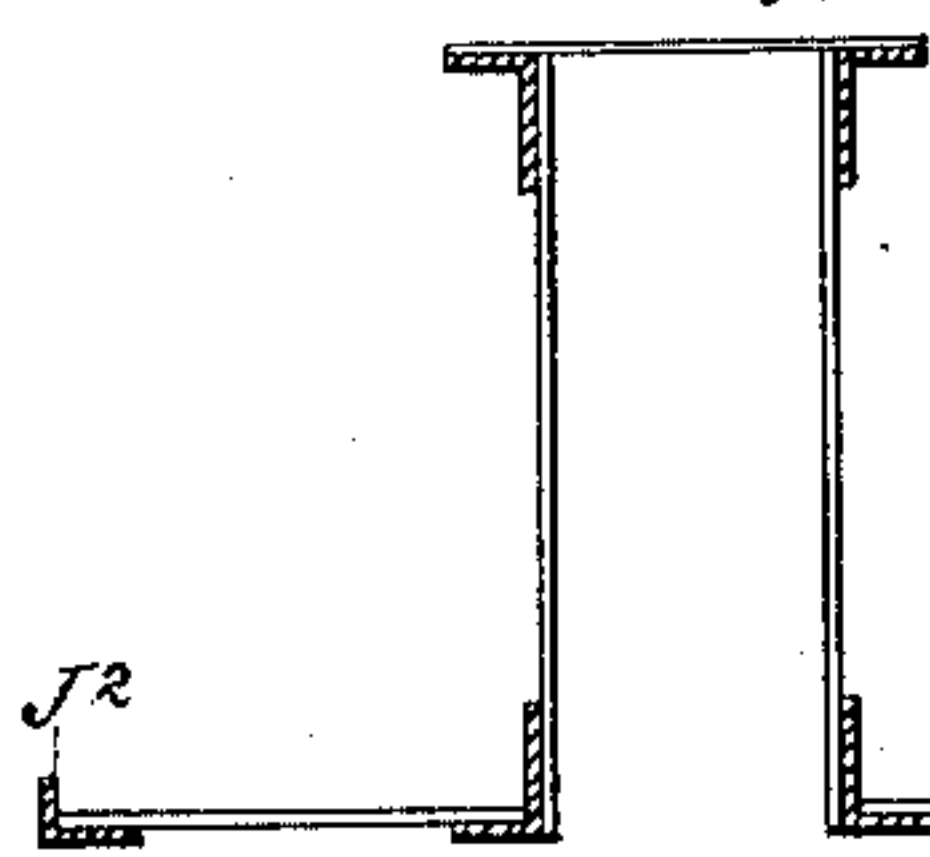


FIG. 8.

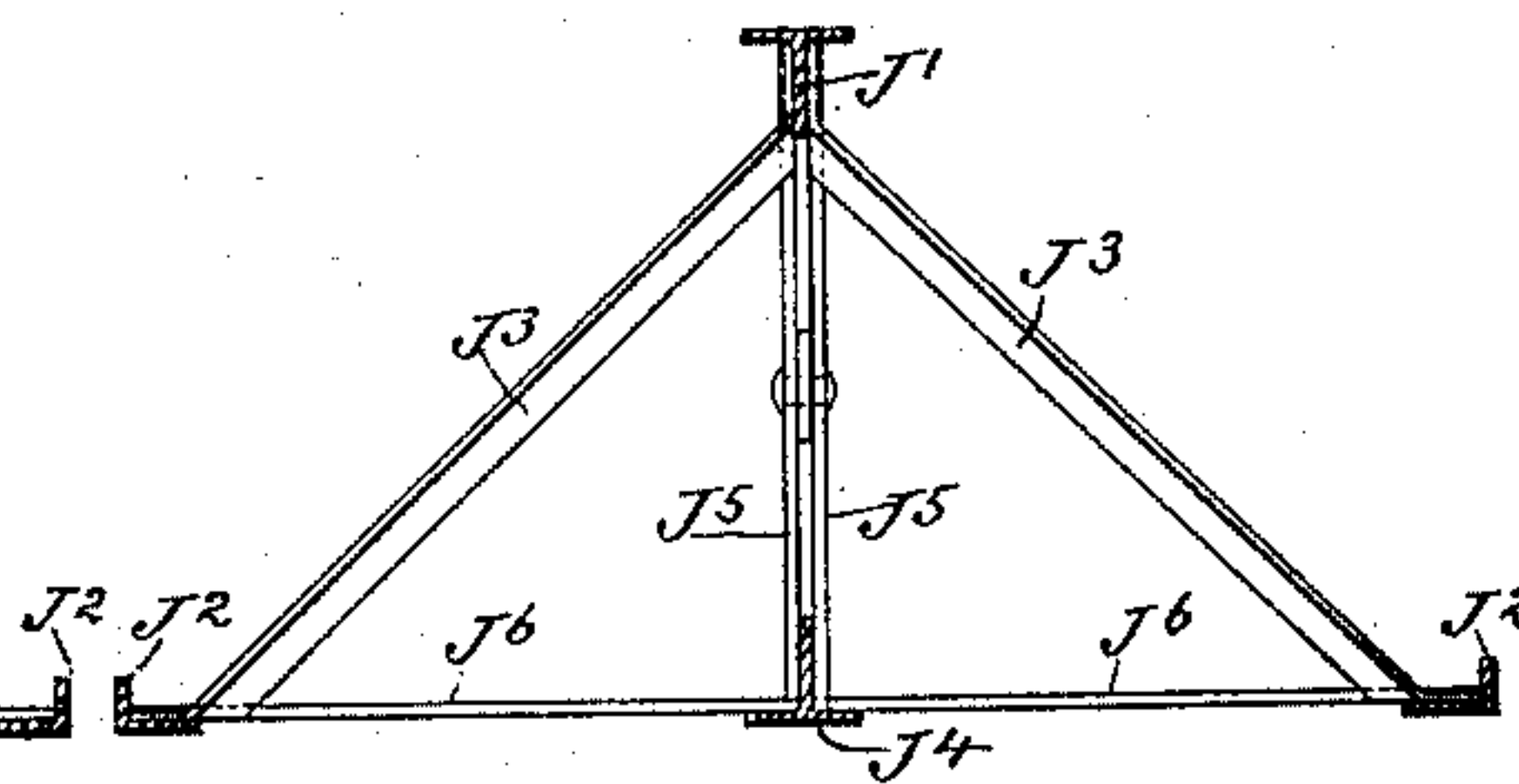


FIG. 9.

