(No Model.) 2 Sheets—Sheet 1.

J. HEMPHILL & J. FAWELL.

HYDRAULIC CRANE.

No. 435,179. Patented Aug. 26, 1890.

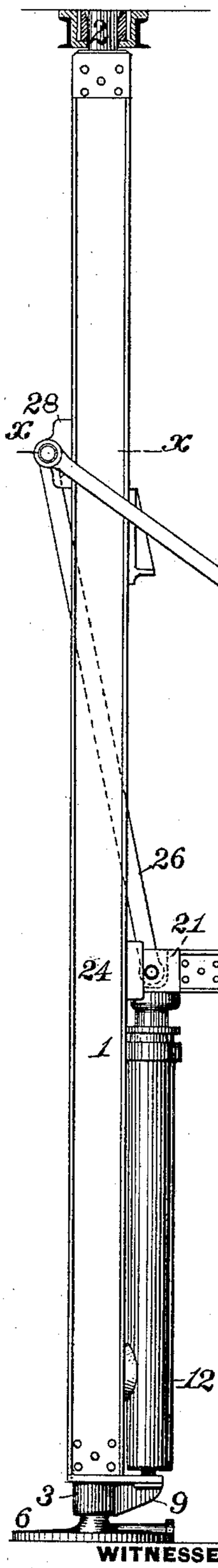

FIG. 1.

