No. 705,338. Patented July 22, 1902.

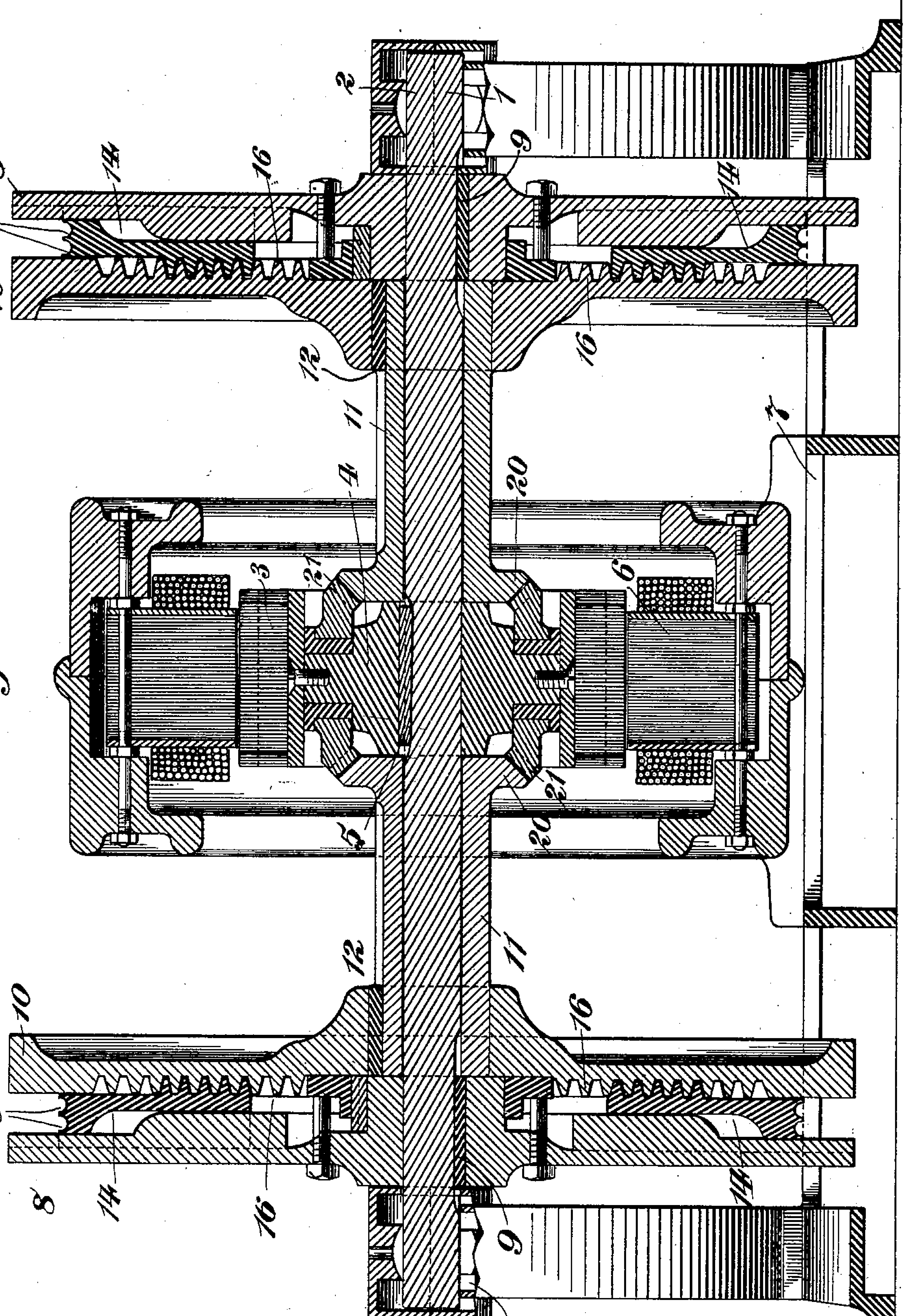
E. R. GILL.

ELEVATOR.

(Application filed Dec. 16, 1899.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



Witnesses
Eduard H. Howard.
James S. Laing.

