No. 719,182.

PATENTED JAN. 27, 1903.

E. H. & V. R. BROWNING.

HOISTING APPARATUS.

APPLICATION FILED OCT. 4, 1901.

NO MODEL.

2 SHEETS—SHEET 1.

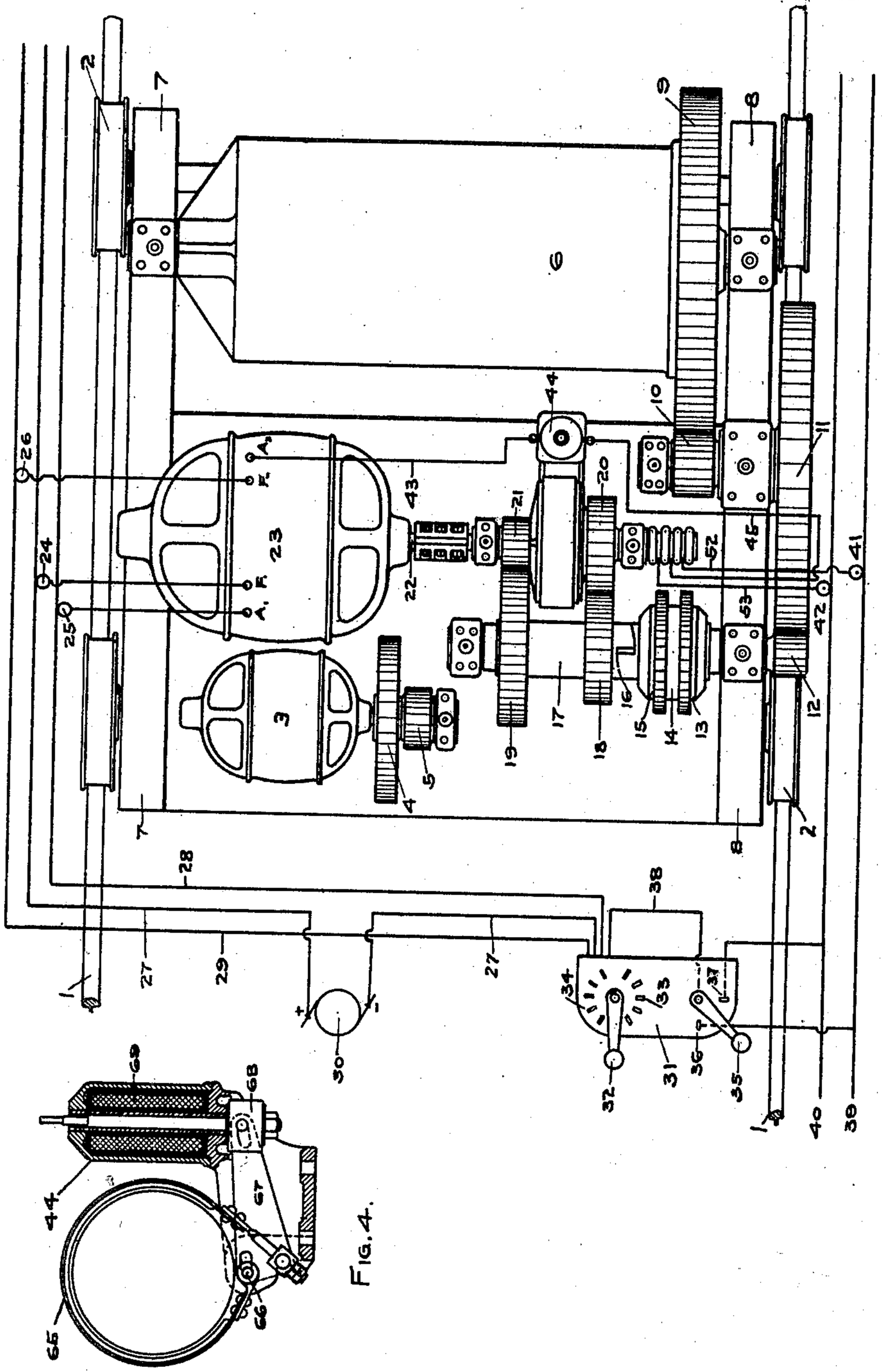

Fig. 1.

Fig. 4.

