No. 617,664. Patented Jan. 10, 1899.

R. W. TRAYLOR.

AUTOMATIC ALARM MECHANISM FOR ELECTRIC MOTORS.

(Application filed June 22, 1898.)

(No Model.)

Fig. 1.

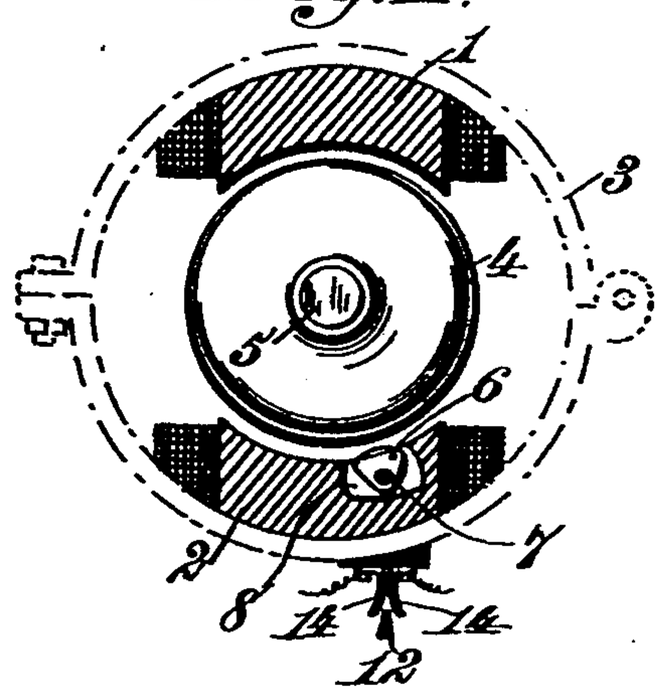
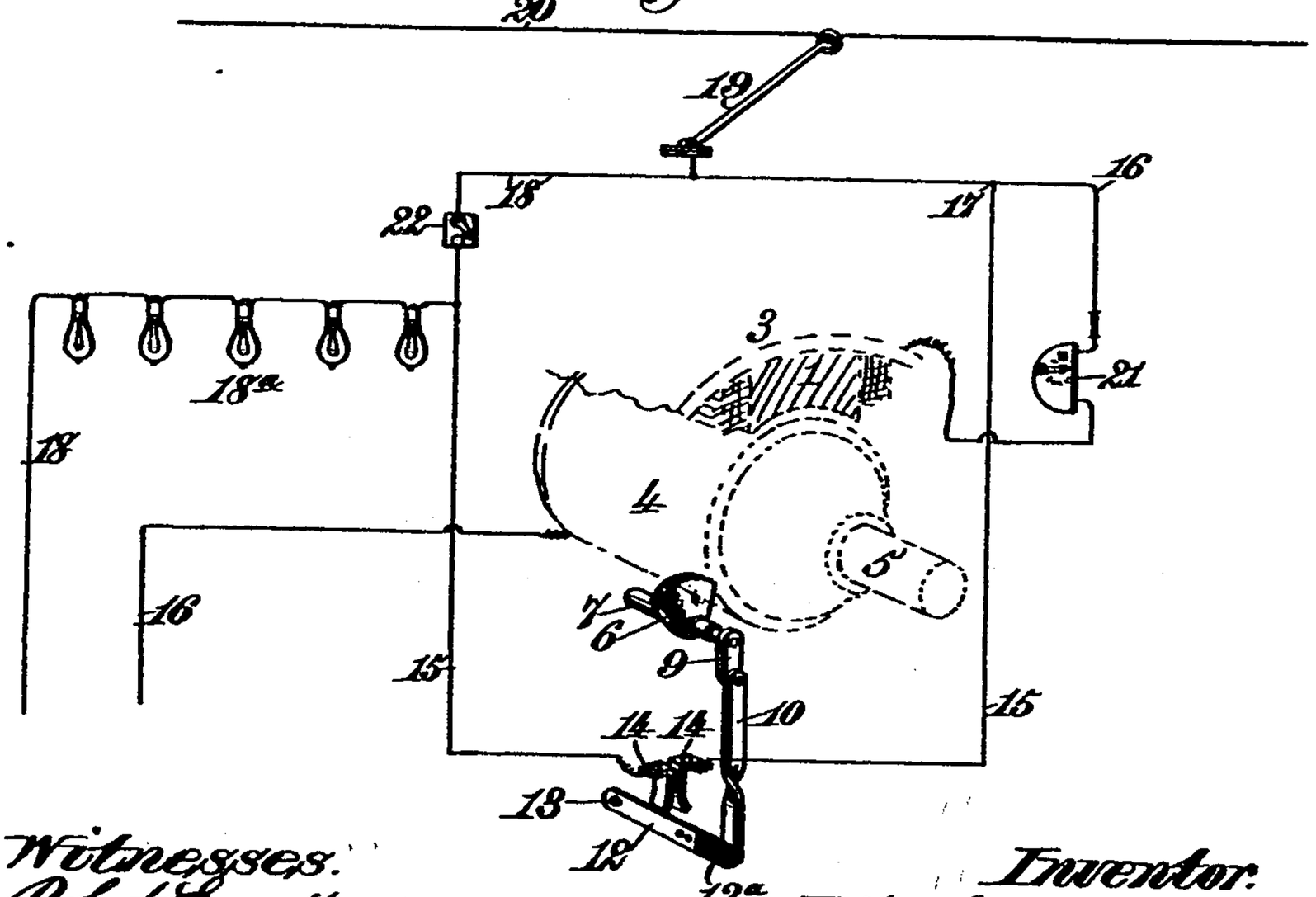