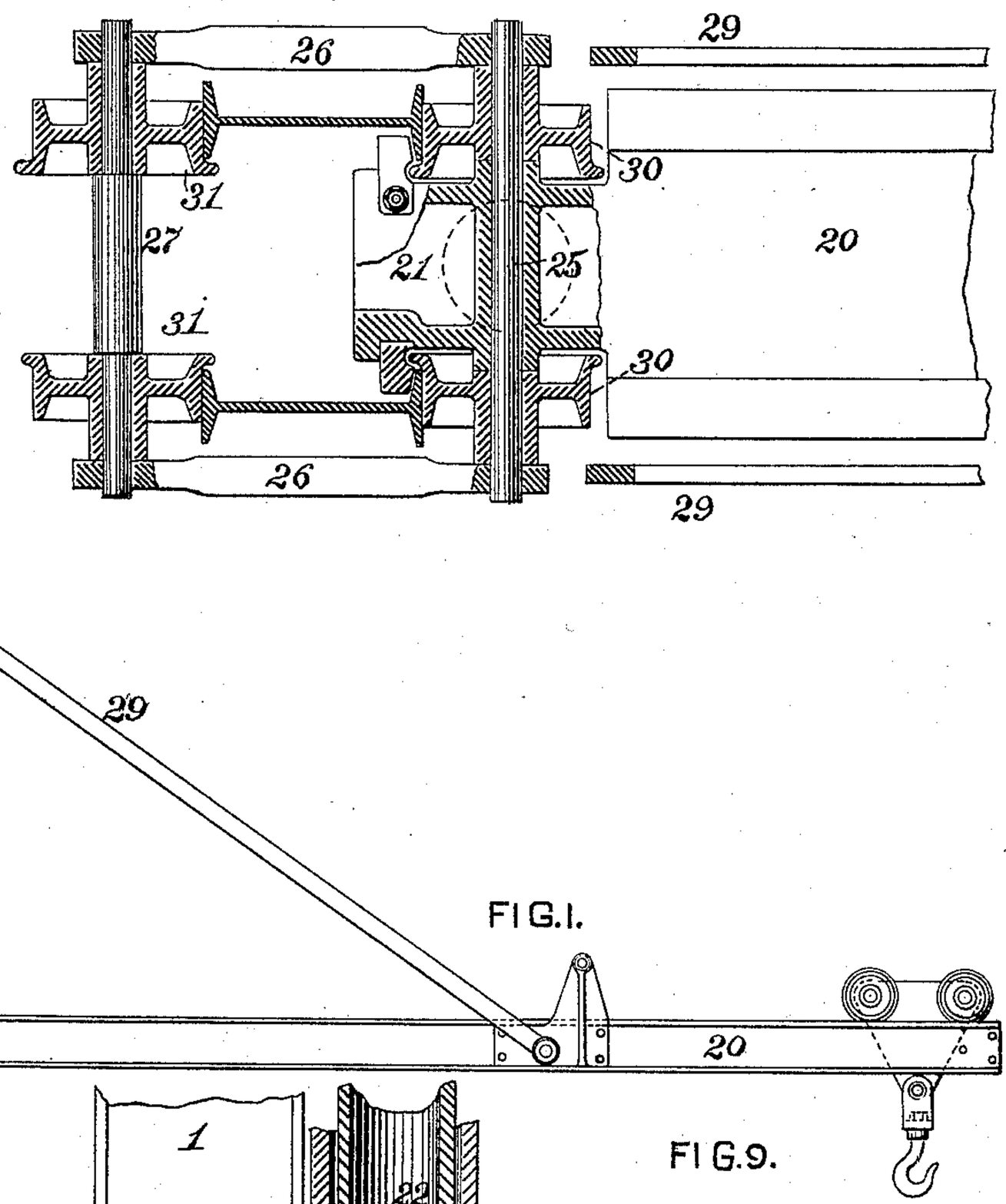

FIG. 7.

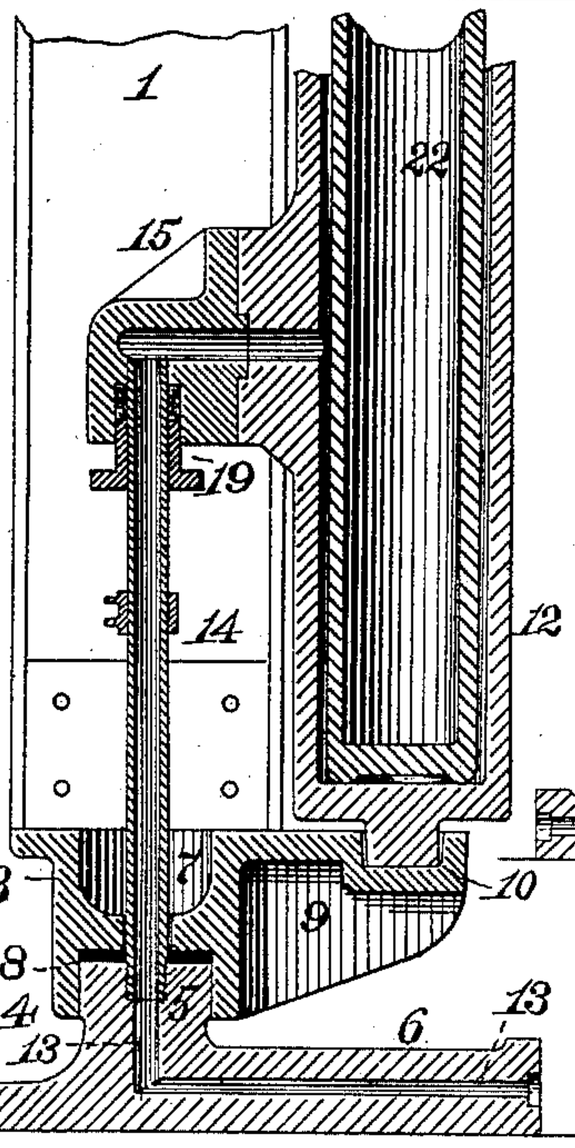

FIG. 2.

