A. SMITH.

HOISTING APPLIANCE.

APPLICATION FILED NOV. 6, 1908.

929,508. Patented July 27, 1909.

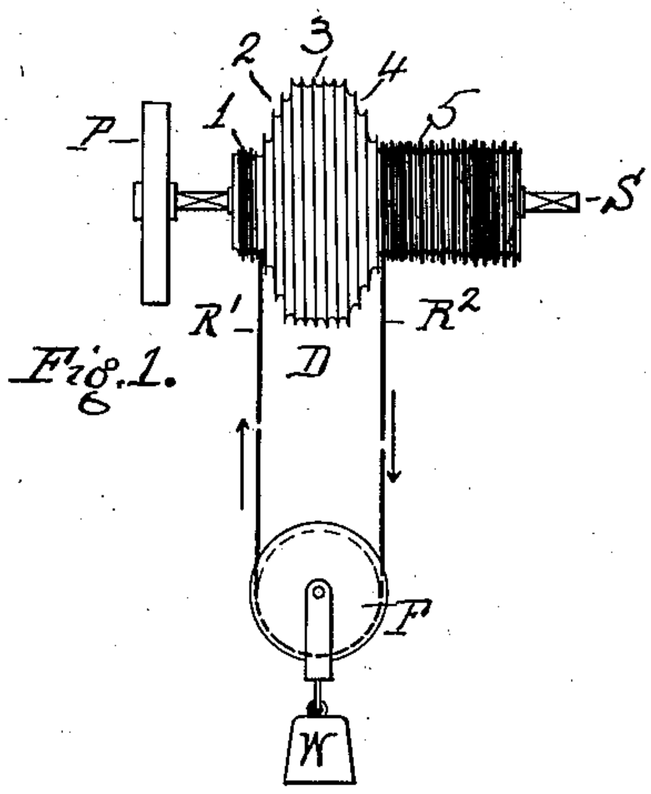

Fig. 1.

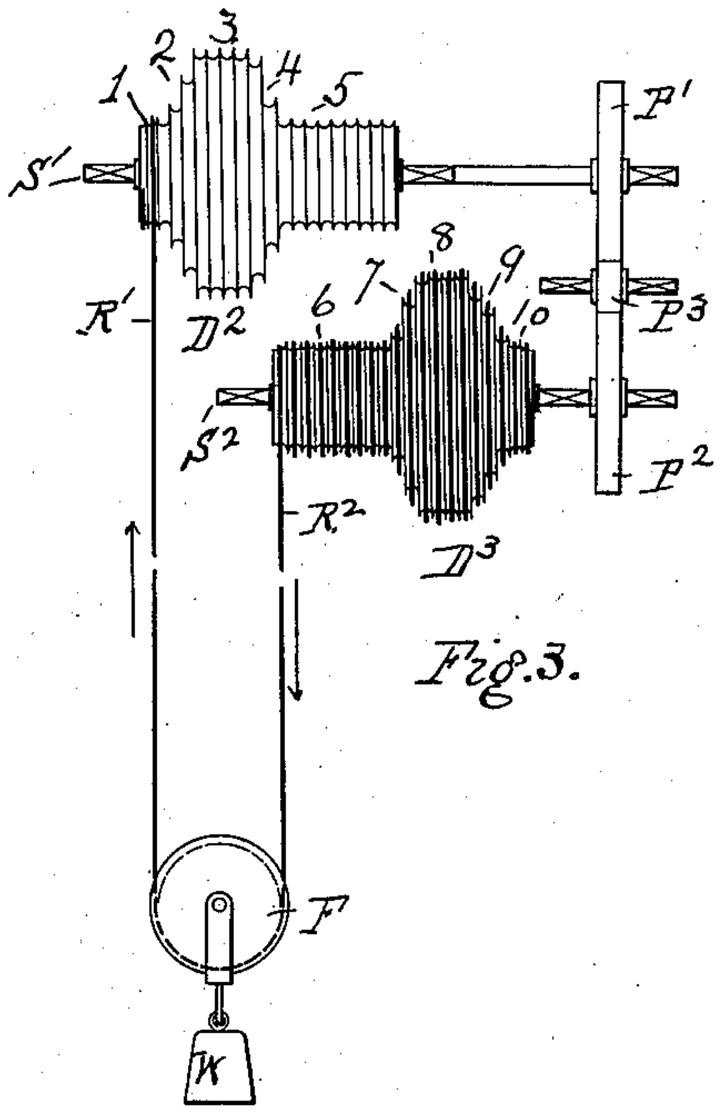

Fig. 3.