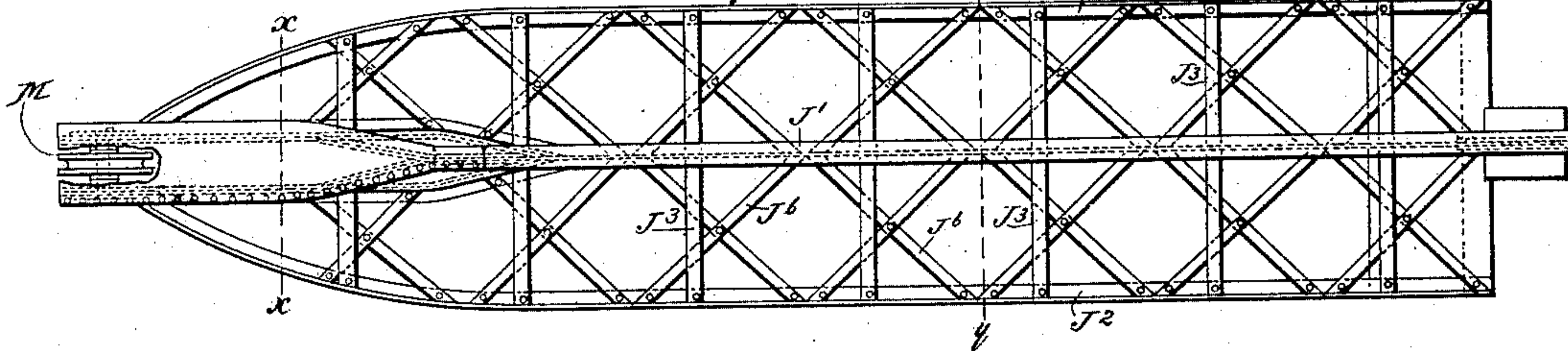
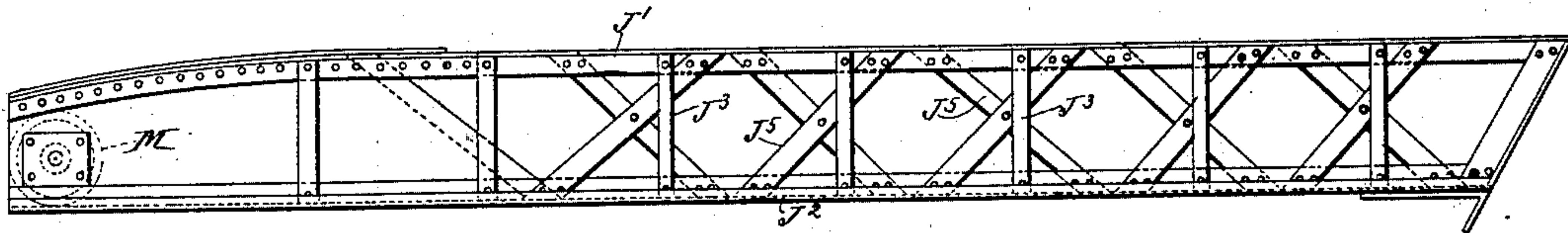


FIG. 10.



Witnesses:  
John Buckler,  
L. H. Osgood.

John K. Howe,  
Inventor:  
By North Osgood  
Attorney.

(No Model.)

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J. K. HOWE.

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FIG. 11.