Edwin R. Gill Inventor
By his Attorney H. S. MacKaye

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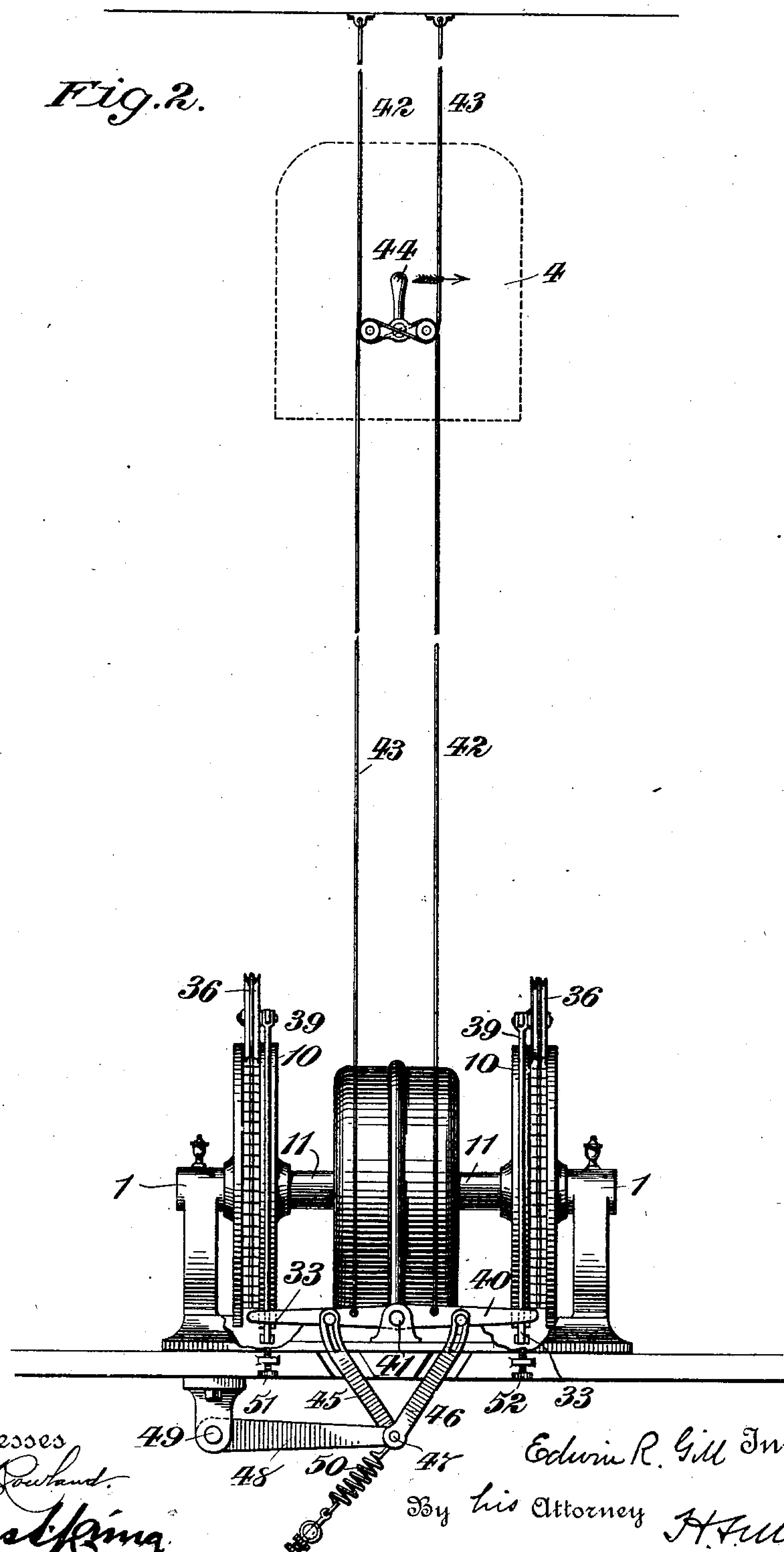
(No Model.) 5 Sheets—Sheet 2.

