(No Model.) 3 Sheets—Sheet 1.

S. H. HALE.

ELEVATOR.

No. 482,247. Patented Sept. 6, 1892.

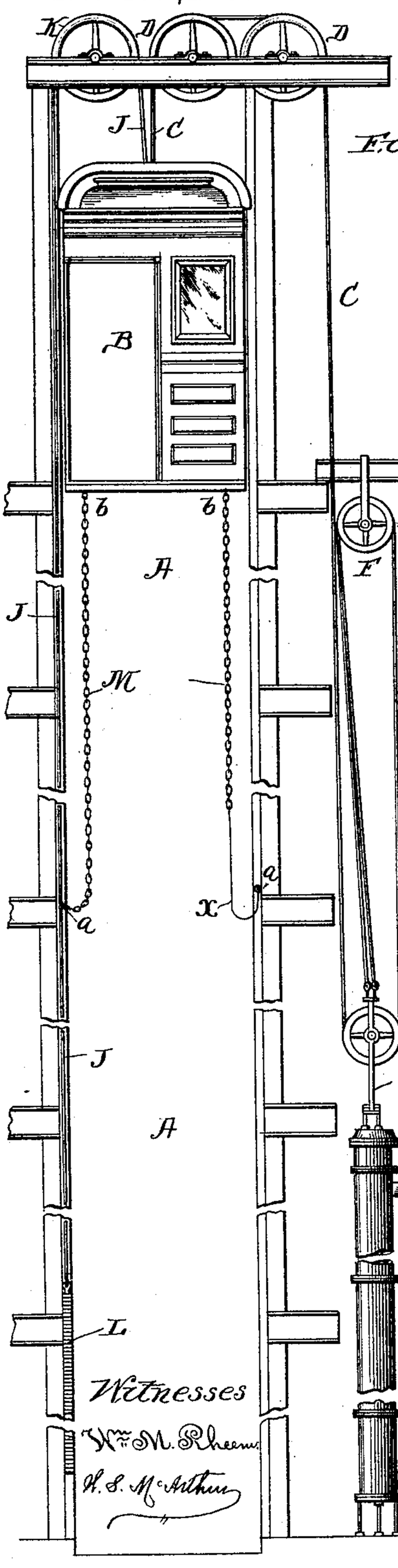

Fig. 1.

