(No Model.) 2 Sheets—Sheet 1.

W. L. SCAIFE.
HYDRAULIC CRANE.

No. 523,445. Patented July 24, 1894.

Fig. 1.

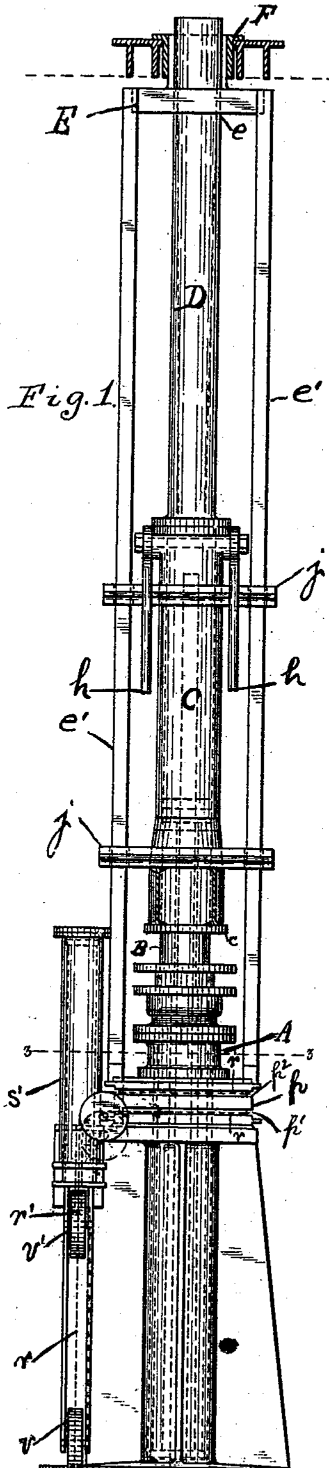

Fig. 2.

