A. M. COYLE.

CURTAIN HOISTING APPARATUS.

APPLICATION FILED OCT. 14, 1907.

959,999. **Patented May 31, 1910.**

2 SHEETS—SHEET 1.

Fig. 1.

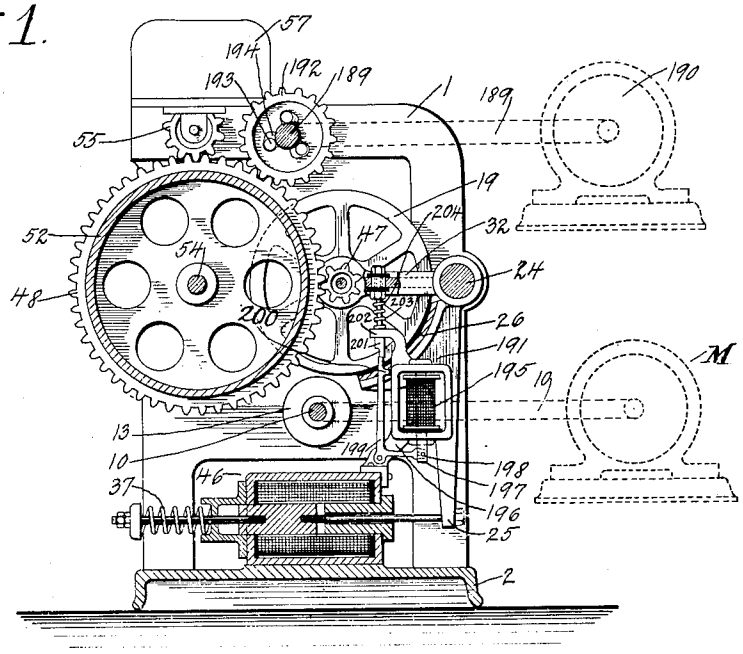
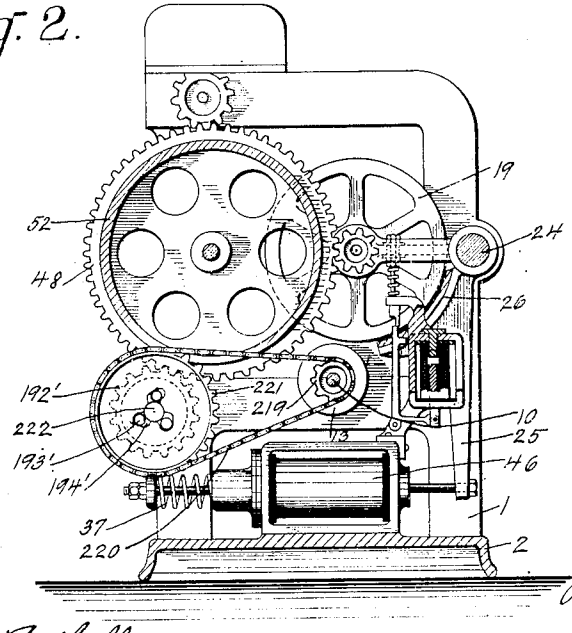


Fig. 2.



Witnesses:

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2 SHEETS—SHEET 2.