Witnesses
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By their Attorney
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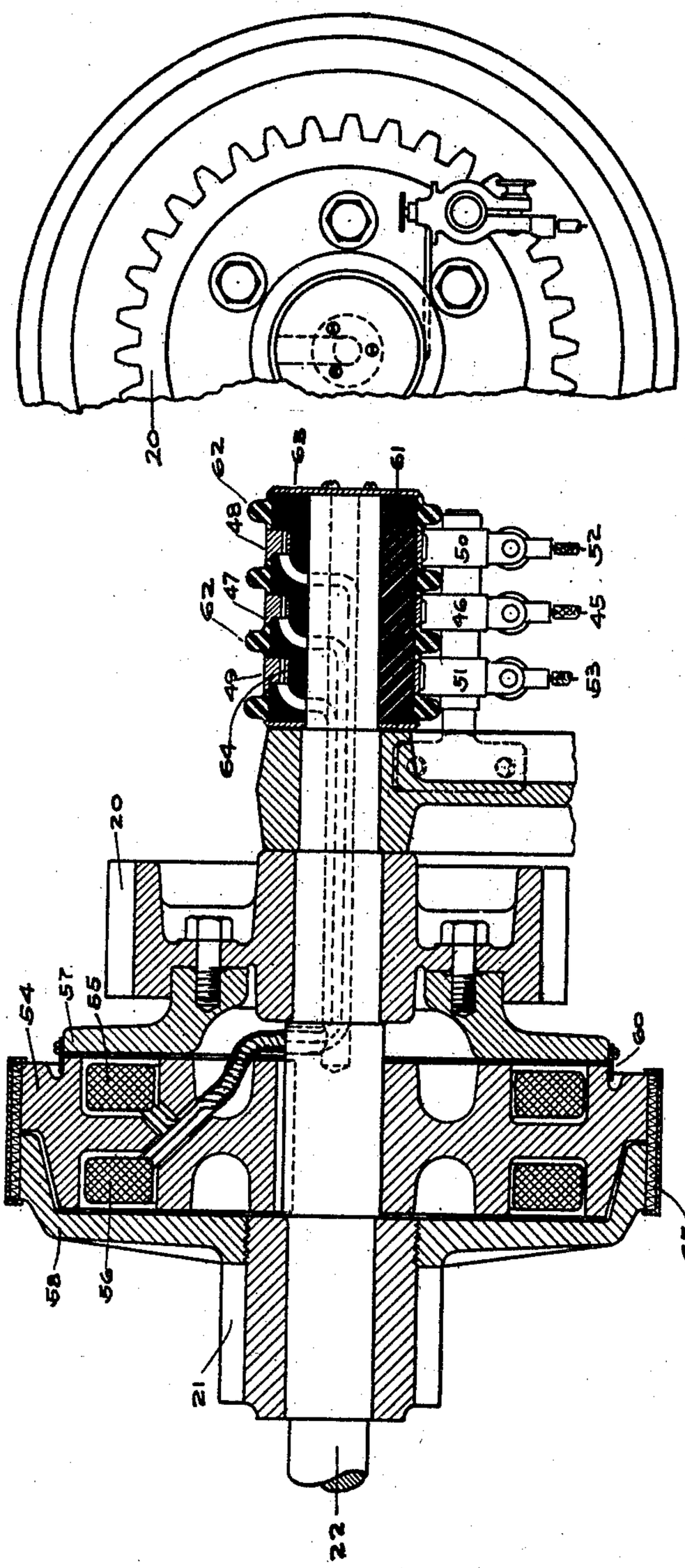

FIG. 3.

FIG. 2.

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UNITED STATES PATENT OFFICE.

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

HOISTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 719,182, dated January 27, 1903.

Application filed October 4, 1901. Serial No. 77,611. (No model.)

To all whom it may concern:

Be it known that we, EARL H. BROWNING and VICTOR R. 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 particular reference to the means employed for dispensing with the auxiliary hoist in devices of this character, said means consisting of a change-speed gearing 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 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 and whereby greater compactness and lightness and greater economy in manufacture may be secured. Numerous other features of construction embodying distinct advances in the art are also employed, all of which will be fully set forth in the following specification and the claims appended thereto.

In the drawings forming part of this application, Figure 1 is a plan view of our improved hoisting device applied to the trolley of an overhead traveling crane and showing in diagram the electrical connection for the same. Fig. 2 shows a section taken through the center of the change-speed mechanism. Fig. 3 is a partial end view of the mechanism shown in Fig. 2; and Fig. 4 is a view, partly in elevation and partly in section, of the magnetic clutch for controlling the hoisting mechanism.

Like 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 speed 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 change-speed-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. 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. 1, shows the runways, upon which the trolley having our improved hoisting apparatus is adapted to travel. While we have chosen to show our invention as applied to a trolley for overhead traveling cranes, it will be obvious that it may be embodied in any sort of hoisting mechanism or may be applied to any shaft which is intended to drive other mechanisms at different speeds.

