(No Model.) 2 Sheets—Sheet 1.

A. J. SHAW.

ELECTRIC HOISTING MACHINERY.

No. 528,620. Patented Nov. 6, 1894.

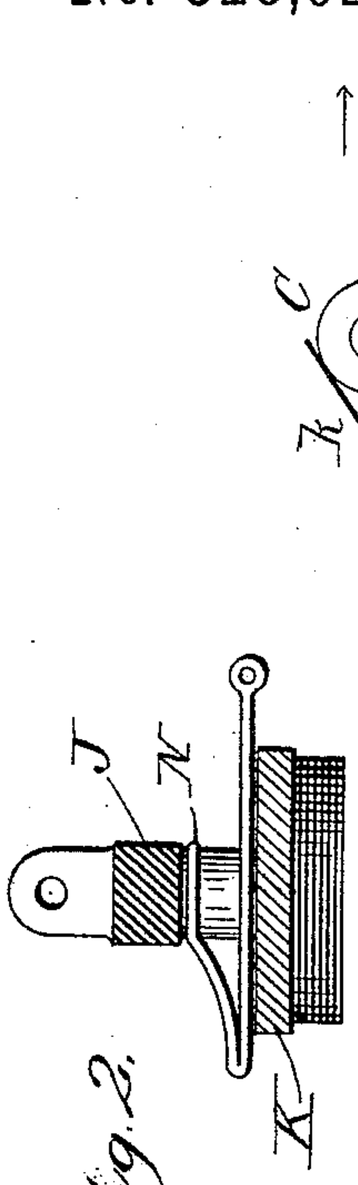

Fig. 2.