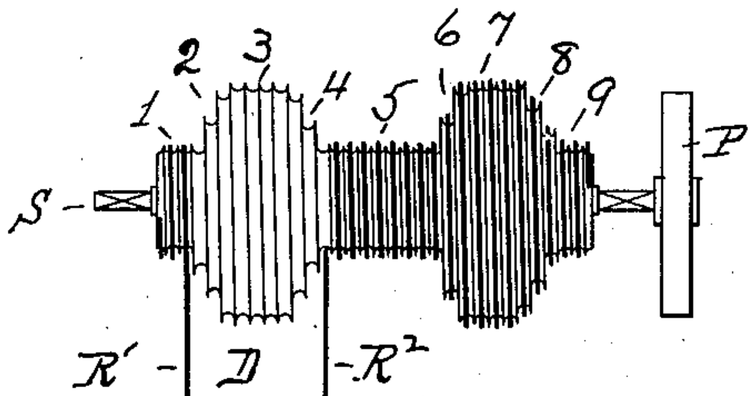

Fig. 2.

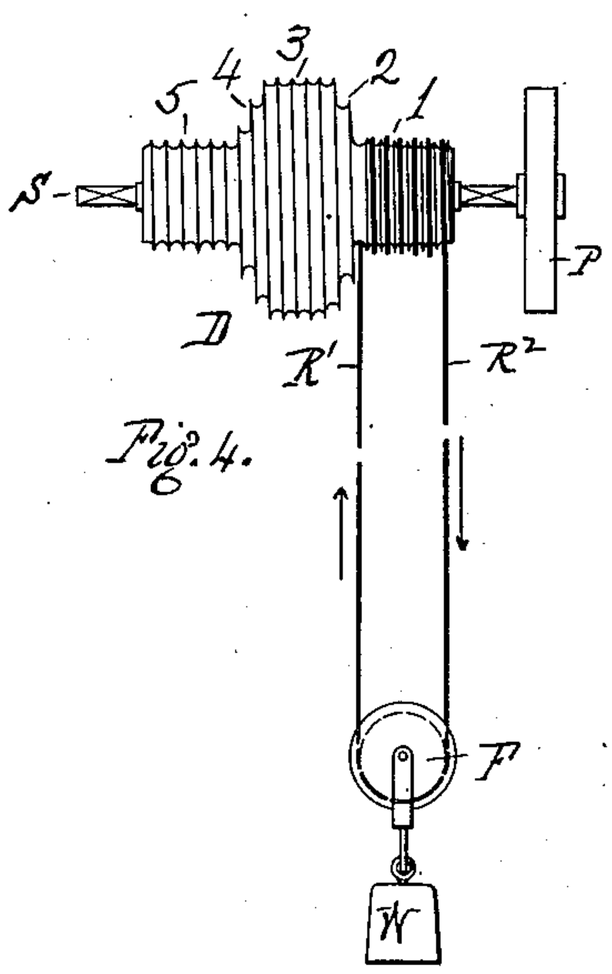

Fig. 4.

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HOISTING APPLIANCE.

No. 929,508. Specification of Letters Patent. Patented July 27, 1909.

Application filed November 6, 1908. Serial No. 461,387.

To all whom it may concern:

Be it known that I, AUGUSTUS SMITH, a citizen of the United States of America, residing in the city of North Plainfield, in the county of Somerset, in the State of New Jersey, have invented a certain new and useful Improved Hoisting Appliance, of which the following is a specification.

The main object of my invention is to so construct a drum and combine therewith a hoisting rope and pulley block that the total hoist or path through which the load, as for instance a skip or dumping bucket, is lifted, is limited absolutely by the shape of the drum itself and is not dependent on stopping the revolution of the drum, when the skip or bucket reaches the upper or lower limit of its travel. This object I attain by the construction and combination hereinafter described.

In the accompanying drawings the four figures are similar diagrams of four of the different forms in which my invention may be embodied.

