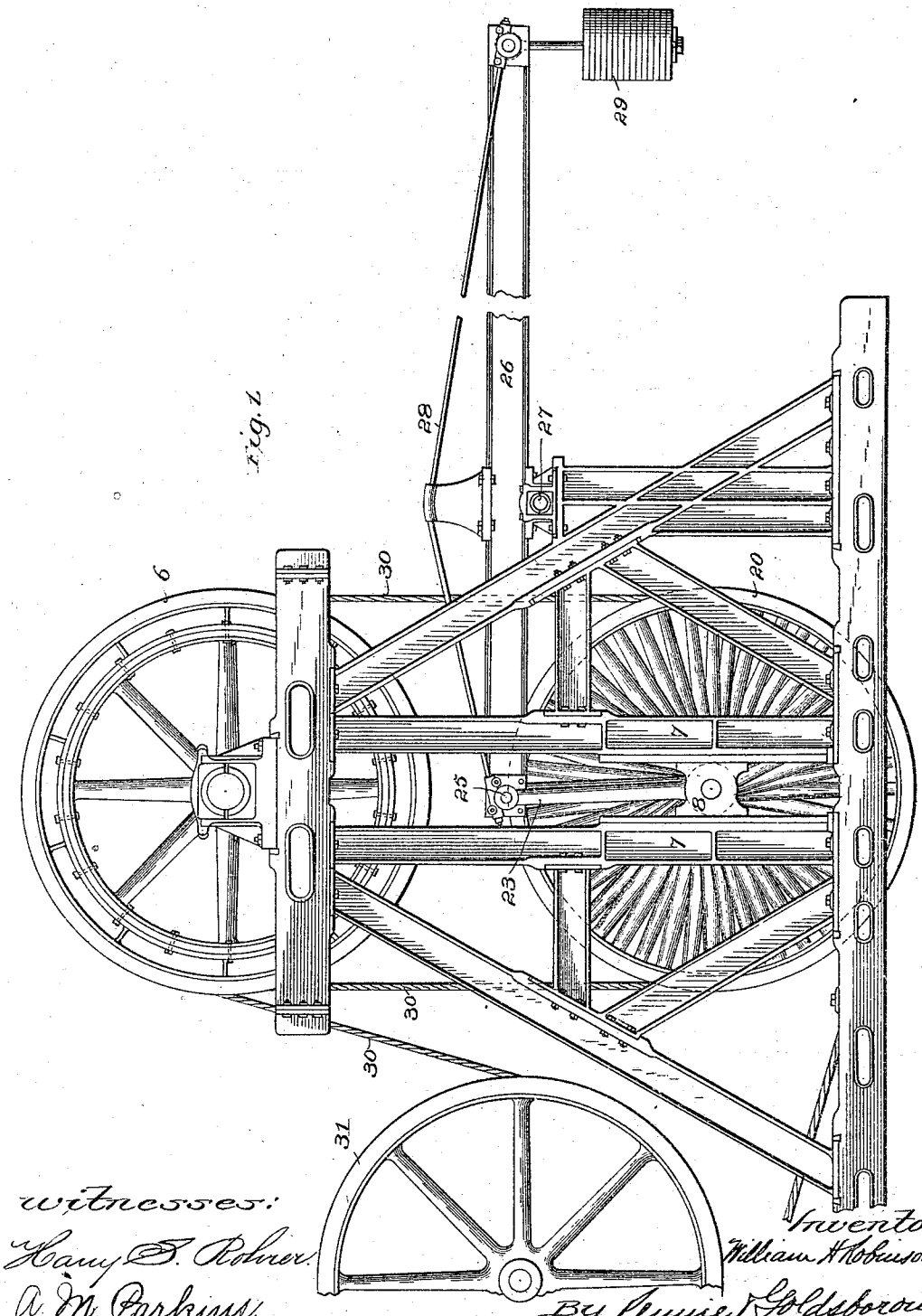
(No Model.) 4 Sheets—Sheet 1.

W. H. ROBINSON.

ROPE DRIVING MACHINERY.

No. 503,684. Patented Aug. 22, 1893.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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Fig. 2.