Fig. 2.



Witnesses
Edward [illegible]
James [illegible]

Edwin R. Gill Inventor

By his Attorney H. F. Mackaye

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E. R. GILL.

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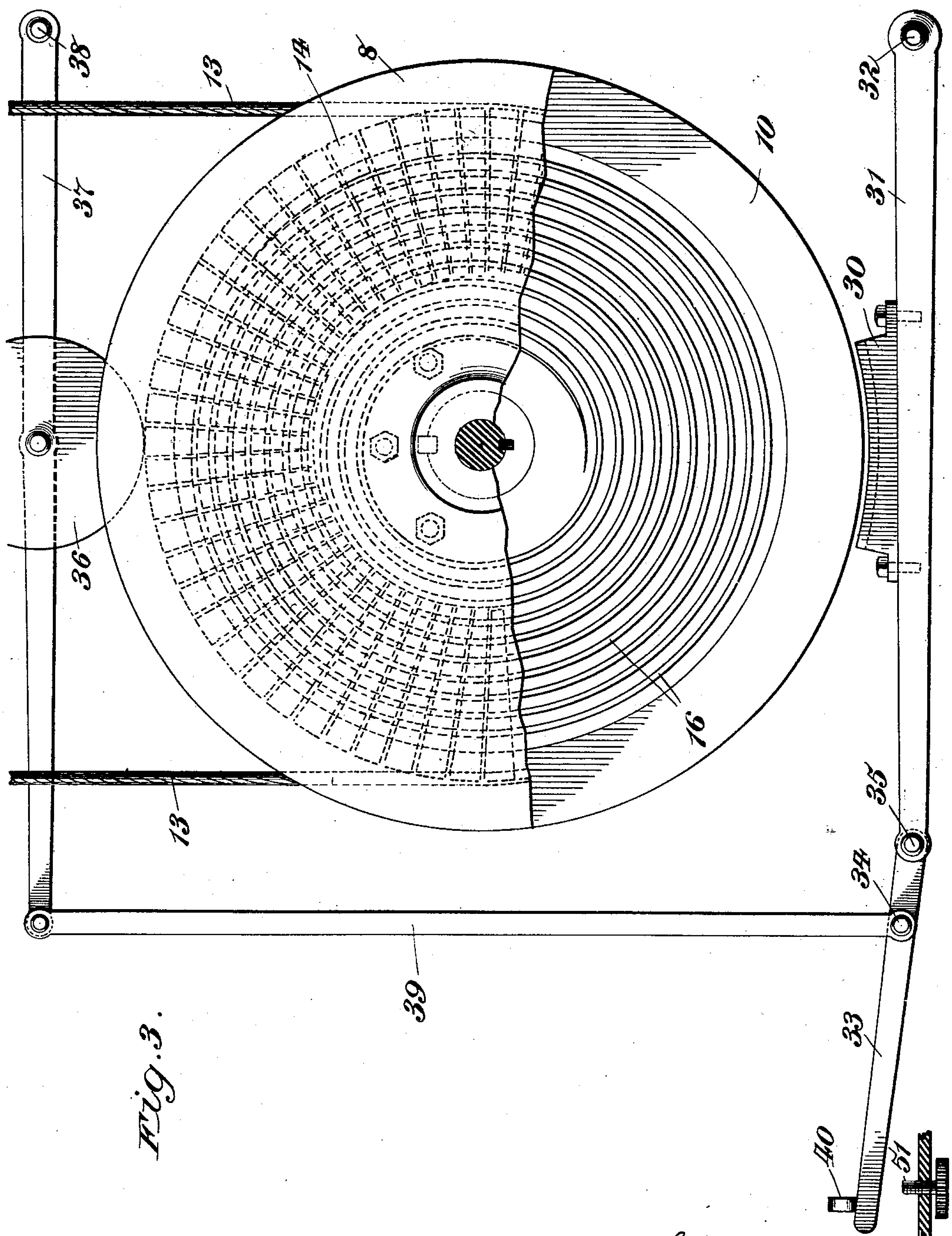

Fig. 3.

