No. 798,494.

PATENTED AUG. 29, 1905.

V. R. & E. H. BROWNING.

HOISTING APPARATUS.

APPLICATION FILED OCT. 4, 1901.

3 SHEETS—SHEET 1.

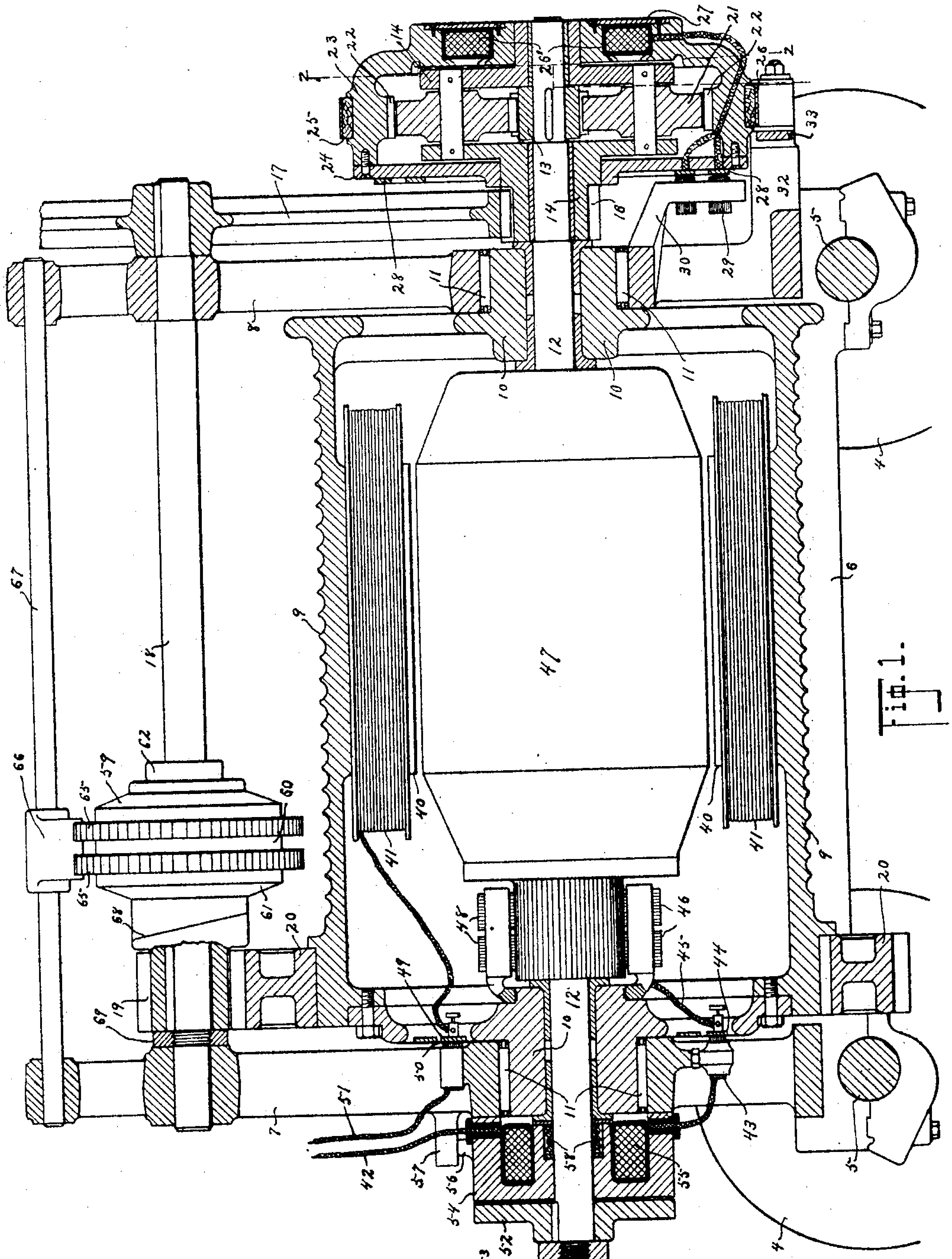

Fig. 1.