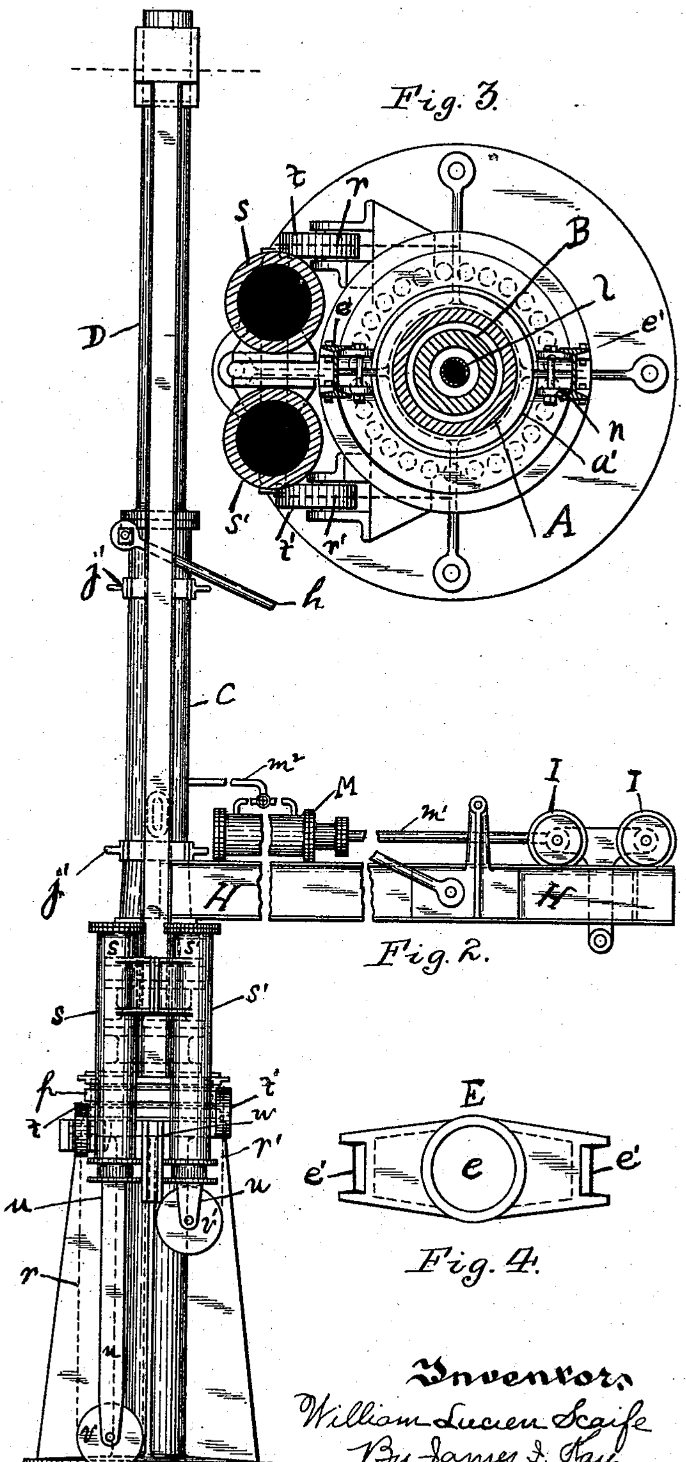

Fig. 3.

Fig. 4.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

W. L. SCAIFE.

HYDRAULIC CRANE.

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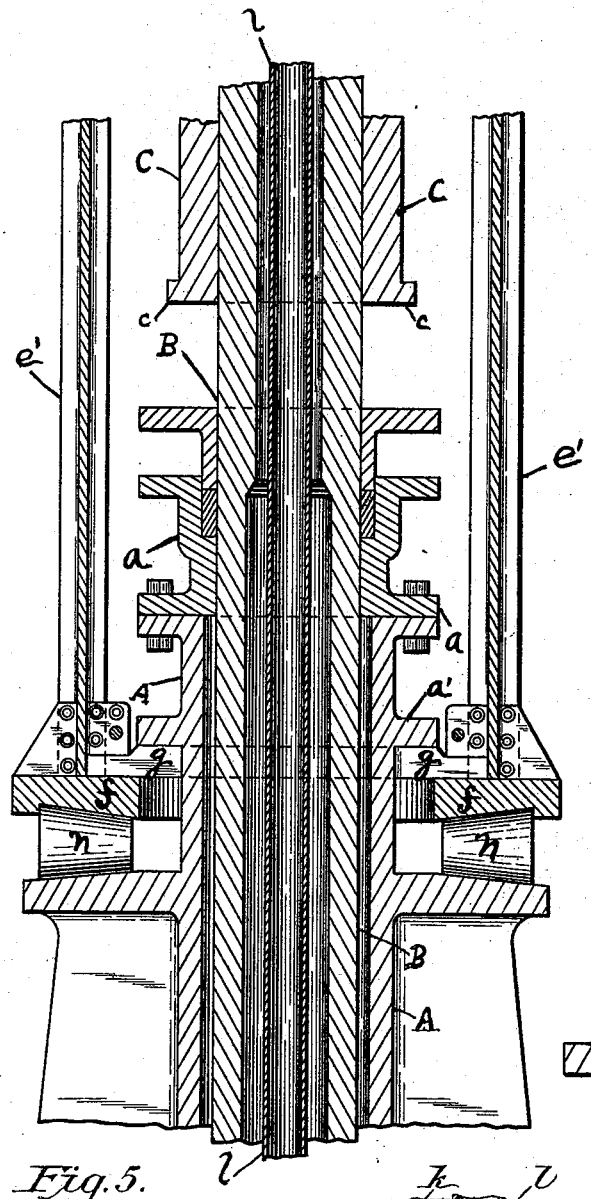

Fig. 5.

