No. 795,641. PATENTED JULY 25, 1905.

J. McGEORGE.

SPEED CONTROLLING DEVICE FOR HOISTING MACHINERY.

APPLICATION FILED OCT. 16, 1903.

3 SHEETS—SHEET 1.

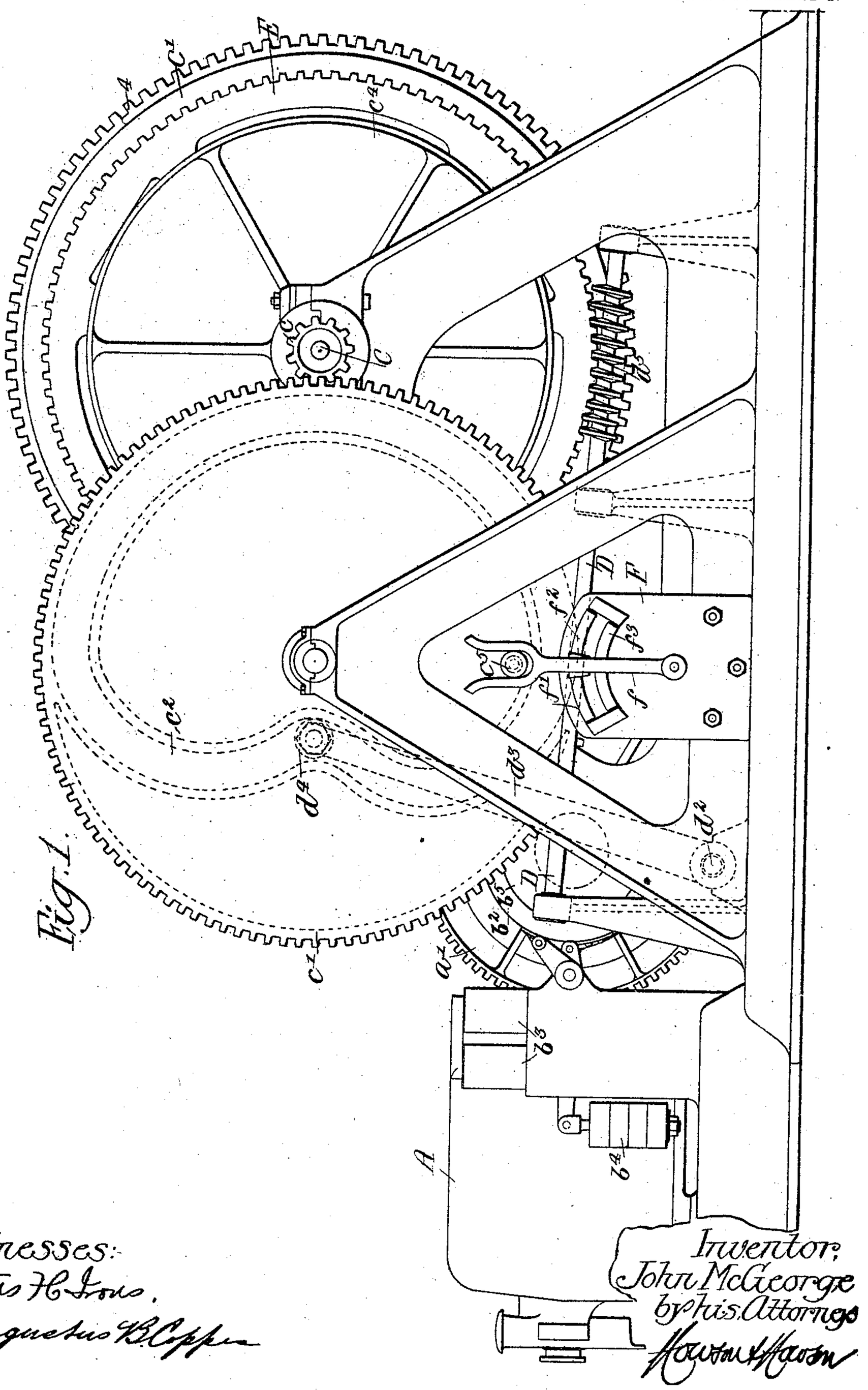

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

