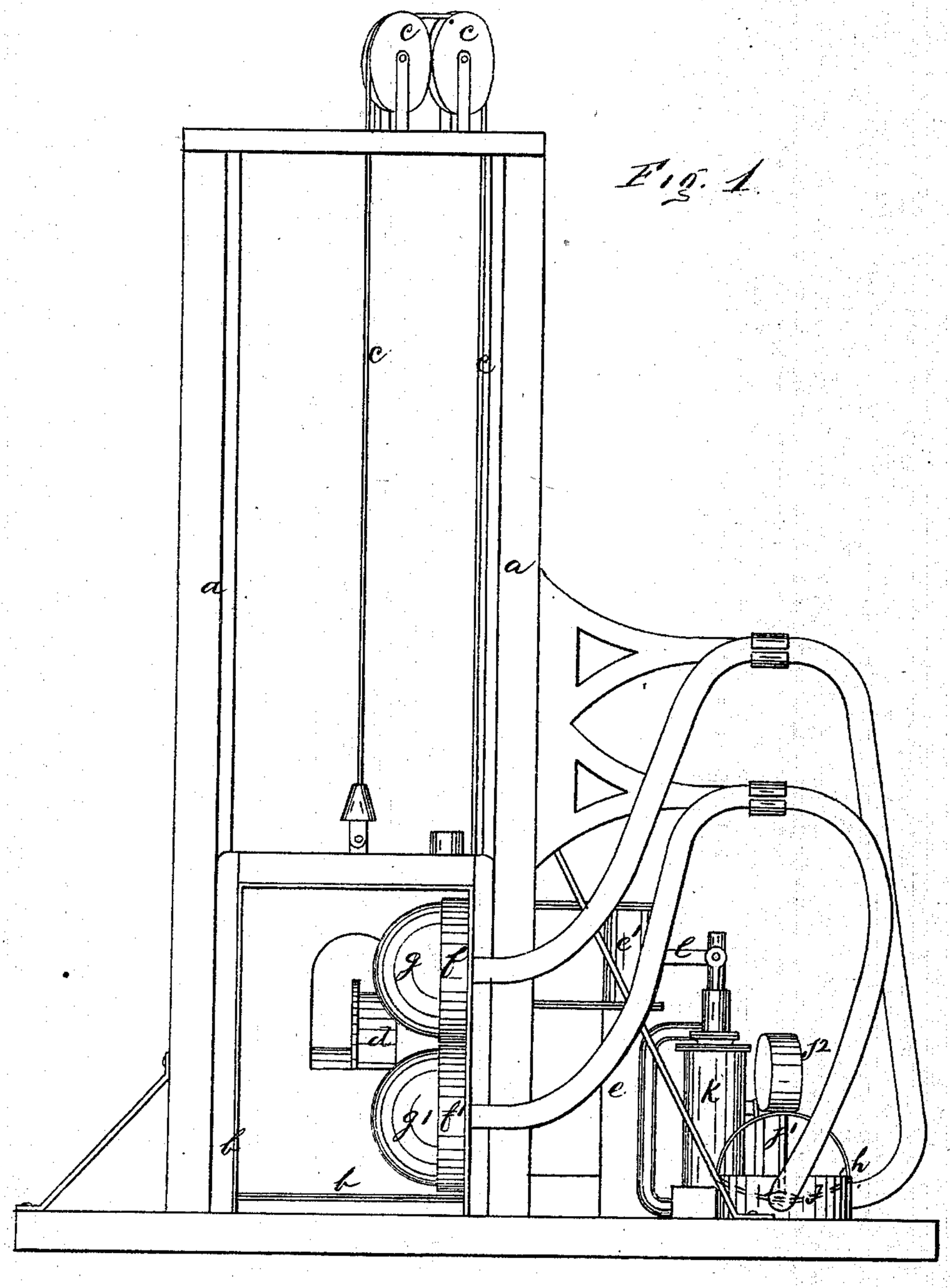
4 Sheets--Sheet 1.