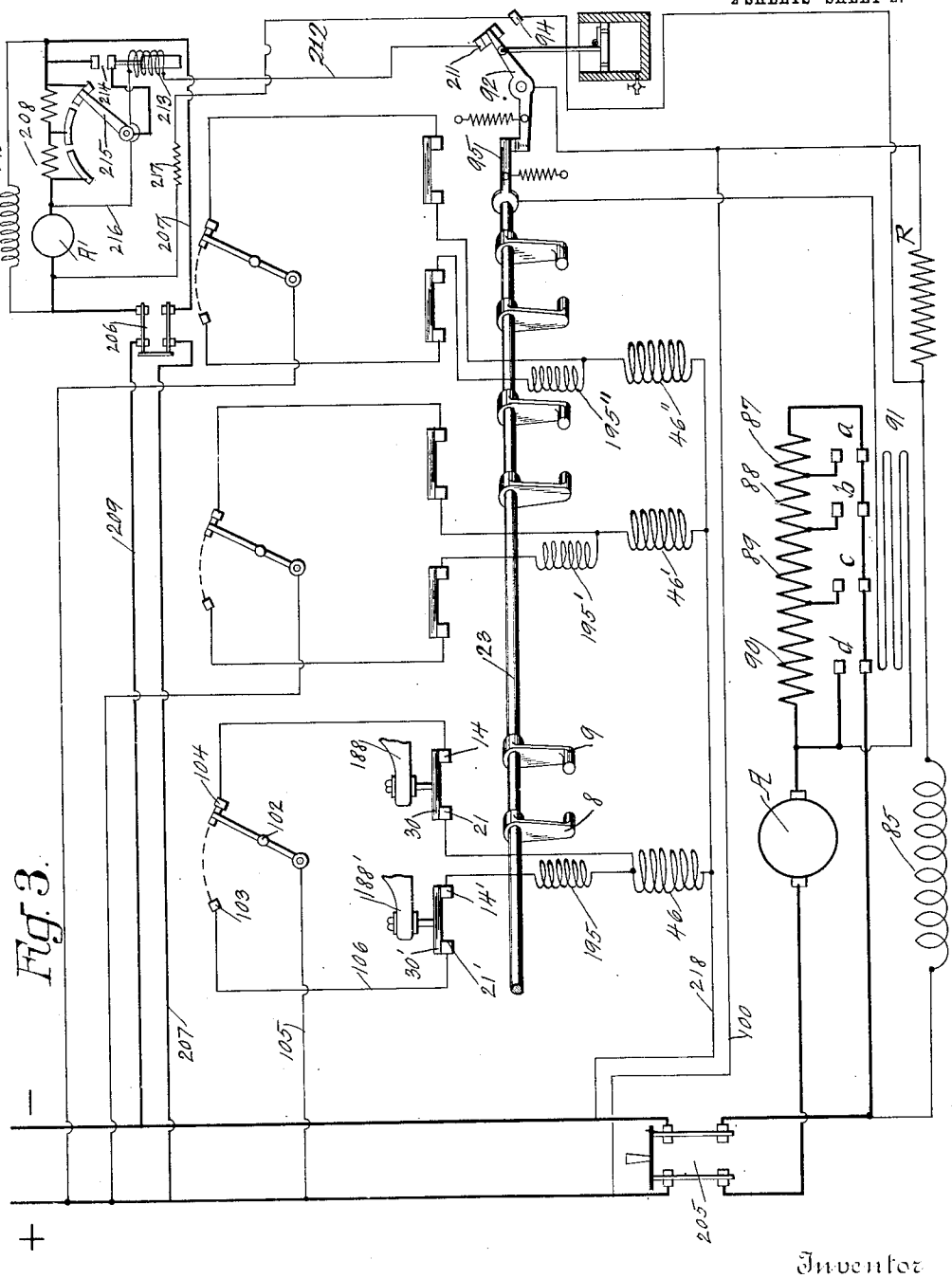

Fig. 3.

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UNITED STATES PATENT OFFICE.

ANDREW M. COYLE, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

CURTAIN-HOISTING APPARATUS.

959,999. Specification of Letters Patent. **Patented May 31, 1910.**

Application filed October 14, 1907. Serial No. 397,310.

To all whom it may concern:

Be it known that I, ANDREW M. COYLE, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented a new and useful Improvement in Curtain-Hoisting Apparatus, of which the following is a specification.

My invention relates to hoisting apparatus, particularly that used for lifting and lowering theater curtains, but it may have a general application.

An object of the invention is the provision of improved means for operating respective units of multiple curtain hoisting apparatus to lift and lower curtains at the same time.