2 shows the track-wheels of the trolley, which roll upon the runways and which are turned to propel the trolley by the motor 3. Any suitable gearing may employed to connect this motor and the wheels, and we have not deemed it necessary to show the same further than to indicate it at 4 and 5.

6 is the hoisting-drum, which is suitably journaled in the side frames 7 and 8 of the trolley and which is driven by the train of gearing 9, 10, 11, and 12. The pinion 12 is mounted on a shaft to which is keyed the members 13, 14, and 15 of a safety lowering device. The member 15 is provided with a helical surface at 16, with which a correspondingly-shaped surface on the sleeve 17 coöperates. Each of the members 13 and 15 is provided with ratchet-rings, with which a stationary pawl (not shown) engages, so that the members may turn in one direction, but are held from rotation in the reverse direction.

Keyed or otherwise secured to the sleeve 17

are two gears 18 and 19 of different diameters, which mesh with another pair of gears 20 and 21, respectively, which are mounted loosely on the motor-shaft 22. These gears are driven one at a time with the shaft by means hereinafter described, and when so driven the sleeve 17 is turned, causing the helical surfaces at 16 to cam themselves apart, compressing the members of the safety lowering device. When they can be pressed together no farther, they must turn with the sleeve 17, and as they are keyed to the shaft it must also turn to drive the drum. In case the drum should start to turn backwardly the pawl would engage with the ratchets and stop it unless the motor is itself driven backwardly to loosen the pressure between the helical surfaces. This is our invention only in the sense that we have employed it in a new combination. Hence it is not considered necessary to describe it further.

The motor for hoisting and lowering is shown at 23. This may be driven by any suitable power, such as electricity, steam, compressed air, gas, &c.; but the electric motor is deemed preferable, and for that reason such a one is shown in the drawings. We desire it to be understood, however, that we do not restrict ourselves to the use of electricity only and that when the word "motor" occurs in the claims it is intended to cover any kind of motor unless the word is necessarily qualified by some other part of the claim. The motor should be readily reversible, and in order to secure such a result we connect with the same three trolleys 24, 25, and 26, which contact with the trolley-wires 27, 28, and 29, respectively. One of these wires, as 27, leads to the source of electric power, as indicated at 30, and they all enter the controller 31, which is operated by the lever 32. This lever makes contact with either of two sets of segments 33 or 34, as it is desired to operate the motor in either direction. The controller is also provided with a switch-lever 35, which is adapted to make contact at times with either of the two segments 36 or 37. The switch-lever is connected to the controller proper by the conductor 38, and the segments are joined to two conductors 39 and 40, respectively, which extend in the direction of motion of the hoisting-trolley. Bearing upon these conductors and connected electrically with the hoisting apparatus are two trolleys 41 and 42.

In general it may be stated that a motor which has its field-magnets and armature in series may be reversed either by reversing the direction of the current through the fields, the direction of current through the armature remaining the same, or by reversing the direction of current in the armature, the direction of that in the field-coils remaining the same. It is in order to reverse one of the currents in this way that the three trolleys 24, 25, and 26 and their three wires 27, 28, and 29 are provided. Assuming that the lever 32 is resting on one of the segments 33, the current from the source of power 30 will flow through wire 27, trolley 24, the field-coils, (indicated at F F^2,) trolley 26, and wire 29 to the controller. This is a well-known method of wiring, and it is not deemed necessary to illustrate or describe the same in any greater detail further than to state that no matter what direction the current takes through the field-magnets that through the armature which is in series therewith always flows in the same direction or if the current is reversed in the armature that in the field will continue in the same direction. From the resistance-coils in the controller the current is led through wire 28, trolley 25 to armature A A^2, by wire 43 to a magnetic brake 44, which is illustrated in detail in Fig. 4, and from thence through wire 45 and brush 46 to a ring 47, which is supported by the armature-shaft 22 near its end. On each side of the ring 47 are similar rings 48 and 49, which are respectively connected through their brushes 50 and 51 with wires 52 and 53, which lead to the trolleys 41 and 42, hereinbefore referred to.

Loosely keyed to the motor-shaft 22, so as to be turned therewith and yet be capable of slight lateral movement thereon, is a central member 54 of a double magnetic clutch. This member is provided on each of its sides with an annular recess, in each of which is embedded a coil of magnet-wire 55 and 56. Each of these coils has one of its ends connected with the central ring 47, and the opposite end of one coil is connected to the ring 48 and the opposite end of the other to ring 49. When the circuit is completed through ring 48, the current will flow, say, through coil 55, although this obviously depends upon the manner in which the wires are connected. As will hereinafter appear, there will be no current flowing through the coil 56 at this time, the only way to get a current through this coil being by completing the circuit through its ring 49.

