(No Model.)

W. S. HALSEY.

STEAM HYDRAULIC CRANE.

No. 505,220. Patented Sept. 19, 1893.

Fig. 2. *Fig. 1.*

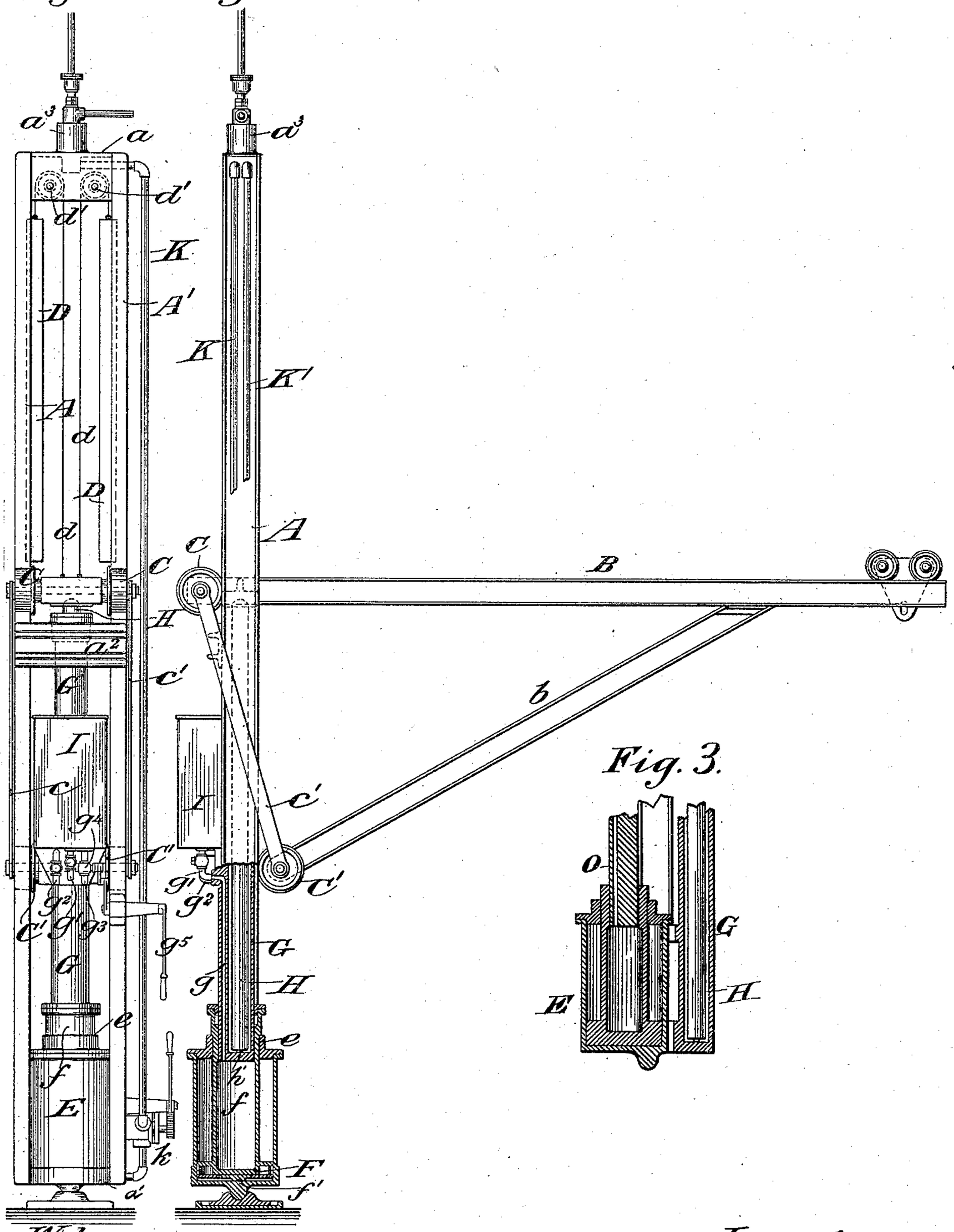

Fig. 3.