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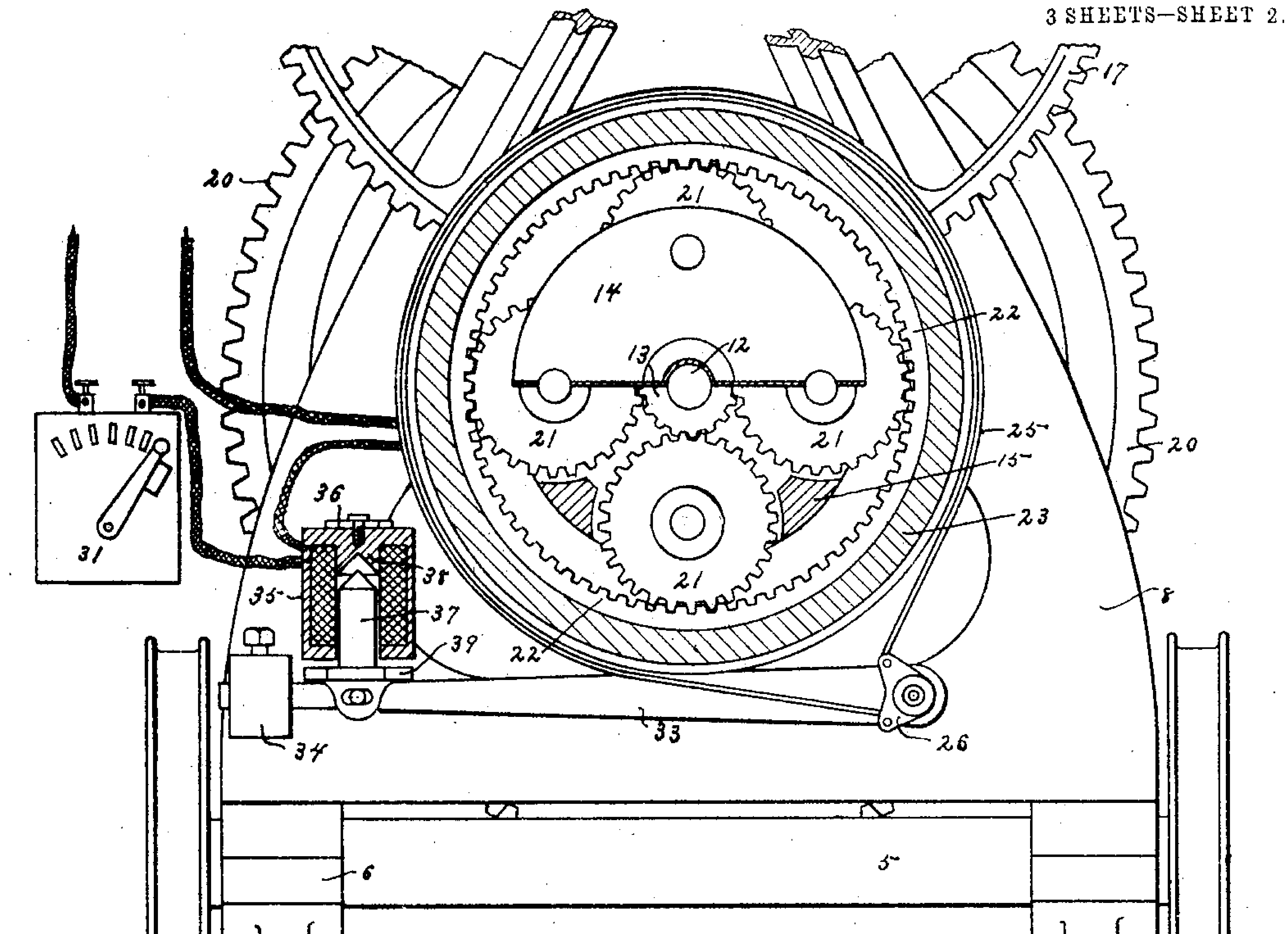

Fig. 2.

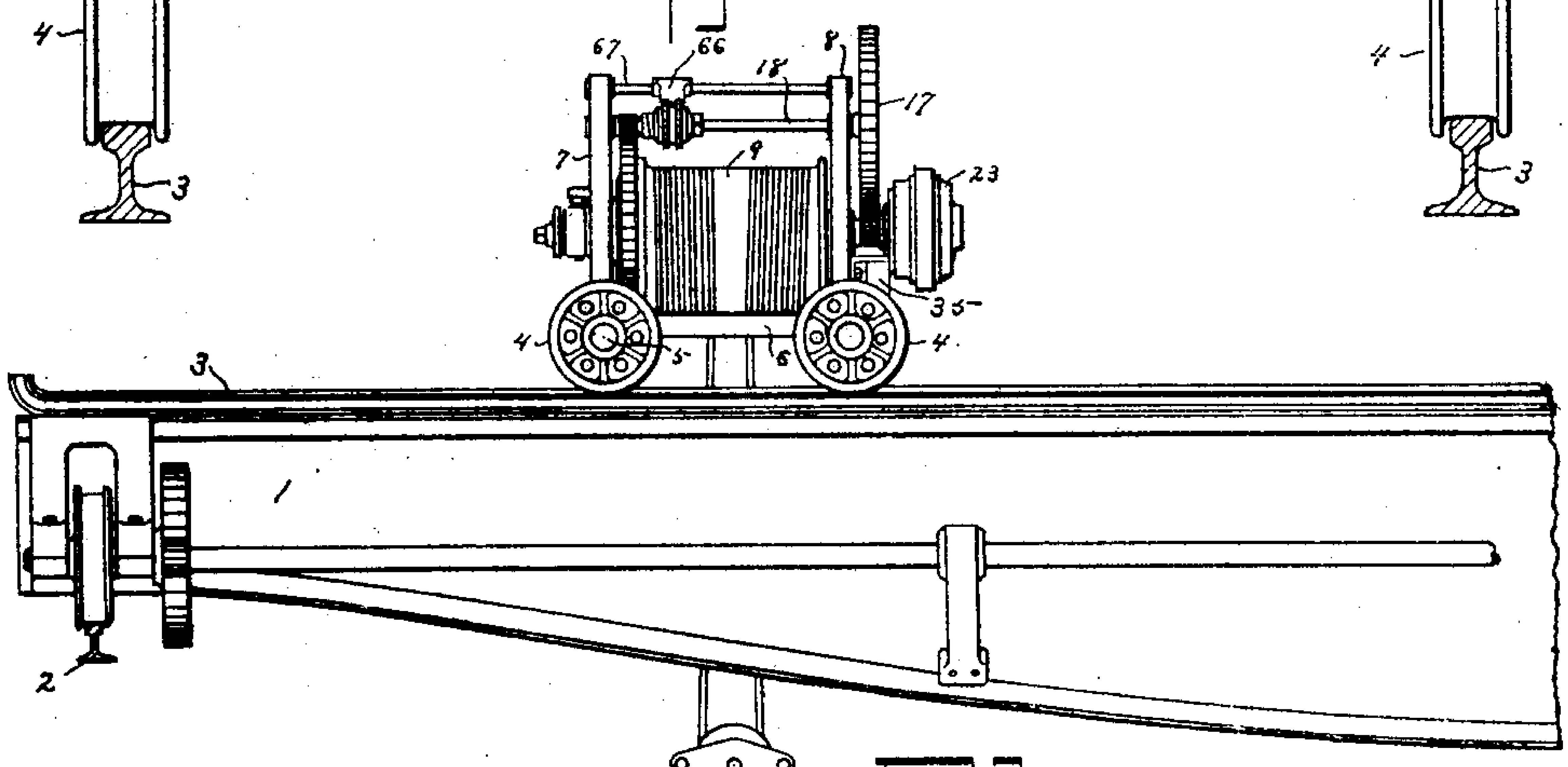

Fig. 3.