Fig. 2.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC ALARM MECHANISM FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 617,664, dated January 10, 1899.

Application filed June 22, 1898. Serial No. 684,150. (No model.)

To all whom it may concern:

Be it known that I, ROBERT W. TRAYLOR, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented new and useful Improvements in Automatic Alarm Mechanism for Electric Motors and other Apparatus, of which the following is a specification.

My invention relates to automatic alarm mechanism for electric motors and other apparatus, my purpose being to provide simple and economical means whereby any material displacement of a shaft due to the wear of its bearings or other causes shall be instantly and automatically indicated or denoted by a suitable signal which may be located at any point preferred.

Although my invention is applicable to mechanism of any type in which a rotating shaft constitutes one of the mechanical elements, there being nothing in its construction or organization that restricts its use to electrical apparatus I have nevertheless shown it in the accompanying drawings as incorporated in an electric motor of any well-known form—such, for example, as those used upon railway-cars. These motors are usually inclosed in a housing or case to protect them from dust and moisture, and for this reason it is not easy to examine them to ascertain whether the armature-shaft is rotating properly and maintaining accurate relations to the field-pieces of the motor. As the attraction of the latter varies as to the square of the distance, it is necessary that the interval separating the field-pieces from the armature-coils be reduced to the minimum. A comparatively small displacement of the shaft, therefore, due to the wear of its bearings or to any other cause, will bring the periphery of the armature into contact with one or the other of the pole-pieces, and the rapid rotation of the armature will speedily effect a burning-out of the armature, thereby causing considerable expense for repairs and serious inconvenience. As these motors are usually placed beneath the cars the motorman and conductor are unable in the absence of automatic signaling apparatus to prevent these injuries, as the only means of learning, while the car is in motion, that the armature-shaft has been displaced is the odor resulting from the charring or burning of the insulation.

Heretofore, and prior to my invention it has been proposed to indicate or give warning of a displacement of the armature-shaft by means of a target or shutter which drops by gravity upon being released from a latch on an armature-bar, the electromagnet attracting said armature being vitalized either by a separate battery or by any other source of energy. The circuit of this electro-magnet is established by the drop or displacement of the armature-shaft, the armature itself having the function of an automatic circuit-closer. Every function of the alarm apparatus is dependent upon the expenditure of electric energy for its proper performance.