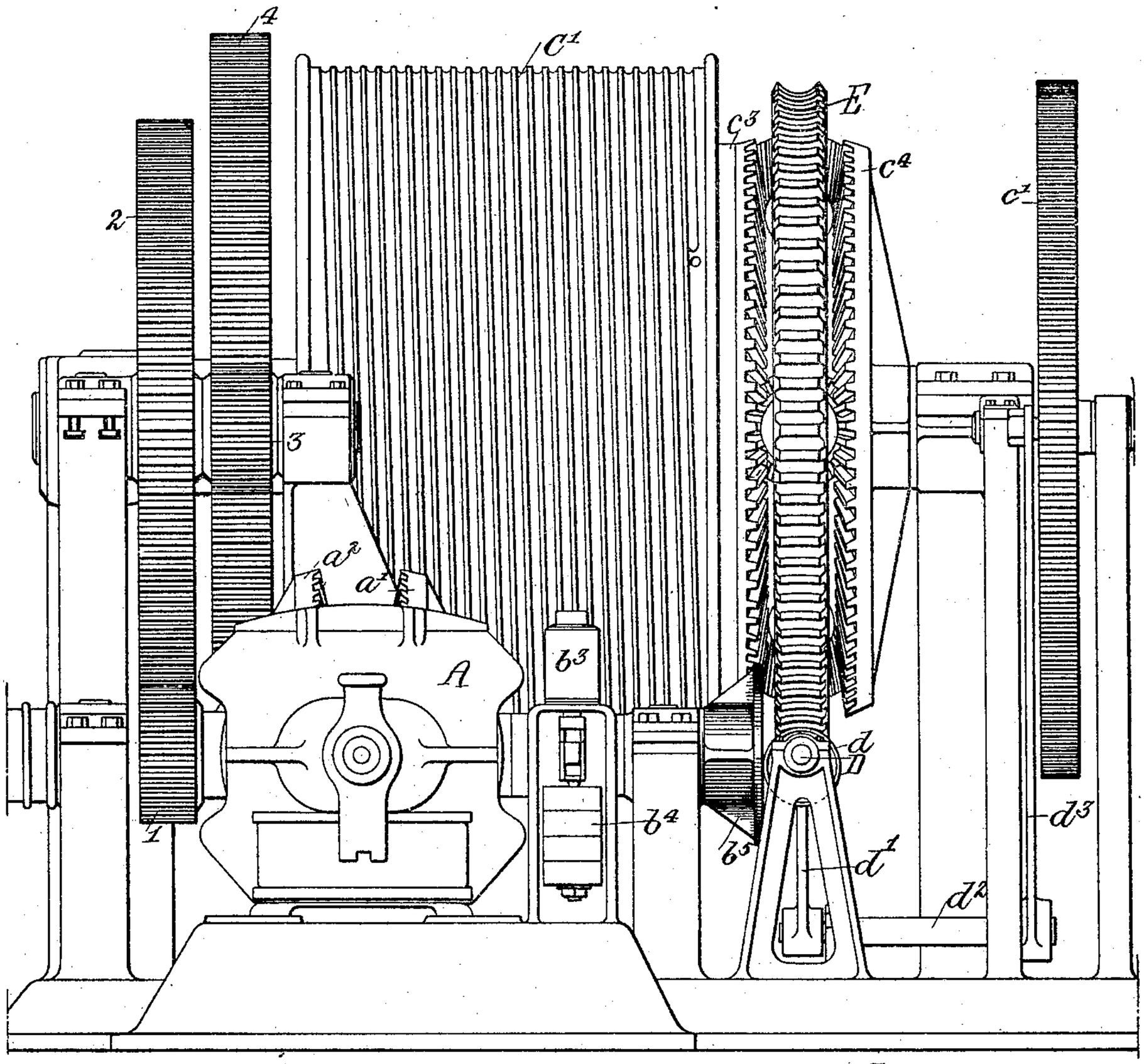
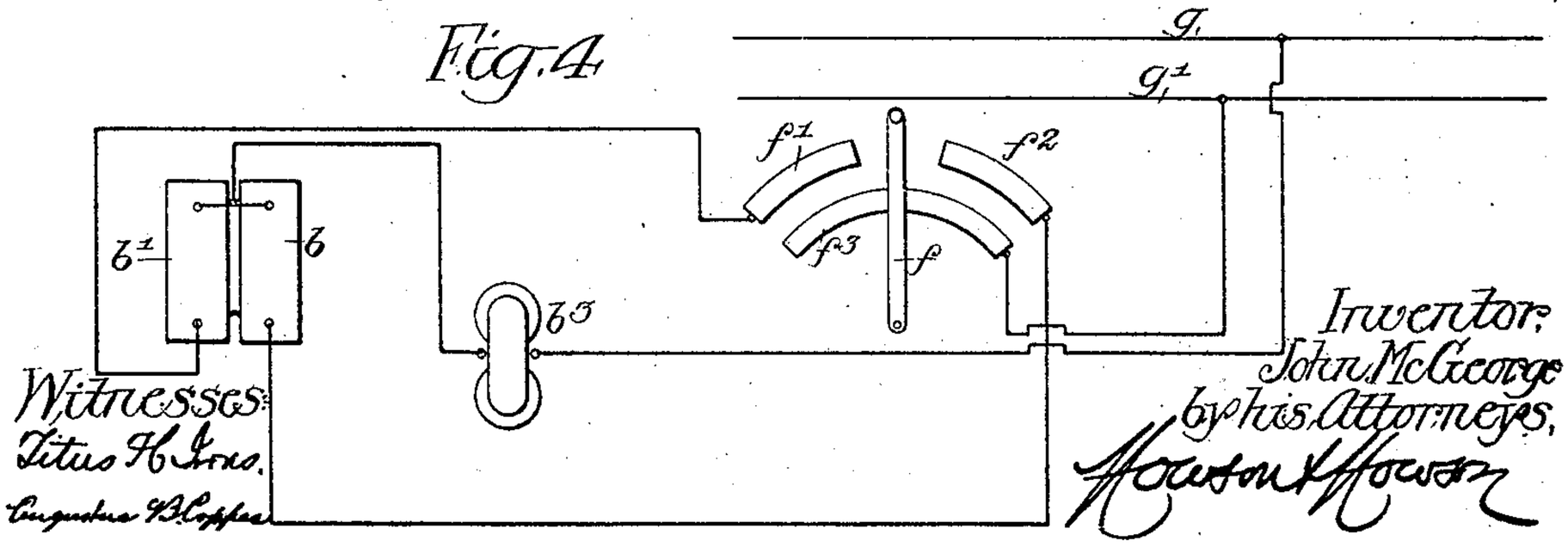