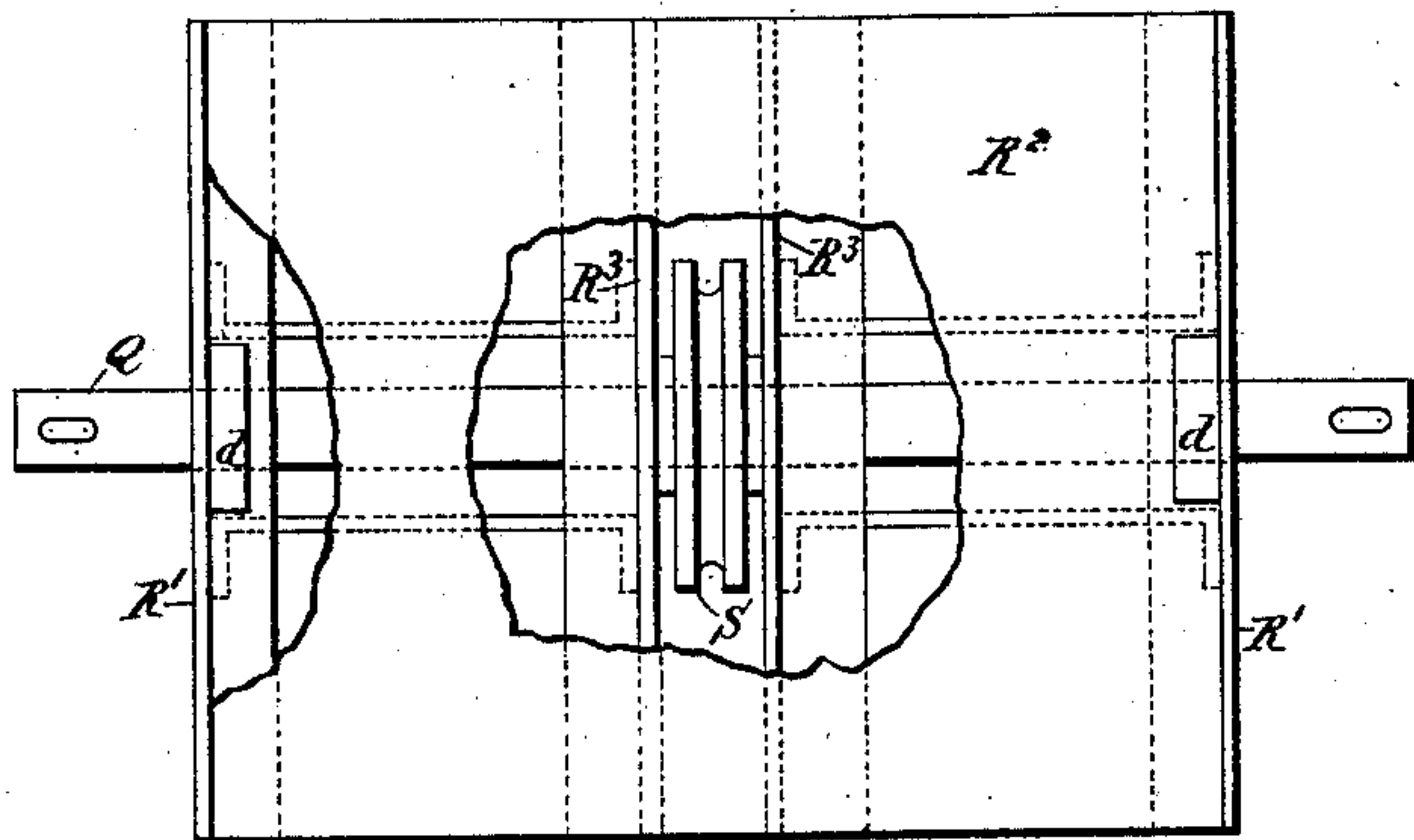


FIG. 12.

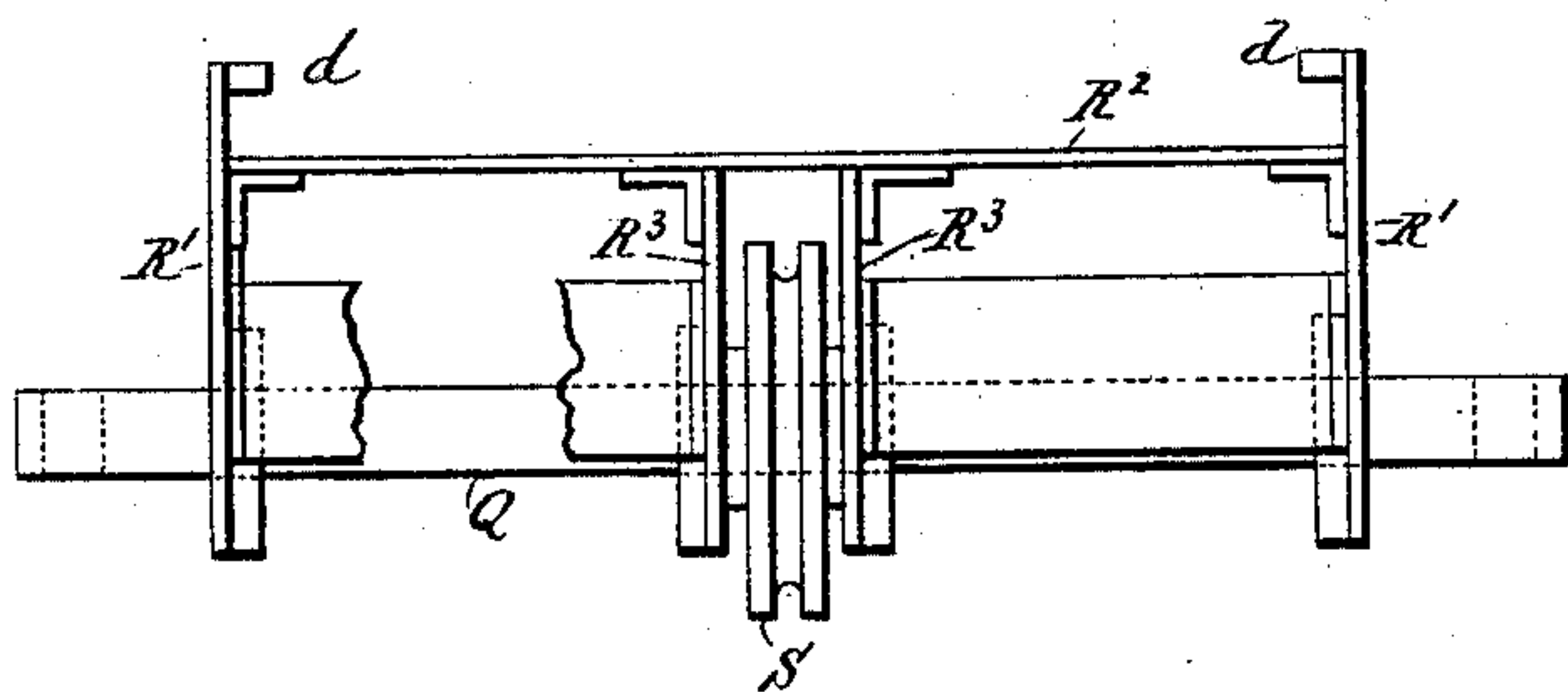


FIG. 13.