C. R. OTIS.

Hoisting-Apparatus.

No. 146,090. Patented Dec. 30, 1873.

Fig. 1.



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4 Sheets--Sheet 2.

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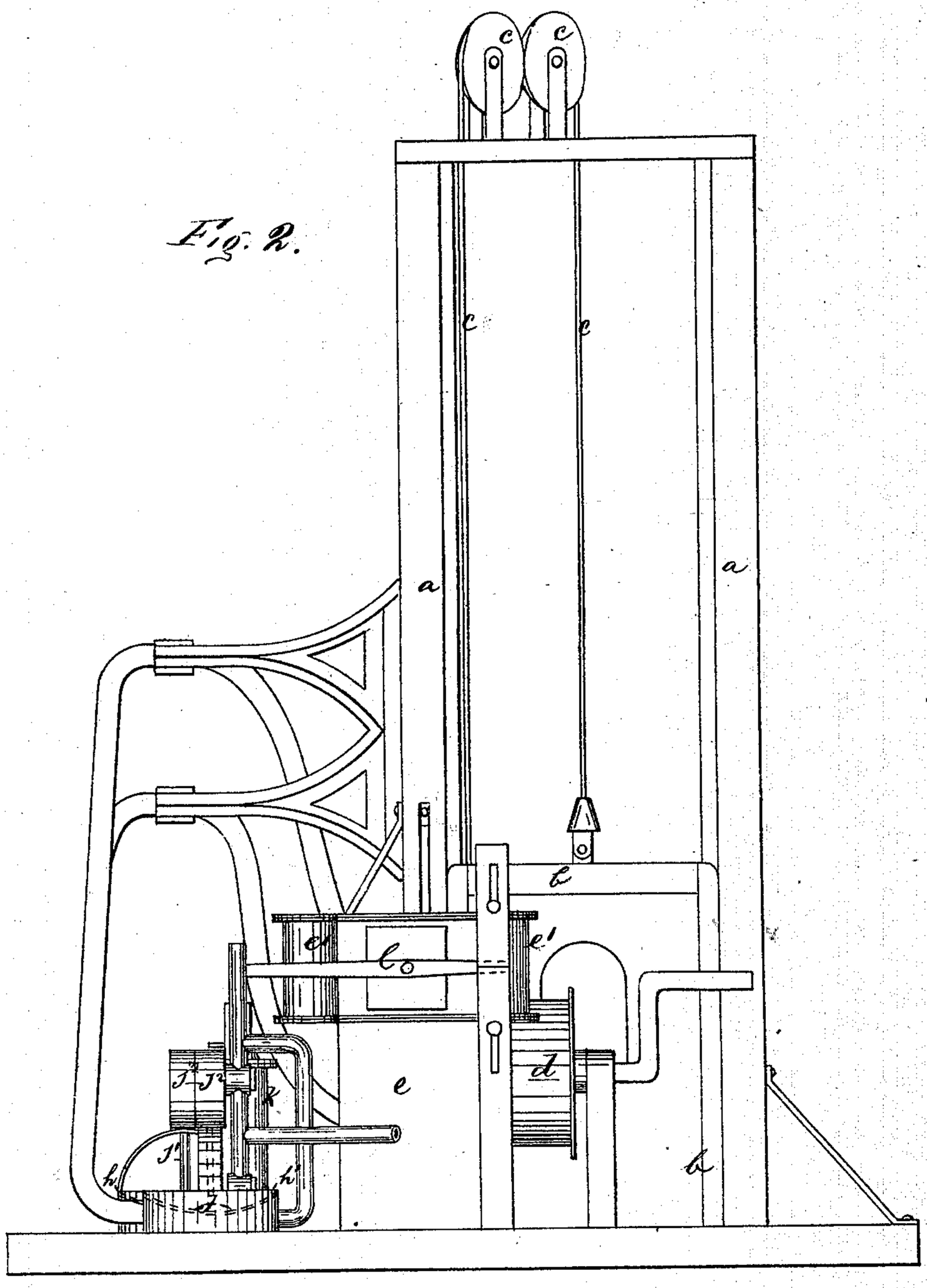
Hoisting-Apparatus.