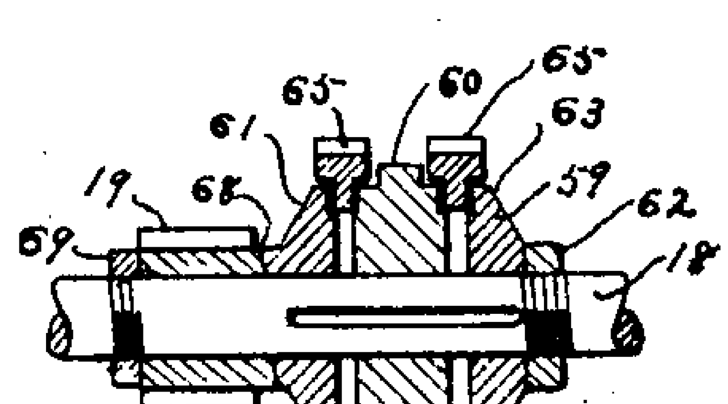

Fig. 4.

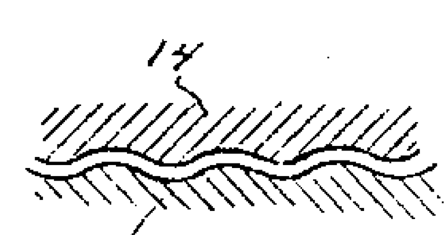

Fig. 5.

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3 SHEETS—SHEET 3.

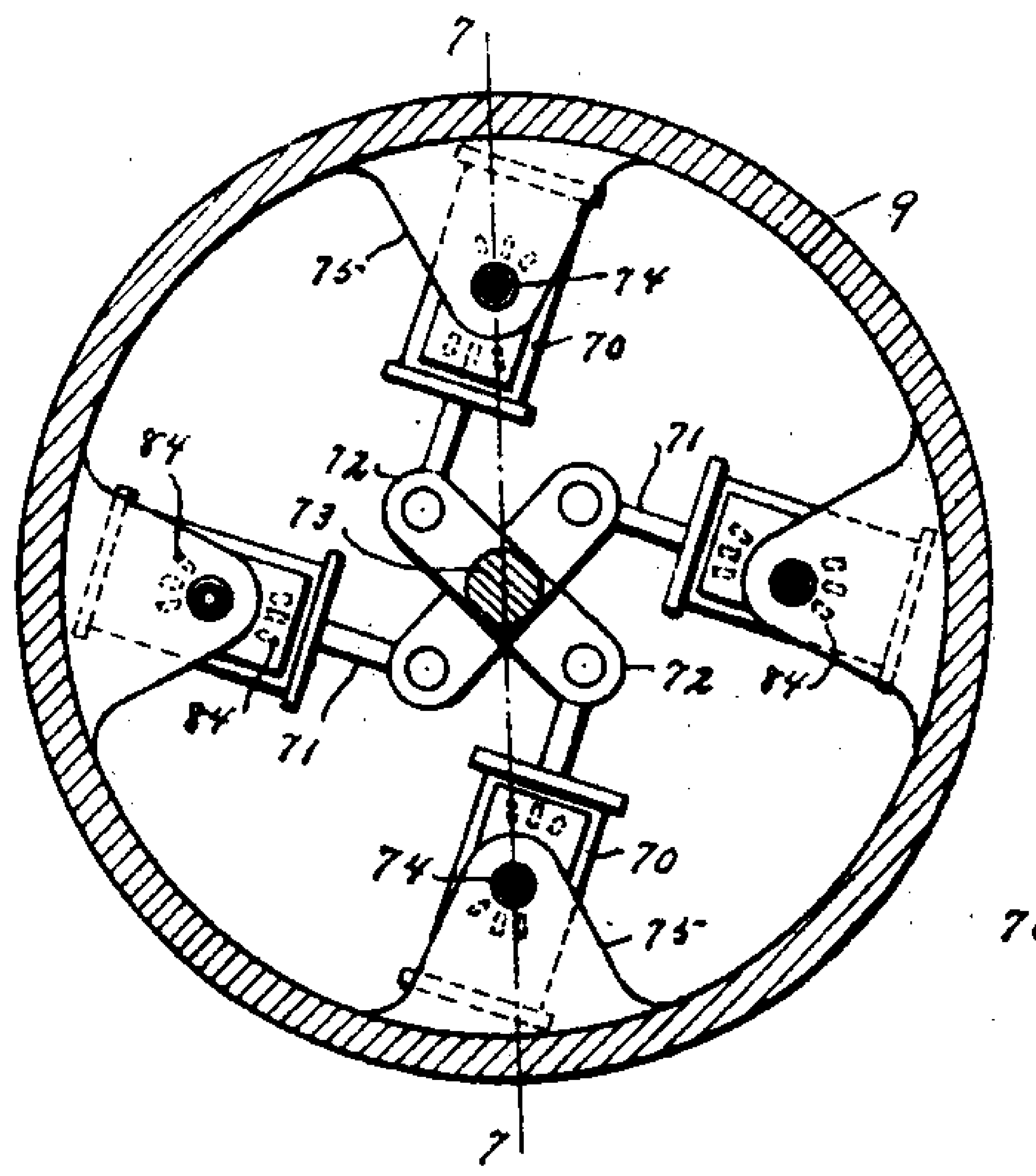

Fig. 6.