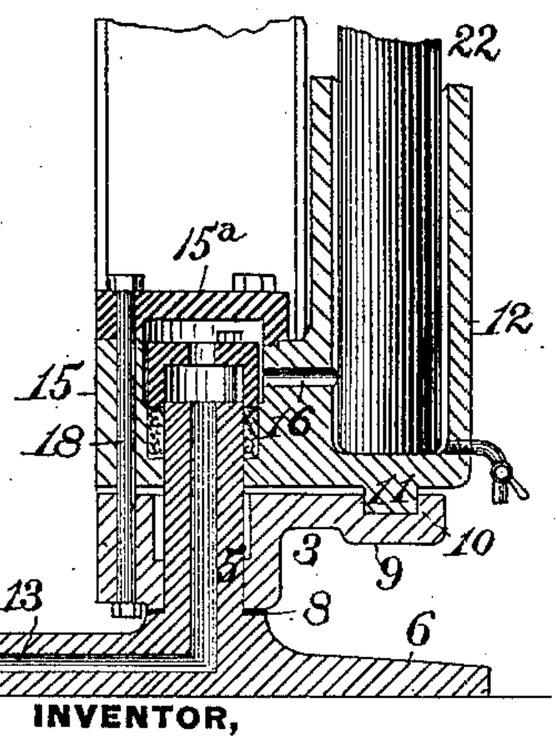

FIG. 9.

WITNESSES:

Damon S. Wolcott

F. E. Gaither.

INVENTOR,

James Hemphill
Joseph Fawell
by George N. Christy
Att'y.

(No Model.) 2 Sheets—Sheet 2.

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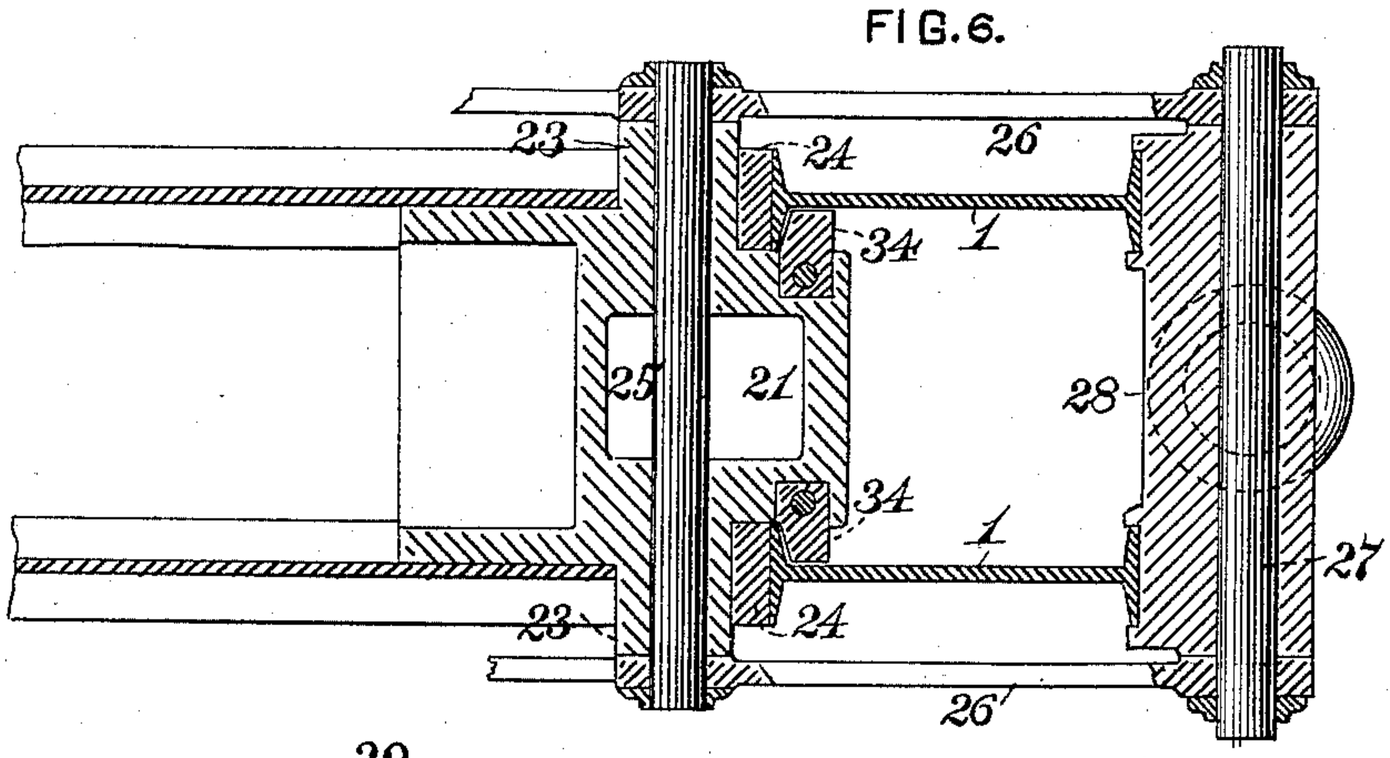
FIG. 6.



