(No Model.) 3 Sheets—Sheet 1.

G. H. REYNOLDS.

ELEVATOR.

No. 587,508. Patented Aug. 3, 1897.

Fig. 1.

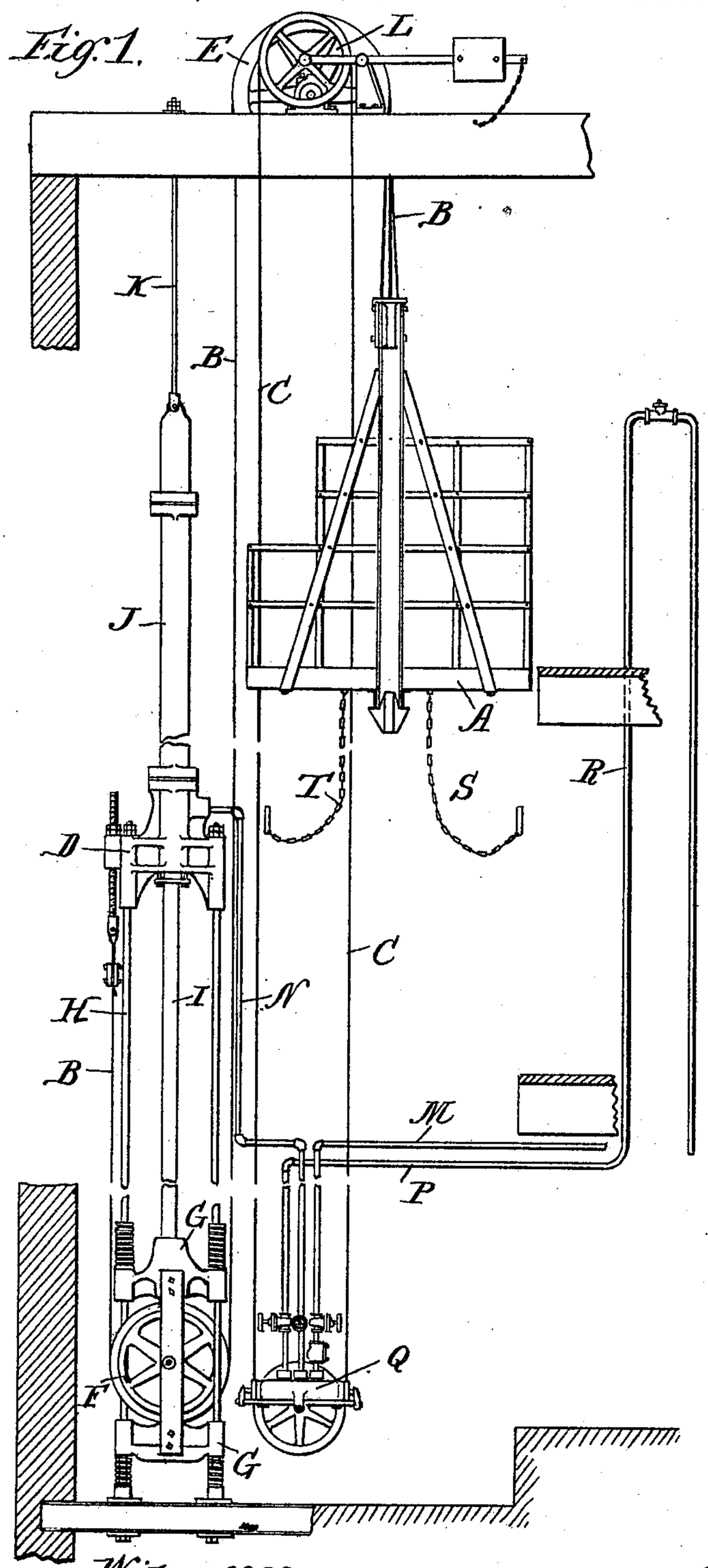
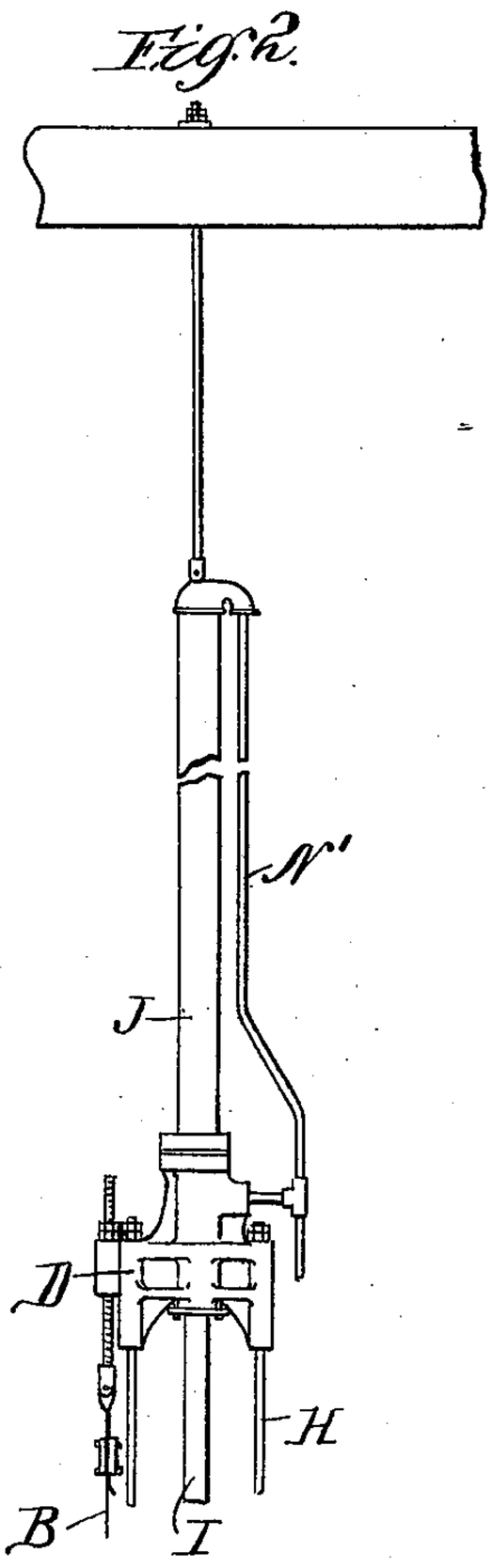