Witnesses
Edward C. Rowland
James Laing

Edwin R. Gill Inventor

By his Attorney H. S. MacKaye

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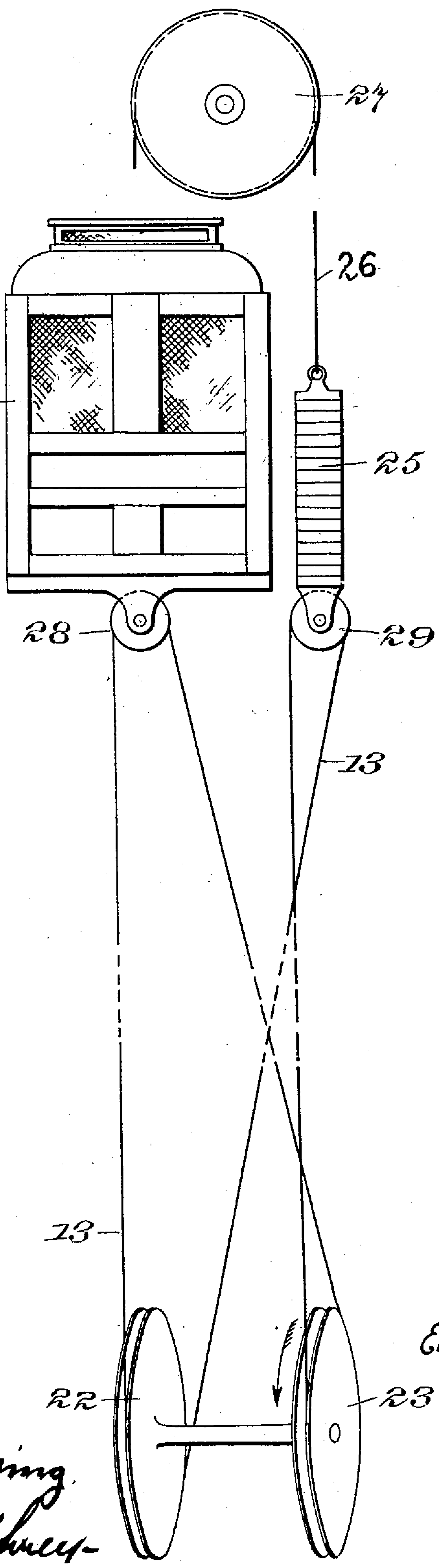
(No Model.) 5 Sheets—Sheet 4.



WITNESSES:

James L. Laing
W. H. Pumphrey

Edwin R. Gill INVENTOR

BY

H. H. MacKaye

ATTORNEY.

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

No. 705,338. Patented July 22, 1902.