It is the purpose of my present invention to avoid the use of the electric current in order to establish the circuit by which the signaling or alarm devices are actuated and to provide simple, inexpensive, and efficient mechanical means, automatically operated by the armature at the moment when any displacement of the shaft takes place, to establish by mechanical action only an electrical circuit in which one or more suitable signaling devices, such as bells or lights, are included.

It is my object also to so construct and arrange the parts composing the alarm mechanism that any material drop or displacement of the armature, by whatever cause it may be produced, will cause the latter to frictionally engage with and operate a segment-gear and a rock-shaft which carries said gear, and thereby bridge over a break in a circuit derived from the motor-circuit and having a suitable alarm or signal, one or more included therein and located at any suitable point or points. By this arrangement the function of the armature in establishing the alarm-circuit is wholly mechanical.

To enable those skilled in the art to which my invention pertains to clearly understand and to make and use the same, I will now proceed to explain said invention in detail, reference being had for this purpose to the accompanying drawings, in which—

Figure 1 is a section taken transversely through the field-pieces of an ordinary elec-

tric motor in which my invention is incorporated, the field-coils and armature-winding being omitted. Fig. 2 is a perspective view showing the upper field-piece and armature, the alarm or signal devices, and a diagram of the circuits of the latter and of the motor, the field-coils and the lower field-piece being omitted.

The reference-numerals 1 and 2 in said drawings indicate the upper and lower field-pieces, respectively, of an electric motor of any type, the form selected for illustration in this instance being an ordinary railway-car motor, the parts of which are inclosed within a suitable housing or casing 3 to protect the commutator and brushes from dust and to exclude water, which would penetrate through the insulation, corrode the wire, and be extremely likely to produce a short circuit.

The reference-numeral 4 designates the armature, which is mounted upon a shaft 5. The bearings for the latter are of any well-known form and arrangement and require neither illustration nor description. The field-coils, armature-windings, commutator, and brushes are also absent from said drawings, being not only well known to those familiar with the art, but having no special connection with my present invention.

Below the armature 4 and arranged in suitable relations to the lower field-piece 2 is a friction-gear 6, having the form, preferably, of a sector of a circle and rigidly mounted upon a short rock-shaft 7. I have shown this shaft in Fig. 1 as provided with bearings in the lower field-piece 2, in which also is formed a narrow recess 8 to receive the friction-gear 6 and permit it to have a limited movement. Upon one end of the rock-shaft 7 is a crank-arm 9, to the end of which is pivoted a connecting-rod 10, which is also attached in like manner to one end of a lever 12, having its fulcrum at 13. Between this fulcrum and the point where the connecting-rod 10 is attached are two electrical contacts 14, which are normally separated from each other, the space between them being somewhat less than the thickness of the lever 12. The ends of said contacts, however, which lie nearest said lever are spread apart sufficiently to permit the latter to enter between them when it is turned upon its fulcrum 13. The contacts 14 lie in and form part of a shunt or derived circuit 15, which is tapped off the motor-circuit 16 at any suitable point—as, for example, at 17. Tracing the derived circuit from this point, it goes to one of the contacts 14 and from the other contact 14 to the regular lamp-circuit 18. In this circuit I have shown a few incandescent lamps 18^a, connected in series; but it is evident that in a three-wire system they may be connected in multiple without affecting my invention.

The motor-circuit goes from the trolley 19, which is shown as underrunning an overhead conductor 20, to one brush of the motor and from the other brush to the return-conductor, which may be the rails or a separate wire.