No. 146,090. Patented Dec. 30, 1873.

Fig: 2.



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4 Sheets--Sheet 3.

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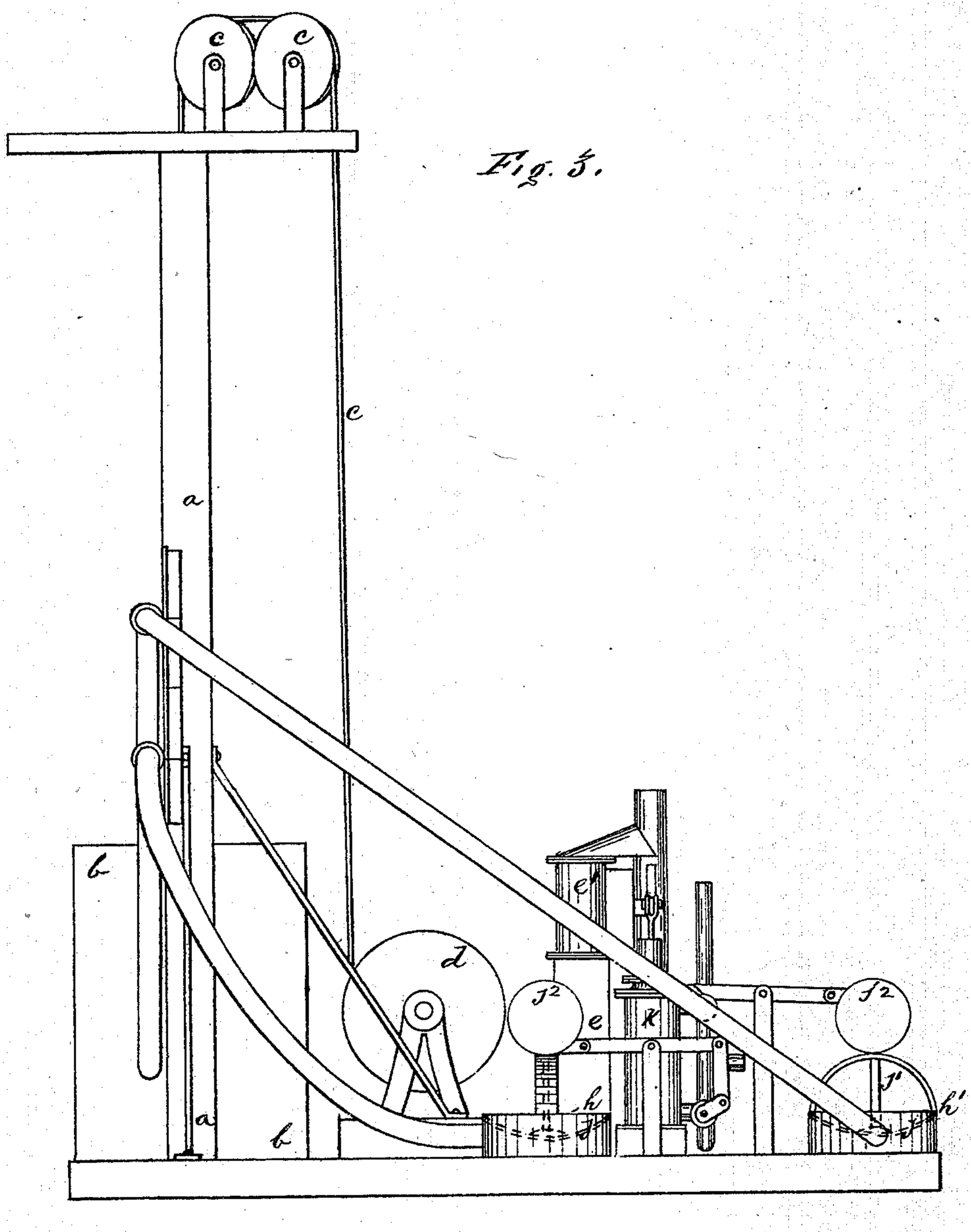
Hoisting-Apparatus.