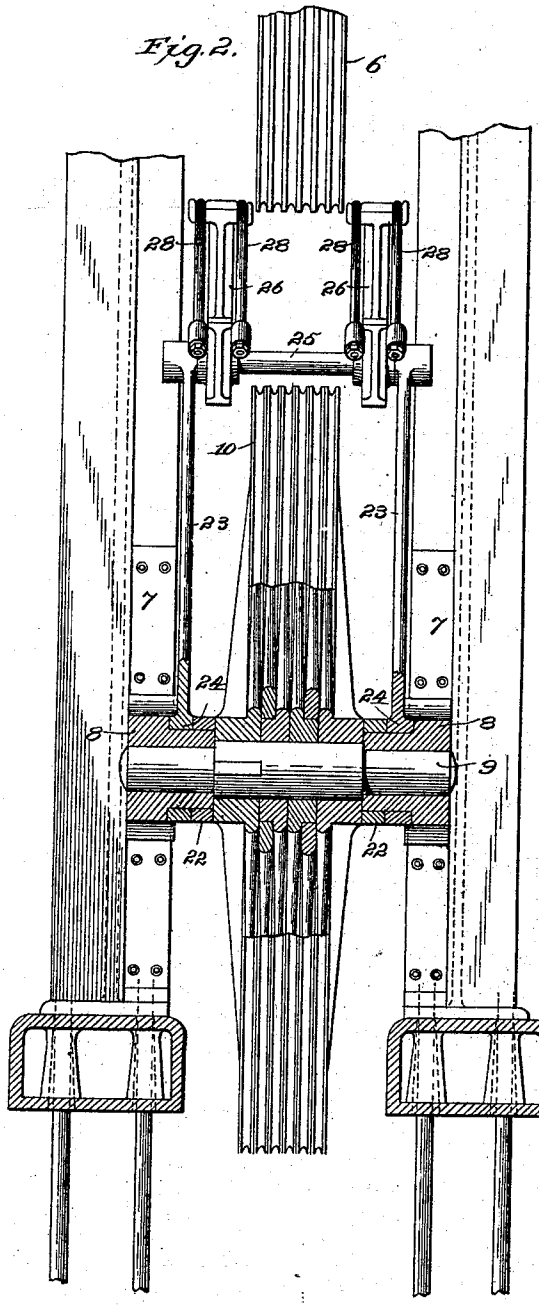
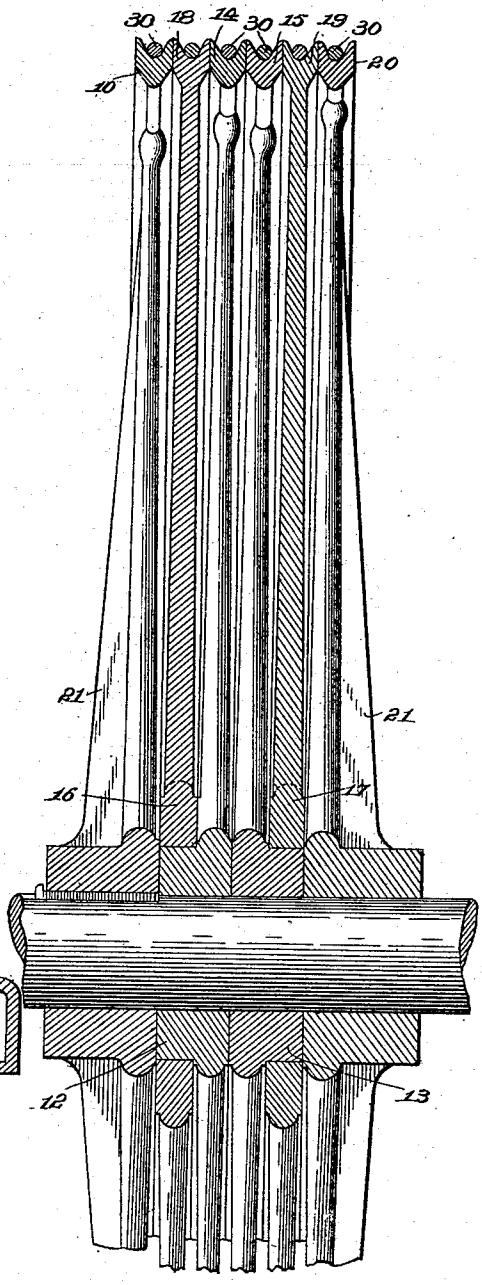


Fig. 3.



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(No Model.)

4 Sheets—Sheet 3.

W. H. ROBINSON.

ROPE DRIVING MACHINERY.

No. 503,684. Patented Aug. 22, 1893.