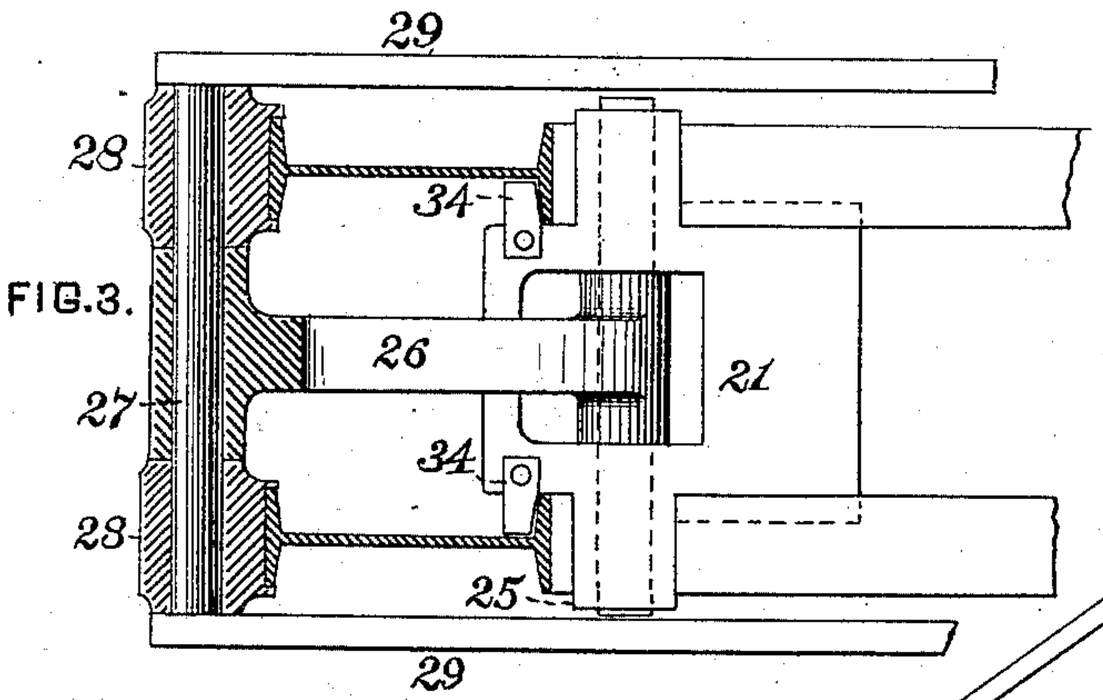


FIG. 3.

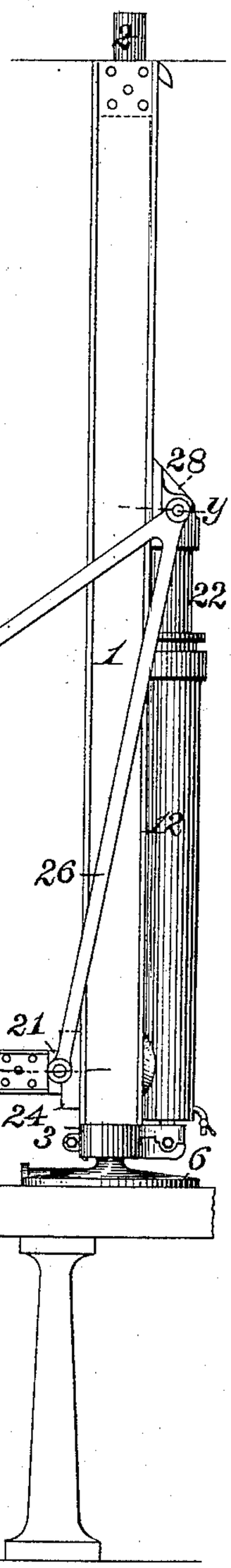


FIG. 4.