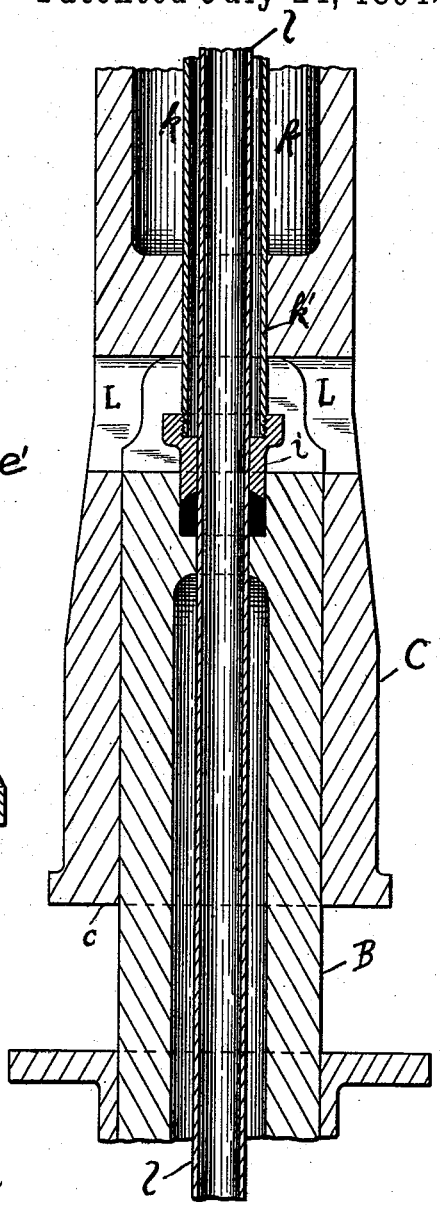

Fig. 6.

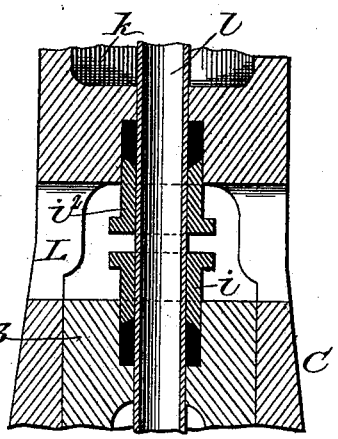

Fig. 7.

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UNITED STATES PATENT OFFICE.

WILLIAM LUCIEN SCAIFE, OF ALLEGHENY, PENNSYLVANIA.

HYDRAULIC CRANE.

SPECIFICATION forming part of Letters Patent No. 523,445, dated July 24, 1894.

Application filed August 7, 1890. Serial No. 361,323. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM LUCIEN SCAIFE, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Hydraulic Cranes; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to hydraulic cranes, it having among its objects, the relieving of the roof of the mill from the upward strain very often exerted by such cranes; the rotation or swinging of such cranes by hydraulic mechanism; and the furnishing of the full hydrostatic pressure employed in raising the crane for the operation of the trolley or carrier on the jib of the crane, or of other operative mechanism, on the movable body of the crane.

My invention is specially applicable to what is known as the Holley crane, though some of the improvements may be employed with other hydraulic cranes, and when so employed are included within my invention.

The ordinary Holley crane is generally constructed with a cylinder, and a plunger moving therein; a middle mast supported by the plunger and to which the jib is secured, and a top mast which extends up through a bearing termed the top steadiment, this top steadiment being supported in the roof of the foundry or mill, and the top mast moving longitudinally through and turning within such steadiment. It is found, however, that the ordinary mill roof is generally constructed to bear downward strains, and that it is seldom sufficiently strong and rigid to bear the upward strain incident to the rising of the top mast through the top steadiment, so that the roof is liable to become injured by the movement of the crane; and the principal object of my invention is to overcome this difficulty. This I accomplish by providing a frame having a top bearing mounted within the top steadiment, and tie rods extending down to the cylinder of the crane and held thereto against upward thrust; and by mounting the top mast or upper portion of the crane in the top bearing of such frame; the top mast thus ascending and descending within the bearing of the frame, which sustains all vertical strains through its tie rods extending down to the cylinder, while the frame itself turns with the plunger. Consequently, all the strain to which the roof is subjected, is a horizontal or transverse strain which it is well adapted to sustain.