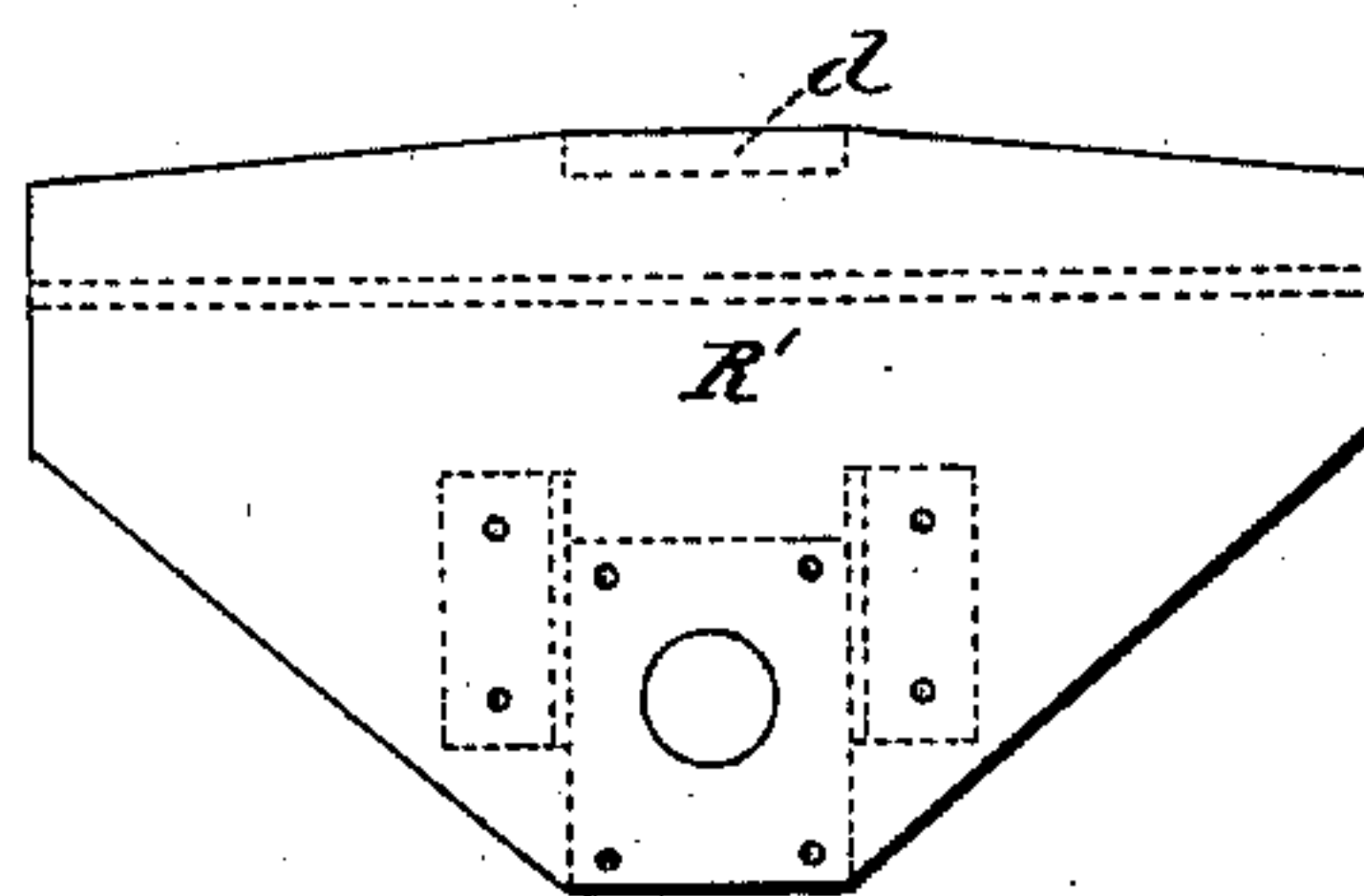
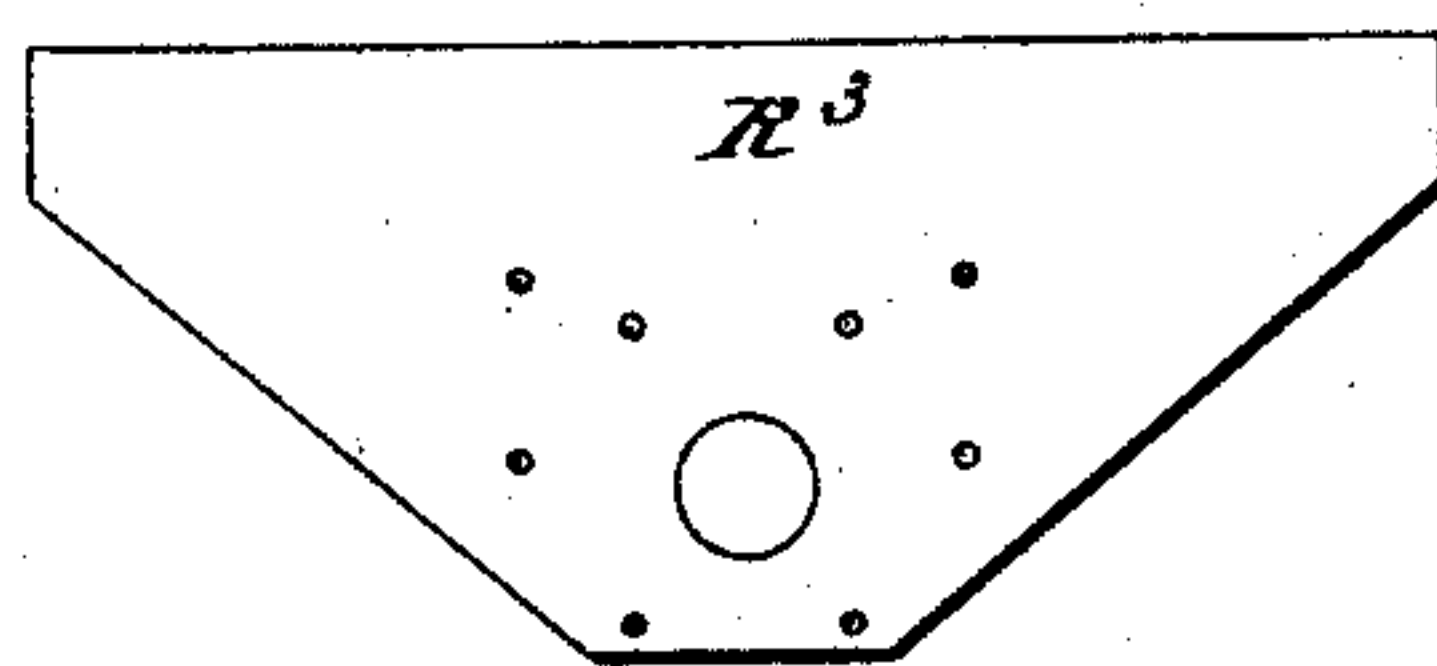