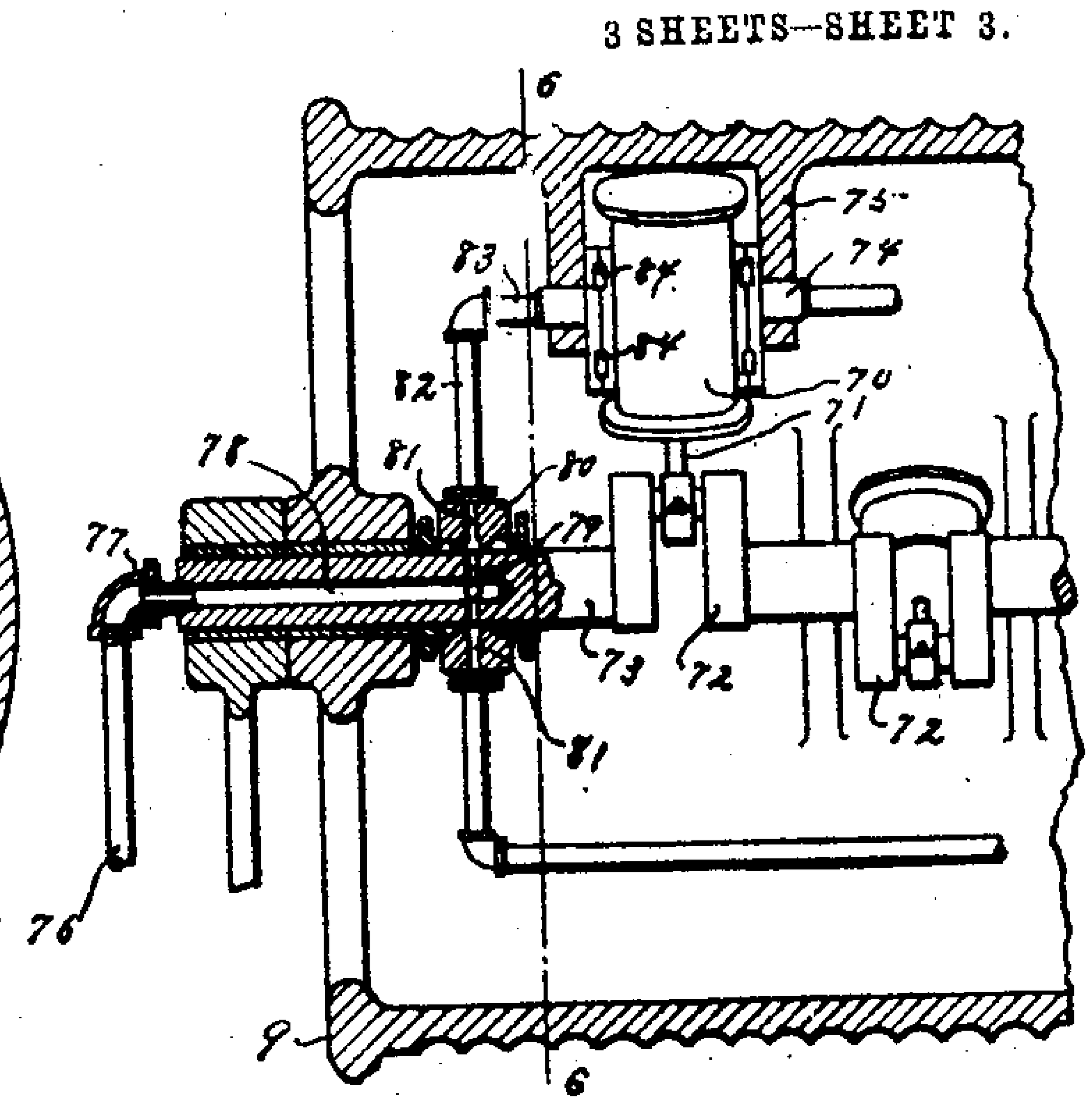

Fig. 7.

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UNITED STATES PATENT OFFICE.

VICTOR R. BROWNING AND EARL H. BROWNING, OF CLEVELAND, OHIO.

HOISTING APPARATUS.

No. 798,494. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed October 4, 1901. Serial No. 77,612.

To all whom it may concern:

Be it known that we, VICTOR R. BROWNING and EARL H. BROWNING, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Hoisting Apparatus, of which the following is a specification.

This invention relates in general to hoisting apparatus, and has more particularly reference to the means employed for dispensing with the auxiliary hoist in devices of this kind, said means consisting of a differential mechanism, which is connected with the motor in such a way that by throwing in the low speed additional lifting force may be secured, or by throwing in the high-speed device a more rapid lifting movement with consequent loss of lifting force may be obtained.

Our invention has for its objects, therefore, the production of a device whereby the speed of lifting can be conveniently controlled without impairing the efficiency of the motor, whereby greater compactness and lightness in structure can be secured, and whereby the transverse swinging movement of the load, which always accompanies devices of this character as heretofore made, may be avoided.

Numerous other features of construction embodying distinct advances in the art are also employed, and these will be more fully set forth in the following specification and in the claims appended thereto.

In the drawings forming part of this application, Figure 1 shows a longitudinal section through our improved hoisting apparatus, taken in a vertical plane through the center. Fig. 2 shows a view looking toward the right-hand end of Fig. 1, a portion of the differential gear mechanism being shown in section, said section being taken on the line 2 2 of Fig. 1. This figure also shows in diagram the electric controller or switch for regulating the strength of current in the electric brake and the magnetic clutch for the differential gear mechanism. Fig. 3 shows a portion of an overhead traveling crane having our improved hoisting device in the trolley therefor. Fig. 4 shows a sectional view through the safety lowering device. Fig. 5 shows a modified form of contacting surfaces for the magnetic clutch, and Figs. 6 and 7 show different means for driving the hoisting-drum in which engines rather than an electric motor are employed.

Similar reference characters designate corresponding parts throughout the several views of the drawings.