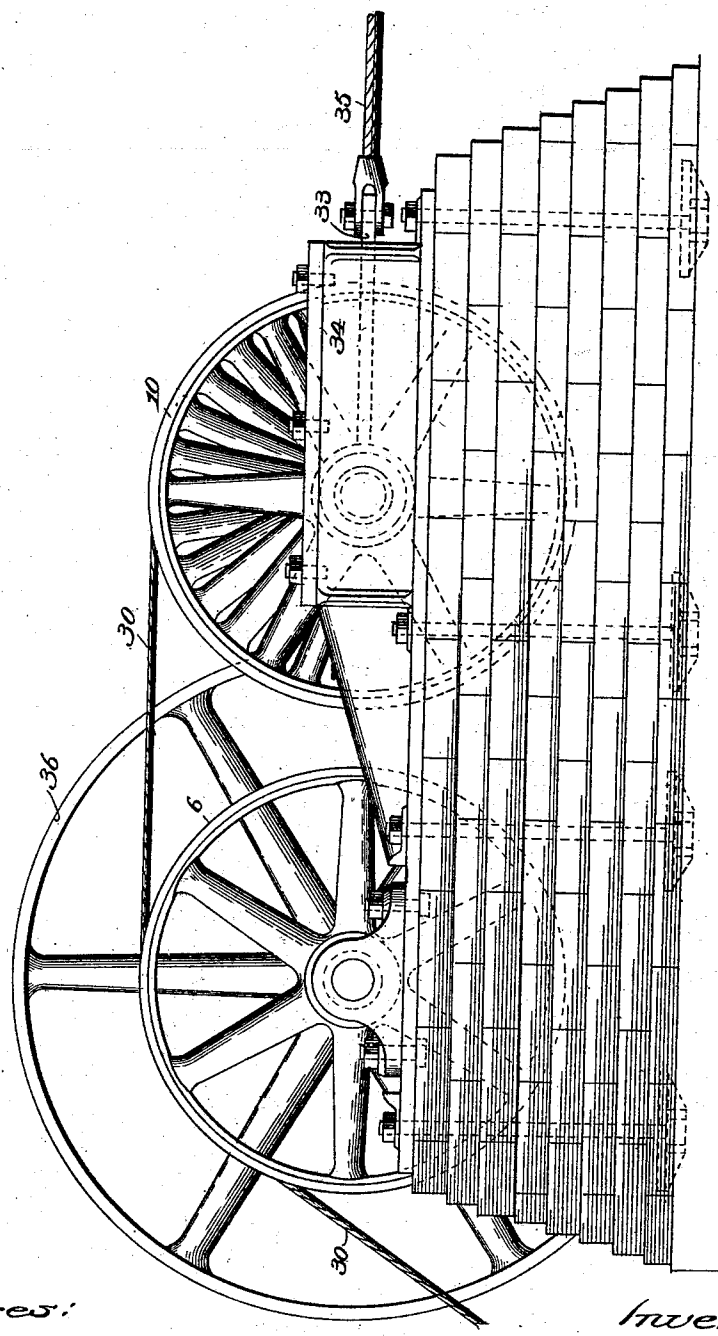

Fig. 4.

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(No Model.) 4 Sheets—Sheet 4.

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ROPE DRIVING MACHINERY.

No. 503,684. Patented Aug. 22, 1893.

