R. B. WILLIAMSON.

DYNAMO ELECTRIC MACHINE.

APPLICATION FILED NOV. 1, 1907. RENEWED FEB. 16, 1911.

1,000,061. **Patented Aug. 8, 1911.**

2 SHEETS—SHEET 1.

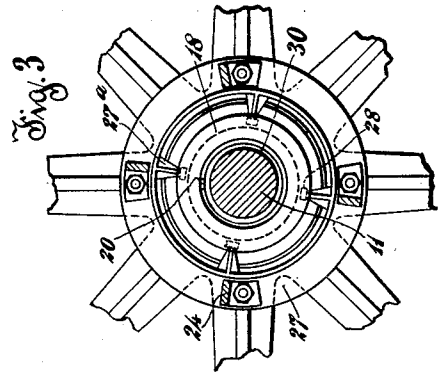

Fig. 3.

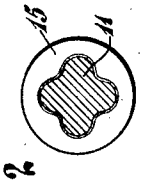

Fig. 2.

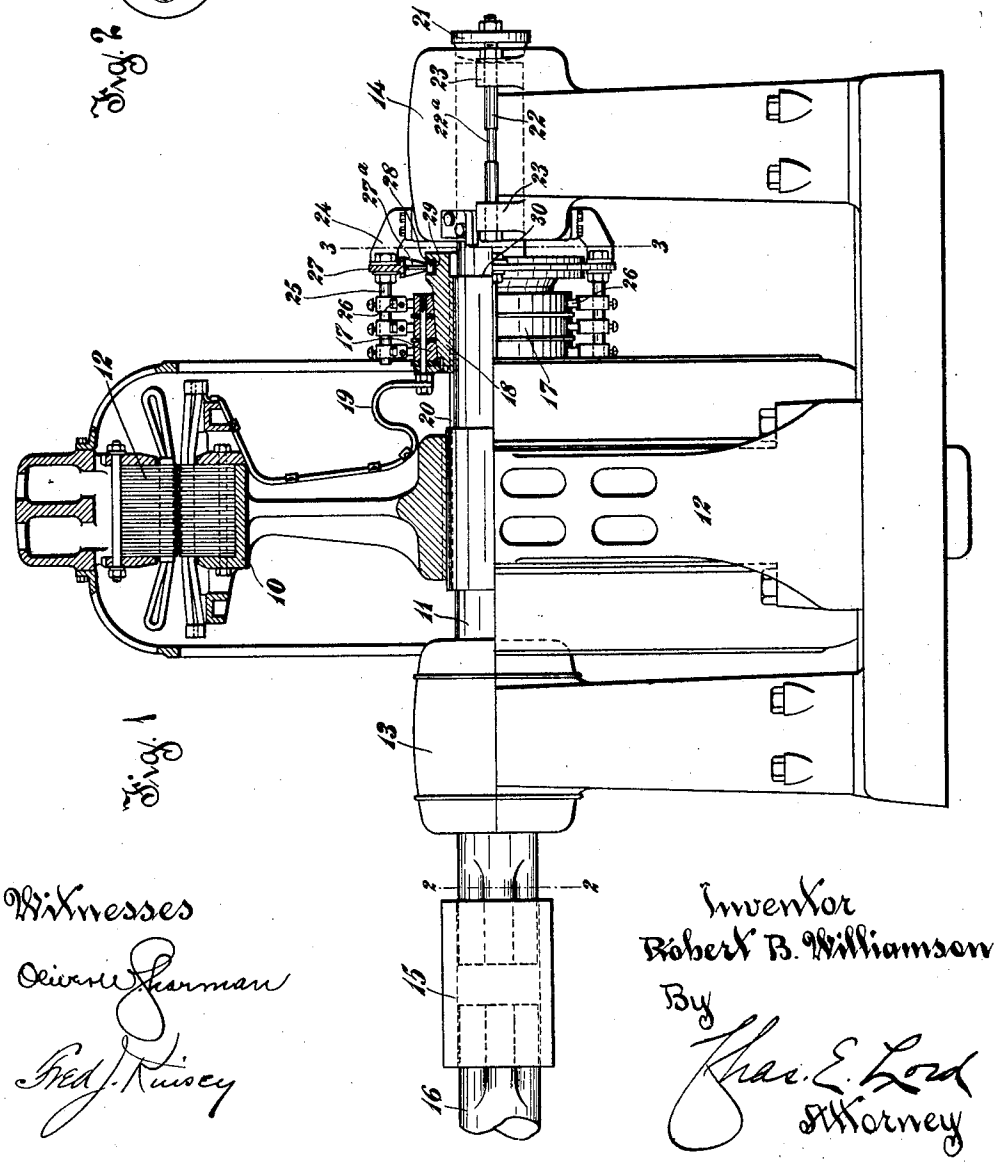

Fig. 1.