Fig. 4



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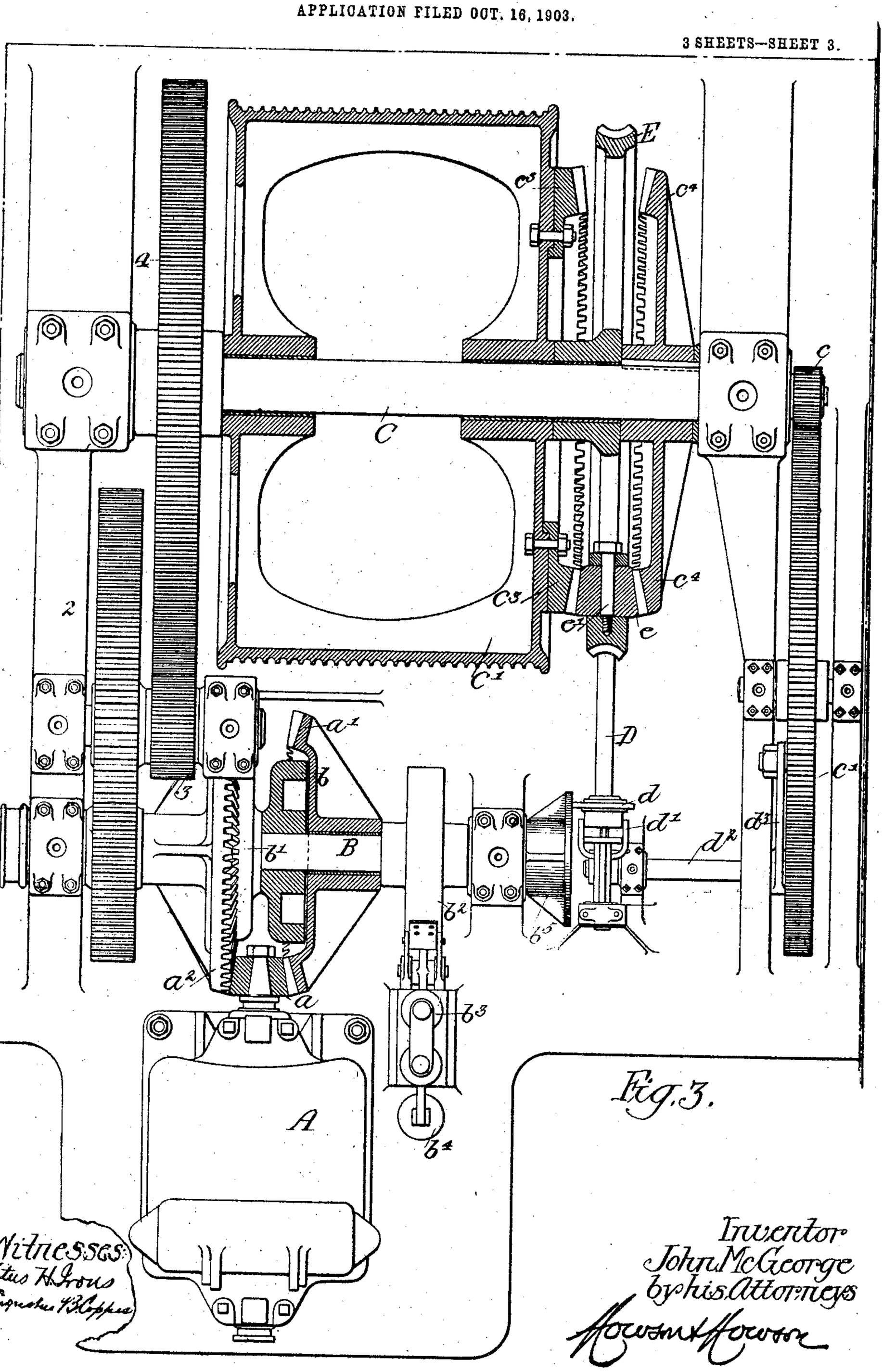

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOHN McGEORGE, OF CLEVELAND, OHIO, ASSIGNOR TO THE ELECTRIC CONTROLLER & SUPPLY COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

SPEED-CONTROLLING DEVICE FOR HOISTING MACHINERY.

No. 795,641. Specification of Letters Patent. Patented July 25, 1905.

Application filed October 16, 1903. Serial No. 177,283.

To all whom it may concern:

Be it known that I, JOHN McGEORGE, a citizen of the United States, residing in Cleveland, Ohio, have invented certain Improvements in Speed-Controlling Devices for Hoisting Machinery, of which the following is a specification.

My invention relates to certain improvements in systems designed to operate automatically to hoist and lower skips or buckets—as, for example, in connection with the charging of blast-furnaces.