The operation of the invention is as follows: As long as the armature-shaft remains in a normal position with relation to the field-pieces 1 and 2 the parts will continue to occupy the position substantially shown in Fig. 2; but should the shaft-bearings become worn sufficiently to permit the shaft to drop by its own gravity until the armature is nearly in contact with the lower field-piece 2 its cylindrical surface will engage the periphery of the friction-gear 6, which projects slightly above the face of the lower field-piece 2. A light frictional engagement is sufficient to insure the operation of the mechanism, there being but a small weight and friction to overcome. The gear 6 being turned in this manner, the rock-shaft 7 is rotated, carrying with it the crank-arm 9, which draws the lever 12 between the contacts 14 and into electrical engagement with both. Said lever being of conducting metal it bridges over the interval or break in the shunt-circuit, and as the current divides at the point 17 enough energy is received by the shunt to light the lamps 18^a, thereby giving both motorman and conductor an unmistakable signal to indicate the displacement of the armature-shaft. It is unnecessary to point out the fact that it is wholly immaterial what causes such a displacement, as this may be due to other conditions.

Evidently, also, I may substitute any preferred form of signal or alarm device, either visual or audible, in place of the lamps 18^a, and if circumstances require it a plurality of signals or indicating devices may be included in the alarm-circuit and arranged at different points. For example, one signal, such as an electric bell, could be placed near the motorman and a second signal at or near the point where the conductor usually stands.

It should be clearly understood that although I have shown my invention as incorporated in a railway-car motor it is in no sense restricted to that type of mechanism. Neither do I limit my improvement to use in connection with mechanism driven by electric energy or for the purpose of generating the same.

The alarm mechanism described is applicable without change to long and heavy shafts, which sag or bend by their own weight when their bearings are worn away and are exceedingly liable to break under such conditions.

By my invention I am able to utilize the armature to impart movement to the circuit-closing devices; but I utilize it in a mechanical sense only, the sole point where current is used being in the alarm-circuit after the latter has been established by the automatic action of the armature upon the friction-gear 6. I am able, therefore, to avoid the annoying failure of springs or other electrical contacts to make electrical engagement with the

cylindrical surface of the armature. Rigid points or conductors when brought into contact with the exterior of the armature-coils are very liable to mutilate, burn, or strip part of the insulation off the wires. Rolling contacts, on the other hand, are too uncertain, and there is probably no electrical apparatus which depends for its automatic action upon the establishment of a signaling-circuit by the displaced armature used as a circuit-closer upon which entire reliance for certainty can be placed. It is otherwise with mechanical mechanism, and it should be noted also that after the armature has moved the friction-gear 6 to its limit and drawn the lever 12 between the contacts 14 the circuit thus established can be maintained as long as desired without any necessity for maintaining the frictional engagement with said gear. The reason for this is too obvious to require explanation.

The ordinary controller 21 and the switch 22 in the lamp-circuit are shown conventionally in Fig. 2, but are both well known, and as they play no part in accomplishing the results proposed by my present invention no further reference to these parts is necessary.

It will be understood that the circuit-closing lever 12 must be electrically isolated from the motor at some point between the contacts 14 and the rock-shaft 7 to avoid the possibility of grounding the current and short-circuiting the motor. I therefore insert an insulating section or portion 12^a of the lever 12, to which one end of the connecting-rod 10 is pivoted.

What I claim is—

1. An automatic alarm mechanism for electric motors and other apparatus, comprising a normally open electric circuit, which includes one or more signaling or alarm devices, a rotating cylindrical body, a friction-gear arranged in suitable relation to said cylindrical body so as to be operated by frictional contact with the latter, due to downward displacement of said body, and a circuit-closing device having an operating connection with said friction-gear to close the normally open circuit and operate the signal or signals.

2. An automatic alarm mechanism for electric motors and other apparatus, comprising a rotating cylindrical body, a friction-gear arranged in suitable relations thereto, a rock-shaft for said gear provided with a crank-arm, an electric circuit normally open and having one or more alarm-signals included therein, and a circuit-closing device connected by a rod to the crank-arm on the rock-shaft, whereby displacement of the rotating cylindrical body will engage its surface with the friction-gear and operate the rock-shaft and circuit-closer to establish the normally open circuit and operate the signal, or signals, included therein, substantially as described.