No. 146,090. Patented Dec. 30, 1873.

Fig. 5.



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4 Sheets--Sheet 4.

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Hoisting-Apparatus.

No. 146,090. Patented Dec. 30, 1873.

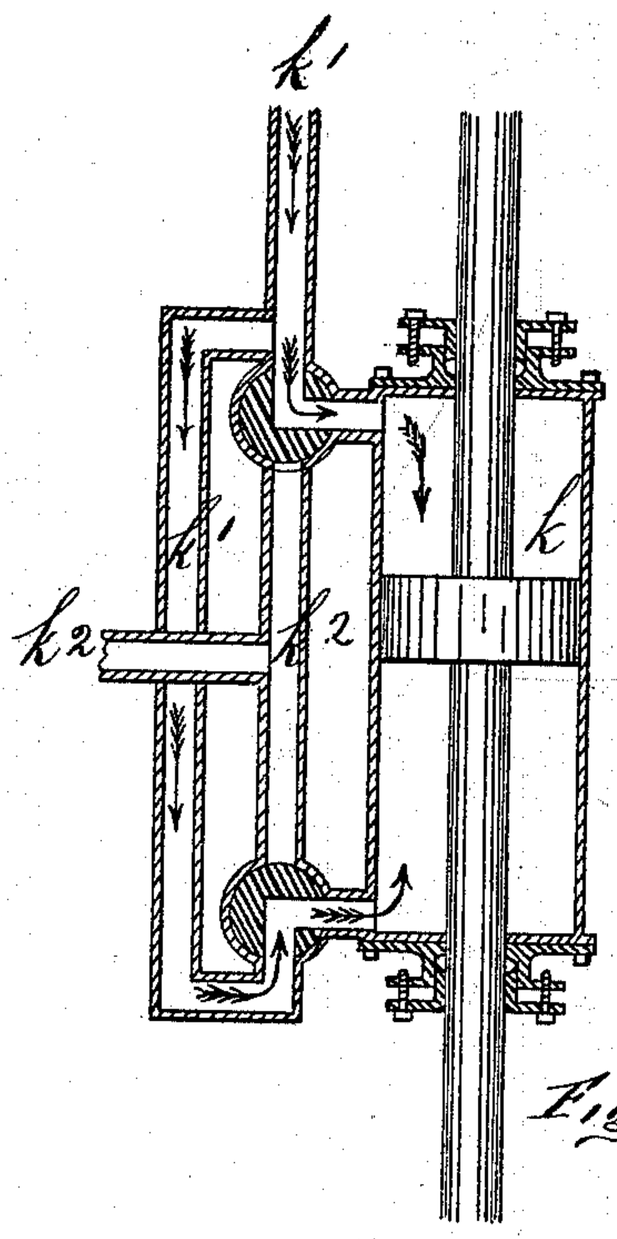

Fig. 4.