The object of the invention is to provide a relatively simple system which while operating to a great extent mechanically shall start a load from rest, bring it up to full speed, and then bring it to rest with a minimum expenditure of energy as well as with a minimum strain on the hoisting apparatus.

A further object of the invention is to provide mechanism operated as above noted which may be driven by a continuously-operating motor.

These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the apparatus constituting my improved system. Fig. 2 is an end elevation of the mechanism shown in Fig. 1. Fig. 3 is an end view, partly in section, showing the detail construction of one of the magnetic clutches and of a portion of the gearing. Fig. 4 is a diagrammatic view illustrating the electrical connections of the clutches, brake, and automatic switch employed in my new system.

In the above drawings, A illustrates the motor for providing the motive power of the apparatus, and while this is shown as an electrical machine it is to be understood that it may be replaced by any desired form of the continuously-operating motor, such as a steam-engine, water-wheel, or gas-engine. The armature-shaft of the electric motor illustrated is provided with a beveled pinion a, and this meshes with two independent beveled gears a' and a^2, which are loosely supported upon a shaft B. This shaft is carried in suitable bearings, as shown, and has keyed to it two electromagnetic clutches b and b', by which either of the gears a' or a^2 may be operatively connected to said shaft B. A train of gears composed of toothed wheels 1, 2, 3, and 4 operatively connect the shaft B with a shaft C, upon which is loosely carried a hoisting-drum C′ of the well-known form.

The shaft B has fixed to it a braking-disk b^2, having a brake-band actuated from an electromagnet b^3, this device being of such a nature that a weight b^4 continually tends to cause the brake-band to grip the disk, which tendency is overcome by the electromagnet as long as this latter is supplied with a suitable current.

There is upon one end of the shaft B a friction-disk b^5, adjacent to which is a shaft D, having splined to it a wheel d, movable toward and from the center of said friction-disk and so placed that its periphery bears upon the plane surface of said disk. A lever-arm d', fixed to a shaft d^2, engages the slidable wheel d, so that as said shaft is turned said wheel is moved upon its supporting-shaft D toward or from the center of the disk b^5. For the purpose of actuating the shaft d^2 a pinion c is provided, which is keyed to the shaft C, and this meshes with the toothed wheel c', having a cam-race, as indicated in dotted lines in Fig. 1 at c^2. A roller d^4, carried on an arm d^3, is in engagement with said cam-race, and said arm is fixed to the shaft d^2.

As shown in Fig. 3, the hoisting-drum C′ has bolted to it a beveled gear-wheel c^3, and the shaft C has keyed to it a similar beveled gear-wheel c^4, while between this latter and the gear-wheel of the hoisting-drum is a worm-wheel E, loosely supported upon the shaft C and carrying three beveled pinions e, supported so as to be free to rotate upon radially-placed spindles e'. These pinions mesh both with the gear-wheel c^4 and with the gear c^3, and a worm d^5, carried by the shaft D, meshes with the worm-wheel E.

There is upon the gear-wheel c' a projection c^5, so placed as to periodically engage a pivotally-placed switch-arm f, belonging to a switch F, suitably supported on the foundation of the structure. This switch, as shown in Figs. 1 and 4, consists of three plates f', f^2, and f^3, arranged on two concentric arcs, so that while the switch-arm f always remains in contact with the plate f^3 it will engage either of the contact-plates f' or f^2, according as it is moved to one or the other side of its mid-position. While I preferably employ the form of electric switch shown in

the drawings, it is to be understood that by the term "switch," as used in the claims, I desire to include any device for controlling the flow of current to the apparatus described.

The magnet b^3 of the brake or holding device has one of its ends connected to one of the current-supply mains g, while its other terminal is connected to a wire extending between the magnets of the electrical clutches b and b', a second terminal of one of these clutches, as b, being connected to the switch-plate f^2 of the switch F, while the free terminal of the magnet b' is connected to the switch-plate f'.