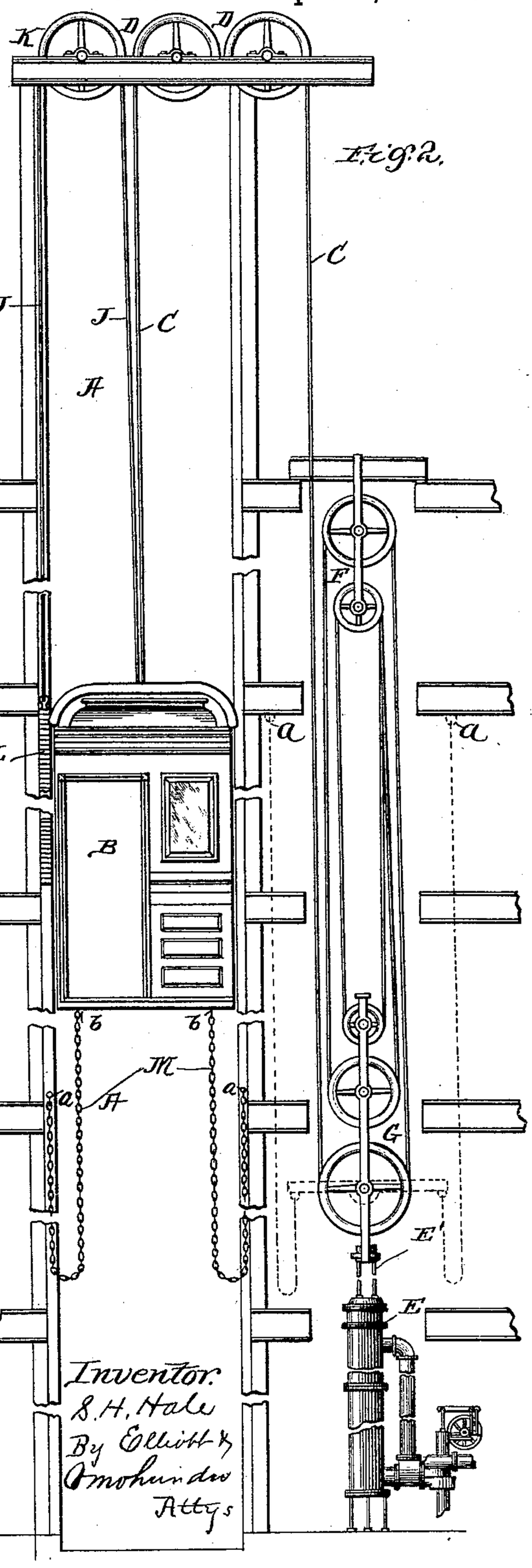

Fig. 2.

Witnesses
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H. S. McArthur

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Attys

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

(No Model.) 3 Sheets—Sheet 2.