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

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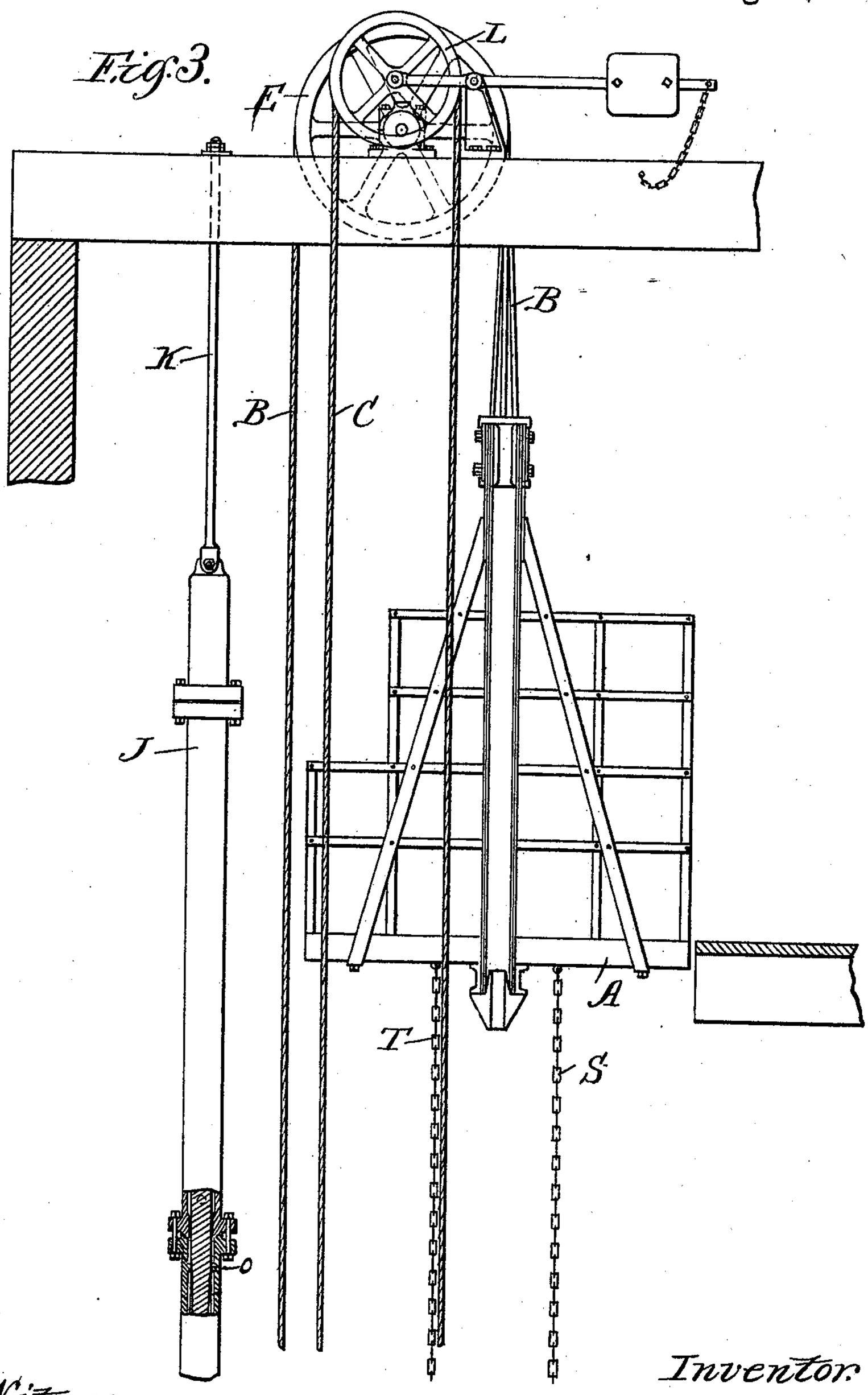
Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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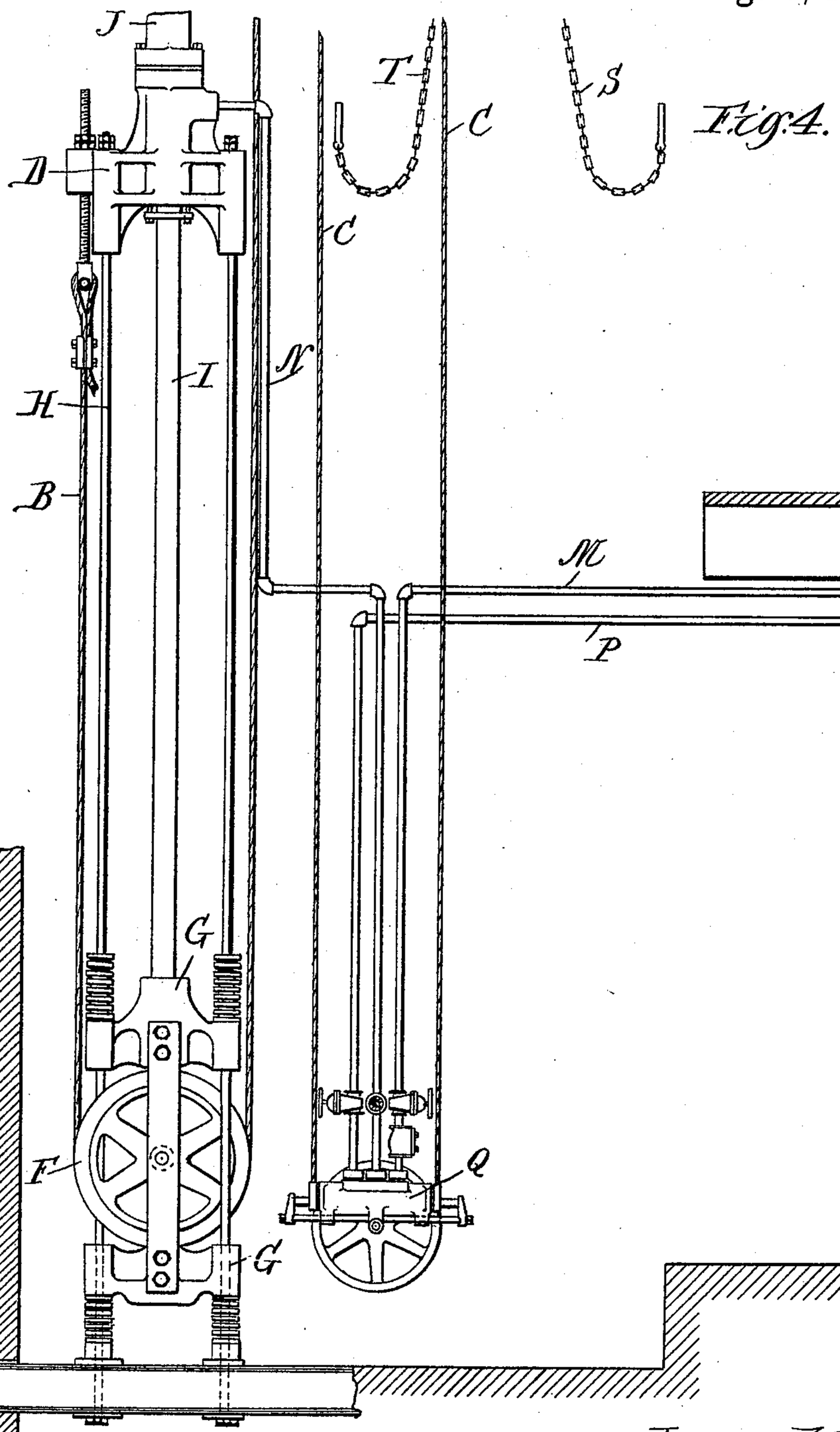

Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE CRANE ELEVATOR COMPANY, OF SAME PLACE.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 587,508, dated August 3, 1897.

Application filed March 27, 1895. Serial No. 543,382. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. REYNOLDS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates more particularly to improvements in hydrogravity-elevators, and has for its prime object the production of an elevator in which the car and its accessory parts fall by gravity and are elevated by a counterbalancing ram or plunger under the influence of hydraulic pressure.

Another object is, in such an elevator, to compensate for the shifting of the weight of the running cables and the presence or absence of a hydrostatic column by a variable counterweight which shall maintain a practical balance between the running cables, the hydrostatic column, and the car, whereby a constant pressure may be employed for all the operations of the elevator apparatus.

These and such other objects as may hereinafter appear are attained by the devices illustrated in the accompanying drawings, in which—

Figure 1 represents an elevation of a portion of a building containing elevator apparatus embodying my invention. Fig. 2 represents a modification of the means for supplying hydraulic pressure to the cylinder; Fig. 3, an enlarged elevation of the upper portion of the apparatus, and Fig. 4 an enlarged elevation of the lower portion of the apparatus.

Referring by letter to the accompanying drawings, A indicates the car, B the lifting-cables, and C the control-cables, all of which may be of the usual or any desired construction.

The lifting-cables are attached at one end to the car and at their opposite ends to the guide-frame D, being trained around the main sheave E and the multiplying-sheave F, which is guided in the frame D by means of cross-heads G, working upon vertical rods H, connecting the upper and lower portions of the guide-frame. These cross-heads are attached to the lower end of the ram or plunger I, which works through the guide-frame and within the cylinder J, which latter is secured at its lower end to the upper end of the frame D and at its upper end is suspended by a rod K or in any other suitable manner.

The construction and mode of operation of the compensating devices L, (shown at the top of Figs. 1 and 3,) as well as other usual accessory parts of an elevator apparatus, form no part of this invention and therefore need not be herein shown and described in detail. So, also, with the valve mechanism at the lower part of Figs. 1 and 4, which need not be illustrated or described in detail, except in so far as their general operation is concerned in the control of admission to and discharge from the cylinder of hydraulic pressure or, rather, of water under high pressure.

The supply of water enters through the pipes M and N into the lower part of the cylinder J and flows past a series of bulkheads O in the cylinder to the upper end thereof, where it exerts a downward pressure upon the end of the ram I, as will be readily perceived. The water discharges from the cylinder through the pipe N and the pipe P, which latter is preferably carried up to a height substantially equal to that of the cylinder for the purpose of maintaining at all times a "head" of water as against the discharge from the cylinder. This action is produced by the change-valve Q, which may be of any usual or desired construction, so that when operated by the control-cables C in one direction it permits the passage of the water through the valve from the supply-pipe M to the pipe N, and when operated in the opposite direction it permits the flow of the water from the pipe N through the valve and out through the discharge-pipe P.

In practice I propose to have the car and its accessory parts of sufficient weight to lift the ram I, so that the car will normally fall by gravity, whether loaded or not, but in its fall lifting the ram or plunger and its accessory parts. To lift the car, hydraulic pressure is applied to the ram, forcing it down to its lowermost position. By this arrangement it will be readily seen that there is great economy in the power required for the operation of my ele-

vator because the ram may be made to nearly counterbalance the weight of the car and its accessory parts, so that hydraulic pressure is required to lift but little more than the weight of the load on the car.

Another important feature of my invention is that the water in the cylinder cannot get away from the ram, for the ram, under all ordinary conditions, is outweighed by the car and its accessory parts, which causes a constant tendency of the ram to move upward in the cylinder against the hydraulic column therein; and any discharge of water from the cylinder will be necessarily immediately followed by a corresponding movement of the ram and car, so that all danger of the cylinder being emptied, without causing a movement of the ram, and the resultant damage that would arise from suddenly admitting water into the empty cylinder, is avoided.

Under all ordinary conditions the discharge of the water from the pipe P will take place at the bottom of the building with perfect safety, but as my apparatus is especially adapted for freight-work and is subject to more careless handling than a passenger-elevator there may arise a condition when the elevator-car would not move down, notwithstanding the water were discharged from the cylinder, and hence the ram would not move upward in the cylinder. Such an instance would be where a board projected from a landing under the elevator or any of the other numerous instances of "hitching" in freight-elevators due to carelessness in the use or operation thereof. To provide against these conditions, it is desirable that the cylinder should discharge against a head or source of pressure, which will at all times prevent the discharge of any water from the cylinder unless the ram moves to displace it. This may be accomplished by extending the pipe P to a height substantially corresponding to that of the cylinder, so as to provide a stand-pipe R, through which the water must be discharged from the cylinder and which is of course put in communication with the cylinder whenever the change-valve is so operated as to discharge the cylinder. Hence, even though the change-valve were operated to discharge the cylinder, if the ram failed to move, by reason of the sticking of the elevator-car or for any other cause, no water would flow out of the cylinder, and hence no damage would result by a reversal of the change-valve, so as to admit pressure to the cylinder.