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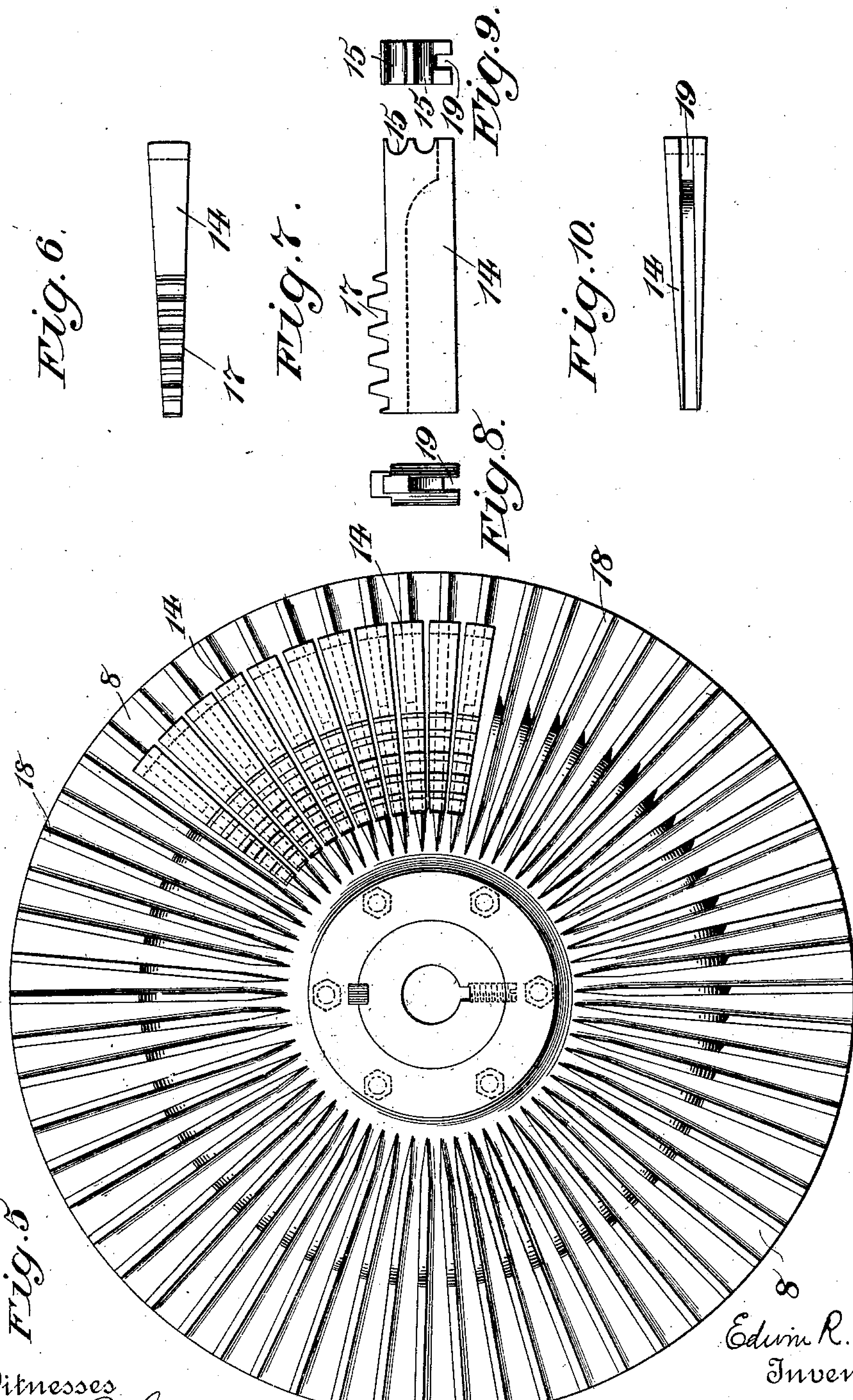
(No Model.) 5 Sheets—Sheet 5.



Edwin R. Gill
Inventor

Witnesses
Edward C. Rowland.
James S. Laing.

By his Attorney H. H. MacKaye

UNITED STATES PATENT OFFICE.

EDWIN R. GILL, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO OTIS ELEVATOR COMPANY, A CORPORATION OF NEW JERSEY.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 705,338, dated July 22, 1902.

Application filed December 16, 1899. Serial No. 740,522. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. GILL, a citizen of the United States, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Elevators, of which the following is a specification.

My present invention has relation to elevator apparatus, whereby a single constantly-running motor driving a single pulley is rendered available for controlling all the necessary movements of an elevator and whereby the stopping, starting, and reversal of the elevator movement are controlled positively and the elevator is automatically stopped when the controlling-handle is released.

The principal advantages of my present invention are the compactness of the apparatus used and the reliability and safety of operation.

The preferred form of my apparatus is illustrated in the accompanying drawings, wherein—

Figure 1 is a central vertical section of my driving mechanism combined with an electric motor. Fig. 2 is a side view of the apparatus shown in Fig. 1 with the controlling devices. Fig. 3 is a side view of one part of my preferred two-part pulleys, a part of the driving member being broken away to better show the construction of the brake member, and the controlling brake-shoe and fulcrum-disk being also shown in side view. Fig. 4 is a diagrammatic illustration of the preferred cable connections between the car, the driving-pulleys, and the counterweight. Fig. 5 is an inner face view of one of the driving members of my driving mechanism, and Figs. 6, 7, 8, 9, and 10 are detail views of the movable sectors upon which the cable rides.