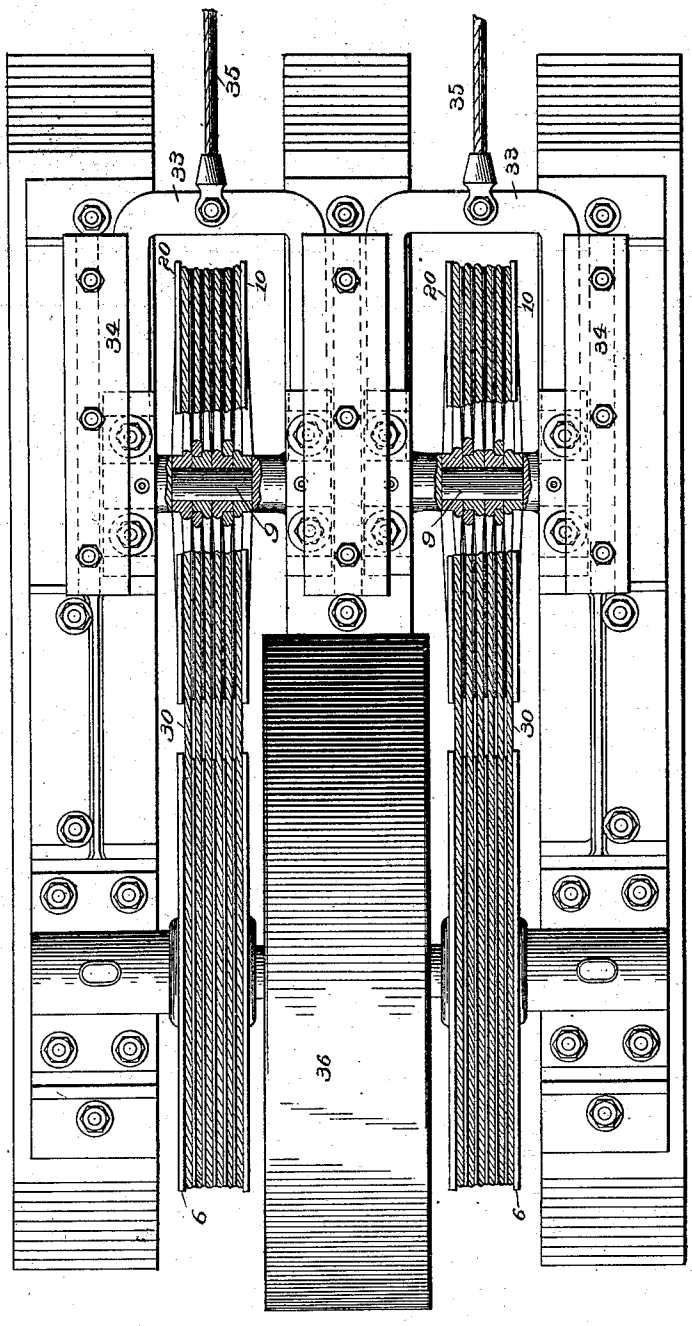

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM H. ROBINSON, OF PHILADELPHIA, PENNSYLVANIA.

ROPE-DRIVING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 503,684, dated August 22, 1893.

Application filed May 11, 1893. Serial No. 473,853. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. ROBINSON, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Rope-Driving Machinery; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In the construction and equipment of cable railways it is customary, at the power station, to secure the adhesion necessary to impart motion to the cable by causing it to take a number of turns around two drums one of which is fixed to the power shaft and the other of which is an idler, both being provided with a number of peripheral grooves corresponding to the cable turns upon them. From these drums, the cable passes around a one-grooved sheave supported upon a tension car whose function is to take up slack in the cable and keep it in condition to respond at all times to the calls made upon it. The tension car is mounted upon a trackway called the tension-run and exerts a constant tension upon the cable, moving backward or forward along the trackway so as to automatically take up and compensate for the varying amount of slack. Where the cable is of great length the tension run is proportionately long to correspond with the demands put upon it.

One of the objects of my invention is to dispense entirely with this lengthy trackway and the sheave-carrying tension car mounted upon it; thereby saving the building space required for its accommodation. To this end, I convert the idler drum hereinbefore referred to, into a tension device by mounting the idler drum bearings in suitable slides or guide ways and providing means for causing the said idler drum itself to exert the necessary slack take-up tension upon the cable. By this expedient, a small movement of the idler drum will be effective to take up a considerable amount of slack, the differential relationship of the two drums causing the idler drum movement to be multiplied in proportion to the number of turns of cable passing over the two drums. The idler drum may be arranged to move horizontally if desired, but I prefer to suspend it to move vertically immediately below the driving drum, in order that its weight may be utilized to keep the cable taut, and in order to effect a still greater saving in ground space, as all the necessary movement can take place in a pit arranged below the driving drum. To obviate any undue strain upon the cable, I may in part counterbalance the weight of the idler drum as will hereinafter more fully appear. I furthermore construct the idler of a series of grooved sheaves mounted side by side upon the same shaft, one of them being keyed thereto in order to carry it around at the speed of the driving drum, but the remaining ones having a capacity of circumferential movement with respect to the shaft and to each other. I thus reduce the wear and tear upon the cable to a very small amount, any slipping of the cable within the grooves due to uneven wear of said grooves, being in great measure prevented by the capacity each sheave possesses of moving relatively to the others. Instead of the cable slipping within any particular groove, therefore, the tendency is for the corresponding sheave to shift its position circumferentially with respect to the others. The life of the cable is consequently materially prolonged the tension upon each turn of the cable upon the drum being equalized, and, in addition thereto, torsional strain upon the idler drum shaft is practically eliminated.