In operation the motor A continually rotates the beveled pinion a, and consequently also turns both of the beveled gears a' and a^2, though in opposite directions. In starting the device the switch-arm f is moved by hand from its central position, so that it forms electrical connection, for example, between the contact-plates f^3 and f^2, current being then permitted to flow from the main g' through the switch-arm f to the magnet of the clutch b, through the brake-magnets b^3 and back to the main g. This results in the weight b^4 being lifted, so as to cause the brake-band to release the disk b^2 and simultaneously clutches the beveled gear-wheel b' to the shaft B. Power is then transmitted from said shaft through the train of gears 1 2 3 4 to the shaft C and to the bevel gear-wheel c^4, keyed thereon. The friction-disk b^5 is also rotated by the shaft B and in turn causes rotation of the shaft D at a relatively high speed through the medium of the wheel d, which in Fig. 3 is shown as bearing on the surface of said friction-disk at a point relatively distant from the center thereof. Revolution of the shaft D turns the worm-wheel E through the medium of the worm d^5, and by proper design said worm-wheel will turn in the same direction as that of the beveled gear-wheel c^4. With suitable proportioning of the various parts the worm-wheel may be given such a rate of rotation that the beveled pinion e, carried thereby, will simply roll upon the bevel-gear c^3, and consequently no motion will be transmitted to the hoisting-drum C'. It will be seen from Fig. 1, however, that as the toothed wheel c' is turned the cam-race c^2 causes the arm d^3 to be moved outwardly or toward the periphery of said gear, thereby turning the shaft d^2 and through it the arm d', so as to move the wheel d toward the center of rotation of the friction-disk d^5. This naturally results in a slowing down of the speed of rotation of the shaft D, and consequently also of the worm-wheel E, so by the time the wheel d is at the center of the friction-disk the worm-wheel is prevented from moving and the hoisting-wheel C' is turned, through the medium of the pinions e and of the bevel-gear c^3, at the same speed as that of the bevel gear-wheel c^4. It will be noted from Fig. 1 that a great portion of the cam-race c^2 is concentric with the center of rotation of the gear-wheel c', so that the wheel d is at the center of the friction-disk, with the worm-wheel E held from revolution for a relatively long though predetermined time. Finally, however, the position of the cam-race is changed so as to again swing the arm d^3 toward the center of revolution of the gear-wheel c, thereby again returning the wheel d' to engagement with the periphery of the friction-disk and gradually speeding up the worm-wheel e from a condition of rest until it turns at such a rate that no motion is transmitted from the gear-wheel c^4 to the gear-wheel c^3, the hoisting-drum being gradually brought to a position of rest. Just prior to complete cessation of the movement of the hoisting-drum the projection c^5 on the gear-wheel c' engages the switch-arm f and returns it to its central or inactive position, thus releasing the clutch b on the bevel-gear a' and simultaneously demagnetizing the brake-magnets b^3, with the result that the weight b^4 is permitted to act and apply the brake-band to the brake-disk, thereby preventing further rotation either of the shaft B or of the shaft C, which is geared thereto. Motion of the switch-arm f in the opposite direction energizes the magnet of the clutch b' and simultaneously releases the brake, so that the above cycle of operations is repeated, the drum C', however, being turned in the opposite direction from that previously described.

From the above it will be seen that I am enabled to operate from a constantly-running motor a hoisting-drum which is gradually speeded up to a maximum velocity, at which it is maintained for a predetermined time, after which said drum is automatically slowed down, the motor being then disconnected and the drum held from turning. These operations are accomplished by the employment of relatively simple mechanical structures and without complexity of electrical apparatus or wiring such as has hitherto been considered necessary.

I claim as my invention—

1. The combination of a continuously-operating motor, a structure driven thereby, a switch, an electrically-actuated clutch in circuit with the switch and connecting said motor with the driven structure, a brake, and automatic means operated from said driven structure constructed to mechanically actuate the switch to effect the action of the clutch and of the brake, substantially as described.