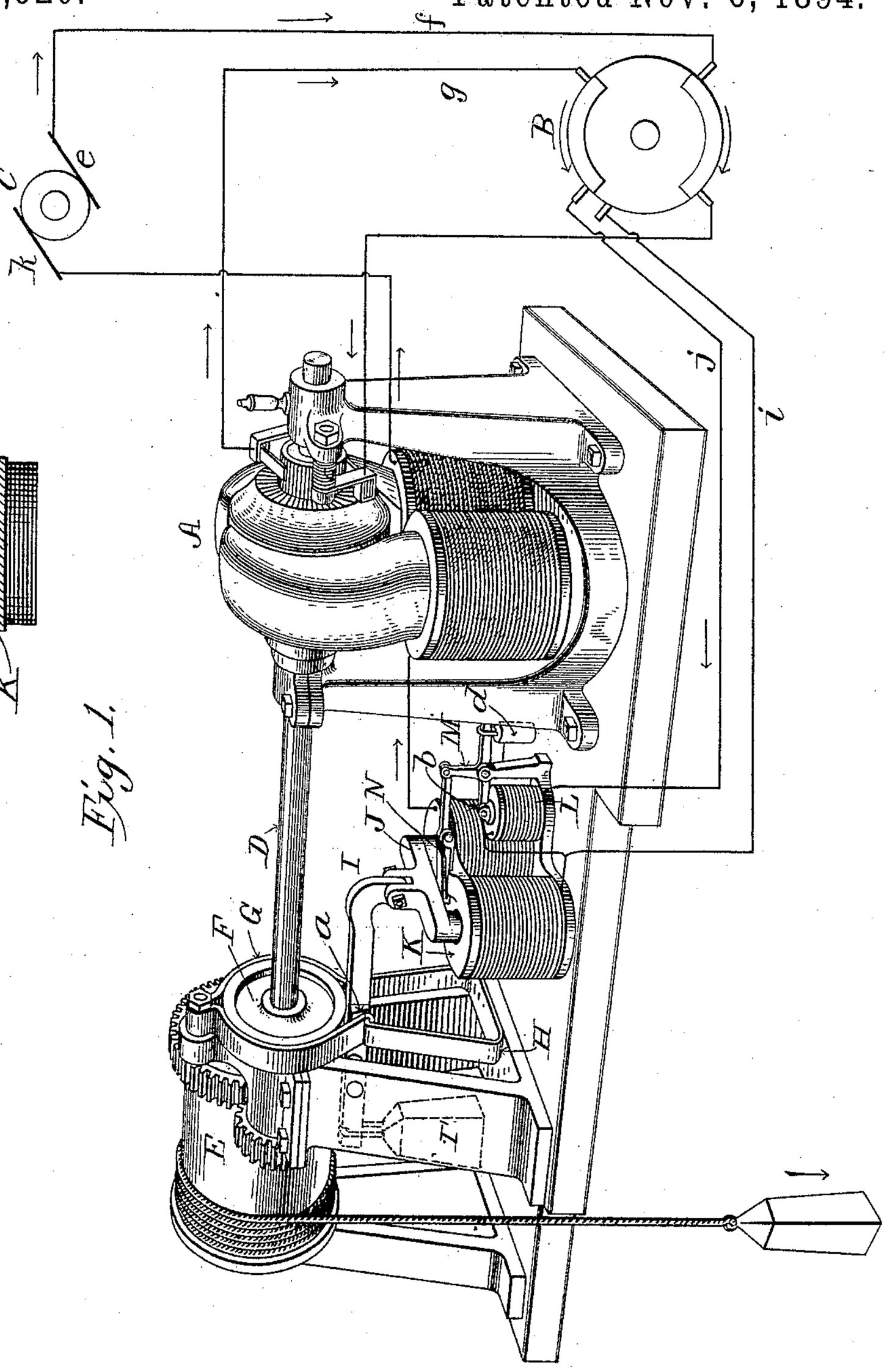

Fig. 1.

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Fig. 3.