3. In an automatic alarm mechanism for electric motors and other apparatus, the combination with a shaft and armature arranged to rotate between field-pieces, of a friction-gear, a rock-shaft for the same having a crank, a circuit-closing device connected to said crank by a rod and a normally open circuit in which one or more alarm devices, or signals are included, the friction-gear being so arranged as to be engaged by the cylindrical surface of the armature when the shaft of the latter is displaced, thereby operating the circuit-closer and establishing the normally open circuit, substantially as described.

4. In an automatic alarm mechanism for electric motors and other apparatus, the combination with a shaft of an armature mounted thereon to rotate between field-pieces, a rock-shaft supported in bearings in one of said field-pieces a friction-gear mounted on said rock-shaft and arranged in a recess in one of the field-pieces with its periphery projecting a little above the face of the latter, a circuit-closing lever connected by a rod to a crank on the rock-shaft, and a normally open circuit in which one or more alarm devices, or signals are included, whereby displacement of the armature due to wear of the shaft-bearings will cause its cylindrical face to engage the friction-gear and operate the rock-shaft and circuit-closing lever, substantially as described.

5. In an automatic alarm mechanism for electric motors and other apparatus, the combination with a shaft and an armature mounted thereon, of field-pieces between which said armature revolves, a circuit for the motor, a normally open shunt-circuit from the motor-circuit to a circuit in which one or more alarm or signaling devices are included, a lever fulcrumed at a point where it may be moved to bridge the break in the shunt-circuit, a rock-shaft supported in bearings in the lower field-piece of the motor and having a crank-arm operatively connected to said lever by a rod, and a sector-shaped friction-gear on said rock-shaft having its periphery projecting slightly above the face of the lower field-piece, substantially as described.

6. In an alarm mechanism for electric motors and other apparatus, the combination with a shaft and armature of field-pieces between which the latter rotates, a circuit for the motor, a normally open shunt from said circuit, two normally-separated spring-contacts forming a part of the said shunt-circuit, a lamp-circuit to one wire of which said shunt-circuit is connected, a circuit-closing lever fulcrumed at such a point that it will oscillate in a plane passing between the said spring-contacts, a rock-shaft supported in suitable bearings and provided with a crank which is connected to the circuit-closing lever by a rod, and a friction-gear rigidly mounted on said rock-shaft and projecting slightly above that face of the lower field-piece which is adjacent to the armature, substantially as described.

7. In an automatic alarm mechanism for electric motors and other apparatus, the combination with a shaft and an armature carried thereby of a sector-shaped friction-gear arranged in a recess in the lower field-piece with its periphery projecting somewhat above the inner face of said field-piece, a rock-shaft to carry said friction-gear provided with bearings in said lower field-piece, a circuit-closing lever having a fulcrum at one end and the other end connected by a rod to a crank-arm on the rock-shaft, a circuit for the motor a shunt-circuit having two elastic contacts which are separated to open said shunt and maintain it, normally, in that condition, said contacts being so located that the circuit-closing lever can enter between them and establish the circuit, and a plurality of lamps connected in series in a branch of the motor-circuit with which the shunt-circuit unites, substantially as described.

8. In an electric motor, the combination with an armature and the shaft carrying the same, of a signaling or alarm device, a motor-circuit, a shunt-circuit included in the motor-circuit and provided at a suitable point with separated contacts to keep the shunt-circuit normally open, a friction-gear arranged in suitable relation to said armature so as to be operated by frictional contact with the latter, due to downward displacement of the said armature, a circuit-closing device coöperating with the said contacts in the shunt-circuit to close the latter and operate the signal, and a connection between the friction-gear and said circuit-closing device, substantially as and for the purpose described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ROBERT W. TRAYLOR.

Witnesses:

JAMES L. NORRIS,

F. B. KEEFER.