In the ordinary crane, difficulty has been found in operating the trolley running upon the jib by hydraulic power, as suitable means have not been provided for carrying the full hydraulic pressure from the accumulator to jacks or cylinders carried by the vertically moving body of the crane, except by flexible hose, which do not permit the complete and unimpeded rotation of the crane. This I have accomplished by forming in the movable body of the crane, a water reservoir from which the pipes may lead to the ordinary jacks or operating cylinders; and by carrying through the plunger and into such reservoir, a stationary pipe, this pipe extending centrally up through the plunger and into such chamber, and so continually supplying the reservoir with the fluid under the accumulator pressure, and at the same time permitting the unimpeded rotation of the plunger around it. I have also improved the construction of the crane in other particulars, as will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a front view of the crane, the jib being broken away. Fig. 2 is a side view of the same. Fig. 3 is a cross section on the line 3—3 Fig. 1. Fig. 4 is a detail view of the top bearing. Fig. 5 is an enlarged detail longitudinal section showing the connection between the cylinder and the frame extending down from the top steadiment. Fig. 6 is a detail longitudinal central section showing the connection between the plunger and middle mast and one method of packing the supply pipe at the top of the plunger and bottom of the reservoir in the middle mast, and Fig. 7 is a detail longitudinal central section showing another method of packing the supply pipe at the top of the plunger and bottom of the reservoir in the middle mast.

Like letters of reference indicate like parts in each of the views.

The principal parts of the crane illustrated in the drawings, are the same as those usually employed in the Holley crane, and these parts will be simply identified, the full description thereof not being considered necessary.

The cylinder A is mounted on any suitable foundation, and in said cylinder is the plunger B which passes through the packing gland *a* at the upper end of the cylinder. The upper end of the said plunger B enters within a socket *c* at the base of the middle mast C; and at the top of said middle mast is the top mast D, which can either be connected thereto by a like joint or by a flange joint as shown. Fitting around the upper end of the top mast is the bearing *e* of the tie frame E, this tie frame having the tie rods *e'*, which extend down to the cylinder A, and having at the base thereof the bearing or ring plate *f*, which is mounted in any suitable manner upon the cylinder A around the packing gland *a* thereof. The tie rods *e'* are generally formed of **I**-beams of proper section, according to the strain to which they are subjected.

In order to tie or hold down the tie frame, I form on the cylinder A, below the packing gland *a*, an annular projection or flange *a'*, which extends out toward the ring *f;* and upon said ring *f*, I place a split ring *g*, which extends inwardly under the annular flange *a'*, and acts through said flange to hold the tie frame down and sustain any upward strain to which said frame may be subjected. By the term "split ring" I mean a ring made in two or more parts, so as to fit around the cylinder and pass under the annular flange or shoulder *a'* thereof; such ring being secured to the tie frame by bolting or in other suitable way. The other end of the frame E is mounted in the top steadiment F, which is connected to the roof of the building, and the frame turns with the crane within the top steadiment, but the only movement sustained by the steadiment is a rotatory one, there being no upward movement of the tie frame whatever; but that frame sustaining all the vertical strains produced by the crane, and so entirely relieving the top steadiment and roof therefrom.

Any suitable arrangements of friction rollers or like devices may be employed between the top bearing *e* of the frame E, and the top steadiment, or between said bearing and the top mast of the crane.

In the crane shown, the jib H is rigidly joined to the middle mast, and extends out therefrom; said jib being generally formed of **I**-beams of suitable section, with suspension rods *h* extending from the upper part of the middle mast down at an incline to the outer end of the jib. The trolley I runs on the **I**-beams forming the jib, and can be operated either by hand power or any other suitable way. For large cranes it is extremely desirable, however, to employ hydraulic power for operating the trolleys I, and I form of or in the middle mast C, a reservoir *k*, for holding the liquid under pressure.