The skip, dumping bucket or other weight to be lifted through a path of definite length is represented by the weight marked W in the accompanying drawing. This weight is suspended from a flying block hanging in the bight of a rope, the two ends of which are so wound on a grooved drum or on separate drums, that as the drum or drums revolve, one end of the rope is paid out while the other end is wound in. The drum or drums is or are made of differing diameters and the ends of the rope are so coiled thereon that at the beginning of the motion the rope is paid out at exactly the same speed at which it is wound in, and the bucket or other load consequently remains at rest, the sheave in the flying block F merely turning with the rope. But after a prescribed number of revolutions of the drum, depending upon the circumstances of the case, the rope will run onto a groove of the drum of increasing diameter, while the diameter of the groove from which the rope is being paid out remains the same, thereby causing the flying block F with its load W to be drawn in toward the drum at an increasing speed, until, if desired, a uniform speed of hoist is attained depending on the relative diameters of the grooves winding in and paying out. As the end of the prescribed path or travel of the skip or other load W is reached, the diameter of the groove upon which the rope is being wound in gradually decreases at any desired rate until the rope is again being wound in at the same speed at which it is paid out at the other end, at which time the skip, bucket or weight will be brought to rest at the upper limit of its travel without stopping the drum.

If the drum be of limited length, its revolution must be stopped soon after the bucket reaches the end of its travel, because the rope remaining on the drum to be paid out will soon all be paid out. The revolution of the drum can be stopped automatically or by a human operator. The stopping of the drum has nothing to do with the stopping of the skip or bucket, except for the practical limits of construction above noted.

In Figure 1 the grooved drum D is mounted on a shaft S, which can be revolved by a pulley, gear wheel or other means at P. This drum is shown as with a short spirally grooved part 1 of small diameter, leading to a part 2 of gradually increasing diameter, a part 3 of large diameter, a gradually decreasing part 4, and a relatively long part 5 of the same diameter as the part 1.

One end of the hoisting rope R^1, R^2, in the light of which the flying block F with its weight is suspended, is secured to the end of the small diameter 1, while the other end is wound on the small diameter 5 of the drum, filling as many grooves as the drum will make rotations. In the diagrams, the rope is shown wound only on the two small and equal diameters 1 and 5 of the drum, so that as the latter is revolved, the part R^1 is being wound onto the diameter 1 at the same rate of speed at which it is being paid off the diameter 5. As the revolution of the drum D continues in the direction indicated by the arrows, the part R^1 of the rope will rise in the spiral groove at 2, being wound in faster and faster as the radius increases, while the part R^2 will be paid out from the diameter 5 at a uniform speed. As R^1 is wound in on the portion of the drum at 3, it will be drawn in at a rate of speed uniformly greater than R^2 is being paid out in unwinding from 5. As the weight or skip reaches the upper limit of its travel R^1 will be wound in on the spiral at 4 with a gradually decreasing radius, causing the load to

be brought gradually to rest until when R^1 reaches the groove at 5, the upward motion of W will cease entirely. If the drum were indefinitely extended to the right, it is obvious that the revolution of the drum could continue without causing the weight W to rise further. It is evident that the same result would ensue if, after starting the revolution of the drum, the rope had been so wound that one end, as R^2 began to be paid out more slowly than the other end was wound in. In other words, the rate of paying out the rope could be decreased instead of the rate of winding increased. In the construction, Fig. 1, this condition would obtain if R^2 were wrapped around the drum to the left hand end of diameter 4, while R^1 began at the left of the diameter 3. If the drum were revolved, with this condition in the same direction as before, R^1 would be wound in uniformly as it traveled from left to right on diameter 3, while R^2 would be paid out more slowly as the radius of the spiral on which it was wound, decreased to 5. The weight would then be raised at a uniform speed as before until R^1 reached diameter 4, where the rate of lift would be decreased as R^1 was wound in on the decreasing radius of this spiral 4 until R^1 reached 5, after which it would be wound in at the same speed that R^2 was paid out as before, and the upward motion of W would cease. By extending the drum D^1 further, as shown in the diagram Fig. 2, on which the same parts are represented by the same letters, so that after the outgoing rope R^2 reaches the end of 5, it begins to be paid out faster as it unwinds from 6 to 7, while R^1 is being wound in on 5, the weight or skip W will begin to descend or return at a gradually increasing velocity, until R^2 reaches the maximum diameter of the drum at 7, after which, if the drum is there made cylindrical, the rate of descent will be uniform, while R^2 is being unwound from 7, at the same time that R^1 is being wound in on 5. As the bucket or skip W reaches the lower limit of its travel, R^2 is paid out on the spiral of gradually decreasing radius, thereby bringing the weight or skip gradually to rest until R^2 reaches 9 where the diameter is the same as 5. The length of groove on 5 is so taken that R^1 will not have passed therefrom by the time R^2 reaches the end of 9, and the skip or weight will, therefore, be brought absolutely to rest at the bottom of its travel without stopping the revolution of the drum. The drum can then be stopped, as before, by some automatic device or by an attendant.