Witnesses

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Fig. 5

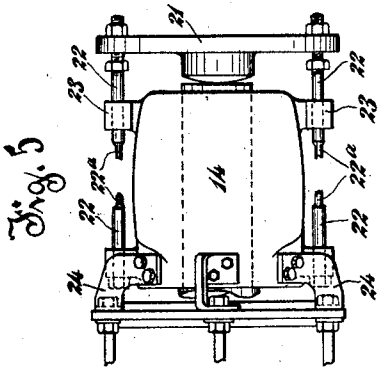
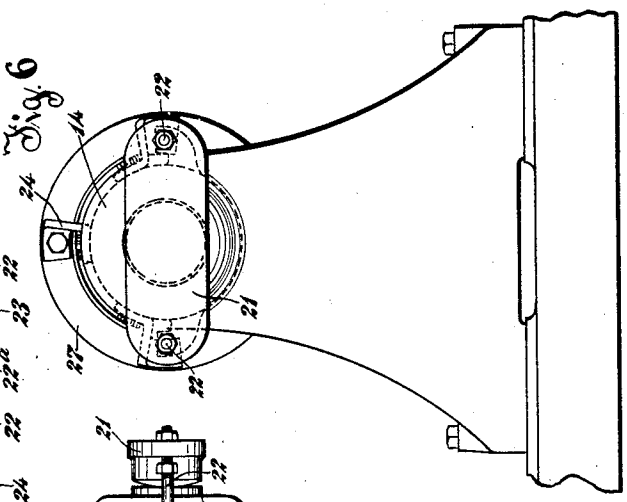
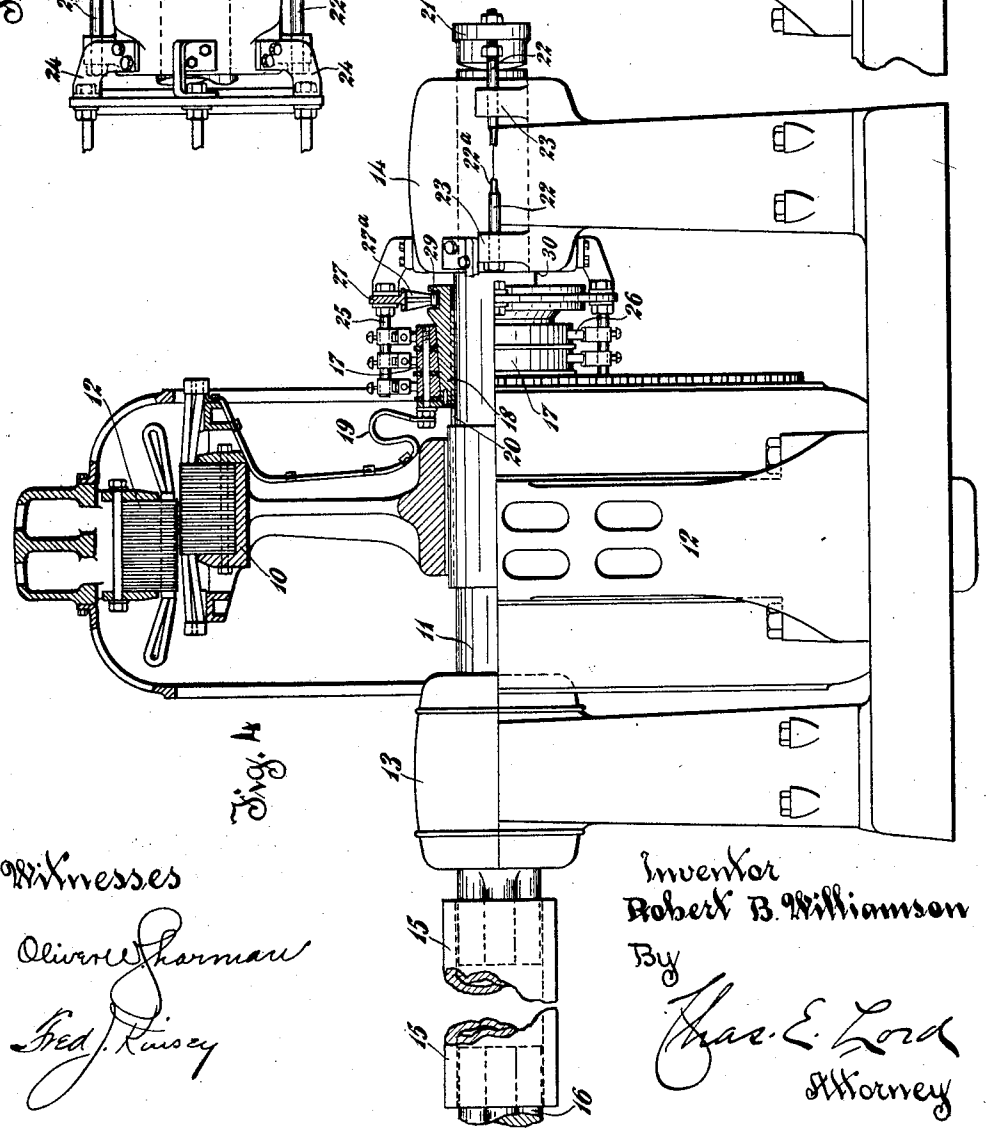