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STEAM HYDRAULIC CRANE.

SPECIFICATION forming part of Letters Patent No. 505,220, dated September 19, 1893.

Application filed January 9, 1893. Serial No. 457,744. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. HALSEY, of Allentown, in the county of Lehigh and State of Pennsylvania, have invented a new and useful Improvement in Steam Hydraulic Cranes, of which the following is a specification.

My invention relates to an improvement in steam hydraulic cranes in which an overhanging counterbalance arm, adapted to travel up and down a mast, is operated by a liquid under the control of steam from a suitable source.

The object is to economize steam and render the structure compact and simple, and at the same time increase its effectiveness and durability.

A practical embodiment of my invention is represented in the accompanying drawings, in which—

Figure 1 is a view of the crane in side elevation, partly in section, the traveling arm being shown in its lowered position. Fig. 2 is a view in front or end elevation; and Fig. 3 is a partial vertical section, showing the ram cylinder at the side of the steam cylinder.

The mast consists, in the present instance, of a pair of parallel uprights A, A′, spaced from each other and united at top and bottom by cross heads a, a' and intermediate of its ends by a cross tie a^2. The mast may be supported in any well known or approved manner to rotate and for purposes of introducing steam inlet and exhaust pipes at the top, I provide the cross head a with a central hollow journal a^3, through which said pipes may pass to and from the position of the steam cylinder at the base of the mast.

The traveling overhanging arm is represented by B and, together with its brace b, is secured to the mast to travel up and down thereon. A pair of wheels C journaled in the end of the arm engage the uprights upon the side of the mast opposite that from which the arm extends and a second pair of wheels C′, journaled in the brace adjacent to the mast, bear against the uprights on that side from which the arm and brace extend. Struts c, c' extend diagonally across the opposite sides of the mast and connect the end of the arm B with the end of its brace b. The traveling arm and the parts permanently fixed thereto are counterbalanced, (less a sufficient weight to cause them to drop under the influence of gravity) by weights D suspended by flexible connections d which extend from the weights over fixed pulleys d' at the top of the mast and thence down to the end of the arm B between the uprights A, A′.

A steam cylinder E is fixed between the uprights A, A′ at the base of the mast. Within the cylinder E a piston F works, the stem f of the piston being hollow and free to slide in the upper head e of the cylinder.

The ram cylinder is denoted by G and extends from the upper head of the cylinder E up to the cross tie half the height of the mast, more or less. The lower end of the ram cylinder is located within the hollow stem of the piston F, and the said stem is adapted to slide on the ram cylinder, the joint between the two being liquid tight.

The ram within the chamber G is denoted by H and is connected at its upper end with the end of the traveling arm B. The joint between the ram and its bearing in the head of the ram cylinder is made liquid tight. Both the piston F and the ram H are provided with central depending teats, as shown respectively at f' and h, to prevent their lower faces from seating on the bottoms of the cylinders steam or liquid tight. A port g leads from the lower end of the ram cylinder along its wall separate from the interior of the ram cylinder, from the interior of the hollow piston stem, to a point near the bottom of a liquid supply tank I, fixed to the mast above the cylinder E. A connecting pipe g' provided with a check valve of any well known or approved form permits the ready flow of liquid from the tank I into the port g and thence into the hollow piston stem but prevents it from returning from the said hollow stem to the tank. A second connecting pipe g^2 provided with a check valve of any well known or approved form, permits the liquid to flow freely under pressure from within the hollow piston stem through the port g into the ram cylinder but prevents it from flowing in the opposite direction. A third connecting pipe g^3, provided with a valve or cock g^4 operated by a lever g^5 under the control of the operator, permits—when open—the liquid

to flow from the interior of the ram chamber into the tank I. Steam inlet and exhaust pipes K, K′ enter the hollow journal at the head of the mast and extend along down by the side of the mast to a three way cock *k*, or other well known controlling device for admitting steam into the cylinder E beneath the piston F and permitting its discharge therefrom.