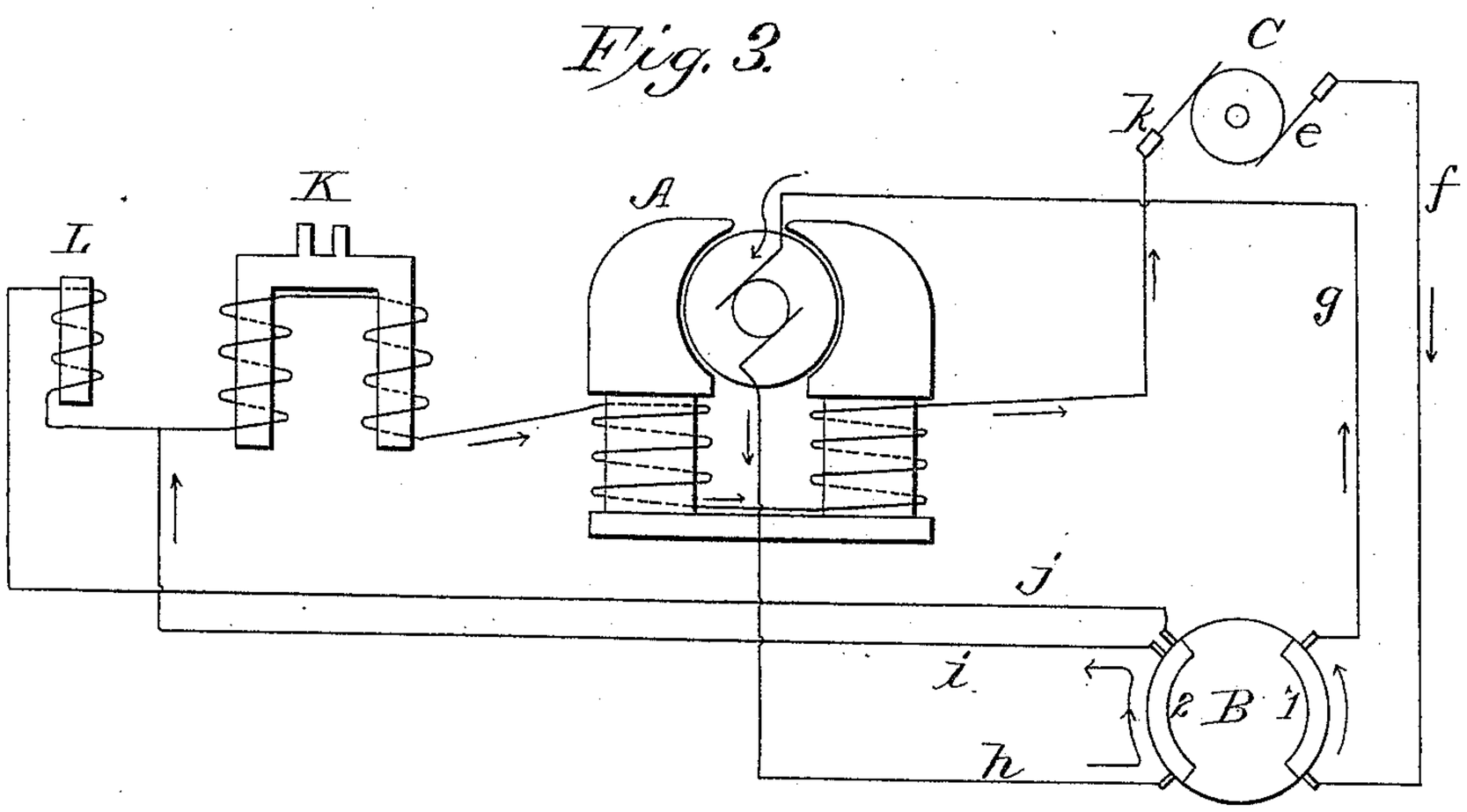
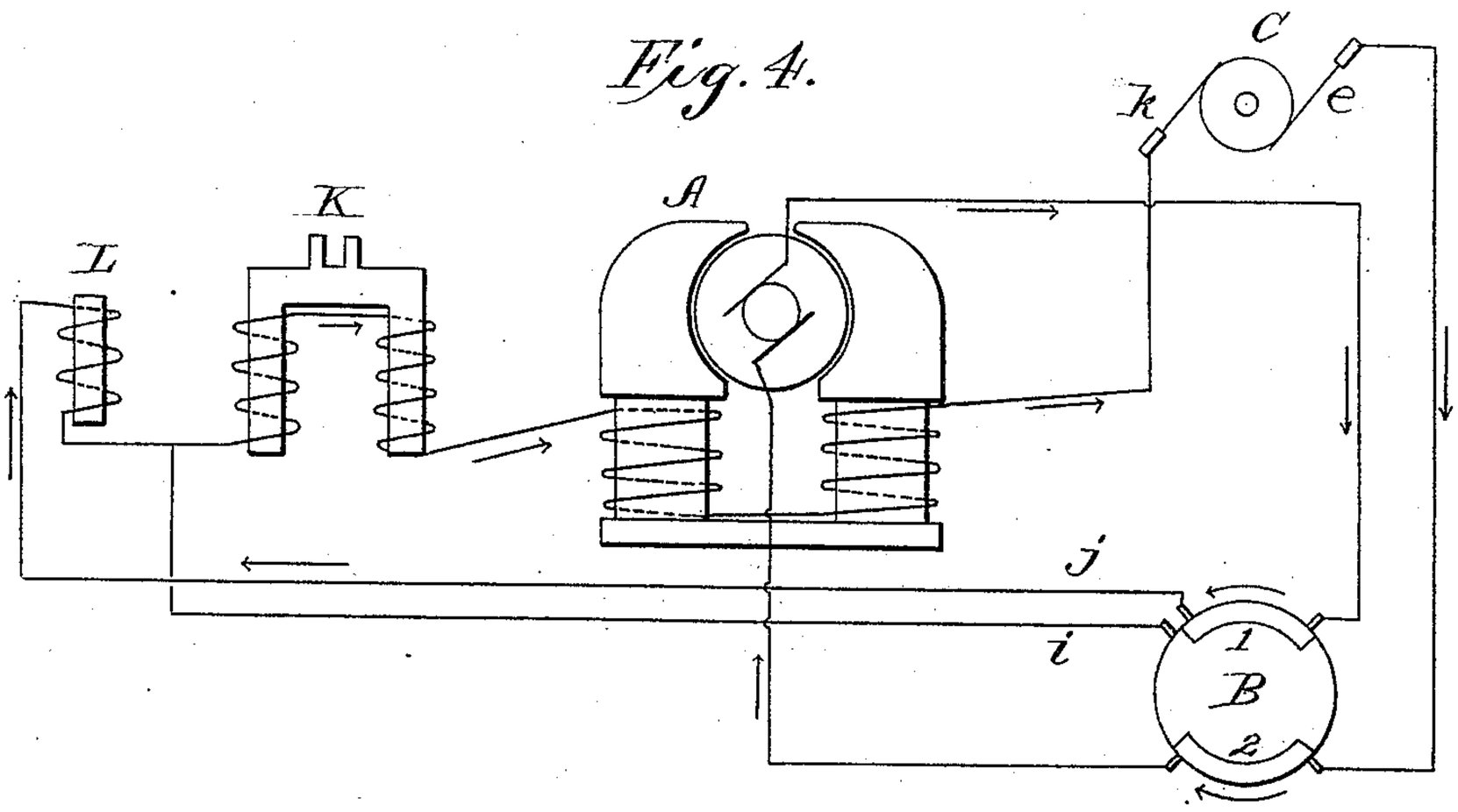