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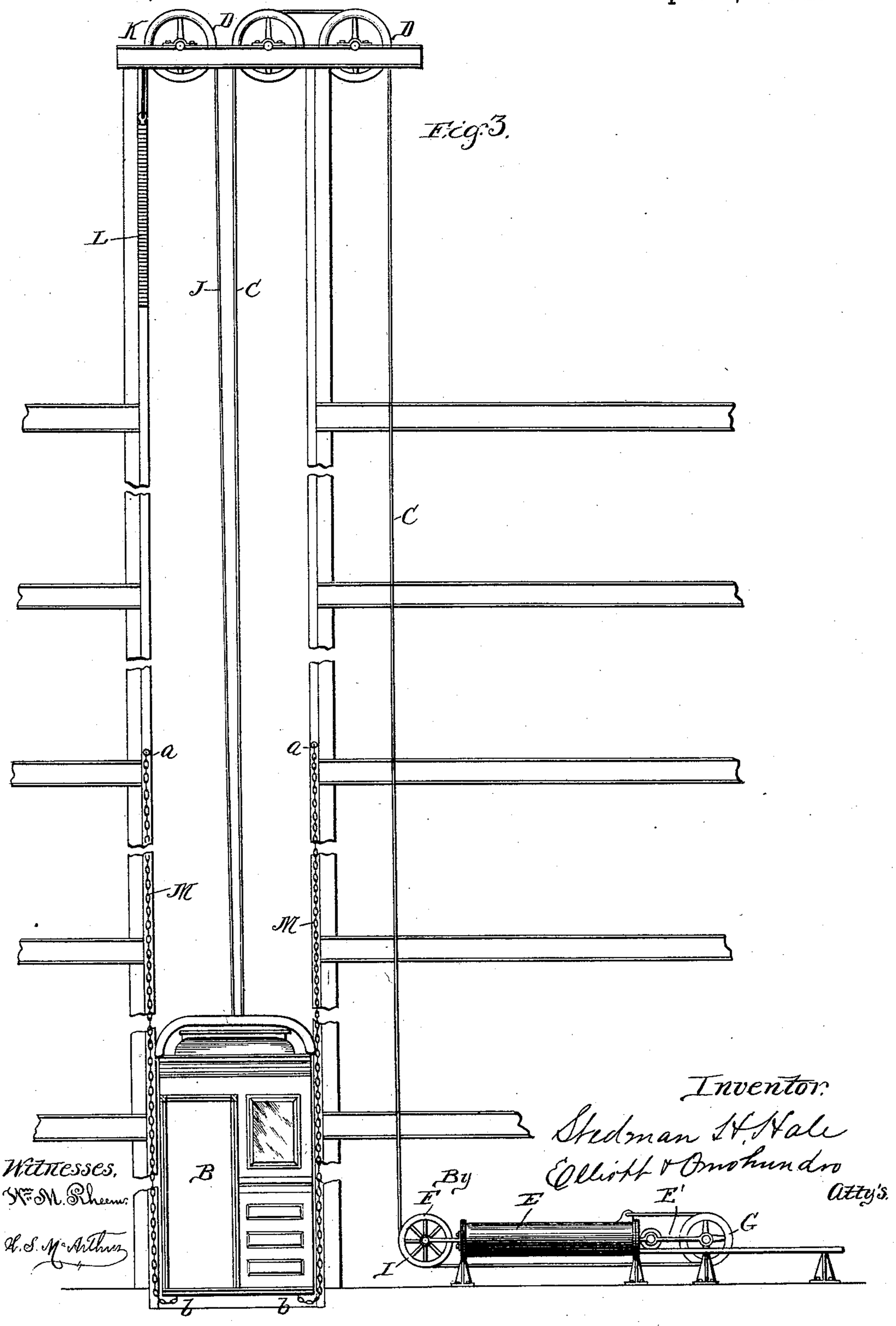
Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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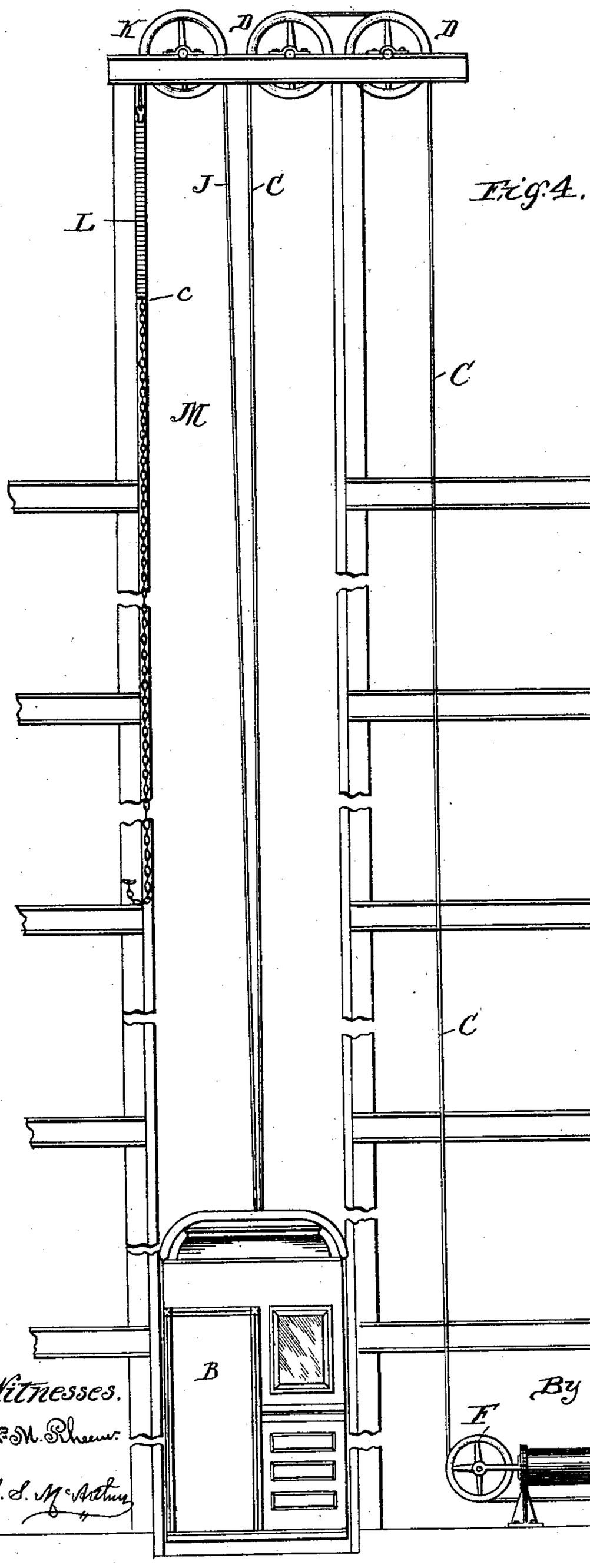

Fig. 4.