While I have shown the supply-pipe N as connected with the cylinder only at the lower end thereof in Figs. 1 and 4, in Fig. 2 I have shown a modification in which a branch pipe N′ leads from the pipe N direct to the upper end of the cylinder. In some classes of work this arrangement may be preferable, in that pressure may be more quickly applied to the ram and will act more directly upon the end thereof. In other respects there is no difference in the operation of the apparatus.

It is well understood that in the operation of elevators as the lifting-cables run from one side to the other of the main sheave E the weight thereof must be counterbalanced, and it is common to provide for this purpose a chain S, attached at one end to the car and at its opposite end suspended from a support about midway the height of the elevator-shaft or allowed to accumulate upon the bottom of the shaft as the elevator descends. Hence as the elevator descends and the weight of the lifting-cable passes to the car side of the main sheave, adding weight thereto, this weight is paid off and compensated for by the chain S, of the weight of which the car is relieved in substantially the proportion that the car acquires weight from the lifting-cables. Conversely, as the car ascends and loses gradually the weight of the lifting-cables it gradually takes up a substantially equal amount of weight in the chain. Now it will also be understood that as the hydraulic pressure is supplied to the cylinder the ram becomes loaded with the weight of a hydrostatic column equal to the distance between its upper end and the upper end of the cylinder, so that when the elevator is at the top of the shaft its lifting power is reduced by this hydrostatic column, or, in other words, the elevator must lift both the ram, with its accessory parts, and this hydrostatic column. To compensate for this hydrostatic column, I propose to provide another variable counterbalance in the shape of a chain T, which shall be picked up as the car is elevated and deposited on the bottom of the shaft or on a support at the side of the shaft as the elevator descends, the purpose being that the weight of the chain as a whole shall counterbalance the weight of the hydrostatic column as a whole and shall vary with the variations in the height or weight of the hydrostatic column according to the position of the car in the shaft. By a provision of this kind the necessity for adding a permanent and unvarying weight to the car is avoided and I am enabled to operate the car under all conditions by the same unvarying hydraulic pressure. Of course in practice a single chain may be employed instead of the two separate chains S and T, or the total weight to be counterbalanced by the two chains may be divided equally between them instead of any effort being made to proportion the weight of either chain to do a particular part of the work, as the result in any case would be the same.

An elevator apparatus made in accordance with my invention is particularly adapted for use in freight-service, where there is not only wide variation in load, but where bulk has little to do with the amount of the load and the car is very apt to be carelessly overloaded. No overloading short of that which would break the lifting-cables or some of the accessory parts would have any injurious or dangerous tendency, and the elevator would remain un-

der perfect control of the operator. Nor would too light loading produce any bad results, because the elevator-car is at all times sufficiently heavy to descend.

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

1. In an elevator, the combination with a vertically-movable ram or plunger and an elevator-car operatively connected with said ram, said car being sufficiently heavy to raise the ram, of a vertical cylinder through the lower end of which works the ram, means for applying hydraulic pressure to the end of said ram in the cylinder, and a variable counterbalance attached to said car for counterbalancing the hydrostatic column in the cylinder and the lifting-cables, substantially as described.

2. In an elevator, the combination with a vertically-movable ram or plunger and an elevator-car operatively connected with said ram, said car being sufficiently heavy to raise the ram, of a vertical cylinder through the lower end of which works the ram, means for applying hydraulic pressure to the end of the ram in the cylinder, and a source of pressure independent of the source of hydraulic pressure applied to the end of the ram for raising the car, and into which said cylinder discharges, substantially as described.

3. In an elevator, the combination with a vertically-movable ram or plunger and an elevator-car operatively connected with said ram, said car being sufficiently heavy to raise the ram, of a vertical cylinder through the lower end of which works the ram, means for applying hydraulic pressure to the end of said ram in the cylinder, and a stand-pipe through which said cylinder discharges, substantially as described.

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Witnesses:
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