2. The combination of a motor, a driven structure, means including a clutch for connecting said structure and the motor, and means for automatically varying the speed of the driven structure independently of the motor, a brake and electrical apparatus for controlling the clutch and the brake, with means actuated by the motor for operating

said electrical apparatus, substantially as described.

3. The combination of a motor, a driven structure, means including a clutch for connecting said structure to the motor, a brake constructed to retard movement of the driven structure at any point of its operation, an electric switch having automatic controlling means actuated from the motor, and connections between the switch, the clutch and the brake arranged to cause release of the clutch and immediate application of the brake when the switch is operated, substantially as described.

4. The combination of a motor, a driven structure, means including a magnetic clutch for connecting said two members, an electromagnetic brake constructed to retard movement of the driven structure immediately upon the cessation of current-flow, a switch connected to the clutch and the brake, with means for automatically operating the switch to cause release of the clutch and the subsequent immediate application of the brake, substantially as described.

5. The combination of a motor, a driven structure, means including a plurality of magnetic clutches for connecting said two members, an electromagnetic brake, and a switch in circuit with the clutches and the brake, said driven structure including a part placed to open the switch after said structure has been operated to a predetermined extent, with means for changing the speed of the driven structure relatively to the speed of the motor, substantially as described.

6. The combination of a motor, a driven structure, means including a clutch and differential gearing for operatively connecting said two members, means for applying and releasing said clutch, and an automatically-operating device acting upon said differential gearing to vary the speed of the driven structure, substantially as described.

7. The combination of a continuously-operating motor, a structure to be driven, means including differential gearing connecting said two members, with means operative upon said differential gearing for varying the speed of said driven structure, an electromagnetic clutch, a brake, and an electrical device for simultaneously causing operation of the clutch and application of the brake, substantially as described.

8. The combination of a motor, a driven structure, a shaft connected to said structure, two wheels loosely carried thereon and driven in opposite directions by the motor, a pair of magnetic clutches for respectively connecting either of said wheels to the shaft, an electromagnetic brake, an electric switch in circuit both with the clutches and with the brake, with means operated by the motor for controlling the switch, substantially as described.

9. The combination of a continuously-operating motor, with a structure driven thereby, a clutch connecting the motor and the driven structure, a switch in circuit with said clutch and constructed to be actuated by some portion of the driven structure, with means for varying the speed of the driven structure relatively to that of the motor, substantially as described.

10. The combination of a continuously-operating motor, a structure driven therefrom, mechanism connecting the driven structure and the motor including a magnetic clutch, an automatic switch in circuit with said clutch, with mechanism automatically actuated by the driven structure for varying the speed of the same independently of the motor, substantially as described.

11. The combination of a continuously-operating motor, a driven structure, mechanism connecting said two members including a magnetic clutch, a switch for controlling said clutch, a wheel provided with a cam-surface and actuated from the motor, an arm having a portion in engagement with the cam-surface, and mechanism connected to said arm whereby the speed of the driven structure is automatically varied as the wheel having the cam-surface is turned, substantially as described.

12. The combination of a motor, a driven structure, with mechanism connecting said two members including a magnetic clutch, differential gearing, a friction-wheel and a friction-disk, with means for controlling the operation of the clutch, and a device for automatically varying the position of the friction-wheel relatively to the friction-disk, substantially as described.

13. The combination of a motor, a driven structure, differential gearing interposed between said structure and the motor, means including a pair of magnetic clutches for operating said driven structure in either direction at will, means for controlling the actuation of said clutches, with automatically-operated mechanism operative upon the differential gearing for varying the speed of the driven structure independently of that of the motor, substantially as described.

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

JOHN McGEORGE.

Witnesses:
C. W. COMSTOCK,
HERBERT P. GLIDDEN.