FIG. 14.



Witnesses:  
John Buckler  
L. H. Osgood,

John K. Howe,  
Inventor:  
By Wm. H. Osgood,  
Attorney.

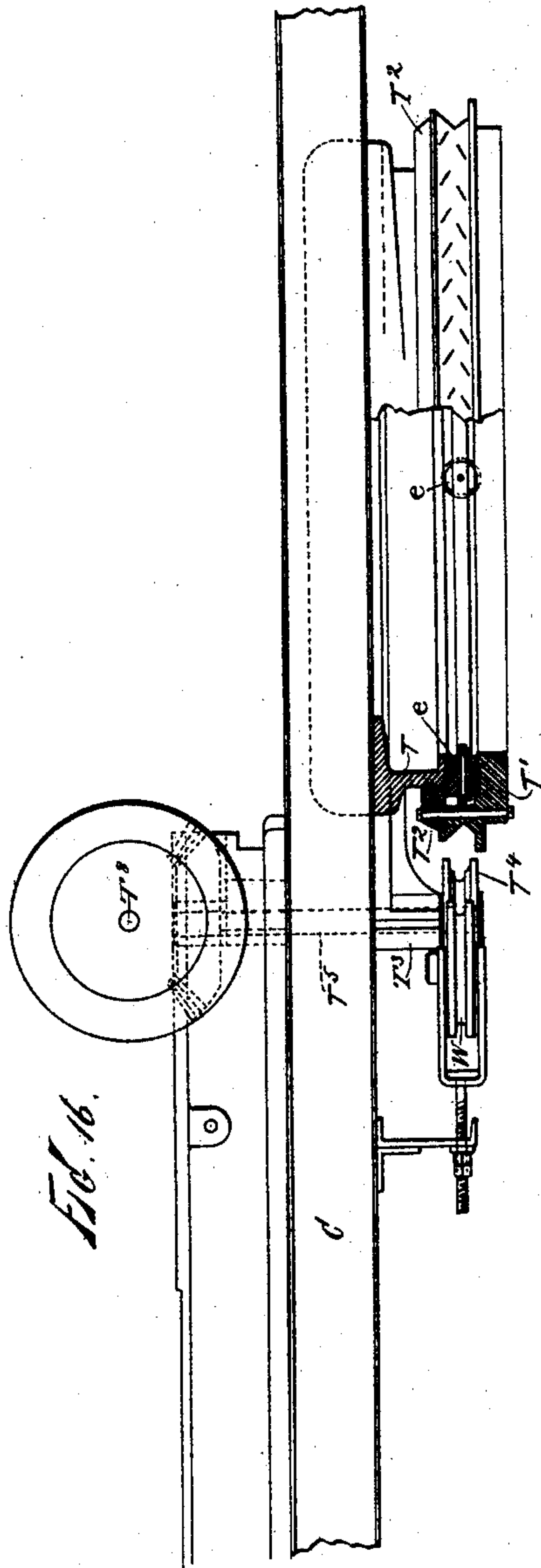
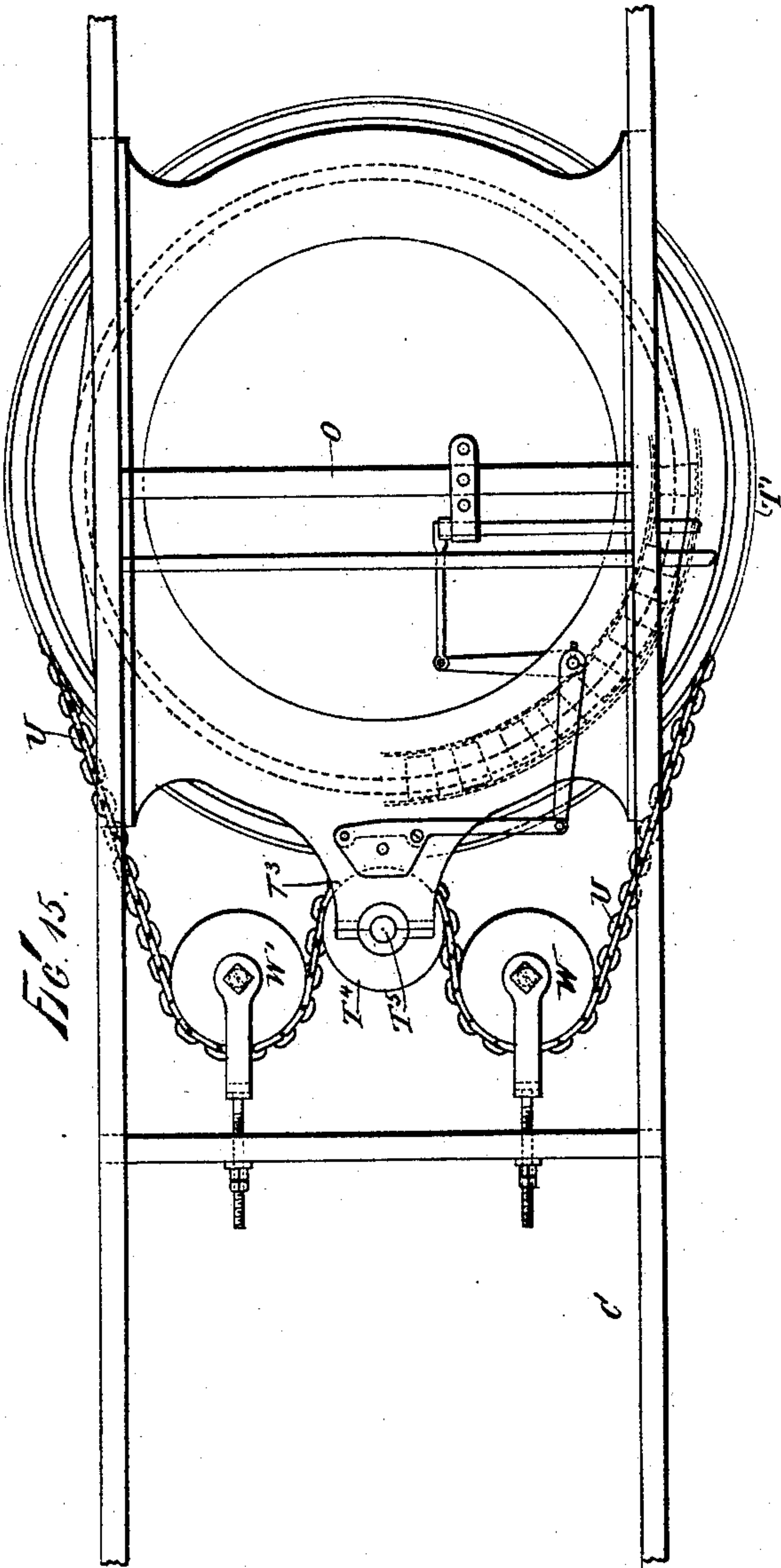
(No Model.)

