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N. P. OTIS & R. C. SMITH.

SCREW ELEVATOR.

No. 570,329. Patented Oct. 27, 1896.

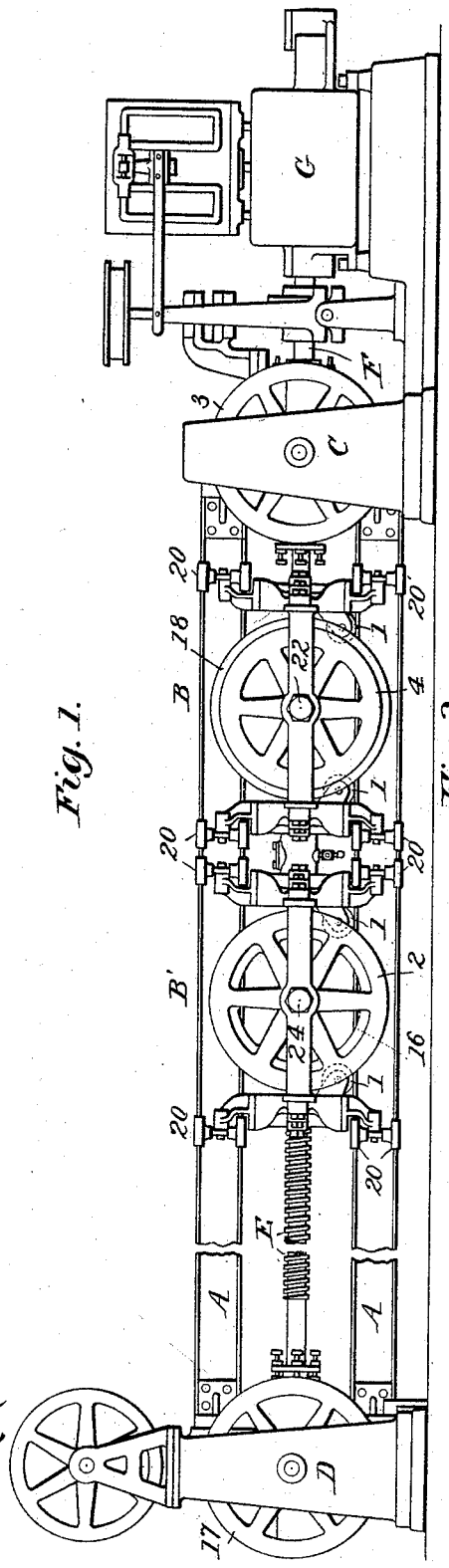

Fig. 1.

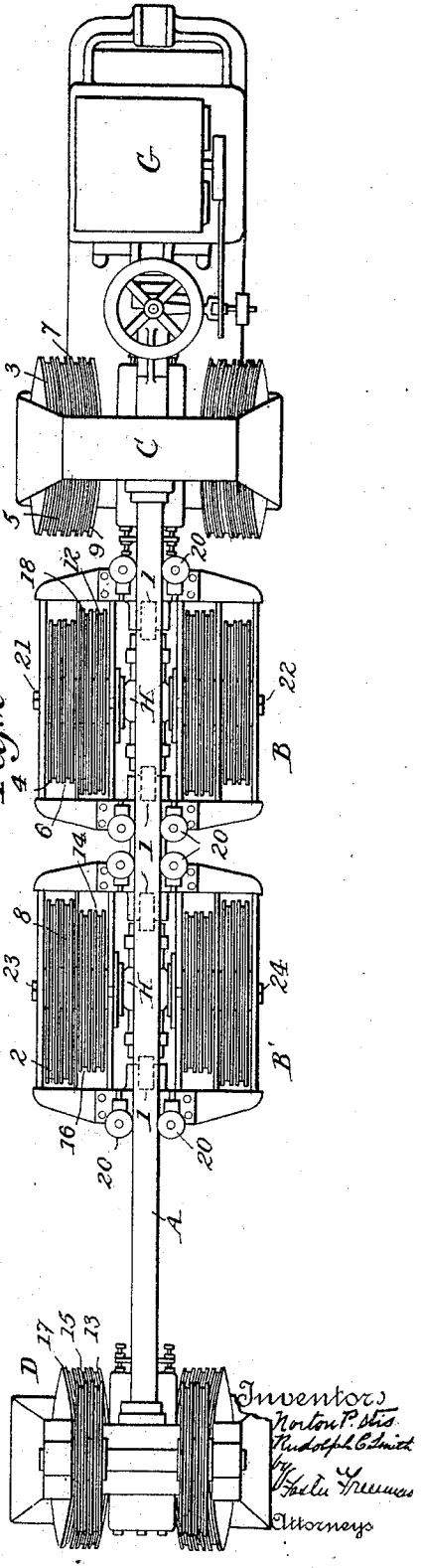

Fig. 2.