Mounted loosely upon the shaft 22 on either side of the member 54 are two coöperating members of the friction-clutch 57 and 58, to which are respectively secured the gear-wheels 20 and 21, hereinbefore referred to. When the current is turned through the coil 55, the members 54 and 57 are strongly attracted, with the result that the member 54 is drawn up against the member 57, and as the motor-shaft and member 54 are rotating the member 57, its pinion 20, and the train of gearing hereinbefore described will be driven to rotate the drum. As the pinions 20 and 18 are nearly the same size, it will be evident that the drum 6 will be driven rapidly, in which case it is adapted to do the work which has heretofore required an auxiliary hoisting device. If now the current is turned through the coil 56, the member 54 will be drawn into contact with member 58 to drive the same, when the power will be transmitted through the small pinion 21 and gear 19 to the train of gearing, and the drum will be driven slowly.

Owing to the great difference in size between the pinion and gear, a tremendous lifting force is secured, although the speed of hoisting is necessarily slow. A plate 60 is secured about the member 57 and overlaps an annular shoulder on the member 54 to keep dirt, grease, &c., from entering between these members.

The rings 47, 48, and 49 are insulated from the shaft 22 by means of a non-conducting sleeve 61, which is placed over the end of the shaft, and the rings are separated from one another by insulating-bands 62, which also surround the sleeve. The sleeve, rings, and bands are held in place by a plate 63, which is secured to the end of the shaft. The sleeve is cut away at its upper part, as seen in Fig. 2, where it appears in solid black, in order to accommodate lugs 64 on the inner parts of the rings to which the ends of the magnet-coils 55 and 56 are secured. This cut-away portion is also indicated in dotted lines in Fig. 3.

From this description it will be understood that the current for operating the clutch always flows from the middle ring 47 into one or the other of the magnet-coils 55 or 56. As has been explained, the current after leaving the outside rings flows through the wires 52 or 53, trolleys 41 or 42, and wires 39 or 40 to the segments 36 or 37. If the switch-lever 35 is in the position shown in Fig. 1, no current can flow, as it does not make contact with either of the segments. When it is placed on segment 36, however, the current will flow from the middle ring 47 through, say, the coil 55 to drive the drum at a high speed, thence through ring 48, wire 52, trolley 41, wire 39, segment 36, lever 35, conductor 38, controller and wire 27 back to the source of power. When it is placed on segment 37, the current must flow through the coil 56, which clutches the low-speed gear 21 to the shaft. Inasmuch as the switch-lever cannot rest on both of the segments 36 and 37 at the same time, it is evident that but one of the gears 20 or 21 can be clutched to the shaft at any one time.

It is desirable to provide apparatus of this character with braking devices to hold the motor stationary except at such times as it is desired to operate the same, when the brake should be automatically released. The brake 44, which is shown in Fig. 4 and which is intended for this purpose, has a band or strap 65, extending about the periphery of the clutch members 54 and 58. While this band may be caused to engage with some other rotating part of the mechanism, we prefer to place it about the members of the clutch, as it thereby aids the safety lowering device heretofore described. Furthermore, when the current is broken and the brake begins to operate it stops the motor by its engagement with the member 54, which is keyed to the shaft, and as the clutch is released at the same time the brake-strap holds the pinion by its engagement with the member 58. The band or strap 65 is secured at one of its ends to a pin 66 on a pivoted lever 67. This lever is provided with a weight 68, which always tends to tighten the brake-strap about the clutch members. Arranged above the weight, so as to attract the same and lift the lever 67, is an electromagnet 69, about which the current through the armature and coils 55 or 56 passes. When, therefore, the circuit is closed by the switch 35, the current will pass through the armature to rotate the drum and simultaneously the current will cause the magnet 69 to loosen the brake and cause the clutch to operate. From this description it will be seen that while the lever 32 determines the speed with which the armature turns and also its direction of rotation the motor-armature cannot receive its current and its shaft cannot be released or clutched to the hoisting-gears until the lever 35 is operated.

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

1. In hoisting apparatus, a drum, a driving-shaft, a plurality of gears having different diameters loosely carried by said shaft, means for securing said gears to the shaft at will, and means connecting said gears with the drum to drive the same at different speeds and without changing the direction of rotation of the drum.

2. A shaft, a drum, a plurality of gears loosely mounted on said shaft, said gears being provided with clutch members, means whereby said gears are always driven in the same direction, a coöperating clutch member secured to the shaft, means for forming a driving connection between any gear desired and said clutch member, and gearing connecting said gear and drum.