Heretofore, as far as we are aware, it has been necessary, especially in overhead traveling cranes, to provide two independent hoisting devices to operate on light and heavy loads. To operate these cranes economically, it is desirable that the speed of hoisting should be proportioned to the weight of the load, otherwise a light load would require as long a time for handling as would a much heavier one. It has not been practicable to change the rate of hoisting to a sufficient degree with one hoisting device to satisfy the requirements for light and heavy loads, however, without greatly sacrificing the efficiency of the motors employed, it being understood that in order to get the greatest efficiency out of a motor it should be run at the speed for which it is designed.

In order to avoid the expense and the necessity of employing both a main and an auxiliary hoist, we have devised a differential gear mechanism, which is connected to the shaft of our motor, by means of which we can at will convert the single hoisting device from a main hoist for heavy loads to an auxiliary hoist for light loads. Furthermore, we have rendered the device very light and compact by using the hoisting-drum as the field-magnet for the hoisting-motor. With these features of construction we also combine certain safety appliances, so that our hoisting mechanism is rendered entirely safe and reliable.

In the drawings, 1, Fig. 3, shows a portion of the bridge of an overhead traveling crane, since it is in connection with this class of hoisting mechanism that we have chosen to show our device applied. It will be understood, however, that our differential mechanism, as well as our hoisting-drum field-magnet, is applicable to any sort of hoisting device where different speeds of hoist are required. 2 shows one of the runway-tracks upon which this crane is adapted to travel. Upon its upper surface, preferably, we provide the crane-body with runway-tracks 3, (shown in Figs. 2 and 3 of the drawings,) upon which run the track-wheels 4 of the trolley. These track-wheels are secured to shafts 5, which are journaled to the lower side of the frame, the longitudinal members of which are shown at 6. Rising above these longitudinal members, preferably over the axles 5, are the end frames 7 and 8, these frames being broad at their bases and converging toward their tops.

In order to economize weight and space and expense, we cause the hoisting-drum, which is shown at 9, to serve not only as a drum for hoisting, but as the field-magnets for our motor. As it is necessary for the drum to turn, and also for the armature to rotate within the same, it is necessary to form the journals of the armature-shaft within the journals of the hoisting-drum. This, as will readily be seen, will require large trunnions or journals for the hoisting-drum, which journals are placed in the end frame-pieces 7 and 8, as shown at 10 in Fig. 1. In order to overcome the friction in these journals as far as possible, we provide the bearings with nests of rollers, which are shown at 11.

The motor-shaft, which is indicated at 12, passes through the center of the trunnions for the drum and extends for some distance beyond the end frames 7 and 8. Keyed to the shaft 12 near its right-hand end, as seen in Fig. 1, is a pinion 13. Also mounted to turn upon this end of the shaft or upon bushings carried by the same is a trunnion-frame 14, which consists of two disk-shaped side plates, which for the purpose of giving the required strength are cast with suitable connecting portions (shown at 15 in Fig. 2.) That face of the disk-shaped side plate which is next to the frame-piece 8 of the trolley is provided with a pinion 16, which meshes with a large gear-wheel 17. This gear-wheel is keyed to a longitudinal shaft 18, which is journaled in the side frames 7 and 8 above the motor-shaft 12, and which carries near its end opposite the gear 17 a pinion 19. This pinion, which is driven with the shaft, meshes with a large annular gear 20, which is keyed to the end of the hoisting-drum 9. From this description it will be seen that when the trunnion-frame 14, with its pinion 16, is turned motion will be transmitted through the gears 17, 19, and 20 to the hoisting-drum 9.