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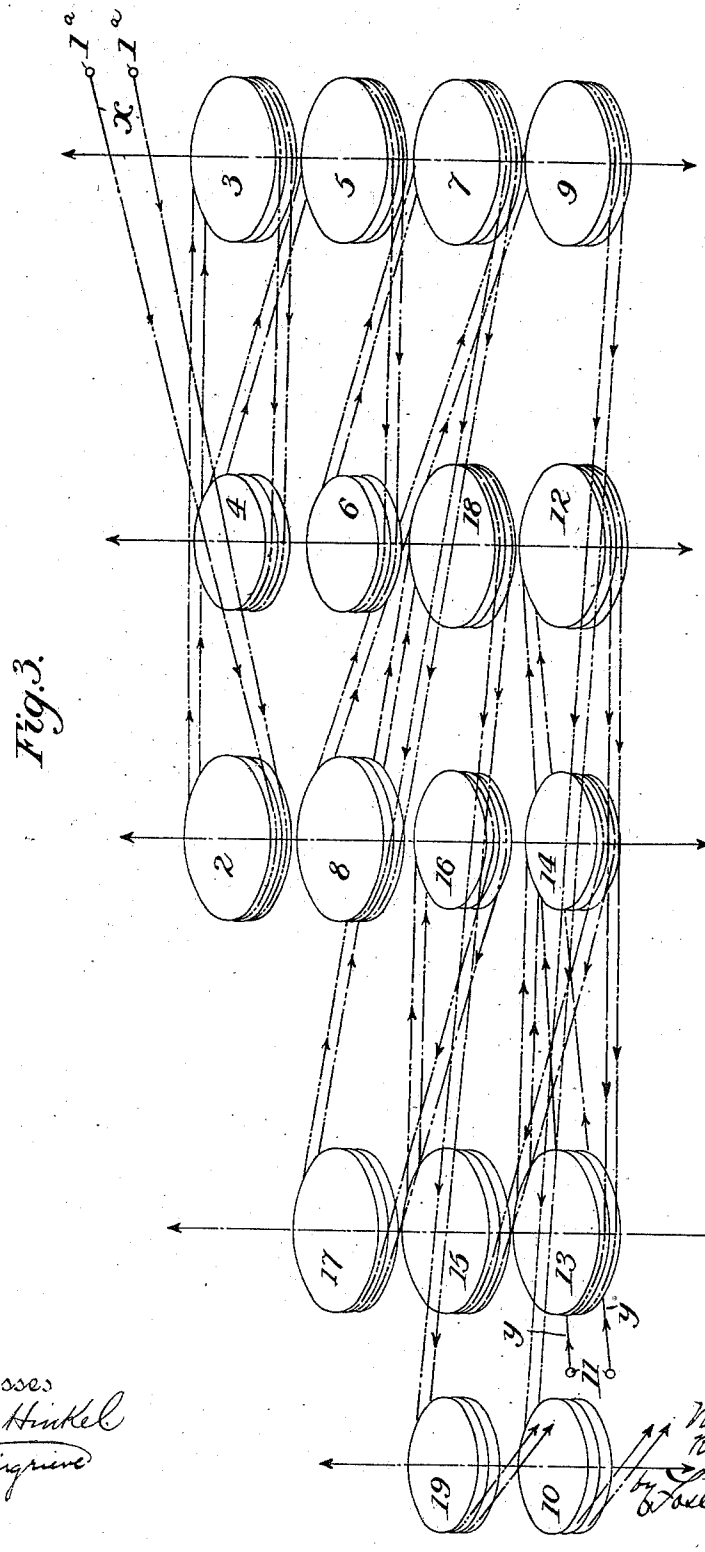

Fig. 3.

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SCREW ELEVATOR.

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Fig. 4.