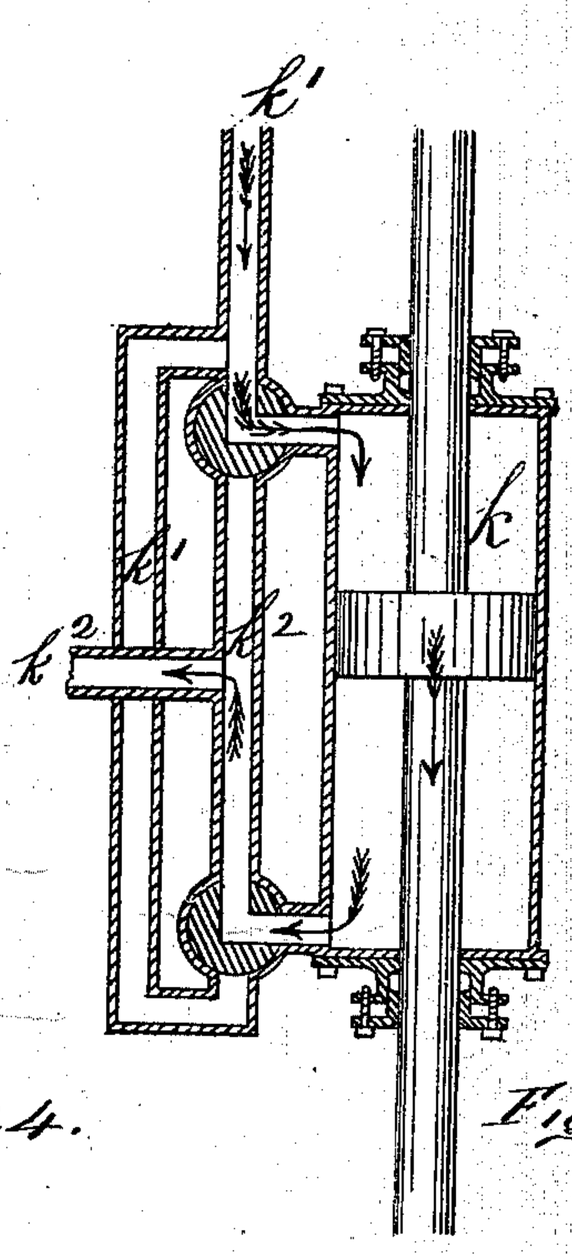

Fig. 5.

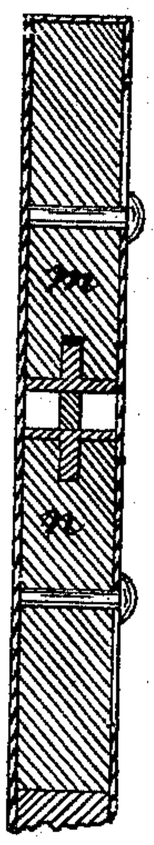

Fig. 6.

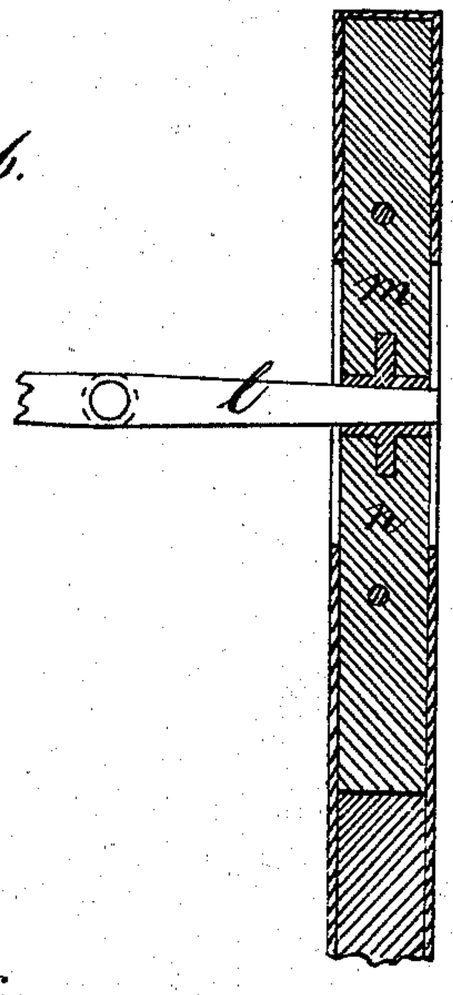

Fig. 7.