Journaled within the trunnion-frame 14 are a number of planet-gears 21, all of which mesh with the pinion 13, which, as has been stated, is keyed to the shaft 12. When the shaft is turned, therefore, and these planet-gears are permitted to rotate, they will turn on their axles in a direction opposite to that of the pinion 13. The disk-like plates of the trunnion-frame 14 are each provided on their outer sides with hub-like extensions, upon which is trunnioned a frame which carries an internal gear 22, which is in line and in mesh with the planet-gears 21. This frame is composed of two main pieces 23 and 24, which are suitably secured together so as to form a box-like covering for the various gears. Were the internal gear 22 and its supporting frame-piece 23 permitted to do so they would turn freely upon their trunnions if the motor-shaft 12 were rotated and no power would be transmitted through the train of gears extending to the hoisting-drums. When, however, this frame and its internal gear are held stationary while the motor-shaft with its pinion 13 is rotated in either direction, the planet-gearing will be caused to travel about within the internal gear 22 in the same direction, and will in this way cause the pinion 16 to be rotated at a speed which is very much slower than the speed of the pinion 13, the ratio of said speeds depending upon the ratio of the diameters of the gears 13 and 22. In order to hold the frame-piece 23 and its internal gear from rotation, we groove its outer circumference for the reception of a brake-strap 25, which passes around the same and has its opposite ends connected to the ends of a bell-crank 26. As has been stated, when the frame 23 and its internal gear are held as described the planet-gears will travel slowly about within the same, and as they are securely journaled in the trunnion-frame 14 the frame and the pinion 16 will be driven slowly, which will also, through its train of gears and shaft 18, drive the hoisting-drum 9 at a slow speed. Therefore when it is desired to lift a heavy load the brake-strap 25 should be caused to engage tightly with the surface of the frame-piece 23, which will hold the internal gear 22 from rotation. There are times, however, when it is very desirable to rotate the hoisting-drum at a much greater speed, and for this reason it should be made possible to turn the pinion 16 at higher rates of speed, the highest possible rate for the mechanism shown being that at which the pinion 13 or the motor-shaft 12 is driven. For purposes of description we will first assume that we desire to change the slow speeds for heavy loads, which is secured as above described, to the highest rate of speed—that is, to the speed which is attained when the pinion 16 is driven with the shaft. As has been stated, when the frame 23 and its internal gear are held stationary the frame 14 rotates within the same. If now the trunnion-frame and the frame 23 were locked together, so that they would be compelled to rotate as a single piece, and the brake-strap 25 were loosened, so that they could so rotate, the pinion 13, planet-gears 21, internal gear 22, and pinion 16 would all be rigidly locked and would all rotate together as one gear. Consequently when the motor-shaft was turned the frame 23 and all the gears which it contains would be driven with the same and motion would be transmitted through the train of gears to the hoisting-drum, driving the same at a very much higher speed than when the trunnion-frame was permitted to move. Various means may be employed for locking the trunnion-frame and the frame 23 together; but we prefer to use the electric clutch mechanism, which is shown in Fig. 1. The frame-piece 23, which is made of iron, has a circular recess extending about and at some little distance from the hub of the trunnion-frame, upon which it is mounted. Within this recess we place a coil of wire 26′ and secure the same in place in the recess by means of an annular soft-iron plate 27. The ends of this coil are drawn through a hole which is made in the part 23, and thence through a hole through the same frame outside the internal gear 22 to rings 28, which are carried in the outer side of the frame-piece 24. These rings, it will be understood, extend entirely about the motor-shaft, so that they may be constantly engaged by brushes 29, which are carried by a bracket 30, projecting from the main frame-piece 8. In Fig. 2 we have shown at 31 a conventional form of controller or switch-box, which is placed in the electric circuit running to the brushes 29 and by means of which the strength of current can be regulated or entirely cut off. When the current is turned through the magnet-coils 26′, the frame-piece 23 is converted into an electromagnet, the lines of force passing through that portion which is embraced by the coil, thence across the air-gap between the frame-piece 23 and the trunnion-frame 14 into the trunnion-frame, thence across the air-gap again, thence through the frame-piece 23 outside the coil, and thence through the plate 27, thus completing the circuit. As is well understood, the trunnion-frame 14 will be very strongly attracted by and will be drawn up to the frame-piece 23, to which it will adhere so closely as to prevent slippage between the contacting surfaces. In view of the previous description it will now be understood that as soon as the current is thrown into the coils 26′, as described, the trunnion-frame will be drawn into contact with the frame-piece 23, and the entire series of gears, including the pinion 16, will be driven as one piece with the motor-shaft, which will greatly increase the speed of the hoisting-drum. The pinions 13 and 16 and also the internal gear 22 are provided with elongated teeth, so as to permit the trunnion-frame, with its planet-gearing and pinion 16, to be drawn over and still remain perfectly in mesh.

In order to permit the frame-piece 23 to rotate, as above described, it is necessary to loosen the brake-strap 25, which normally holds it stationary. As has been stated, this brake-strap is secured at its opposite ends to the bell-crank 26. This bell-crank is pivoted to a bracket 32, which projects from the main piece 8. Secured to this bell-crank and rigid therewith is a lever-arm 33, which projects forwardly below the frame-piece 23 and carries at its forward end a weight 34. As long as this weight is permitted to hold down the end of this lever the brake-strap will be held tightly about the circumference of the frame-piece 23, thus holding the same from rotation. Before it can be permitted to rotate, therefore, this brake-strap must be loosened, and in order to secure this result we provide an electromagnet 35, which is secured to a bracket 36, projecting from the main frame-piece 8. This magnet, which is of peculiar construction, in order that it may attract its plunger 37 with as great force as possible is composed of an outer soft-iron cylindrical shell, within which is placed the magnet-coils. Projecting from the top of the magnet at the center between the coils is a soft-iron boss or hub 38, said boss being provided with a conical countersink to fit the upper end of the plunger 37. This plunger forms a portion of the armature, the main portion 39 of which is jointedly secured to the lever 33. This structure causes the lines of force to pass upwardly through the plunger, and thence across the gap between the conical end thereof and the countersink in the magnet. This gives the magnet the effect of a solenoid, so that when the lever 33 is in its lowermost position the magnet will have sufficient strength to draw in the plunger and lift the lever. The armature 39 will also be attracted by the lower portion of the shell, which will securely hold the lever in its position with the brake-strap released. As will be understood, it is necessary to release this brake-strap to free the frame-piece 23 at the same time that the current is thrown into the friction-clutch coils 26′, and for this reason the two magnet-coils are placed in series, the same current passing around both. Whenever, therefore, the current is turned into this circuit, it will result in releasing the frame-piece 23 from the brake-strap at the same time that it secures it to the trunnion-frame 14. When, therefore, it is desired to change the hoist from a slow to a high speed, all that is necessary is to turn the switch 31 and throw the current through these two magnet-coils.

Thus far we have described our device as adapted to only two speeds—viz., the slow speed for heavy hoisting and the rapid speed when the gears are firmly locked together and rotate with the shaft. There are loads, however, which are too heavy for this very high speed and too light to make it economical to use the very slow speed, the ratio of these speeds under most conditions being about four to one, although any other ratio may be employed. It is desirable, therefore, to provide a structure whereby any required intermediate speed may be secured. The structure already described, however, is adapted to this end, for the reason that the surfaces between the brake-strap and the frame-piece 23 and between this piece and the trunnion-frame are smooth and may be permitted to slip when in contact. Now the ease with which these surfaces may slide upon each other will depend upon the strength of the current passing through the magnet 35 and the friction-brake coils 26′. Thus when the lever of the switch 31 is moved to the first segment shown a weak current will pass, which will loosen the brake-strap only slightly and will also create only a small amount of friction between the trunnion-frame and the frame-piece 23. Consequently the frame-piece 23 will move very slowly, while the movement between the trunnion-frame and the frame-piece will be but slightly diminished, so that the rate of hoisting will not be very greatly increased. When, however, the switch-lever is moved to the farthest segment and the current is thrown on in full strength, the trunnion-frame will be securely held to the frame-piece and the brake-strap entirely released, so that the maximum rate of hoisting will be secured. It will be understood that when the switch-lever is placed upon any of the intermediate segments the strength of current will be again changed, and the amount of slippage in the brake and the friction-clutch will also vary, so that the speed of hoisting will be changed. In this way any speed desired within the two fixed limits first described may be secured.