Another object of the invention is the provision of simple and efficient means for lifting a load and permitting the same to descend by gravity, retarded by a variable brake.

Other objects of the invention will appear hereinafter, the novel combinations of elements being set forth in the appended claims.

In the accompanying drawings, Figure 1 represents a sectional elevation of a hoisting unit with my invention applied thereto; Fig. 2 is a similar view of a modification; and Fig. 3 is a wiring diagram of a system of control.

Similar reference characters designate similar parts in all the views.

The principal features of the particular form of hoisting mechanism illustrated is disclosed and covered in my co-pending application, Serial No. 282,234, filed October 11, 1905, for an improvement in multiple curtain hoisting apparatus, and the system of control for the main motor is covered in my co-pending application, Serial No. 381,314, filed June 28, 1907, for an improvement in stop motion apparatus for hoists. Other systems of control than that illustrated in Fig. 3 may be used, however, for the apparatus shown in Figs. 1 and 2.

I have shown in Figs. 1 and 2 only one unit of a multiple hoisting device, as the units are all alike and preferably mounted side by side in the framework 1 which rests on the bed-plate 2. Common to these units are the drum bearing rod 54, the brake arm bearing rod 24, the driving shaft 10, and the retarding or brake shaft 189. To the driving shaft 10 is connected the main motor M and to the retarding shaft 189 is connected an auxiliary motor 190. Each unit of the hoisting apparatus comprises a winding drum 52 mounted loosely on the rod 54, a gear wheel 48 movable with the drum, a pinion 47 meshing with the said gear wheel, an arm 32 pivoted at one end on the bearing rod 24 and carrying said pinion at the other end, a friction wheel 19 movable with the pinion, a disk or drum 13 movable with the driving shaft 10, a brake shoe 26 associated with the friction wheel 19, a brake arm carrying said shoe and suspended from the rod 24, an electro-magnet 46 for actuating the arm 25 to release the brake, and a spring 37 for applying the same. These parts of each unit are as illustrated in the co-pending application hereinbefore referred to, and so also is the stop motion mechanism 57 which is connected to the drum gears by the intermediate gear wheels 55; the electrical connections being shown diagrammatically in Fig. 3. I have added to the parts just enumerated the retarding shaft 189 and its connections, and also an electro-mechanical tripping appliance 191. This is shown in Fig. 1. Fig. 2 shows a modification, in that the driving shaft is used also as a retarding shaft and only one motor is employed.

In Fig. 1 I have shown a clutch gear 192 in mesh with the drum gear 48, there being one such gear 192 for each unit of the multiple hoisting apparatus. These gears 192 are mounted loosely along the shaft 189, ball clutches intervening and consisting of balls 193 in irregularly shaped recesses 194 such that when the shaft 189 is driven anti-clockwise the gear 192 will be released. Other forms of clutches may be used, however, the one described being shown simply by way of illustration.

The tripping appliance 191 comprises an electro-magnet solenoid 195 mounted in a frame supported by a bracket 196 fastened to the frame of the brake magnet 46. Movable in the solenoid 195 is the plunger or core 197 having a pin-and-slot connection 198 at its lower end with a horizontal arm of a bell crank lever 199 which is pivoted to the bracket 196 in this instance. The vertical arm of this lever is provided with a projection 200 to limit the movement of the same when the tripping or trigger magnet

is deënergized. The upper end of the vertical arm of the bell crank lever forms a trip or trigger to hold in its upper position the block, stop or abutment 201. To the latter is connected an upwardly extending stem 203 which is fastened to but insulated from the arm 32. Preferably the stem 203 passes through a guide 202 and is of reduced diameter or thickness to limit the upward movement of the stop 201. Furthermore, a spring 204 surrounds the stem 203 and serves to let the wheel 19 down gradually when the stop 201 is released. When the trip is set as illustrated in Fig. 1 the wheel 19 is supported in its upper position out of engagement with the drum 13 by means of the spring 37, brake lever 25 and shoe 26, the friction wheel 19 resting on the shoe 26, and the trip preventing the wheel 19 from descending even when the brake shoe is released by the energization of the electro-magnet 46.