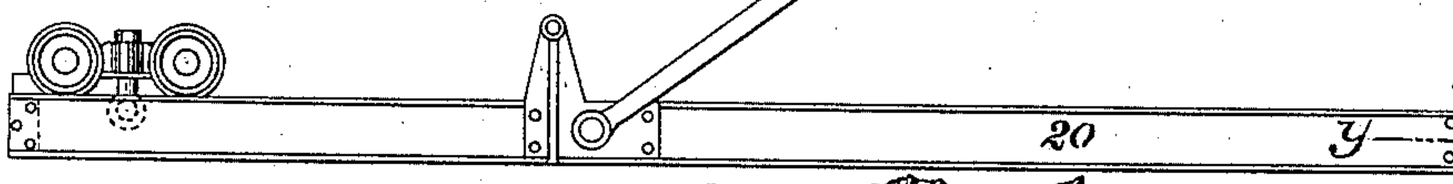


FIG. 8.

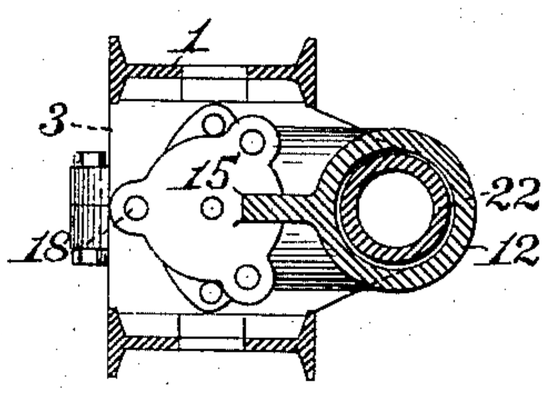
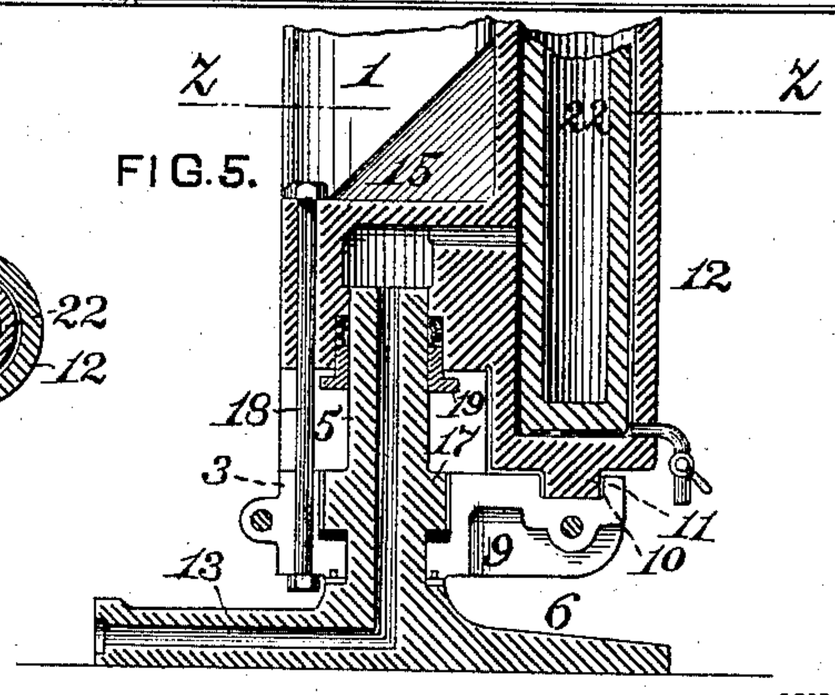


FIG. 5.