From the foregoing description it will be seen that the pinion 16 is always driven in the same direction as the pinion 13, whether it is locked to turn therewith by the friction-clutch device or is driven therefrom through the intermediate planetary gearing. This will cause the drum 9 and armature 47 to always turn in the same direction. This we regard as a valuable invention, as it enables a motor which is designed for a comparatively low speed with reference to its magnet-fields to attain a high speed with reference to outside objects, said latter speed being the summation of the former speed and the speed of rotation of the field-magnets. Thus by gearing up the field-magnets, so that they rotate at a higher rate of speed, the same armature will rotate with that much greater speed with reference to outside objects. It will be understood also that if a slow armature speed with reference to outside objects is desired this may be secured by interposing an idler in the train of driving-gears, which will rotate the field in the opposite direction.

While we have never had any difficulty and believe that no difficulty will ever be experienced in using smooth contacting surfaces between the trunnion-frame and the frame-piece 23, at the same time if it should be found that a sufficient amount of friction cannot be produced between these surfaces to lift the required loads they may be corrugated, as shown in the detailed view at Fig. 5, in which 14 represents the trunnion-frame and 23 the frame-piece, as before. When constructed in this manner, it will be impossible for these surfaces to slip unless they cam themselves apart, and the pull of the electromagnet will be sufficient to prevent any such action. As will be evident, however, this construction makes only the two extreme speeds of hoist possible, and for this reason we prefer not to use the corrugated surface except under conditions when it becomes absolutely essential.

As has been stated, the drum 9 is caused to serve as the field-magnet for the electric motor. With this end in view we form in the inner surface of the drum a suitable number of inwardly-projecting pole-pieces 40, about which are placed spools of magnet-wire, as shown at 41. The current for the motor enters, say, through the wire 42, thence through a magnetic clutch, which will be hereinafter described, from which it passes to the brush 43 and from thence to the ring 44, which is mounted upon the end of the drum 9. From this ring the current is led through the wire 45 and brush 46 to the armature 47. After passing through the armature the current is led by way of the brush 48 to the field-magnet coils 41 and thence to the ring 49 on the end of the drum, from which it then returns through the brush 50 and wire 51 to its original starting-point. It will thus be seen that the armature and field-coils are in series, although they may obviously be placed in parallel, if preferred. In order to stop the motor as quickly as possible without a sudden shock, we key or otherwise secure to the end of the motor-shaft 12 a disk 52, the same being held in place by a nut 53. Loosely mounted upon the shaft 12, between the disk 52 and the frame piece 7, is a cylindrical piece of iron 54, which constitutes one member of the magnetic clutch. On that surface of the clutch member 54 which is turned toward the armature 47 we form a circular groove, in which are placed the magnet-coils 55. The current for the motor is led through these coils, which are connected up in series with the armature and field-magnets 41. In order to prevent the clutch member from turning with the shaft 12, we provide the same with a projection 56, which is adapted to engage with stationary fingers 57, which project, preferably, from the end-frame 7. This construction will permit of a slight movement in the direction of the shaft 12, but will not permit the member 54 to turn therewith.

When the current is off and the armature stationary, the clutch member 54 is pushed outwardly against the disk 52 by means of a helical spring 58, which is coiled about the shaft and is under compression when the clutch member 54 and the disk 52 are in position. When the current is sent through the magnet-coils 55, the member 54 becomes magnetized and attracts the frame-piece 7 and the trunnion of the drum 9, so that it is drawn toward them and away from the disk 52, thus compressing still further the spring 58. This removes all friction between the member 54 and the disk 52, so that the shaft 12 can rotate freely. When, however, the current is cut off, the spring forces the said member against the disk, and as the former is held from rotation the friction between the contacting surfaces will be sufficient to bring the motor quickly to rest. It will be seen, therefore, that when the current is sent through the motor to drive the same the clutch member will be held away from contact with the disk 52, so that the armature can rotate freely.

In order to avoid any possibility of a fall or a too rapid descent of the load by reason of the stoppage of the current or the breakage of any of the driving parts, we place at some convenient and suitable point in the train of gearing a safety lowering device, which will permit the load to descend only as the motor is positively driven in a reverse direction. This device is shown in the drawings as applied to the shaft 18, Fig. 4, being a detail sectional view thereof. It consists of three members 59, 60, and 61, which are keyed to rotate with the shaft, but are capable of slight longitudinal movement thereon. The member 59 is prevented from moving too far by a collar 62, which is secured to the shaft. The adjacent faces of the members 59, 60, and 61 are provided with frictional surfaces, as indicated at 63, Fig. 4, which are adapted to engage with inwardly-extending ribs 64 of ratchet-rings 65. The ratchets on these rings are engaged by a detent-pawl 66, which is supported from a cross-rod 67, so that the rings can turn in but one direction, that being the direction in which the shaft 18 turns when a load is being hoisted. In case this shaft should turn backwardly, therefore, the ratchet-rings would be held, and if the friction between the ribs 64 and the surfaces of the members 59, 60, and 61 is great enough the shaft will be prevented from turning and the load will be held suspended. The pinion 19, which is loosely mounted on the shaft 18, is provided on its face next the member 61 with a helix or cam shaped surface, (indicated at 68,) and the said member is also provided with a corresponding surface engaging therewith. The pinion is prevented from moving too far from the member 61 by a collar 69, which is secured to the shaft. Between the collars 62 and 69 there is room for mounting the members 59, 60, and 61 and the pinion 19, provided the helical surfaces 68 are fitted together. Let it be assumed that they are in the position with the collar in place and that the shaft 18, with the members 59, 60, and 61, are driven, so that their upper parts move toward the eye, as seen in Figs. 1 and 4. The pinion 19 will resist such movement because of its connection with the drum 9, which is lifting the load. This pinion will therefore refuse to turn until the helical surfaces 68 cam themselves as far apart as the collars 62 and 69 will permit, when it must also rotate with the shaft. This wedging action of the cams has resulted in pressing the frictional surfaces 63 and the ribs 64 very tightly together, so that the ratchet-rings 65 are also compelled to rotate, which the detent-pawl permits as long as they rotate in this direction. Now bearing in mind that the load on the drum is always tending to rotate the pinion backwardly, which presses the friction members and the ratchet-rings tightly together, let the current be turned off of the motor or some of the gearing break. Immediately the friction members and the ratchets will start back with the pinion 19; but the ratchets will at once be caught and held by the detent-pawl, and the friction between them and the said members is so great that the shaft will be held and the load be prevented from descending, and the ratchets and pawl will continue to hold the shaft 18 until it is driven backwardly by the motor itself, thus forcing the friction members and the ribs 64 to slip. It will be understood that the heavier the load that is lifted the greater is the friction in the safety lowering device, and as the frictional surfaces are designed so as to check and hold any load that the motor can lift said load can only be lowered by reversing the motor, the speed of which is under perfect control.