In the accompanying drawings, Figure 1 represents, in side elevation, a driving drum, idler wheel and their accessories, arranged and constructed in accordance with one form of my invention. Fig. 2 represents an end elevation thereof, partly in section, and on a somewhat larger scale. Fig. 3 represents a partial view of my improved idler drum, also in section. Fig. 4 represents, in side elevation, another arrangement embodying my invention; and Fig. 5 represents a plan view of the same partly in section.

Similar numerals of reference indicate similar parts throughout the several views.

Referring to the drawings, 6 indicates the usual solid grooved driving pulley fixed to its shaft and driven in any suitable manner from the source of power, as will be readily understood. In the form of the invention shown in Figs. 1 and 2, the solid grooved pulley 6 is supported upon a frame provided with verti-

cal guides 7, and within these guides are adapted to reciprocate the bearings 8 of a rotatory shaft 9. The shaft 9 forms the axis of rotation of the idle wheel, which is made up of a grooved sheave 10, keyed to the shaft by the spline or feather 11, and of additional grooved sheaves not fixed to the shaft but capable of independent movement with respect to each other so as to be capable of shifting independently of each other and of the shaft, while still preserving a working fit at their bearing surfaces. The hubs of the sheaves are connected to their rims preferably by spokes, as shown, and in order to increase the bearing surface of the hubs of the intermediate sheaves, two of said hubs are mounted upon the other two. Thus, as shown in the drawings, the hubs 12, 13, of the two innermost sheaves 14, 15, are extended laterally to form bearings for the hubs 16, 17 of the adjacent sheaves 18, 19. By this expedient, the hubs of all of the intermediate sheaves have a greater bearing surface than if they were all mounted side by side upon the shaft 9 and the strain upon said shaft when the sheaves shift is more evenly distributed upon it. The outer sheaves 10, 20, have laterally extending hubs and are braced against side strains by ribs 21 from the hubs to the spokes. The sheaves 10, 12, 13, 18, 19 and 20 are thus assembled upon the shaft 9 to form an idle pulley conforming in general structure to the solid grooved pulley, and having its grooves in the same plane with the corresponding grooves of said solid pulley. Spacing rings 22 are mounted upon the shaft 9 beyond the hubs of the sheaves 10, 20, and beyond the said spacing rings the shaft 9 is suspended by hangers 23, whose ends 24 encircle the guide-block-bearings 8 but with a capacity to turn thereon. The hangers 23 are adapted to have a slight oscillating movement and to this end are journaled at their upper extremities upon a cross shaft 25 mounted within bearings formed in the ends of levers 26, which levers are fulcrumed upon a suitable support or trunnion 27, and are provided with struts 28. In practice, these levers will generally be formed of heavy steel I-beams twenty inches deep and strutted to sustain with safety a load of forty to fifty tons, and the trunnion shaft 27 will generally be an eight inch shaft resting in suitable bearings, as shown.

In Fig. 1, I have shown the levers 26 as partly broken away, in order to indicate that the outer ends of the levers, beyond the trunnion shaft 27, are, in general, longer than the inner ends from which the idler pulley is suspended. These longer ends are provided with adjustable or removable weighting facilities, as, for instance, the suspended weights 29, for the purpose of partly counterbalancing the idler pulley, if required, so that the latter may not exert an undue strain upon the rope or cable. It will be understood however, that the idler is not to be completely counterbalanced, inasmuch as its weight is relied upon to be utilized to keep the proper tension upon the rope or cable. The fact that the idler sheaves are thus suspended or hung within the loops of the rope or cable from the driving pulley enables it to keep the rope taut at all times and to act with equal effect upon each of the loops by reason of the capacity for independent shifting possessed by the idler sheaves.

The rope or cable is indicated in Fig. 1 by the numeral 30. After passing around the grooves of the idler and driving pulley it is led immediately back for service on the line, the usual "tension-run" being entirely dispensed with and superseded by the action of the suspended idler. A suitable guide sheave as 31 may be used to give the desired direction to the outgoing portion of the cable, as will be understood.

It is a characteristic merit of my invention that the slack, which has heretofore not been taken up until after it had passed over the drum and was on the way out again, is now compensated for at the moment of its occurrence by immediate action on the part of the idler, thereby avoiding the unpleasant jerking motion of the cars incident to the former system.