WITNESSES:

Damon S. Wolcott

F. E. Gaither.

INVENTOR,

James Hemphill,
Joseph Fawell
by George H. Christy Att'y.

UNITED STATES PATENT OFFICE.

JAMES HEMPHILL AND JOSEPH FAWELL, OF PITTSBURG, PENNSYLVANIA.

HYDRAULIC CRANE.

SPECIFICATION forming part of Letters Patent No. 435,179, dated August 26, 1890.

Application filed April 14, 1890. Serial No. 347,824. (No model.)

To all whom it may concern:

Be it known that we, JAMES HEMPHILL, a citizen of the United States, and JOSEPH FAWELL, a subject of the Queen of Great Britain, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Hydraulic Cranes, of which improvements the following is a specification.

The invention described herein relates to certain improvements in hydraulic cranes of that class or kind wherein provision is made for relieving the plunger of the fluid-pressure cylinders from all lateral strains, which are borne by a suitably-arranged mast.

The invention has for its object such an arrangement of the fluid-pressure cylinder with reference to the points of bearing of the jib and its stay-rod upon the mast that the action of the fluid-pressure cylinder in moving the jib and its connections will effect a considerable reduction of the friction between the shoes or slides of the jib and stay-rod and the mast; and it is a further object of this invention to so construct and arrange the connection of the fluid-pressure supply with the cylinder of the crane that the fluid-pressure will operate to relieve the step or base to a greater or less extent of the weight of the crane and to such extent diminish the friction at such point.

In general terms the invention consists in the construction and arrangement of mechanical devices or elements, all as more fully hereinafter described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view in side elevation of a crane embodying our invention. Fig. 2 is a sectional elevation, on an enlarged scale, of the lower portion of the crane, the plane of section passing through the axis of the cylinder. Fig. 3 is an irregular section taken through the points of bearing of the jib and stay-rod, the plane of section being indicated by the line *x x*, Fig. 1. Fig. 4 is a view, similar to Fig. 1, of a modified form of the crane. Fig. 5 is a sectional elevation of the lower portion of the crane, showing a modification in the manner of mounting the mast on the step. Fig. 6 is a sectional view of the crane shown in Fig. 4, the plane of section being indicated by the line *y y*, Fig. 4. Fig. 7 is a sectional view similar to Figs. 3 and 6, showing the construction wherein friction-rollers are employed. Fig. 8 is a transverse section on the line *z z*, Fig. 5; and Fig. 9 is a sectional view similar to Fig. 5, showing a modification of the construction illustrated in Fig. 5.

In the practice of our invention the mast is formed by I-beams 1, which are bolted at their upper ends to a casting provided with a pin 2, adapted to fit in a suitable bearing secured to the roof-beams of the building, and at their lower ends to a casting 3, provided on its lower side with a socket 4, adapted to fit over a boss or projection 5 on the base or foundation-plate 6. This construction and arrangement of the socket and its supporting boss or projection will prevent the entrance of dirt between the wearing-faces of the two; and, further, this construction permits of the formation of an oil-receptacle 7 in the upper side of the casting, the oil passing down around the fluid-pressure-supply pipe leading to the cylinder and onto the wearing-faces of the projection 6 and socket 4, between which parts it is preferred to place a steel washer 8. The casting or foot-piece 3 is formed with a horizontally-extending bracket 9, provided with a recess 10 for the reception of a stud 11, formed on the lower end of the fluid-pressure cylinder 12, thus providing for the arrangement of the cylinder at one side of the mast or eccentric to its pivotal axis. For the supply of fluid-pressure to the cylinder a passage 13 is formed radially through the base-plate 6 and up through the boss or projection 5. This passage is connected by a pipe 14, screwing into the boss, to an abutment 15 on the cylinder 12, said abutment being either bolted to the cylinder, as shown in Fig. 2, or formed integral therewith, as shown in Figs. 5 and 9. Through this abutment or shoulder is formed a horizontal passage 16, connecting at its inner end with the cylinder and at its outer end with the supply-pipe 14 in such manner that the fluid-pressure shall impinge at an angle, preferably a right angle, the wall of the passage 16. It will be understood that in this construction the fluid-pressure will always have