Fig. 4.



WITNESSES

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INVENTOR:

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UNITED STATES PATENT OFFICE.

ALTON J. SHAW, OF MUSKEGON, MICHIGAN, ASSIGNOR TO THE SHAW ELECTRIC CRANE COMPANY, OF SAME PLACE.

ELECTRIC HOISTING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 528,620, dated November 6, 1894.

Application filed June 25, 1894. Serial No. 515,682. (No model.)

To all whom it may concern:

Be it known that I, ALTON J. SHAW, a citizen of the United States, residing at Muskegon, in the county of Muskegon and State of Michigan, have invented certain new and useful Improvements in Hoisting Machinery, of which the following is a specification.

My invention relates to electric hoisting machinery, and consists in combining with the magnetic brake and its releasing or withdrawing device, a mechanical device by which the complete withdrawal of the brake shall be prevented when the load is acting with the motor, though permitted when the load is opposed to the motor.

The purpose of my invention is to accomplish mechanically the same result substantially as is attained electrically by the construction covered by Letters Patent No. 515,255, granted to me on the 20th day of February, A. D. 1894; that is to say, to enable the motor to run freely and without impedance when raising a load or performing work, but to hold it more or less in check when lowering or running with the load.

Figure 1 is a perspective view of an apparatus embodying my invention, the same being made without careful regard to proportion and but little more than diagrammatic in its nature, for convenience and simplicity of illustration; Fig. 2, a detail view of the wedge hereinafter referred to; and Figs. 3 and 4 are diagrams illustrating the circuit connections under the different adjustments for hoisting and for lowering.

A indicates a reversible electric motor, the reversal being effected by changing the direction of current through the armature by means of a switch B.

C indicates a dynamo-electric generator supplying the motor A, its current being delivered through and controlled by the switch B.

The shaft D of motor A imparts motion through suitable gearing to a hoisting drum E, which may be either a barrel or a chain wheel, or any other usual and convenient form of hoisting device.

Upon the shaft D is a disk or hub F, which is clasped and held with greater or less pressure by brake arms G urged against the disk by a powerful spring H.

To withdraw or remove the pressure of the brake arms G, I provide a lever I which has a wedge shaped portion *a* to enter between the free or movable ends of arms G and force them apart, as described in Letters Patent No. 461,052, granted to me on the 13th day of October, 1891.

The lever I carries a soft iron yoke or double magnet core J, the limbs of which enter within the coils of a powerful electro-magnet K.