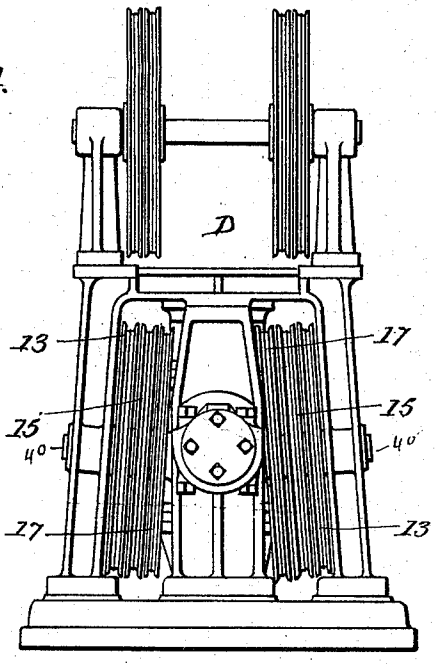
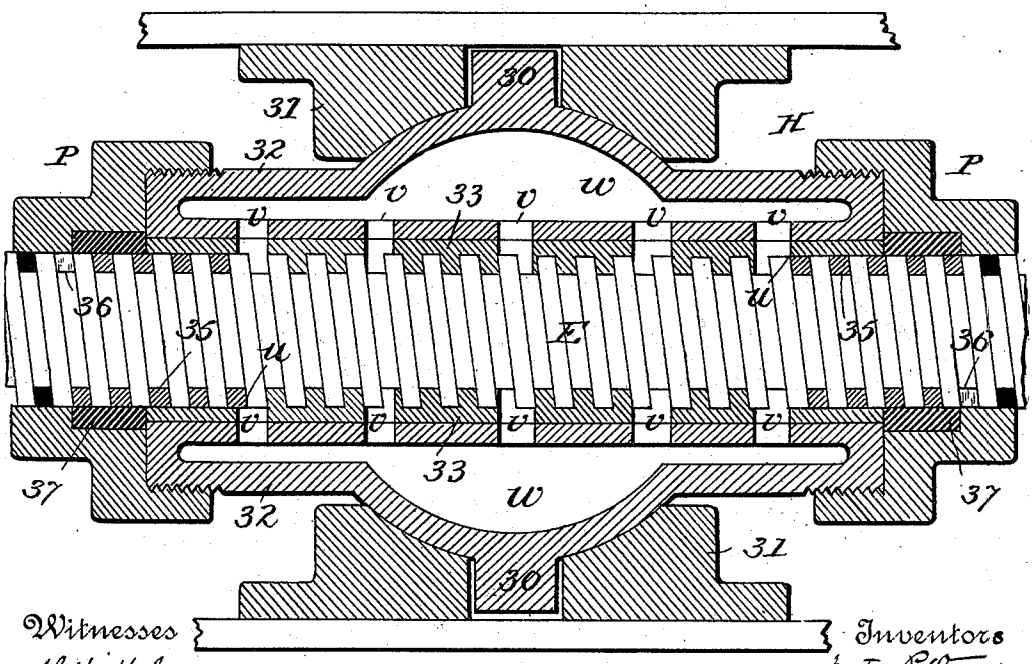


Fig. 5.



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UNITED STATES PATENT OFFICE.

NORTON P. OTIS AND RUDOLPH C. SMITH, OF YONKERS, NEW YORK, ASSIGNORS TO THE OTIS BROTHERS & COMPANY, OF NEW YORK, N. Y.

SCREW ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 570,329, dated October 27, 1896.

Application filed January 28, 1895. Serial No. 536,487. (No model.)

To all whom it may concern:

Be it known that we, NORTON P. OTIS and RUDOLPH C. SMITH, citizens of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Screw Elevators, of which the following is a specification.

Our invention relates to improvements in elevator apparatus of that character in which cables pass around sheaves having stationary bearings, around sheaves carried by a traveling carriage moved by a rotating screw, and are connected at their lower ends to fixed points; and our invention consists in certain details of improvements, some of which are adapted to other apparatus, fully set forth hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of part of an elevator apparatus embodying our improvements. Fig. 2 is a plan. Fig. 3 is a diagram illustrating the arrangement of the cables on the sheaves. Fig. 4 is an end view of one of the stationary frames with its sheaves. Fig. 5 is an enlarged sectional view of one of the nuts.

The frame of the machine is provided with suitable guides A A for a carriage, consisting, preferably, of two connected parts or sections B B′, with rollers 1 bearing upon the lower guide and suitable side bearing-rollers 20 20 20, and two sets of sheaves are arranged one set upon each side of the guides, so as to counterbalance each other and equalize the strain. By this arrangement the strain of the cables has no tendency to cause the carriage to bind at any point upon the guides.