5 Sheets—Sheet 5.

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Witnesses:  
John Buckler,  
L. H. Osgood,

John K. Howe,  
Inventor:  
By North Osgood  
Attorney.



# UNITED STATES PATENT OFFICE.

JOHN K. HOWE, OF TROY, NEW YORK.

## EXCAVATOR.

SPECIFICATION forming part of Letters Patent No. 362,083, dated May 3, 1887.

Application filed October 8, 1886. Serial No. 215,667. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN K. HOWE, of Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Excavators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention has relation to that class of machines employed for excavating earth, &c., and elevating, swinging, and discharging the excavated material at any required point, which machines are commonly known as "excavators" or "steam-shovels."

While my improvements are especially applicable for use in connection with excavators which are mounted upon cars and intended for operation upon land, it should be understood that they may be used in connection with under-water excavators, which are mounted upon boats or scows and commonly called "dredges;" or the machinery may be mounted upon any suitable platform or foundation.

Among the objects of my invention are the production of a comparatively light and inexpensive machine or excavator of ample strength or power for the hardest usage, wherein the power is applied to better advantage than in former constructions for forcing the dipper into the bank to take its load and for raising the load, wherein the necessary swinging movements are easily and quickly accomplished and the dipper rapidly returned to its working position, and wherein the parts are few and simple and all under control of a single operator, and the production of a machine or excavator which may be operated with equal facility and stability at any point of the circle about its center and through which it is free to revolve, and which may be easily and quickly advanced or retracted, as occasion or the condition of the work may require.

To accomplish all of this, my improvements involve certain new and useful arrangements or combinations of parts, peculiarities of construction, and principles of operation, as will be herein first fully described, and then pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of a machine or excavator constructed and arranged for operation in accordance with my

invention and involving my improvements. Fig. 2 is a plan view of the same. Fig. 3 is a plan view, and Fig. 4 a side elevation, of the gallows-frame detached. Fig. 5 is a plan view, and Fig. 6 a side elevation, of the dipper-handle support detached. Fig. 7 is a cross-section (enlarged) through line *x x* of Fig. 9, and Fig. 8 is a similar view (enlarged) through line *y y* of Fig. 9. Fig. 9 is a plan view, and Fig. 10 a side elevation, of the dipper-handle detached. Fig. 11 is a plan view of the dipper-handle bearing or saddle detached, portions of the top plate thereof being removed to show the shaft and sheave below. Fig. 12 is a front elevation, and Fig. 13 a side elevation, of the dipper-handle bearing. Fig. 14 is a side elevation of one of the center plates employed in the dipper-handle bearing. Fig. 15 is a plan view illustrating the chain-connections for swinging the machine or turning it about its axis. Fig. 16 is a view in side elevation and partly in section, showing the manner of mounting the machine and securing it upon its turn-table, and indicating in dotted lines the vertical shaft and gear connections for revolving the chain-wheel. Of these figures, those from 3 to 16, inclusive, are upon scales enlarged beyond that of Figs. 1 and 2; and in all like letters of reference, wherever they occur, indicate corresponding parts.

A is the car or foundation, upon which the operating machinery is mounted, shown as provided with wheels to enable it to be moved upon an ordinary railroad-track and provided with jack-screws, as at B B, by which it is steadied and held from moving while the excavator is at work.

C is the movable platform for directly sustaining the machinery, this platform being arranged so as to be turned about a vertical axis, thus swinging the entire working machinery and the load in a manner which will be hereinafter explained.