The preferred construction, as illustrated in the drawings, may be described as follows:

Between a single pair of bearings 1 a main driving-shaft 2 is driven by any desired form of motor, the form preferred being shown at Fig. 1, wherein the armature 3 of an electric motor is carried by a hub 4, locked upon the shaft 2, as by means of the key 5. The field-magnet of the motor is shown at 6 and is preferably attached to the base 7, which is fast to the supports for the bearings 1, the whole forming, preferably, one casting.

In the form shown at Fig. 1 my driving-pulley consists of two expandible parts, each involving three members. One of these members, which I term the "driving member," is shown at 8 and always revolves with the driving-shaft 2, being fastened thereon by the key 9 or otherwise. The second member I call the "brake member," the same being shown at 10 in Fig. 1 and being made fast upon the sleeve 11 by means of the key 12 or otherwise. The sleeve 11 turns loosely upon the shaft 2. The third member of each expanding part may be termed the "bearing member," and is intended to carry the driving-cable 13. (Shown in Figs. 3 and 4.) This bearing member consists of a number of radially-moving sectors 14, which may be caused to move toward or away from the center of revolution in a manner hereinafter described. The circumferential surfaces of the sectors 14 are similarly grooved for the reception of the driving-cable, and, as shown in Fig. 1, two grooves 15 are employed, as a pair of driving-cables reinforcing one another should be used in the best practice.

The construction of the various members of the expanding parts of my pulley is shown in detail in Figs. 1 and 3 and 5 to 10, inclusive. The brake member 10 carries upon its inner face one or more spiral ridges 16, lying, preferably, in one plane and adapted to fit corresponding depressions 17 on the sectors 14, as shown in Figs. 1 and 6.

As shown in Fig. 5, the driving member or disk 8 is provided with radial ridges 18, upon each of which one of the sectors 14 is adapted to slide, the sector being provided with a longitudinal median notch 19. This notch is shown in end view in Figs. 8 and 9, and its formation to fit the profile of the ridges 18 is clearly shown in Figs. 1, 7, and 10. The sectors 14 are so placed on the driving member that their outer grooved ends conform to the periphery of a circle, as shown in Fig. 5 and in dotted lines in Fig. 4.

In the preferred form shown in Fig. 1 the two sleeves 11, carrying the brake members 10, are provided with beveled gears 20, adapted to mesh with corresponding beveled gears 21, which turn loosely upon the hub 4, carrying the armature-poles 3. As is well understood, this gearing insures equal and contrary rotation of each of the brake members 10 when either is moved. Correspondingly if both members 10 are revolving in the same direction modification of the revolution of one will cause opposite modification of movement in the other by means of the action of the gears 20 and 21. If now we suppose the armature 3 to revolve when the motor is started and the shaft 2 and the driving members 8 with it, there being no resistance to movement of the brake members 10, these members, together with the sectors 14, will revolve with the shaft 2 and the driving members 8, the whole forming a single two-part driving mechanism. Supposing this rotation to have been set up, if either of the brake members 10 is retarded there will be caused an equal and opposite relative rotation between the brake and driving members in each expandible pulley. Inasmuch as the sectors 14 are prevented by the ridges 18 from sharing this relative movement set up in the brake members 10, the turning of the spiral ridges 16 within the depression 17 on said sectors 14 will act to cause their radial movement in or out, depending upon the direction of the relative rotation between the disks 10 and 8. Inasmuch as this relative movement is equal and contrary in the two brake members 10, it is evident that the screwing action of the spirals 16 will result in equal radial expansion and contraction, respectively, in the two bearing members formed by the sectors 14. The function of this change in diameter in the two bearing members will be evident on inspection of Fig. 4, wherein the disks 22 and 23 represent the two bearing members carrying the endless cable 13. The elevator-car is shown at 24 and its counterweight at 25, the two being connected by an overhead cable 26, riding on a sheave or sheaves 27, as is well understood in the art. The car and counterweight carry the pulleys 28 and 29, respectively, and supposing the bearing members 22 and 23 to revolve together in the direction of the arrows the cable will be taken on at the front edge of disk 22, will pass thence to pulley 29, over the front of disk 23, and back over pulley 28, to return to disk 23.