The part B of the carriage is constructed to support two pins or axles 21 22, and upon each pin turn four or more pulleys 4 6 18 12; and the part B′ supports two pins 23 24, upon each of which turn four pulleys 2 8 16 14. The stationary part C of the frame to which the guides are connected at one end supports two sets of pulleys turning upon inclined pins or axles 40, each set consisting of four pulleys 3 5 7 9, and the stationary part D of the frame at the opposite end supports two sets of pulleys, each consisting of three pulleys 13 15 17, also turning upon an inclined axle 40.

A screw-shaft E has its bearing at one end in a suitable step or box of the part D of the frame, and near the other end in a box of the part C of the frame, and to this shaft is detachably connected one end of the armature F of an electromotor G, or the said shaft F or the screw-shaft E may be otherwise connected to be rotated, when desired, with suitable means for stopping and starting it and, if necessary, for varying the speed.

The carriage B B′ is provided with a nut H, threaded to fit the threads of shaft E, so that the revolution of the latter in one direction or the other will move the carriage between the end portions C D of the frame.

The hoisting-cables x, of which there may be one, two, or more, are secured at their ends to fixed points 1^a upon the frame C and thence are laid around the different pulleys, which are grooved at the peripheries to receive them. Thus, referring to Fig. 3, it will be seen that the pulleys 3 5 7 9 at one end and the pulleys 13 15 17 are in stationary frames, the pulleys 2 8 16 14 are in the movable section B′ of the carriage, and the pulleys 4 6 18 12 are in the other carriage-section B, and from the point 1^a each cable extends to the pulley 2, over and around the latter to the under side of the pulley 3, around the latter to the upper side of the pulley 4, from the under side of the latter to the under side of the pulley 5, over the latter, over the pulley 6, under the pulley 7, and over the latter to the pulley 8, and around and under the latter to the under side of the pulley 9, and around and over the latter to the guide-pulleys that direct it properly to and in the well and to the cage. One of these, the pulley 10, is shown.

The counterweight-cables y, of which there may be any suitable number, are connected at fixed points 11 to the part D of the frame, and each passes from said point below and around the pulley 12, over and around the pulley 13, under and around the pulley 14, over and around the pulley 15, under and around the pulley 16, over and around the pulley 17, under and around the pulley 18, and thence to the guide-pulleys, of which one pulley, 19, is shown.

It will be seen that the draft of the cage exerted through the cables x upon the various

pulleys and the carriage tends to move the latter to the right, Fig. 2, while the draft of the counterweight, through its cables and the pulleys, tends to move the carriage in the opposite direction, one force thus counterbalancing the other to a great extent and reducing the pressure and the friction between the nut of the cage and the threads of the screw E, and by arranging the cables in two sets looped around the pulleys on opposite sides of the guides we so distribute the strains as to prevent any tendency to tilt or throw the carriage out of a straight line and cause any binding of the nut upon the screw, the pressure being evenly balanced by the two sets of nuts.

While we have referred to a single nut, we prefer to have two nuts, one for each carriage-section, as thereby we are enabled to distribute the pressure and divide it between the nuts, so that each nut has to support a strain or pressure of one-half what would otherwise be thrown upon it, and we prefer to so connect the carriage-sections to the nuts that while they will move longitudinally therewith they are capable of a limited play independently of said nuts, thus insuring an absolute coincidence of the nuts with the screw at all times and permitting very long nuts to be employed without any tendency to swing or tilt said nuts from any swinging or tilting of the carriage. These nuts may be of any desired length, and in order further to reduce friction and prevent any binding upon the screw we prefer to pivot or otherwise connect the nuts loosely with the carriages.

As shown, each nut H is provided with trunnions 30, which fit bearings 31 of the frame of the carriage-section to permit a vibration of the said nut for the purpose described.

The nuts are preferably in the form of cast-metal casings 32, provided with inner tubular bearings 33, of bronze or other suitable material, and threaded to fit the threads of the screw-shaft, and we prefer to form in the casing 32 a chamber *w* and to form openings *v* in the tubular or sleeve bearings 33 to permit the ready flow of oil from the chamber *w* to the nut. It is of course necessary to prevent the flow of oil from this chamber at the ends of the nut, and it is therefore necessary to provide peculiar stuffing-boxes that will permit the nut to travel upon the threaded shaft, but prevent the oil from leaking at the ends of the nut. To this end we cut away the threads in the nut or in a sleeve 33, fitting the same for a certain distance from each end, say to the point *u*, Fig. 5, so that we can introduce between the threads of the screw a flexible packing-piece 35, rectangular in cross-section, to fit tightly between the threads of the screw, and of leather or other suitable material, the said flexible screw-packing extending spirally between the threads of the screw from the point *u* to a point where it meets a projection 36 upon a cap P, which projection holds the packing 35 in place. The cap P is also recessed to receive a packing 37, which is held by the cap in close contact, not only with the packing 35, but also against the end of the screw-sleeve 33, covering the joint between the latter and the box and preventing leakage at this point.