3. A shaft, a plurality of driven parts loosely mounted on said shaft, a driving member mounted on the shaft and capable of longitudinal movement thereon to coöperate with the driven parts, a brake for normally holding the shaft stationary, and means for releasing the brake and for connecting one of the driven parts with the said driving member.

4. A shaft, a plurality of driven parts loosely mounted on said shaft, a driving member secured to the shaft to coöperate with the driven parts, a plurality of magnet-coils, one for each of the driven parts, and means for passing a current of electricity through any coil desired to clutch its corresponding driven part to the driving member.

5. A shaft, a plurality of driven parts loosely mounted on said shaft, a driving member secured to the shaft to coöperate with the driven parts, a plurality of magnet-coils, one for each of the driven parts, a brake for normally holding the shaft stationary, means for passing a current of electricity through any magnet-coil desired to clutch its corresponding driven part to the driving member, and

means for simultaneously releasing the brake to free the shaft.

6. A shaft, a plurality of driven parts loosely mounted on said shaft, a driving member secured to the shaft to coöperate with the driven parts, a plurality of magnet-coils, one for each of the driven parts, carried by the driving member, a brake for normally holding the shaft stationary, an electromagnet for releasing the brake, means for passing a current of electricity through the electromagnet to release the brake, and for simultaneously passing a current through any one of the magnet-coils desired to clutch its corresponding driven part to the driving member.

7. An electric motor, an armature for said motor, a shaft driven by the motor, a gear loosely mounted on the shaft, mechanism adapted to be driven by said gear, an electric clutch for securing the gear to the shaft, and connections for passing a current through the armature and the clutch to simultaneously start the shaft and clutch the gear thereto.

8. In hoisting apparatus, a drum, a motor, a shaft driven by said motor, an electric brake for normally holding said shaft stationary, and connections for passing a current through the motor-armature and the brake to simultaneously release and start the shaft, and driving connections between said shaft and drum.

9. In hoisting apparatus, a drum, a motor, a shaft driven by said motor, a gear-wheel loosely mounted on said shaft, an electric clutch for securing the gear to the shaft, driving connections between the gear and drum, and electric connections for passing a current through the motor and the clutch to start the shaft and to simultaneously clutch the gear thereto.

10. A shaft, a plurality of gears loosely mounted on said shaft, a clutch member secured to the shaft, a plurality of magnet-coils, one for each gear, carried by the clutch member, a plurality of conducting-rings, one for each magnet-coil, carried by said shaft, an extra ring also carried by said shaft, connections for sending a current of electricity into the said extra ring and for passing it about any magnet-coil desired and thence out through the conducting-ring corresponding with the said magnet-coil.

11. In hoisting apparatus, a drum, a motor, a shaft driven by said motor, a plurality of gear-wheels loosely mounted on said shaft, driving connections between said gear-wheels and the drum, a clutch member secured to the shaft and coöperating with the gear-wheels, a plurality of magnet-coils carried by said clutch member, there being one coil for each gear-wheel and means for passing an electric current through the armature of the motor and through any of the magnet-coils desired to connect the gear corresponding to that coil to the shaft and to simultaneously start the motor.

12. A shaft, a gear loosely mounted on said shaft, mechanism adapted to be driven by said gear, a clutch member secured to the shaft, a magnet-coil carried by said clutch member, a brake normally engaging with said member to hold it and the shaft from rotation, an electromagnet for releasing said brake, and connections for passing a current through the electromagnet and the magnet-coil to release the clutch member and to simultaneously clutch it to the gear.

13. In hoisting apparatus, a drum, a motor for driving said drum the field-magnets and armature of which are in series, means for reversing the current in one of said parts of the motor, a shaft driven by the motor, a gear loosely mounted on said shaft, driving connections between said gear and drum, a clutch member secured to the shaft, said member being provided with a magnet-coil, and connections for passing a current through the other part of said motor and the coil of the clutch member to drive the shaft and to secure the gear thereto.

14. In hoisting apparatus, a drum, a motor for driving said drum the field-magnets and armature of which are in series, means for reversing the current in one of said parts of the motor, a shaft driven by the motor, a plurality of gears loosely mounted on said shaft, driving connections between said gears and drum, a clutch member secured to the shaft, a plurality of magnet-coils, one for each of the gears, carried by said clutch member, and connections for passing a current through the other part of the motor and through any one of the coils on the clutch member to secure the corresponding gear to the shaft and to start the motor.

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

EARL H. BROWNING.
VICTOR R. BROWNING.

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