The reservoir *k* may either be formed of the body of the middle mast, or, if desired, a wrought metal cylinder *k'* may be secured therein, as shown in Fig. 6. In order to feed the liquid to such reservoir, I provide the supply pipe *l*, which enters the base of the cylinder A, and passes upwardly through the plunger B centrally thereof, (the plunger being formed hollow as shown,) and thence enters into the reservoir *k* of the middle mast. The pipe *l* is of such length as to extend close to the upper end of the reservoir when the ram is in its lowest position, and as said pipe is stationary, it thus acts to supply the fluid to the reservoir in all the movements of the ram.

I prefer to form the supply pipe *l* of brass to prevent friction and rusting, and in order to prevent the escape of the fluid either upwardly through the plunger or downwardly from the reservoir in the middle mast, I provide the stuffing boxes as more clearly shown in Fig. 7, these stuffing boxes being located in a horizontal passage L extending through the middle mast and upper end of the plunger. The gland *i* acts to pack the pipe *l* at the upper end of the plunger B and the gland i^2 acts to pack said pipe at the lower end of the reservoir in the middle mast so as to prevent escape of the fluid from the reservoir. These glands can be operated in any suitably way, either by screwing them into the plunger or reservoir of the middle mast, or by the use of bolts, as may be desired. The horizontal passage L above referred to, gives easy access to these glands and provides for the repacking of the stuffing boxes in case of leakage.

Where the removable reservoir *k'* is employed as illustrated in Fig. 6, it can be formed of a wrought metal tube, and the lower end of the tube can be secured to the gland of the stuffing box between the pipe *l* and plunger, so that the single stuffing box will serve to pack the pipe in both the plunger and reservoir. By such constructions, the full pressure of the accumulator may be carried into the reservoir *k* in the middle mast and pass thence to any suitable jack or cylinder for operating the trolley I, or any like part supported on the movable body of the crane. For example I have illustrated the cylinder M, the piston rod *m'* of which is connected to the trolley I, said cylinder being supplied through the pipe m^2 from the reservoir *k*.

The tie frame E is connected to the movable body of the crane in any suitable way so as to rotate therewith, and for this purpose the brackets *j* are connected to the middle mast, and extend out at the upper and lower ends thereof in line with the tie rods *e';* the brackets having either shoes or rollers *j'* or like devices, traveling over the edges of the tie rods, so that as the movable body of the crane rises or descends, said shoes will travel

along the tie rods, but when the crane is turned, through such brackets the tie frame E will be turned with it. In order to reduce the friction between the lower end of the tie frame and the cylinder A, I prefer to employ any suitable turning surfaces, such as vertical friction rollers *n*, as in Fig. 3, or horizontal friction rollers as in Fig. 5.

Where the crane is turned or swung by any suitable power, such power mechanism preferably operates upon the lower bearing of the tie frame, and is attached to the main cylinder of the crane. In the construction shown in Figs. 1, 2 and 3, I have shown suitable means for turning the movable body of the crane, this consisting of the chain wheel *p*; chains *r r'* passing around the same and hydraulic jacks *s s'* for operating the chains. This chain wheel *p* forms part of or extends below the ring *f* in the construction shown in Figs. 1, 2 and 3, and has on the periphery thereof, the annular recesses *p p'*, in which said chains *r r'*, respectively, fit, the chains *r r'* being secured to the chain wheel at the rear face thereof and extending in said grooves in the opposite directions to each other, around the wheel *p* and over guiding sheaves *t t'*. The jacks *s s'* are preferably single working, as shown, and the jacks have plungers *u u'*, said plungers carrying sheaves *v v'* under and around which the chains *r r'* pass, said chains being secured to the cylinder between the jacks as at *w*.

The valve mechanism of the two hydraulic jacks *s s'* is so connected as to provide for the movement of their plungers regularly in opposite directions, so that in order to turn or swing the crane, upon admitting the pressure to one jack, through its plunger and the sheave thereon, it will force down the chain, and thus rotate the chain wheel, while at the same time the plunger of the other jack is raised by its chain into position to draw the crane in the opposite direction when desired. Any desired movement of rotation can thus be imparted to the crane.