When the electro-magnet 46 is energized so as to release the brake shoe 26 from the wheel 19 the load is free to turn the drum 52 in a clockwise direction, but this rotation causes the clutch in the gear 192 to grasp the shaft 189 and tend to turn same in an anti-clockwise direction. Such rotation of the shaft 189 cannot be accomplished if the latter is sufficiently heavy or if there is considerable friction at its journals. This retardation will be augmented if the armature of the auxiliary motor 190 is quite heavy or if some independent retarding device is associated with the shaft 189. It will therefore be assumed that the shaft 189 is so heavy or retarded in any desired manner that the descending load cannot drive it, but that the motor 190 must drive the shaft 189 to release the drum 52, the purpose being to control the speed of lowering the load. This is an important feature of my invention, for while one or more of the units are hoisting corresponding curtains, other curtains may be lowered at variable speeds, and thus desirable scenic effects obtained in blending the changes from one scene to another, or time may be economized in the change of scenery.

Referring now to Fig. 3, it will be seen that I have added to Fig. 4 of my co-pending application, Serial No. 381,314, the main line switches 205, 206, the trip magnet solenoids 195, 195′, 195″, and an auxiliary motor and its control. When the switch 205 is closed and the lever 102 is in its right-hand position, the trip magnet 195 will not receive current, and therefore the magnet 46 will merely release the wheel 19 so that the curtain will tend to descend by reason of its own weight or that portion thereof which is not balanced by a counterweight. If, now, the switch 206 is closed the auxiliary motor 190 will receive current through a circuit which may be traced as follows: From the positive main through the conductor 207, starting resistance 208, armature A′, conductor 209, and thence to the negative main. A circuit will also be closed through the shunt field winding 210. The auxiliary motor will therefore start at slow speed so as to continuously release the clutch in the gear 192 and permit the curtain to descend at slow speed. At the same time that the motor circuit is closed a circuit is also closed from the positive main through conductor 100, lever 92, fixed contact 211, conductor 212, magnet 213, conductor 216, armature A′, conductor 209 to the negative main. It will thus be seen that the magnet 213 is connected in parallel with the starting resistance 208, and when energized closes the switch 214 so that the manual lever 215 may be employed to vary the resistance 208 to change the speed of the motor. If the lever 215 is moved to the left one or more sections of the starting resistance will be cut out so as to permit more current to flow through the motor and therefore effect an increased speed of the latter to permit the curtain to descend at a correspondingly greater speed. Any form of speed control may be used for the auxiliary motor if desired.

When the curtain reaches its lower limit of travel, the stop motion mechanism will actuate the lever 9 to rotate the shaft 23 so that the electrical connection between the arm 92 and contact 211 will be interrupted and the said arm electrically connected to the fixed contact 94. This will have the effect of deënergizing the magnet 213 to reinsert the starting resistance in series with the motor armature, and the connection of the arm 92 with the fixed contact 94 will place the electro-dynamic brake resistance 217 across the mains, after which the lever 188 will lift the contact plate 30 off the contacts 21 and 14 and interrupt the circuit through the brake magnet 46, whereupon the brake spring 37 will apply the brake shoe 26 to the friction wheel 19 to positively stop the drum 52. The tripping appliance is at this time set as shown in Fig. 1.