D is the boiler; E E, the engine-cylinders; F, the hoisting-chain drum; G, the backing-chain drum; H, the central spur-wheel, through which movement is communicated to either or both drums; I, the dipper; J, the dipper-handle; K, the dipper-handle support, and L the gallows-frame.

The dipper I is of the pattern known as "scoop-dippers," and is securely mounted



upon the end of the dipper-handle J and at an angle with the axis thereof, substantially as shown, so that it may be forcibly crowded into the bank under the influence of the hoisting-chain without danger of disarrangement, and without interference with its cutting or digging capacity.

The dipper-handle J is amply strong to withstand the severe strain to which it is subjected both while crowding the dipper into the bank and while forcing it out of the bank, as well as swinging the load. It (the dipper-handle) is shown as composed of a central top rib of T-iron, J', firmly united with the lower side pieces, J<sup>2</sup> J<sup>2</sup>, (of angle-iron,) by inclined braces J<sup>3</sup> J<sup>3</sup>, and with a central lower rib, J<sup>4</sup>, by braces J<sup>5</sup>, the rib J<sup>4</sup> being connected with the side pieces, J<sup>2</sup> J<sup>2</sup>, by braces J<sup>6</sup>. This construction is well calculated to produce a rigid handle, the parts being thoroughly braced in every direction and as light as is consistent with the requisite strength; but of course the handle may be otherwise braced or trussed. The upper end of the handle carries the sheave M, for the hoisting-chain, and upon the lower part of the handle the sheave N is mounted, for the backing-chain.

The gallows-frame L is composed of two similar side pieces, Figs. 3 and 4, of T-iron well braced or trussed, the side pieces being united at top by cross-braces, as L' L', and at bottom by a shaft, O, which shaft is located about over the vertical axis of the revolving platform, securely fixed thereto, and operating also to receive the lower end of the dipper-handle support. A shaft, P, at the upper end of the frame receives the stay-rods a a and b b, of which a a are suitably anchored to the rear of the platform and b b extend to the shaft Q, passing through the outer end of the dipper-handle support and constituting the axis of the saddle.

The gallows-frame inclines rearwardly, so that it is well out of the way of the dipper-handle during any of its movements, and having been adjusted to the proper inclination by turning it upon its lower shaft or axis it is firmly held in place by the stay-rods mentioned in connection with the dipper-handle support and other rods, to be hereinafter referred to. The object of this frame is to afford a rigid and effective support for the outer end of the dipper-handle support and to suitably distribute the weight and the various working strains in such manner as to avoid overloading the front of the machine.

The particular construction of the frame is of course not essential.

The dipper-handle support K, like the gallows-frame, is shown as made up of trussed side pieces, the two being connected by cross-braces K' K', Fig. 5. The lower end of this dipper-handle support is mounted upon the shaft O, so that it may turn thereon when required for vertical adjustment. Its outer end, having been brought to the required height, is sustained by the rods b, and any tendency to

upward movements is counteracted by rods c c, which are anchored to the front of the platform.

The rods a, b, and c secure the gallows-frame and the dipper-handle support to the platform in such manner that neither can move or give independently of the others while the machine is at work, thus securing a rigid point of support for the dipper-handle. The height or inclination of the dipper-handle support can be varied by simply varying the length of the rods connected therewith.

The dipper-handle bearing or saddle is represented at R, Fig. 1. This is mounted upon the shaft Q, between the side-pieces of the dipper-handle support, and is capable of movement on said shaft to correspond with the various inclinations which the dipper-handle may be made to assume. It is shown, Figs. 11 to 14, as composed of two side pieces, R' R', a top plate, R<sup>2</sup>, and two central plates, R<sup>3</sup> R<sup>3</sup>, suitably united. The shaft Q passes through the side and central plates and receives also a guide sheave, S, over which the backing-chain passes. The side pieces extend beyond the top plate and carry the projections d d, under which ride the lower side strips, J<sup>2</sup> J<sup>2</sup>, of the dipper-handle. The dipper-handle travels in the direction of its length in or on this saddle or bearing; but when it moves about a horizontal line (as in any upward or downward movement of the dipper) the saddle and handle revolve or move together upon the shaft Q. The projections d d operate to prevent any jumping of the handle out of its seat and to prevent the handle falling away from the saddle when it is vertical, and they are very seldom called into play. The saddle being of considerable length, affords a long bearing for the dipper-handle, and thus avoids great strain, such as would arise from bending it over a small shaft or a drum. The particular construction of the saddle may be variously modified.

M' is the hoisting-chain, the same leading from the hoisting-chain drum F over the sheave M in the upper end of the dipper-handle and down to the shaft O, to which it is securely anchored by the parts M<sup>2</sup> M<sup>2</sup>, Fig. 2.

N' is the backing-chain, the same leading from the backing-chain drum G over the guide-sheave S in the saddle, around sheave N, near the lower end of the dipper-handle, and back to the saddle, where it is securely anchored. Under this arrangement, the dipper being assumed to be at the position ready for taking its load, by winding up the hoisting-chain the dipper is powerfully forced into the bank, and the power is applied in such manner that, acting with the weight of the dipper and its handle, the tendency of the dipper while taking its load is to move into the bank rather than out of it, as is observed in those excavators wherein the power is applied on the same side of the fulcrum or turning-point as the dipper. By holding the backing-chain drum so as to prevent movement of the backing-chain, the



dipper is forced through an arc of a circle, of which the center is in the shaft Q, and thus out of the bank.

The object of the backing-chain is to control and regulate the position of the handle on the saddle, thus determining the distance at which the dipper digs and dumps.