In the case shown in Fig. 1, the bucket, skip or weight can be returned to its starting point by reversing the direction of rotation when the cycle of operations will obviously be reversed.

In the case shown in Fig. 2, if the total increase in the length of the groove from 1 to 5 over the length of the same number of coils on the cylindrical portion 5 is exactly the same as the increase in the total length of the groove from the end of 5 to the beginning of 9 over the same cylindrical portion 5, the bucket, skip or weight will, after rising and pausing for a prescribed time (depending on the design of the drum) return again exactly to the point of starting without stopping the rotation of the drum. In this case in order to repeat the cycle, the direction of the rotation of the drum must be reversed at each alternate round trip of the skip or weight, W. It is not necessary that both ends of the rope R^1 and R^2 should be wound up on different portions of the same drum, as the same result can be secured where R^1 is wound up on a drum D^2 mounted on shaft S^1, while R^2 is unwound from another drum D^3 mounted on shaft S^2, as illustrated in Fig. 3, provided the drums be revolved synchronously by means of gears, as indicated by the toothed wheels, P^1, P^2, P^3, or by other means to accomplish the same result.

In the case shown in Fig. 3, the diameters of the grooves at 1 and at 6 must be the same (if the drums revolve at the same speed) in order that the skip or weight may remain at rest at the commencement of the revolution of the drum, and the diameters 5 and 6 must similarly be the same if the skip or weight is to remain at rest at the upper limit of its motion, while the diameter at 5 must be the same as at 10 if the skip or weight is to remain at rest on its return to its starting point prior to the stopping of the drums.

Where there is no mechanical objection to suspending the skip or weight W in the bight of an endless rope as shown in Fig. 4, the cycle of operations accomplished by the arrangement shown in Figs. 2 and 3, can be accomplished with a slightly simpler form of drum, having one swell 3. In this case the rope is wound so that at the commencement of the revolution R^1 is wound on at the same rate as R^2 is paid out on the same diameter 1, the weight or skip, therefore, remaining at rest. As the revolution of the drum proceeds R^1 is wound in on a spiral 2 with an increasing radius, thereby gradually raising the weight at an increasing velocity until R^1 reaches the diameter 3, after which if the drums are constructed as shown with a cylindrical portion of larger diameter, the rope R^1 will be wound in from throughout the length of 3 at a uniformly higher rate of speed than R^2 is paid out along 1, so that the bucket or weight W will be drawn upward toward the drum, until R^1 reaches the spiral of descending radius at 4, and the ascending of the skip or bucket

will be gradually checked until it ceases, when R^1 has reached 5. If the diameters 1 and 5 be equal, the skip or weight will remain at rest at the upper limits of the travel until the continued revolution of the drum begins to pay off the rope R^2 on the spiral of increasing radius at 2, when the bucket will begin to descend, reaching a uniform velocity as R^2 proceeds along the length of part 3, and coming to rest at the starting point, when R^2 reaches 5. The skip or weight may thus be returned exactly to its point of starting, quite independent of the precise stopping of the rotation of the drum, which as before, must be stopped on account of the mechanical limits of its construction. In this case the cycle can be repeated by reversing the direction of the rotation of the drum.

It is obvious that the rope R^1 and R^2 can be led over guide sheaves, if desirable, so that the hoisting drums may be placed at some more convenient point than directly over the weight to be lifted. It is obvious also that the relative diameters and arrangements of the small and large portions of the drums with their connecting spirals, may be arranged in a number of ways to meet varying conditions.

I claim as my invention—

The combination of a spirally grooved hoisting drum or drums of varying diameters with a rope and a lifting pulley block in a bight of the rope, the ends of the latter being secured to and wound on the different parts of the drum or drums, substantially as described, whereby at the commencement of rotation the sheave of the lifting pulley block turns but the load remains at rest, then the load gradually does acquire motion as the rotation of the drum continues and subsequently is brought to rest at a predetermined point, depending solely on the physical proportions of the drum or drums and independent of the exact time of stopping the rotation thereof.

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

AUGUSTUS SMITH.

Witnesses:
WALTER ABBE,
HUBERT HOWSON.