If the lever 102 is moved on to the contact 103 instead of the contact 104, a circuit will be closed from the positive main through the conductor 105, lever 102, contact 103, conductor 106, contact 21′, plate 30′, contact 14′, tripping magnet 195, brake magnet 46, conductor 218 to the negative main. Both the magnets 46 and 195 will then be energized, the former releasing the brake shoe from the wheel 19 and the latter operating the bell crank lever 199 to release the trigger and permit the wheel 19 to descend into engagement with the drum 13. If the switch 205 is open at this time the starting resistance sections 87, 88, 89 and 90 will be in series with the motor armature A, as shown,

and when the switch 205 is closed a circuit will be closed having therein the armature and said resistances in series with each other; the field winding 85 being also connected across the mains in series with the resistance R. The main motor M will therefore start at slow speed to rotate the drum 13 in an anti-clockwise direction, the wheel 19 in a clockwise direction, and the drum 52 in an anti-clockwise direction to lift the curtain. Such rotation of the drum 52 will merely rotate the gear 192 freely on the shaft 189. The accelerating magnet 91 will close the switches *a*, *b*, *c*, *d*, successively, to effect an acceleration of the main motor to full speed. When the curtain approaches its upper limit of travel the stop motion apparatus will actuate the lever 8 and rotate the shaft 23 to disconnect the switch arm 95 from the switch arm 92 to cut out the magnet 91 and thus re-insert the starting resistance. Substantially at the same time or a short time before the arm 92 will engage the contact 94 to short-circuit the field resistance R to assist in slowing down the motor M. Finally the lever 188′ lifts the contact plate 30′ and interrupts the circuit through the magnets 195 and 46. The latter will therefore release its core and permit the brake spring 37 to move the brake shoe 26 to the left to lift the wheel 19 out of engagement with the driving drum 13. The deënergization of the magnet 195 causes the plunger 197 thereof to tend to move the vertical arm of the bell crank lever 199 to the right and will move under the stop 201 when the wheel 19 is lifted in the manner stated.

The stop motion mechanism may be so arranged that after the main motor is slowed down so that the ascending curtain will come gradually to a stop, the said main motor may again be increased in speed automatically to continue its actuation of other curtains connected to corresponding units in the multiple curtain hoisting mechanism.

In Fig. 2 I have shown a modification, in that the same shaft 10 may be connected to various units of multiple curtain hoists to lift and lower curtains at the same time. Mounted on the shaft 10 so as to rotate therewith is the sprocket wheel 219 which is connected by the sprocket chain 220 to a larger sprocket wheel 221. The latter is mounted loosely on the shaft 222. It should be understood that such a sprocket wheel and sprocket chain connection is used for each unit. Connected to the shaft 222 so as to rotate therewith is the gear wheel 192′ meshing with the drum gear 48. When the drum 13 is actuated in an anti-clockwise direction the load will be lifted and the sprocket wheel 221 will rotate freely on the shaft 222 as the clutch device intervening will be released, that is, the balls 193′ will tend to ride into larger portions of the recesses 194′. When, however, the load is permitted to descend, the shaft 222 will be driven anti-clockwise and operate the clutch to tend to transmit motion to the shaft 10. If, however, the weight of the curtain is not sufficient to rotate the shaft 10 the same must be rotated by the motor M to permit the curtain to descend. Therefore if the motor actuates the shaft 10 in an anti-clockwise direction while the tripping appliance holds the wheel 19 out of engagement with the drum 13 and the brake shoe 26 is released, the clutch device associated with the sprocket wheel 221 will be continuously released to permit the curtain to descend, and the speed of the lowering of the curtain may be varied as in connection with the motor 190.

It should be noted that the shaft 10 always rotates in an anti-clockwise direction and constantly tends to release the clutch associated with the sprocket 221. It will be evident that if in one unit the wheel 19 is in engagement with the driving drum 13 and the tripping mechanism released, and in another unit the tripping mechanism set so as to hold the wheel 19 out of engagement with the drum 13, one drum 52 will be lifting the curtain, and another drum will permit a curtain to descend at the same time, the ascending curtain and the descending curtain being dependent upon the speed of rotation of the driving shaft 10, and this speed of rotation may be varied automatically at the limits of travel in the manner referred to, or at will between limits by manually controlled arrangements. It should be noted that a separate shaft 222 is employed for each unit and may be supported in proper position in any desired manner.