The hoisting-chain and backing-chain may be wound or unwound simultaneously, or one at one time and one at another, and by suitably timing their movements the dipper may be easily and quickly controlled in its various movements upon the saddle. The load being swung to one side, the dipper-door is released to discharge the load, in the usual manner, being swung back over the bank, and the hoisting-chain released, gravity carries the dipper downwardly or causes the handle to approach a vertical position. If allowed to fall rapidly, the momentum of the dipper will carry it near to the machine or the handle beyond the vertical position. Thus the dipper may be lodged at any point by regulating its movements through the medium of the chains. No clamp is required to hold the dipper-handle, as in other machines, and no power beyond the hoisting-chain is required to force the dipper into the bank. The working power is applied to the best possible advantage, and the movements are all rapid and effective. The various brake and friction levers are carried to a position where they can all be operated by one man, so that all the movements of the machine are under the control of a single operator. Thus a given amount of work may be performed by a smaller engine and by fewer men than in other forms of machine using a scoop dipper.

The machinery described is all mounted upon the car or foundation and turns thereon to swing the load, the dipper-handle support and dipper having no lateral movement independent of the platform, being specially braced against such movement, as indicated. The turn-table, interposed between the platform C and car A, is composed of two essential parts, T and T', of which T is affixed to the platform and T' to the car, the former movable upon the latter. Between these two parts are a series of conical friction-rollers, one of which is represented at e, Fig. 16, a portion of the series being indicated in dotted lines, Fig. 15. These rollers are connected by interior and exterior bands and move upon a ledge on the interior of T'. The lower margin of T rides upon the rollers, and the piece is held in proper place by a circular band, T<sup>2</sup>, bolted to T'. The turn-table may be built and operated without rollers, letting the upper part revolve and slide directly upon the lower. The rollers are not essential, but are only to reduce friction.

An arm, T<sup>3</sup>, affixed to T, carries a chain-sheave, T<sup>4</sup>, having a vertical shaft, by which it is revolved in either direction. The swinging chain U is an endless chain passed around the part T', (in the V-shaped channel therein,) around two tightening-sheaves, W W', and

around the sheave T<sup>4</sup>, in the manner shown in Fig. 15. The channel in T' for the chain may have a series of ribs or projections to afford a secure hold or bite for the chain, and the sheaves W and W' are connected with some portion of the platform and made adjustable, so that the chain may be tightened to prevent slipping and to compensate for stretching.

If the sheaves T<sup>4</sup> be revolved, it is plain that the platform must move with it, the force being applied through the chain and acting upon the upper part of the turn-table in a direction always tangent to the circle thereof, no matter to what position it is moved, the chain being taken up on one side and paid out on the other, and always leading in the same general direction. This method of connecting the swinging gear with the turn-table is simple, durable, and effective, and not liable to undue strains or to get out of order.

The vertical shaft T<sup>5</sup> of chain-wheel T<sup>4</sup> carries a beveled wheel, T<sup>6</sup>, at top, and this is turned in either direction by one of two pinions, T<sup>7</sup>, mounted upon the main driving-shaft T<sup>8</sup>, and thrown in or out of connection with the shaft by suitable frictions or clutches, as at T<sup>9</sup>. The dipper having been brought to the required height, as above explained, is swung with the machine and returned with the machine after having been dumped.

The machine may be used for excavating at any point of the circle within which it may be turned. It is easily moved upon the track by lowering the dipper and "kicking" it along. It is calculated to be transported with any train of cars, and may be employed for clearing the track of any wreckage or other obstruction.

The water-tank is preferably located under the platform at the rear, as at f, Fig. 1, but might be placed in any other suitable position.

The machine thus constructed has been found in practice to admirably answer the purposes or objects of the invention, as previously stated.

I do not claim the mere mounting of a scoop-dipper excavator upon a turn-table, upon which it may be occasionally turned to correspond with the position of the bank; but,

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an excavator, the combination, as before set forth, of a dipper-handle, dipper, hoisting-chain, and vertically-adjustable support for the handle, the hoisting-chain being applied on one side of the support and the dipper on the other and the handle arranged to slide up and down upon its support, substantially as shown and described.

2. In an excavator, the combination, with the sliding dipper-handle, of the hoisting-chain, the support for the dipper-handle, and the backing-chain, the hoisting-chain engaging with the handle on one side of the support and the backing-chain on the other, substantially as and for the purposes set forth.



3. In an excavator, the combination of the turning platform, the dipper-handle support mounted thereon, with the sliding dipper-handle, the hoisting-chain applied at the upper end and the backing-chain at the lower end thereof, the platform being arranged to swing the dipper and its load and carrying the engine and boiler, substantially as and for the purposes set forth.

4. In an excavator, the combination, with the vertically-adjustable dipper-handle support, of the saddle mounted upon the outer end thereof, arranged to turn upon a horizontal axis and to sustain the sliding dipper-handle, and the stay-rods connected with the axis of the saddle, substantially as and for the purposes set forth.

5. In an excavator, the turning platform, gallows-frame, vertically-adjustable dipper-handle support, the saddle mounted upon the outer end of the support, and the tie-rods uniting the axis of the saddle and gallows-frame, all arranged and combined and mounted upon said platform, substantially as shown, and for the purposes set forth.

6. In an excavator, the dipper-handle support carrying the dipper-handle, the gallows-frame mounted upon the turning platform and both secured thereto at or near the axis of revolution, the platform carrying the engine and boiler, and the endless chain for turning the platform and its load, combined and arranged substantially as shown and described.

7. In an excavator, the turning platform, the dipper-handle support and gallows-frame mounted thereon, the sliding dipper-handle, dipper, and hoisting and backing chains connected with the dipper-handle on opposite sides of its support, all arranged and applied substantially in the manner and for the purposes set forth.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two witnesses.

JOHN K. HOWE.

Witnesses:

JAMES CLARK,

JAMES H. BLESSING.