In Fig. 3, I have shown the parts of the idler pulley on a larger scale, so as to distinguish them clearly.

While I prefer to mount the idler in such manner as to be suspended to move up and down as shown in Figs. 1 and 2, I do not restrict myself to that arrangement but contemplate broadly any equivalent means for causing it to move toward and from the driving pulley. Thus, in Figs. 4 and 5, I have illustrated means for mounting the idler to move horizontally with respect to the driving pulley. In this construction, the idler pulley proper with its shaft and independently shiftable grooved sheaves is of the same construction as that hereinbefore described. It is mounted within a yoke 33 adapted to slide in guide bearings 34, and connected by a tension-rope 35, with any suitable means for exerting a yielding tension upon the idler, as, for instance, a hydraulic cylinder.

In Fig. 4, I have shown two pairs of driving drums and idlers, operated by an intermediate power pulley 36, and it will, of course, be understood that the invention is involved in both pairs. The mechanism is mounted securely upon a foundation 37 of masonry or the like, suitably strengthened and anchored, and a sufficient tension is put upon the tension-rope 35 to insure the cable loops between the idler and driving drum being kept taut, while at the same time not sufficient to endanger the cable but permitting the idler to respond by backward and forward movements of its sliding yoke-bearing 33 to the varying amount of slack to be compensated for.

It will be apparent that broadly speaking the operation of the form of my invention shown in Figs. 4 and 5 is the same as the operation of the form shown in Figs. 1 and 2;

but I prefer the latter, for the reason that it is more compact, takes up less ground space, and utilizes the weight of the idler itself to put the tension on the cable loops in which it is hung.

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

1. In rope-driving machinery, the combination with the rope-driving pulley having a plurality of rope-receiving grooves, of an idler having a corresponding number of rope-receiving grooves, said idler receiving the rope from the driving pulley and returning it thereto and being mounted to move backward and forward with respect to the driving pulley, the rope being distended between the driving pulley and idler to form a plurality of loops; whereby the varying slack is taken up in the space between the driving pulley and idler and is distributed between the multiple loops of the rope; substantially as described.

2. In rope-driving machinery, the combination with the rope-driving pulley having a plurality of rope-receiving grooves, of an idler having a corresponding number of rope-receiving grooves, said idler receiving the rope from the driving pulley and returning it thereto and being suspended from the driving pulley within the multiple loops of the rope; substantially as described.

3. In rope-driving machinery, the combination with the rope-driving pulley, of an idler receiving the rope from the driving pulley and returning it thereto, said idler being suspended from the driving pulley through the intermediacy of the rope, and a counterbalance for in part relieving the rope of the weight of the idler; substantially as described.

4. In rope-driving machinery, the combination with the rope driving pulley, of an idler receiving the rope from the driving pulley and returning it thereto, said idler being located immediately below the driving pulley and suspended therefrom through the intermediacy of the rope, guides within which the idler bearings are adapted to move, and a counterbalance lever connected to the idler; substantially as described.

5. In rope-driving machinery the combination with the rope driving pulley, of an idler receiving the rope from the driving pulley and returning it thereto, said idler being suspended from the driving pulley through the intermediacy of the rope, guides within which the idler bearings are adapted to move, a counterbalance lever, and hangers connecting said lever with the idler drum, said hangers being loosely connected to both lever and drum so as to oscillate to the degree required by the movements of the idler; substantially as described.

6. In rope-driving machinery the combination with the rope-driving pulley, of a co-operating idler consisting of a series of grooved sheaves assembled upon a common shaft, one of said sheaves being secured to the shaft and the remainder being mounted loosely thereon and independently of each other; substantially as described.

7. In rope-driving machinery the combination with the rope-driving pulley, of a co-operating idler provided with a series of grooved sheaves assembled together upon a common shaft and mounted loosely thereon, and provided with an additional grooved sheave fixed to said shaft, the hub of the fixed sheave being located to one side of the hubs of the loose sheaves; substantially as described.

8. In rope-driving machinery, the combination with the rope-driving pulley, of a co-operating idler consisting of a series of grooved sheaves assembled upon a common shaft, one of said sheaves being fixed thereon, and the remainder being loosely mounted some upon the shaft direct and some upon the hubs of the others; substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM H. ROBINSON.

Witnesses:
FRANK BUCHARD,
WM. H. POWELL.