In the operation of the crane as it is raised or lowered through the pressure within the cylinder A, the top mast rises through the top bearing *e* of the tie frame E, and any friction of said top mast in said bearing is sustained by said tie frame, which is tied or held down to the cylinder, so that there is practically no upward strain upon the top steadiment. In case it is desired to swing the crane from side to side, the top bearing of the frame E moves within the top steadiment and the only strain brought upon said steadiment is the transverse strain resulting therefrom and from the load carried, and which the ordinary mill or foundry roof can be readily adapted to sustain.

The crane may be swung around either by hand, or by power through any suitable power connections; or through that illustrated, namely, the movement of the chains around the chain wheel *p*, the same being operated by the hydraulic jacks *s s'*. In such case the jacks turn the tie frame, and, through the brackets *j* on the middle mast thus turn the mast and the parts connected thereto.

In case it is desired to move by power, the trolley I upon the jib, or like parts on the movable body of the crane the full pressure from the accumulator may be employed for this purpose, through the connections with the reservoir *k*, the fluid being continually supplied to said reservoir from the accumulator through the supply pipe *l*, so that sufficient pressure to move any load can be obtained. At the same time as the entire pressure of the accumulator passes into this reservoir, the total lifting pressure obtained is equal to that due to the entire section of the plunger, the loss of pressure caused by the supply pipe *l* in the cylinder, being replaced by the upward pressure in the reservoir, due to the same pipe. The dead load of the movable body of the crane is also to any extent counterbalanced by varying the diameter of the pipe *l*, and part of the fluid employed in lifting is saved, for as the crane descends a portion of the fluid in the reservoir is forced back through the pipe *l* into the accumulator and the crane must descend against the pressure thereof.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a hydraulic crane, the combination with the stationary cylinder and the vertically movable body, of the revoluble tie frame mounted at its bottom on the cylinder and held from upward movement, the vertically movable body having its plunger moving in said cylinder and its upper end journaled in the top bearing of the tie frame, substantially as and for the purposes set forth.

2. In a hydraulic crane, the combination with the stationary cylinder, of a tie frame mounted at its bottom on the cylinder and held from upward movement, a top steadiment in which the top bearing of said tie frame is journaled, and a vertically movable and revoluble body having its plunger moving in said cylinder and its upper end journaled in the top bearing of the tie frame, substantially as and for the purposes set forth.

3. In a hydraulic crane, the combination of a stationary cylinder, a tie frame mounted at its base on the cylinder and having a lip extending under a flange on the cylinder to hold the frame against rising, and a vertically movable moving body having its upper end journaled in the top bearing of the tie frame, substantially as and for the purposes set forth.

4. In a hydraulic crane, the combination of a cylinder, a tie frame mounted on said cylinder, a vertically movable body having its plunger moving in the cylinder and its upper end journaled in the top bearing of the tie frame, said body having brackets extending out and traveling upon the said frame, and power mechanism engaging with the lower

part of said frame for turning said frame and with it the vertically movable body of the crane, substantially as and for the purposes set forth.

5. In a hydraulic crane, the combination of the main cylinder, a vertical frame mounted thereon and having a chain wheel at its base, chains secured to and passing around said chain wheel in opposite directions, and power cylinders supported on the main cylinder and connected to and moving said chains, substantially as and for the purposes set forth.

6. In a hydraulic crane, the combination with a cylinder, of a vertically movable body containing a reservoir, and having a plunger moving within the cylinder, and a tube passing centrally through the cylinder and plunger into said reservoir to supply fluid under pressure thereto, said stationary tube having no communication with the cylinder and being the entire source of supply to the reservoir.

7. In a hydraulic crane, the combination of a cylinder, a vertically movable body having a plunger moving within said cylinder, a removable reservoir secured within said vertically movable body, and a stationary tube passing centrally through said plunger and into said reservoir, substantially as and for the purposes set forth.

In testimony whereof I, the said WILLIAM LUCIEN SCAIFE, have hereunto set my hand.

WILLIAM LUCIEN SCAIFE.

Witnesses:
J. N. COOKE,
ROBT. D. TOTTEN.