In operation, suppose the traveling arm to be down in the position shown in Fig. 1, the piston F at the bottom of the cylinder E, the hollow piston stem filled with liquid, the tank I supplied with liquid, and the ram cylder G filled with liquid between the ram and its wall, the ram itself being in depressed adjustment. If now it be desired to elevate the arm B, steam from a suitable supply may be admitted into the cylinder E beneath the piston F to an amount sufficient, either by direct pressure or by working expansively, to raise the piston F to a height which will give the arm B the desired elevation. The rise of the piston F will expel the liquid from within its hollow stem, forcing it through the port *g* and connection g^2 into the ram cylinder and thereby lifting the ram and its load. The arm B may be lowered by throwing the cylinder E open to the exhaust and then manipulating the valve g^4 to permit the liquid to escape from the ram cylinder into the tank I from whence it will escape under its own weight through the connection *g′* and port *g* into the hollow stem of the piston F as the latter descends to the bottom of the cylinder E. At whatever point in the upward travel of the arm B the steam be cut off, the arm will be held in that position because of the closure of the ram cylinder against the flow of liquid therefrom excepting by the intentional opening of the valve g^4. When, for any cause, it is desired to stop the arm B intermediate of its full upward movement and to subsequently elevate it still further, there will be no loss of steam on account of condensation or escape within the cylinder E, for the reason that, as soon as the volume of steam beneath the piston F begins to diminish and the piston to fall, the space within the hollow piston stem will be automatically supplied with liquid from the tank I through the connection *g′* and port *g* so that when steam is again admitted to the cylinder E to cause a further upward movement of the arm B, it will work against a full volume of liquid within the hollow piston stem and the piston F will require to be lifted only an amount equal to the additional distance it would have been required to be lifted had the additional upward movement of the arm B taken place continuously with its first upward movement.

It will be observed that the construction and arrangement of the parts are very simple, that the liquid is compactly held in proximity to the point where its lifting power is to be finally exerted, that the steam is not permitted to come in contact with the liquid which it forces and that there is very little extent of pipe surface for conducting either liquids or steam.

Instead of arranging the piston stem to slide over the ram cylinder, it may be constructed to slide over a separate plunger O, as shown in Fig. 3, and the ram cylinder may be placed out of alignment with the steam cylinder and placed with its lower end at the base of the steam cylinder.

It is obvious that slight changes might be resorted to in the form and arrangement of the several parts described without departing from the spirit and scope of my invention. Hence I do not wish to limit myself strictly to the construction and arrangement herein set forth, but

What I claim is—

1. The combination with the mast mounted to turn, and the traveling arm thereon, of a hydraulic cylinder with its piunger for operating the traveling arm, and a pump cylinder and piston for forcing the liquid to the hydraulic cylinder, the said hydraulic and pump cylinders being mounted to turn with the mast, substantially as set forth.

2. In combination, the mast, the traveling arm, the steam cylinder at the base of the mast, the ram cylinder extending upwardly from the steam cylinder along the mast, the ram seated within the ram cylinder and engaged with the traveling arm, the piston adapted to reciprocate within the steam cylinder, means for admitting steam to the cylinder upon one side of the piston, an inclosed volume of liquid between the piston and the ram cylinder, a liquid supply tank located above the steam cylinder and liquid conduits with their valves connecting the supply tank and inclosed volume of liquid with each other and with the ram cylinder, substantially as set forth.

3. The combination with the mast and traveling arm, of a ram cylinder, a ram seated within the cylinder and engaged with the arm, a steam cylinder at the side of the ram cylinder, a steam piston having a hollow stem adapted to fit and slide over the end of a plunger, a liquid supply tank, a conduit leading from within the hollow piston stem to the ram cylinder, a check valve in the conduit, a conduit leading from the supply tank to the hollow piston stem, a check valve in the conduit, a conduit leading from the ram cylinder to the supply tank, a valve in said conduit under the control of the operator, and means for admitting steam to the steam cylinder, substantially as set forth.

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