Although we have thus far confined our description to the form of device shown in Figs. 1 to 5, in which an electric motor is employed for driving the drum, we do not limit our invention to that kind of motor. In Figs. 6 and 7 we show a hoisting-drum, in which are mounted a number of engine-cylinders 70, the pistons of which are connected through rods 71 with cranks 72 on the main shaft 73, said shaft corresponding with the motor-shaft 12, shown in the other views. The cranks are placed at angles with one another, so that when one is passing its dead-center one or more of the others will be in operating position. The engine-cylinders are trunnioned in brackets 75, which project from the interior of the drum 9. Although different means may be employed for conducting the steam, compressed air, gas, or other driving agent to the various cylinders, we prefer to use a pipe 76, which is connected through a swing-joint 77 with a tube-like opening 78 in the center of the shaft 73. Inside the drum this opening branches into radial openings 79, which extend to the outside of the shaft. Secured to the shaft so as to cover these openings is a collar 80, which is also provided with radial openings 81, said openings being in register with those in the shaft. Pipes 82 and 83 connect the openings in the collar with the trunnions 74 of the cylinders, through which the steam is admitted through valves 84, as is common in oscillating engines of this character.

As stated above, steam, compressed air, or gas may be employed for driving these engines, or, if desired, explosive-engines may be used instead. It will be seen, therefore, that we do not limit our invention to any particular form of driving means, and when the general term "motor" is used in the claims it is to be understood as including any form of driving means, whether electric motor, steam-engine, or any other generating device whatever.

As shown in Fig. 3, the hoisting-drum extends parallel with the bridge of the crane rather than perpendicularly therewith, as in the usual construction. This we regard as an important improvement, inasmuch as the two strands of the supporting-cable prevent the load from swinging transversely to its direction of motion as the crane is traveling along its runways. When the path through which the load is moving is narrow, this becomes a valuable feature of our crane, as it prevents the load from bumping into machines, &c., which stand at the sides of the path.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a hoisting apparatus, frame-pieces, a drum trunnioned in said frame-pieces, magnetic pole-pieces connected with said drum, an armature mounted in the field of said pole-pieces and supported by the trunnions of the drum, and gearing connecting said armature and drum.

2. In a hoisting apparatus, frame-pieces, a drum trunnioned in said frame-pieces, magnetic pole-pieces projecting from the inner surface of said drum, an armature mounted for rotation within the drum and between the pole-pieces, the shaft of said armature being journaled in the trunnions of said drum, and gearing connecting said shaft with the drum to rotate the same.

3. In a hoisting device, frame-pieces, a hoisting-drum carrying magnet pole-pieces trunnioned in said frame-pieces, a rotatable armature within the field of said pole-pieces, the shaft for which is journaled in the trunnions of the same, and means for rotating said field-magnets in the same direction as the armature in order to increase the speed of the latter.

4. In a hoisting apparatus, a rotatable drum, a shaft passing through said drum, a motor for turning said shaft, gearing connecting said shaft with the drum, and means whereby the speed of the drum may be varied without changing the speed of the motor.

5. In a hoisting apparatus, a drum, magnetic pole-pieces connected with said drum, an armature rotatably mounted in the field of said pole-pieces, gearing connecting said armature with the drum to rotate the same, and means whereby the speed of the drum may be varied without changing the speed of the motor.

6. In a hoisting apparatus, frame-pieces, a drum trunnioned in said frame-pieces, magnetic pole-pieces projecting from the inner surface of said drum, an armature mounted for rotation within the drum and between the pole-pieces, the shaft of said armature being journaled in the trunnions of said drum, gearing connecting said shaft with the drum to rotate the same, and means whereby the speed of the drum may be varied without changing the speed of the motor.

7. In a hoisting apparatus, a drum, a shaft passing through said drum, a motor mounted in said drum for turning the shaft, a train of gearing connecting said shaft and drum, and a safety lowering device interposed in said train.

8. In a hoisting apparatus, a drum, a shaft passing through said drum, a motor for turning the shaft, a train of gearing connecting the shaft and drum, a disk secured to said shaft, a clutch member non-rotatably mounted on said shaft but capable of slight longitudinal movement thereon, a spring for normally holding said clutch member in frictional contact with the disk, and means for moving the same out of contact when it is desired to move the shaft.

In testimony whereof we affix our signatures in the presence of two witnesses.

VICTOR R. BROWNING.
EARL H. BROWNING.

Witnesses:
S. E. FOUTS,
H. A. AUER.