When the magnet K is de-energized, the counterweight I′ of lever I lifts cores J and raises the wedge portion *a* so that the spring H is free to apply the brake arms G to the hub F with full force and effect; but when the magnet K is strongly excited, the cores J are drawn thereinto, the wedge portion *a* is drawn between the brake arms, and they are thereby forced apart against the pressure of spring H, sufficiently to relieve the hub or disk F from the pressure of the arms G.

The magnet K is at all times in circuit with the motor, and this is important in order that the brake shall be automatically and certainly applied whenever from any cause the motor current is interrupted or the circuit broken. In the absence of some provision for lessening or modifying the action of the magnet K, therefore, it is apparent that the brake will be released or withdrawn equally, whether the load is being lifted or lowered, whereas it is manifestly desirable that in lowering a load, the brake should be applied sufficiently at least to prevent too sudden descent thereof, and also to prevent racing of the motor. To effect this object, I provide a second electro-magnet L, the movable core *b* of which is carried by one arm of a three-armed lever M, Fig. 1.

N represents a wedge-shaped slide or bar moving in or between guides at the top of the spools of magnet K, and designed to enter beneath the cross bar or yoke of the movable cores J of magnet K. This sliding block or wedge is connected by a link *c* with an upright arm of lever M, and the third or rearwardly-projecting arm of said lever is provided with

a counterweight *d* which, when the magnet L is weakened, serves to rock the lever M on its pivot and withdraw the slide N from beneath the yoke of core J, wholly or partially.

The magnet L is arranged in series with the magnet K, but a second path is provided for the motor current, branching off from the conductor connecting said magnets, at a point between them, and the switch is so constructed and arranged that a path is afforded for the current through the two magnets, either in series or in shunt, according to the direction in which the motor is operating, the shunt arrangement causing the magnet L to be practically eliminated during the hoisting of a load.

Measurably good results may be secured through the use of a solid wedge or detent, which may be of different inclination in different portions of its length, or of regular taper; but the best results are obtained through the use of a spring wedge or detent, such as shown in Fig. 2, which, by reason of its elasticity, will oppose a considerable resistance to the withdrawal of the brake, though not absolutely preventing such withdrawal.

The advantage and importance of the elastic wedge will be appreciated when it is considered that all brakes of this type are first released by the surge of current, or by a heavy current which passes through the circuit before the motor starts, but that when the brake is once released, a very much smaller current will be sufficient to hold it off than is required to effect the initial release or withdrawal. This is due not only to the peculiar formation of the wedge which separates the arms of the brake, and to the fact that the rolls of said arms or brakeshoes move up to and bear upon the nearly parallel faces of the brake-releasing wedge, but also to the further fact that on account of the retraction of the solenoid cores into the coils, the air gap in the magnetic circuit so decreases with the given current that the attraction or pull of the solenoids is greatly increased, or does not decrease with a considerable decrease in current.

With the spring wedge or detent the action of the device is very effective. If, owing to the insufficient or limited withdrawal of the brake strap G, the current required to lower should increase beyond a certain point, this increase of current would cause an increase in the pull or attractive force of the solenoid K, and thereby compress the spring detent N to a greater or less extent, partially releasing the brake strap G. This being effected, the current would naturally decrease, thereby allowing the brake strap to be re-applied. These two efforts would soon reach a balance, and a steady lowering movement would be the result.

It is manifest that the precise form of the spring detent is not important, and I have represented in the drawings simply a flat steel blade or plate bent back upon itself, as a type and as a convenient and simple form.

Referring now to Fig. 3, the circuits will be traced out for the hoisting adjustment. Proceeding from the brush *e* of generator C, the current passes by conductor *f* to section 1 of switch B, thence by conductor *g* to the upper commutator brush of motor A, through the armature windings, and by the lower brush and conductor *h* to section 2 of switch B, which, under this adjustment, affords two paths for the current, one by conductor *i* and the other by conductor *j*, the terminals of both at this time being in contact with section 2 of switch B.