It is evident that as long as disks 22 and 23, which revolve together, are of the same diameter the driving-cable 13 will travel idly over the various pulleys. This state of things is shown in Figs. 1 and 4. If, however, the bearing members 22 and 23 or either of them is made to change its diameter, there will be a corresponding downward or upward movement of the car 24. Supposing the disk 22 to be larger than the disk 23, for instance, the car will move downward, and if it be made smaller the car will move upward.

The spirals on the faces of the disks 10 in the form shown in Fig. 3 are in such a direction that if either disk 10 is retarded during rotation of the driving mechanism it will preferably produce inward movement of its own sectors 14 toward the center, thus contracting the diameter of that individual member which is carried on its own spiral. The reason for contracting and not expanding the diameter of the bearing member on retardation of its corresponding braking member will be seen hereinafter. In Figs. 2 and 3 is shown my preferred means for control of the elevator mechanism.

In proximity to each brake member 10 is placed a brake-shoe or equivalent device 30, carried or controlled by an appropriate lever 31, having its fulcrum at 32, said lever being operated by a controlling-lever 33, having a moving fulcrum 34 and pivoted to lever 31 at 35. Upon each bearing member or on the driving-cable itself there rolls a fulcrum-disk 36, carried by a lever 37, pivoted at 38. The lever 37 carries at its outer end a fulcrum-rod 39, which supports the movable fulcrum 34. At 40 in Fig. 2 is shown a tipping bar pivoted in the middle at 41 and projecting at its two ends over the two controlling-levers 33 under the brake members 10. The end of the tipping bar 40 is shown in Fig. 3 over the end of the lever 33.

The tipping bar 40 is preferably controlled by means of two cables 42 and 43, passing over disks in front of and behind the handle 44 in the car 4. Movement of the handle one way or the other will therefore cause tipping of the bar 40 in a corresponding direction, as is well understood in this art.

I prefer to provide means for the automatic return of the tipping bar 40 in case of breakage of one of the cables 42 and 43 and whenever the handle 44 is released. One form of device for this purpose is shown in Fig. 2, wherein links 45 and 46 are suspended from pins on the two sides of the bar 40 and come to a common pivot at 47, which pivot is borne on the end of the lever 48, turning on the bearing 49. The spring 50 tends constantly to bring the two links into the position shown in Fig. 2 and causes return of the bar 40 to the middle position, as shown, whenever strain on either cable 42 43 is released. The stops 51 and 52 under the ends of the lever 33 are adjustable, as shown, and limit the degree to which said levers can be depressed in controlling the car.

The operation of my driving mechanism and its control can now be made clear.

Supposing the sectors 14 on each side of the driving-pulley in Fig. 1 to be equally distant from the centers, as shown in that figure, the result will be an idle movement of the driving-cable 13, and the elevator will stand still. If now the handle 44 is moved in the direction of the arrow in Fig. 2, the tipping lever will be depressed on the right side and will bear down upon the controlling-lever 33, as shown in Fig. 3. Since the fulcrum-disk 36 always bears on the outer grooved peripheries of the sectors 14, the pin 34 will serve as a fulcrum for the lever 33, and depression at the point 40 will cause the end 35 of the lever 31 to be raised and the shoe 30 to be applied to the periphery of the disk 10. As heretofore stated, this will cause a contraction of the bearing member, due to inward movement of its sectors 14. The disk 36 will follow this movement and will cause a lowering of the fulcrum 34. If pressure upon the tipping bar 40 is not continued, the lowering of fulcrum 34 will soon relieve the pressure of the brake-shoe 30, thus preventing further contraction of the bearing member. Owing to the gears 20 and 21 the contraction of one bearing member corresponds to expansion of the other, and consequently the controlling-lever 33 on the left-hand side of Fig. 2 will follow up after the tipping bar 40, this movement being caused by the fulcrum-disk 36. The two bearing members having thus been made to change their relative diameter, their continued rotation will cause movement of the elevator in one or the other direction, as heretofore explained. It is evident that by causing the tipping bar 40 to follow up the downward movement of the fulcrum 34 the pressure of the brake-shoe 30 can be maintained until the controlling-lever 33 has been brought down to a final bearing on the stop 51. It is thus evident that the position of the stop 51 will determine the extreme contraction and expansion which can be given by the controlling mechanism to the two bearing members.