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

UNITED STATES PATENT OFFICE.

STEDMAN H. HALE, OF CHICAGO, ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 482,247, dated September 6, 1892.

Application filed June 29, 1891. Serial No. 397,835. (No model.)

To all whom it may concern:

Be it known that I, STEDMAN H. HALE, 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 specification.

In elevators it is common to counterbalance to a greater or less extent the weight of the car, cage, or platform and its directly-attached parts by means of a counter-weight connected with the car by a cable passing over suitable guide-pulleys. Even when the weight of the counter-balance equals that of the car there is not a perfect counterbalance, owing to the variations in the extent of the cables upon opposite sides of the guide-pulleys, the greater portion of the cables being on the well side when the car is at the limit of its downward motion, while when the car is at the top of the well nearly the entire length of the cable is on the opposite side of said pulleys. To remedy this difficulty supplementary cables connected at their upper ends to the car and to the counter-weight have been used; but this is attended with an expense in construction and other disadvantages which I avoid by the use of a flexible weight, as one or more chains or cables, each attached at one end to a vertically-movable part of the apparatus and at the other to a fixed point, as fully set forth hereinafter, and as illustrated in the accompanying drawings, in which—

Figure 1 is an elevation illustrating an elevator apparatus embodying my invention, the car being at the limit of its upward stroke; Fig. 2, a similar view with the car in a lower position and illustrating a modified form of multiple gear. Fig. 3 is an elevation illustrating my invention in connection with a horizontal engine, the car at the limit of its lower motion. Fig. 4 illustrates the main construction of elevator, as in Fig. 3, but shows the counterbalance-chain connected with the counterbalance-weight.

The cage, car, or platform B, whatever may be its form or construction, moves up and down upon suitable guides within the the well A under the action of a motor-engine E, which may be of any suitable character and construction and operate under the action of any suitable motor fluid.

In the construction shown the engine is a hydraulic engine, and the flexible suspensories C, of any suitable number, according to the weight to be sustained, are connected to the yoke of the car and pass around any suitable number of guide-pulleys D to the engine and around the multiplying pulleys F G thereof, two of such pulleys being shown in Fig. 1 and five in Fig. 2 in connection with an upright engine, while Figs. 3 and 4 show each two pulleys in connection with a horizontal engine.

The usual counterbalance-weight L is arranged to slide in suitable guides beside the well and is connected with the yoke of the cage by a cable J, passing over a pulley K. It will be evident that when the cage is at the top of the well, as shown in Fig. 1, the greater portion of the cable connected with the counter-weight and of the suspensory cables connected with the engine will be outside of the well, so that if the cage a little more than counterbalances these outside connections when at the limit of its upward movement it will descend upon the upward movement of the piston; but there will be a great increase in the weight of the parts on the well side of the pulley D when the cable is at the limit of its downward movement, as shown in Figs. 3 and 4, so that a sufficient power is required in starting the cage upward to lift the surplus weight of the cables within the well, and also the weight of the passengers that may be within the cage. With such an arrangement, therefore, it is not possible to maintain the cage and its connections in equilibrium even when the cage is unloaded. To obviate these objections, I connect with a vertically-movable part of the apparatus, as with the cage, one or more flexible weights, each in the form of a series of connected weights or links, constituting a chain or a cable or cables M, termed hereinafter a "chain," and one end of this chain I connect with a fixed support *a* in the wall at about the center of its height, so that when the cage is at the limit of its upward motion practically the entire length of the chain will be suspended from the cage, and when the latter is at the limit of its lower motion the cage will be relieved of the entire weight of the chain, which will be suspended from the fixed point *a*. By properly proportioning the weight of the chain or chains M to that of the cables con-