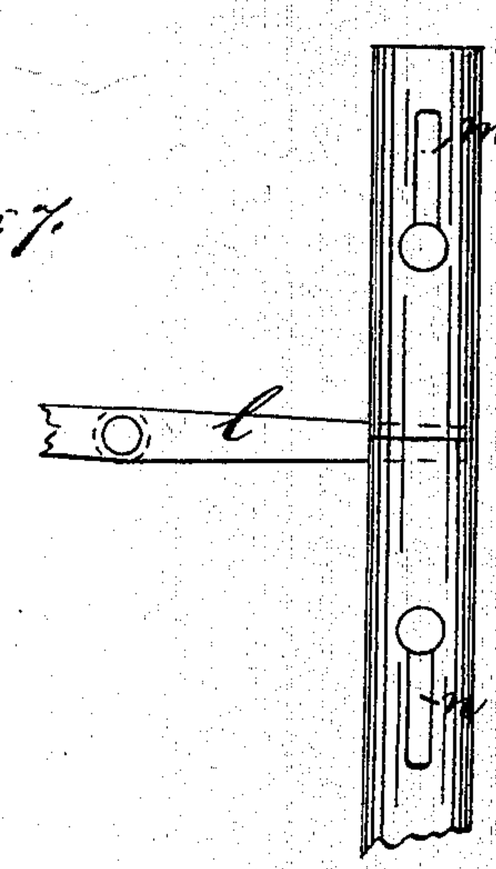

Fig. 8.

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UNITED STATES PATENT OFFICE.

CHARLES R. OTIS, OF YONKERS, NEW YORK.

IMPROVEMENT IN HOISTING APPARATUS.

Specification forming part of Letters Patent No. **146,690**, dated December 30, 1873; application filed November 4, 1873.

To all whom it may concern:

Be it known that I, CHAS. R. OTIS, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Hoisting Apparatus, such as are used in hotels, warehouses, manufactories, &c.; and that the following, taken in connection with the drawings, is a full, clear, and exact description thereof.

The drawings represent the preferred form of the apparatus, but are not in proper relative proportions, being so made for the purpose of showing more clearly certain of the important parts.

In the drawings, Figure 1, Sheet 1, is a front view of a hoisting apparatus with my improvements applied thereto. Fig. 2, Sheet 2, is a rear view of the same. Fig. 3, Sheet 3, is a side view of the same; and on Sheet 4 are Figs. 4 and 5, which are longitudinal central sections through a cylinder and valves used in the preferred form of my apparatus; and Figs. 6 and 7 are longitudinal sections, and Fig. 8 an elevation, of the preferred form of certain springs, which are also used in the preferred form of my contrivance.

My invention is a new apparatus, which can be acted upon by an attendant riding in the cage or on the platform, and which will communicate motion to the stop and reversing valve of the engine or engines, or the substitutes for such valves; and also certain new combinations of various devices with such apparatus.

The apparatus invented by me is one in which air confined in a tube or hose is the medium for communicating a force exerted in the cage to the stop and reverse valve.

In the drawing uprights or guides for a hoist are represented at *a a*, the cage, car, or platform at *b b*, the rope and pulleys at *c c*, the drum round which the rope is wound at *d*, the engine-frame at *e*, the steam-cylinders at *e' e'*, and all these parts may be of any proper or usual construction.

In the cage are two air-tight cylinders or drums, *f f'*, each provided with a flexible diaphragm, which I call a moving diaphragm, *g g'*, and from each of these cylinders lengths of hose or flexible tubing extend to similar cylinders *h h'*, each provided with a diaphragm, which I call stationary diaphragms, *j j*, upon each of which rests a disk, which is attached to the lower end of a spindle, j^1 j^1, guided so as to rise and fall vertically or nearly so, and having secured at its upper end a weight, j^2 j^2.