a lifting action on the crane proportional to the area or diameter of the upper end of the conductor of fluid-pressure to the passage 16, so that when the crane is designed to raise heavy loads it is preferred to employ the construction shown in Figs. 5 and 6. In this construction the connecting pipe 14 is dispensed with, the boss 5 being extended up into the abutment 15, so that fluid-pressure flows directly from the passage 13 into the enlargement at the outer end of the passage 16. As the lifting-power of the fluid-pressure acting on the abutment is considerable and may be sufficient to displace the crane when free from a load, the casting or foot-piece 3 is made in two parts, in order that it may be placed around the boss 5 and under a shoulder 17 formed thereon, and the abutment and foot-piece are securely connected by bolts 18, thereby overcoming any liability of displacing the crane. This manner of introducing the fluid-pressure possesses a still further advantage in the accessibility of the stuffing-box 19, surrounding the pipe 14 or boss 5 where they enter the abutment 15.

In Fig. 9 is shown a construction wherein the abutment 15 is made with an open top and is closed by a removable cap or cover 15ª, normally held in position by the bolts 18, employed for connecting the abutment 15 and the casting 3. This construction permits of the arrangement of the stuffing-box 19 within the abutment, and can be adjusted by removing the cap 15ª.

In the construction of crane shown in Fig. 1 the I-beams forming the jib 20 are attached at their inner ends to a casting or cap-piece 21, provided with a socket for the reception of the piston 22. This casting is provided with lateral wings 23, extending across and somewhat beyond the flanges of the I-beams, as shown in Fig. 3, and between these wings and the faces of the beams shoes or slides 24 are interposed. As shown in Fig. 3, a portion of the cap-piece 21 extends between the I-beams a little beyond the flanges thereof, and to such inwardly-projecting portion are secured keys or blocks 34, passing behind the flanges and serving to prevent any outward movement of the jib. In the upper side of the casting or cap-piece 21 is formed a recess for the reception of the lower end of the compression-rod 26, which is held therein by a pin 25, passing through the casting and an eye on the lower end of said rod. This rod extends upwardly in a diagonal direction between the I-beams 1, and is attached at its upper end to a pin 27, passing through the slides 28, adapted to bear upon and slide along the flanges of the beams 1, as shown in Fig. 3. To the ends of the pin 27 are also connected the upper ends of the tension-rods 29, whose lower ends are connected to the jib 20 at any suitable point along its length. In this construction the load on the jib is transferred by the rods 29 partly to the mast and partly to the compression-rod, and by it to the head of the piston 22. It will be observed that the jib, the tension-rods, and compression-rod form a triangle supported at one of its angles by the piston 22. It will be further observed that as the compression-rod forms an angle with the axis of the piston, said angle being greater or less in proportion to the width of the I-beams, the upward push of the piston will tend to force the slides 28 away from the I-beams, and, vice versa, the downward thrust of the compression-rod, produced by the load and transmitted through the tension-rods, will tend to force the casting or cap-piece 21 away from the I-beams.