nected with the cage and counter-balance the added weight of the chain M taken up upon any determined upward movement of the cage—say one foot—may be made to equal exactly the weight of the amount of cable that is carried from the insides of the pulleys D K to the opposite side thereof, so that the cage, its cable, and counter-weight are maintained practically in equilibrium, except so far as the weight of the passengers is concerned, and the amount of power exerted by the engine is therefore only that required to lift the passengers. Referring, for instance, to Figs. 1 and 2, suppose the car B to weigh two thousand pounds and to move two hundred and fifty feet in the well, the counter-weight weighing two thousand four hundred and fifty-six pounds and the cable J when the weight L is down weighing three hundred pounds upon the weight side and the suspensory cables C outside of the pulley D weighing five hundred and sixty pounds, while the weight of the chain M (or chains, if more than one is used) is one thousand two hundred and seventy-four pounds. In such case the combined weight of the car and chains (two thousand plus one thousand two hundred and seventy-four) will be three thousand two hundred and seventy-four pounds, while the combined weight of the cables and counter-weight outside the well (five hundred and sixteen plus three hundred plus two thousand four hundred and fifty-eight) will be also three thousand two hundred and seventy-four pounds, so that the parts are counterbalanced in this position. If then the car descends to its lowest position, the weight of the cables will be transferred to the well side, while the weight of the chain will be wholly taken from the car, so that the weight within the well would be two thousand eight hundred and sixteen pounds (two thousand plus five hundred and sixteen plus three hundred) if the suspensories C were connected directly with the pulley G or the piston and the pulley or piston had an upward movement equal to that of the downward movement of the cage. Owing, however, to the use of the multiplying gears F G, the upward movement of the pulley G is equal only to part of that of the cage, so that the entire weight of the suspensory cables C (five hundred and sixteen pounds) is not transferred to the opposite side of the pulley D, the proportion thus transferred varying according to the extent of the multiplication of the gear, and the parts are therefore so proportioned that when the cage is at the limit of its downward motion the difference in the weight on the cage side of the suspensories C will be but one hundred and fifty-eight pounds, or approximating thereto as closely as possible, so that the total weight on the cage side will be two thousand plus three hundred plus one hundred and fifty-eight, or two thousand four hundred and fifty-eight pounds, which is the same as the weight of the counter-weight, the equilibrium of the parts being thus maintained. It will be seen that this result is partially owing to the fact that the effect is the same as if the suspensories C were practically suspended from the pulley F, the loop being gradually taken up as the cage descends and as the loop of the chain M is gradually reduced (as regards the amount of weight suspended from the car.) For this reason the construction above set forth is peculiarly applicable with elevators having multiple gears arranged vertically. With a horizontal engine the arrangement may be the same as shown in Fig. 3; but preferably the chain is connected at its free end with a counter-weight, as shown in Fig. 4.

It will be evident that according to the character of the multiplying gear and the engine and connections there may be a more or less differential action, necessitating an increase or decrease in the amount of weight taken up or delivered at different points of the movement of the cage, and that this may be counteracted by using two or more cables of different lengths and weights, completing the connection between each short cable and the suspension point *a* by means of a fine cord or cable *x* of sufficient strength, as shown at the right in Fig. 1.

Instead of connecting the chain or chains with the cage or counter-weight they may be connected with a cross-head on the piston, as shown in dotted lines, Fig. 2.

Without limiting myself to the precise construction and arrangement of parts shown and described, I claim—

1. The combination, in an elevator and with the car, counterbalance connected by a cable with the car, and motor-engine and connections, of a supplemental counter-balance in the form of a flexible weight or chain connected at one end to a fixed elevated support and at the other with a vertically-moving part of the apparatus, substantially as set forth.

2. The combination, with the cage, counter-balance, vertical engine, and multiplying gears and flexible suspensories, of one or more flexible weights or chains connected each with an elevated support at one end and at the other with a vertically-moving part of the apparatus, substantially as set forth.

3. The combination, with the car of an elevator, of one or more flexible weights or chains, each connected at one end with a fixed elevated support and at the other with the car, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

STEDMAN H. HALE.

Witnesses:
W. R. OMOHUNDRO,
R. C. OMOHUNDRO.