Inasmuch as the conductors *i* and *j* unite at a point between the magnets K and L, it follows naturally that but very little of the current will traverse conductor *j* since it encounters the added resistance of that conductor and magnet L as against the conductor *i* which is entirely without this resistance. From the magnet K the current proceeds from the field windings of motor A and back to brush *k* of generator C. As a consequence of this arrangement, the magnet L is energized but feebly if at all, and its strength is insufficient to overcome the action of the counterweight *d*. Hence said counterweight rocks the lever M and withdraws the wedge bar N from beneath the yoke of magnet cores J, leaving said cores free to descend their full distance.

The current passing with no appreciable diminution through the coils of magnet K, vigorously energizes said magnet and draws the cores J into the same, thereby depressing lever I and forcing the brake arms G apart, thus leaving the brake disk or hub and the hoisting apparatus entirely free to be efficiently propelled by the motor.

In order to reverse the motor, the switch B is adjusted to the position shown in Fig. 4, that is to say, so that one of the sections connects the conductors *f h*, and the other connects the conductors *g j*, while conductor *i* is cut out. The current consequently passes from brush *e* of the generator C by conductor *f* to section 2 of switch B, thence by conductor *h* to the lower commutator brush of motor A, through the windings of the armature, and by the upper brush of the motor and conductor *g* to section 1 of the switch B, thence by conductor *j* to the coils of magnet L, thence to the coils of magnet K, thence to the field windings of motor A, and finally by commutator brush K back to the generator G. Under this arrangement it will be seen, the entire current is forced to traverse the windings of magnet L, and consequently said magnet is fully energized, and its core *b* is consequently drawn inward with force sufficient to slide the wedge bar N beneath the yoke of pole piece J, thereby limiting the descent of said pole piece and consequently restricting the releasing effect of lever I upon the brake arms G. The extent to which the wedge bar shall act to thus prevent the descent of lever I will be determined by the circumstances of each par-

ticular case, and proper adjustment will be made therefor.

It is obvious that the precise mechanism shown and described is not essential, and that any limiting or retarding device placed within the path of movement of lever I or its connected parts, will serve the purpose here set out, my invention consisting broadly in the interposition of a limiting stop to prevent the complete withdrawal of the brake when the load is acting with instead of against the motor.

Having thus described my invention, what I claim is—

1. In combination with electric hoisting machinery, a magnetic brake for controlling the same, a stop or detent to limit the action of the brake, and an electro-magnet included in circuit with the hoisting motor and serving to control the position of the stop or detent.

2. In combination with electric hoisting machinery, a magnetic brake for controlling the same, an elastic stop or detent to limit the action of the brake, and an electro-magnet included in circuit with the hoisting motor and serving to control the position of the stop or detent.

3. In combination with a hoisting drum, and with an electro-motor for propelling the same, an electro-magnetic brake controlling the action of the apparatus; a stop or detent movable into and out of the path of the brake controlling lever, an electro-magnet for actuating said detent, and a switch interposed between the source of electric current and the hoisting apparatus and serving to direct the current through the brake magnet and the detent-actuating magnet in series when the load is opposed to the motor, and through the detent-controlling magnet in shunt when the load is acting with the motor.

4. In combination with a source of electric energy, an electric motor, a hoisting drum propelled by said motor, a brake drum F, an automatic brake adapted to act upon said drum, a lever I for releasing said brake, provided with magnet core J, an electro-magnet K for actuating said lever, a second electro-magnet L, a counterbalanced lever M carrying a core *b* for said magnet L, a detent N carried by said lever, and a switch B adapted to direct the current from the source of energy through the magnet L either in shunt or in series with the magnet K according as the current is passed in one or the other direction through the armature of the motor A.

In witness whereof I hereunto set my hand in the presence of two witnesses.

ALTON J. SHAW.

Witnesses:
F. W. BABCOCK,
T. C. AKIN.