It will of course be evident that the screw may have either a single or a double thread, and in the latter case there is a spiral packing for each groove.

It will be evident that the improved nut, with its oil-reservoir and the packings, or the nut of a screw-shaft above described, may be used in other constructions than elevator apparatus and in elevator apparatus where there is a single carriage for the carriages in one section.

It will also be apparent that a nut pivotally connected with the carriage may be used, whether the carriage is in one, two, or more sections, and that two or more carriages or carriage-sections may be used where there is no counterbalance and there is but one cable or set of cables extending to the car.

It will also be seen that if a single carriage is employed the disadvantages from using one long continuous nut may be overcome by connecting two or more nuts with the set carriage, preferably by jointed connections.

It will be seen that the different sections of the carriage carry sheaves of different diameters. This arrangement is adopted to permit the different loops of the cables to cross each other without contact.

It will also be seen that the sheaves in the stationary end frames are upon inclined shafts or axles, in order to properly direct the cables to the traveling sheaves. We have found that this arrangement is preferable to inclining the axes of the sleeves upon the traveling carriage.

Without limiting ourselves to the precise construction and arrangement of parts shown and described, we claim—

1. In an elevator apparatus a screw-shaft turning in stationary bearings and sheaves for the hoisting-cables also turning in stationary bearings, combined with movable carriage-sections connected to travel together, each provided with a nut engaging the said shaft and carrying the traveling sheaves of the hoisting-cables, substantially as set forth.

2. The combination in an elevator apparatus, of a hoisting-cable, a screw-shaft, sheaves for the hoisting-cable turning in stationary bearings, and a carriage consisting of connected sections each provided with a nut engaging the shaft and sheaves on the carriage for the hoisting-cable, said sheaves being of different diameters, substantially as set forth.

3. The combination in an elevator apparatus of a screw-shaft, sheaves having inclined shafts turning in stationary bearings, and a

carriage driven by said screw-shaft carrying sheaves arranged upon horizontal axes, substantially as set forth.

4. The combination of a screw-shaft, sheaves turning in stationary bearings, a carriage provided with nuts engaging said screw-shaft, guides arranged above and below the shaft upon the same vertical plane and rollers upon the carriage bearing upon said guides, substantially as set forth.

5. The combination with the screw-shaft of a screw-elevator apparatus, of a series of nuts engaging said shaft, and a carriage with which all of said nuts are connected and carrying movable sheaves, substantially as described.

6. The combination with the screw-shaft of a screw elevator, of a carriage consisting of connected sections carrying the sheaves, and an independent nut upon each section engaging the screw-shaft, substantially as set forth.

7. In an elevator apparatus, a screw-shaft turning in stationary bearings combined with sheaves turning in stationary bearings and connected carriage-sections each having a nut engaging said screw-shaft and sheaves carried by the carriage-sections, substantially as described.

8. The combination with the guide-sheaves for hoisting and counterbalancing cables of an elevator, of a screw-shaft and connected carriage-sections intermediate the guide-sheaves carrying the traveling sheaves of said elevator, and a nut connected with each carriage-section engaging the screw-shaft, substantially as set forth.

9. The combination with the horizontal screw-shaft and carriage carrying the traveling sheaves of an elevator, of a nut jointedly connected with the said carriage, substantially as and for the purpose set forth.

10. The combination of the screw-shaft, carriage and nut engaging the said shaft provided with an oil-reservoir with openings extending from the reservoir to the threaded bearing of the nut, substantially as set forth.

11. The combination of the screw-shaft and nut having a casing containing an oil-reservoir and a spiral packing at each end of the nut confined within the space between the threads of the screw, substantially as set forth.

12. The combination of the screw-shaft, nuts therefor having the threads cut away at each end, a spiral packing arranged between the threads of the screw and caps with bearings for the ends of the said packing, substantially as set forth.

13. The combination of a screw-shaft, and a nut having a casing with an oil-reservoir, a threaded sleeve adapted to the shaft, spiral packings 35, caps P, and annular packings 37, all substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

NORTON P. OTIS.
RUDOLPH C. SMITH.

Witnesses:
HENRY L. BRANT,
W. L. RICKARD.