I prefer to make the diaphragms and hose of india-rubber, or rubber and canvas, and to support the hose at about midheight of the guides or uprights. The hose must be long enough to extend from the supports to the platform when in its highest and lowest positions, and must in that part of its length be flexible, or made in such manner as to accommodate itself to the motions of the cage. Between the supports and the stationary air-cylinders the hose may be replaced by a rigid tubing. These parts are so put together that there is a connection through the hose between the cavities of each stationary cylinder and its corresponding moving-cylinder in the cage, and so that when one of the diaphragms in the cage is pressed into its cylinder, the contained air acting through the hose will lift the diaphragm of the corresponding stationary cylinder with its disk-spindle and weight. When the pressure upon the diaphragm of the moving cylinder is relaxed, then the weight will fall, and the diaphragm of the moving cylinder will be restored, by the action of the air, to its normal or expanded position. It is evident that by this apparatus either or both spindles of the stationary diaphragms may be lifted or lowered by an attendant riding in the cage, and that this can be done at any stage of elevation or depression of the cage. I intend at times to substitute a ball or bag of india-rubber for the cylinders and diaphragms; also, at times to substitute pistons for the diaphragms; also, to apply to the diaphragms in the cage disks provided with handles, or levers and handles, so that the moving of the handle shall compress the diaphragm; and I also intend to use at times only one hose and one moving and one stationary cylinder, or its equivalent, but in that case there should be applied to the diaphragm or its substitute in the car some gage or scale to show when it is compressed or squeezed inward half-way or thereabout. By the use of such a gage or mark the attendant can tell when the corresponding stationary diaphragm is half bulged out or is midway between its highest and lowest positions.

In the preferred form of my apparatus each

spindle of each stationary diaphragm is connected, by links or otherwise, to a valve communicating with one end of an auxiliary steam-cylinder, *k*. The valves are best shown in Figs. 4 and 5, which also exhibit the steam and exhaust passages, the steam-connection with the boiler at k^1, and the exhaust-pipe at k^2. When neither of the moving diaphragms is pressed upon, both of the stationary diaphragms will be in the depressed position, and both the valves will occupy the positions shown in Fig. 4; steam will then be pressing upon both sides of the piston, and the piston will remain in the center, or nearly so, of the cylinder. If the lower valve be turned into the position shown in Fig. 5, the lower exhaust will be opened and the piston will descend, and it will thus descend when the lowest diaphragm in the cage is pressed in by the attendant. The opposite effects will take place when the upper piston is pressed upon by the attendant, and inspection of the drawings will show that, by pressing upon either or both diaphragms, the piston may be forced to assume a central position or a position at either end of the cylinder; but as I desire to cause the piston to assume its central position by merely relaxing the pressure upon the diaphragm that may have been pressed upon by the attendant, and as it is not perfectly certain that the piston will assume that position when the pressure is merely equalized, I connect with the piston-rod, either directly or indirectly, a weight or spring, hereafter described, which will force the piston to assume the central position when the pressure on its two sides is equalized. The piston-rod (a hollow one, or trunk, is represented in the drawings) of this cylinder is connected to a lever, *l*, by a link and pins, and this lever is secured to any of the well-known forms of cock or valve, which will shut off steam entirely from an engine, and so admit it as to cause the engine to go ahead or to back, according to the position of the valve. It may be a slide-valve or a turning valve, or a piston or puppet valves, or the valve may be a sliding seat or seats for a slide valve or valves, or the lever may be attached to the link of a link-motion or link of two link-motions, the link or links being a well-known substitute for a stop and reversing valve, but the valve, or its equivalent or substitute, must be so connected to the lever that three positions of the valve or link shall correspond with three positions of the lever when it is at the two extremes, and at the center, or nearly so, of its range of motion. In the arrangement shown in the drawings the engines go ahead when the end of the lever connected to the auxiliary piston-rod is up, reverse when that end of the lever is down, and are stopped when the lever is horizontal, or nearly so. This valve or link thus follows the motions of the piston in the auxiliary cylinder *k*, and the position of that piston is governed by the attendant, and the latter consequently stops or reverses the engine or engines at pleasure. The end of the lever not connected with the auxiliary piston-rod lies between two springs, *m n*, each, by preference, made of india-rubber and inclosed in a tube. Each of these springs has a pin passed through it which works in a slot in the tube, and when either spring is compressed by the motion of the lever, it will tend to throw the lever back to the central position, and no farther. When the pressure is equalized upon the sides of the auxiliary piston, these springs, acting through the lever-link and piston-rod, will cause the piston, and consequently the lever, to assume the central position, thus shutting off steam and stopping the engines. I intend to use spiral or other springs in place of the india-rubber springs, and at times to use a weight attached to a cord leading between two wheels, and thence to the lever, the center line between the two wheels being on a level with the end of the lever when it is in a central position. A weight thus applied to the lever will act in the same way as the springs, and is a substitute or equivalent thereof.