Obviously those skilled in the art may make various changes in the details and arrangements of parts without departing from the spirit and scope of my invention, and I desire therefore not to be limited to the precise constructions herein disclosed.

Having thus fully described my invention, what I claim and desire to have protected by Letters Patent of the United States is—

1. The combination with a rotatable member, of two motors, power-transmitting means between one of said motors and said rotatable member, and means between the other motor and said member for retarding the rotation of said member to a speed proportional to that of said last named motor.

2. The combination with a hoisting drum, of a wheel connected thereto, a support for said wheel, a driving member, means for lifting said wheel to disconnect the same from said driving member, and an electro-responsive device for holding said wheel in its lifted position.

3. The combination with a hoisting drum,

of a wheel geared thereto, a prime mover for driving said wheel, apparatus for moving said wheel to disconnect the same from said prime mover, and electrically controlled means for holding said wheel in its disconnected position.

4. The combination with a hoisting drum, of a brake wheel connected thereto, a driving shaft associated with said brake wheel, a brake, a spring for applying the brake to the brake wheel and disconnect the latter from said driving shaft, and an electro mechanical tripping device for holding said brake wheel in its disconnected position independently of said spring and brake.

5. The combination with a hoisting drum, of a friction wheel geared thereto, a friction member for driving said friction wheel to transmit motion to said hoisting drum, a brake associated with said friction wheel, mechanism for applying said brake and holding said friction wheel out of engagement with said friction member, an electro-magnet for releasing said brake, and an electro-mechanical tripping appliance for holding said friction wheel out of engagement with said friction member even after said electro-magnet has released said brake.

6. In curtain hoisting apparatus, the combination with a hoisting device, of brake mechanism therefor, means for releasing the brake mechanism to permit the load to descend by gravity, a shaft, a clutch connected between the hoisting device and said shaft and grasping the shaft as the load tends to descend, and a motor for actuating said shaft to release the clutch and permit the load to descend.

7. In curtain hoisting apparatus, the combination with a hoisting drum, of a brake wheel geared thereto, a brake, mechanism for applying said brake to said brake wheel and holding the same in a predetermined position, a driving member associated with said brake wheel, an electro-magnet for releasing said brake and permitting the brake wheel to move into engagement with said driving member, an electro mechanical tripping appliance normally preventing such movement of the brake wheel, means for retarding the load as it tends to descend, and a motor for operating said means to permit the load to descend at any desired speed.

8. In curtain hoisting apparatus, the combination with a hoisting drum, of a brake wheel geared thereto, a driving member for actuating said brake wheel to transmit motion to said drum, a brake associated with said brake wheel, mechanism for applying said brake and move the brake wheel out of engagement with said driving member, a tripping device for holding said wheel out of engagement with said driving member independently of said brake-applying mechanism, an electro-magnet for releasing said brake to permit said brake wheel to turn freely, and an electro-magnet for releasing said tripping device.

9. In curtain hoisting apparatus, the combination with a hoisting drum, of driving connections to effect the lifting of the curtain, means for holding such connections inoperative to permit the curtain to descend by gravity, a retarding shaft, a clutch connected between the hoisting drum and said shaft, and a motor for rotating said shaft to continuously release said clutch to permit the curtain to descend.

10. In curtain hoisting apparatus, the combination with a hoisting drum, of a brake wheel connected thereto, a driving member for actuating said brake wheel to transmit motion to said drum, a brake associated with said gear wheel, mechanism for applying said brake and moving said brake wheel out of actuating connection with said driving member, a magnet for releasing said brake, a mechanical tripping appliance for holding said brake wheel out of connection with said driving member independently of said brake-applying mechanism, an auxiliary magnet for releasing said tripping appliance, a retarding shaft, and a clutch associated with said shaft and geared to said driving drum.

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

ANDREW M. COYLE.

Witnesses:
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