It has been the practice heretofore to arrange the fluid-pressure cylinder with its axis coincident with the axis of rotation of the mast and connect the jib and the tension-rods directly to the piston of said cylinder, the lateral thrust of the jib and the like pull of the tension-rods being transferred from the piston by suitable friction-rollers to opposite sides of a mast formed of I-beams arranged alongside of the fluid-pressure cylinder. It is evident that in such a structure the action of the piston cannot in any way affect the lateral strains to which the mast is subjected, and hence the employment of anti-friction rollers is necessary; but by arranging the cylinder eccentric to the axis of rotation of the crane and connecting the point of junction of the jib and piston by a compression rod or rods to the point of bearing of the tension-rods upon the mast, said bearing-points of the jib and tension-rods being on opposite sides of the mast, the upward movement of the piston will so reduce the normal lateral pressure of the tension-rods and jib upon the mast as to permit of the employment of slides and shoes in lieu of friction-rollers to transfer the load from the tension-rods and jib to the mast. If desired, however, friction-rollers may be employed, as shown in Fig. 7, wherein friction-rollers 30 are employed in lieu of the wings 23 and slides 24 to transfer the lateral thrust of the jib, and rollers 31 are substituted for the shoes or slides 28. These friction-rollers 30 and 31 are mounted loosely upon the pins 25 and 27, as shown.

The construction of crane shown in Fig. 4 is adapted for use in places where a considerable lift is required, but where the height of the building or other circumstances render it impossible to use long masts, as are required in the form of crane shown in Fig. 1. In this form of crane the fluid-pressure cylinder 12 is arranged on one side of the mast and the jib on the opposite side, and the piston 22 is connected to the casting to which the upper ends of the tension and compression rods are attached. The connection of the piston with the point of junction of the compression and tension rods permits of the passage of the jib below the upper end of the fluid-pressure cylinder, as shown, thereby permitting of a more compact construction of crane without in any way di-

minishing the vertical lift. This construction of crane is especially advantageous where the arrangement of the plant is such that the base of the crane cannot extend to the floor, it being possible to place the crane on a bracket or shelf, as shown in Fig. 4, without interfering with its efficiency.

By reference to Figs. 4 and 6 it will be observed that the shoes or slides 28 and the socket for the upper end of the piston are formed integral with each other, and, further, that the rods 26 (two being employed in this construction) are compression or tension rods, in accordance with the position of the load on the jib.

We claim herein as our invention—

1. A hydraulic crane having, in combination, a rotatable mast, a jib bearing at its inner end against one side of said mast, tension-rods extending from the jib to the opposite side of the mast and having a bearing thereon, rod or rods connecting the inner end of the jib and the upper ends of the tension-rods, a fluid-pressure cylinder, and a piston vertically movable within the cylinder and connected to the rods extending to the jib at or near their junction with each other, substantially as set forth.

2. A hydraulic crane having, in combination, a rotary mast, a jib movable thereon, a fluid-pressure cylinder supported by the mast eccentric to its axis of rotation, a piston for operating the jib, an abutment projecting laterally from the cylinder and having a passage formed therein leading to the cylinder, and a fluid-pressure connection passing through the pivotal support of the mast and connected to the passage in the abutment, substantially as set forth.

3. A hydraulic crane having, in combination, a base-plate having an upwardly-projecting boss having a passage therethrough connected with the fluid-pressure supply and provided with a shoulder 17, a sectional foot-piece surrounding the boss under the shoulder 17, a rotary mast attached to the foot-piece, a jib movable thereon, a fluid-pressure cylinder supported by the foot-piece eccentric to the axis of rotation of the mast, a piston for operating the jib, and an abutment projecting laterally from the cylinder and adapted to fit over the upper end of the boss of the base-plate and having a passage connecting the passage in the boss with the cylinder, substantially as set forth.

4. A hydraulic crane having, in combination, a base-plate provided with an upwardly-projecting boss having a passage therethrough connected with a fluid-pressure supply, a foot-piece having the mast attached thereto and surrounding and supported by said boss, a fluid-pressure cylinder supported by the foot-piece eccentric to the axis of rotation of the mast, an abutment having an open top and projecting laterally from the cylinder, said abutment fitting over the upper end of the boss and provided with a passage communicating with the cylinder, a stuffing-box surrounding the boss within the abutment, and a cap or cover for the abutment, substantially as set forth.

In testimony whereof we have hereunto set our hands.

JAMES HEMPHILL.
JOSEPH FAWELL.

Witnesses:
R. H. WHITTLESEY,
DARWIN S. WOLCOTT.