The springs or their substitute may be applied to a pin on the auxiliary piston-rod, or one spring may abut against each end of the piston-rod when it passes through both cylinder-heads, as represented in the drawings. The place and manner of attachment of the springs or weight is unimportant, so long as they cause the auxiliary piston and lever, and consequently the stop and reverse valve, to assume a central position. When the auxiliary piston is dispensed with, as hereinafter provided for, the springs will act upon the lever, and stop and reverse valve only. In place of the valves or cocks shown in the drawings as applied to the auxiliary cylinder, I intend to use any other known form or arrangement of valves which will produce the same effect, and I sometimes intend to dispense with the cylinder entirely, and in such case I connect the lever of the stop and reversing valve directly with the stationary diaphragm or diaphragms. If one stationary air-cylinder and diaphragm only be used, then the lever may be connected by a link directly to the spindle of the diaphragm; but if both stationary diaphragms be used, which I prefer, then one weight is to be arranged under each end of the lever. The lever when in the central position touching neither weight, but being above it a distance equal to one-half of its range of motion, either diaphragm, when lifted to half its extent, will then commence to act upon the lever and lift it through the residue of the range of its motion. I prefer to use the auxiliary cylinder, as the valve or valves thereon may be very small, and will require but little force to move them, and will when moved bring into action the whole power of the auxiliary piston to move the stop and reverse valve. That part of the hose between the supports and the stationary cylinders, and these cylinders themselves, may be filled with water or other liquid, not so full as to run down into the other part of the hose between the supports and the

cage when the latter is down; but the whole hose cannot be filled with liquid, as in that case the pressure to the inch would be very different when the cage was up and when it was down, and this difference of pressure might lift the diaphragm of the stationary cylinder when the attendant did not press upon the corresponding moving diaphragm. When a sliding or rectilinear moving stop and reverse valves is used, I can connect the auxiliary piston-rod, or the spindle or spindles, to it without the use of a lever. I can also dispense with a lever when I use a link-motion, but I prefer the lever.

I claim as of my own invention—

1. The combination, substantially as herein described, of a stationary diaphragm, by means of a hose with a moving diaphragm, attached to and capable of moving with the car, or cage, or platform of a hoist, whereby the stationary diaphragm may be caused to lift a weight, as described.

2. The combination of two sets of diaphragms and two hose-pipes with an auxiliary cylinder, substantially in the manner and for the purposes described.

3. The combination of two sets of diaphragms and two hose-pipes with a stop and reversing valve, substantially in the manner and for the purpose described.

4. The combination of the springs with the lever of a stop and reversing valve, substantially as hereinbefore set forth.

5. Two diaphragms, one stationary and the other moving, combined by means of a hose, in combination with a lever and a stop and reversing valve, the combination being substantially such as herein set forth.

6. A stop and reversing valve, in combination with two sets of diaphragms, and two hose-pipes, and an auxiliary cylinder, substantially in the manner and for the purposes set forth.

7. A stop and reversing valve and a lever acting upon it, in combination with two sets of diaphragms and two hose-pipes, substantially as described.

8. The combination of springs with the piston of an auxiliary cylinder, and a stop and reversing valve, the combination being and acting substantially as hereinbefore set forth.

CHAS. R. OTIS.

Witnesses:

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EMANUEL SCHILHAFER.