In order to stop the movement of the elevator, the handle 44 may be brought back to the middle position, thus bringing the tipping bar back and applying the brake 30 on the left-hand side for contraction of the left-hand bearing member in the manner above described for the right-hand member. This will bring the two members to the same diameter and cause the driving-cable to run idly. It is evident that opposite movement of the bar 40 will cause opposite change of relative diameter in the two bearing members, and thus reverse the direction of the car.

It is clear that a variety of constructions might be employed with my expanding pulleys for causing necessary changes therein without departing from my invention.

I do not limit myself to the use of a driving mechanism having two expandible parts, since it is evident that the apparatus shown in Fig. 1 would be operative if modified so that the driving member, brake member, and bearing part on one side should be as illustrated in that figure, while on the other side an unchanging bearing part was used with a brake-wheel not connected with it, but simply geared in a manner equivalent to that shown in Fig. 1 to the other brake member. This form of my invention would cause upward or downward movement of the elevator, according as the expanding part was given a diameter greater or less than the fixed part, or vice versa.

A variety of driving means might be devised for use with my invention, and I am not limited to the particular form or arrangement shown. It is further clear that one motor may be made to drive a number of two-part driving mechanisms without departing from my invention.

While my invention in its preferred aspect involves the use of a single mechanism having two parts constantly rotating together, I have also claimed hereinafter the use of two expanding parts operating substantially as described above, whether driven by one or more motors, and therefore either mechanically joined or separate.

My invention is capable of a considerable number of changes in form, and I am not limited to the details of description above given.

What I claim is—

1. In an elevator apparatus, a driving mechanism comprising two expansible pulleys, each of which comprises a driving-disk, a bearing-disk divided into sectors sliding radially on said driving-disk, and an independently-rotatable brake-disk operating to change the diameter of said bearing-disk; in combination with an endless driving-cable arranged in two bights, each bight embracing one of said driving-pulleys.

2. In an elevator apparatus, a driving mechanism composed of two expandible pulleys, each comprising a bearing member and an independently-rotating brake member operating to contract said bearing member when retarded; in combination with gearing connecting said brake members for opposite movement and means for applying retarding pressure to one or the other brake member at will.

3. In an elevator apparatus, a driving-motor having a rotating member and attached main driving-shaft, a two-part driving-pulley having one part expandible, two brake-disks sleeved on said shaft, which operate the expanding part of said pulley, gearing on the rotating part of said motor joining said sleeves for independent contrary rotation thereon, and means for operating said brake-disks.

4. In an elevator, a driving mechanism, comprising two pulleys one of which is expandible and comprises a brake-disk for controlling its effective diameter; in combination with brake mechanism, and means operated by said expandible part for relieving the pressure on said brake.

5. In an elevator, a driving mechanism, comprising two pulleys one of which is expandible and comprises a brake-disk for controlling its effective diameter; in combination with a brake mechanism, an operating-lever adapted to apply pressure thereto, a disk moving in and out with the periphery of the expanding pulley, and means controlled by

said disk for relieving the pressure on said brake.

6. In an elevator, a driving mechanism, comprising two pulleys one of which is expandible and comprises a brake-disk for controlling its effective diameter; in combination with a brake shoe and lever, an operating-lever therefor having a movable fulcrum, a support for said fulcrum and a disk moving in and out with the periphery of the expanding pulley affording an abutment for said support.

7. In an elevator, a driving mechanism comprising two pulleys each of which is expandible and comprises a brake-disk for controlling its effective diameter, and gearing between said disks insuring opposite movement thereof; in combination with a brake for each brake-disk, a brake-lever for operating each brake, and a tipping bar adapted to press on both levers and arranged to depress one lever while permitting the other to rise.

EDWIN R. GILL.

Witnesses:

JAMES S. LAING,

HAROLD S. MACKAYE.