Fig. 6





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UNITED STATES PATENT OFFICE.

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DYNAMO-ELECTRIC MACHINE.

1,000,061. Specification of Letters Patent. Patented Aug. 8, 1911.

Application filed November 1, 1907, Serial No. 400,156. Renewed February 16, 1911. Serial No. 608,980.

To all whom it may concern:

Be it known that I, ROBERT B. WILLIAMSON, a citizen of the United States, residing at Norwood, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a full, clear, and exact specification.

My invention relates to dynamo-electric machines.

In the operation of rolling mills by electric motors there is generally provided between the motor and the rolls of the mill a special form of coupling, which is designed to withstand a smaller torque than the shaft and other rotating parts. In case of an overload on the rolls this coupling breaks and allows the motor to continue to run, but without load. This coupling thus serves a purpose very similar to that of a fuse in an electric circuit. These couplings are usually made of cast iron. However, when such a coupling breaks it usually does so on a diagonal, and the two halves by their relative rotation force themselves apart and force the motor shaft endwise. In some cases this end thrust on the motor is exceedingly heavy, and therefore it is necessary to provide special means for taking up such thrust. This may be done by providing the outboard bearing with a thrust collar and making such bearing and its pedestal heavy enough to withstand the excessive side strain thereon. It is proposed to avoid this strain on the outboard bearing pedestal by providing means for allowing the motor shaft and the rotatable member of the motor to have a limited endwise motion upon the breaking of the coupling between the motor and the rolling mill, but for stopping such motion after it has been sufficient to allow the two parts of the coupling to separate. This, however, causes an axial movement of the collecting device carried by the shaft relative to the stationary brushes carried by the movable member. If the collecting device on the motor shaft is a commutator this is objectionable, while if such collecting device consists of several slip-rings, as in rotor wound induction motors and in synchronous motors, such movement is ordinarily absolutely unallowable.

It is the object of my present invention to provide means whereby there may be relative axial movement of the two elements of the motor without any such relative movement between the collecting device on the shaft and the brushes. This result is accomplished in my present invention by providing means whereby upon axial movement of the shaft and rotatable element of a dynamo-electric machine, the collecting device on the shaft of the machine may remain substantially fixed axially of the stationary element of the machine. In the specific embodiment of my device which is here shown, the collecting device, such as a commutator or group of slip-rings, is mounted on a sleeve which can slide longitudinally of the motor shaft but must rotate therewith, flexible connections being provided between such collecting device and the rotatable element of the machine.

The novel features of my invention will appear from the description and drawings and will be particularly pointed out in the claims.

Figure 1 is a partly sectional elevation of a rotor wound induction motor, coupled to a shaft which may be the driving shaft of a rolling mill; Fig. 2 is a section from the line 2—2 of Fig. 1, showing the coupling in elevation; Fig. 3 is a section on the line 3—3 of Fig. 1; Fig. 4 is a view similar to Fig. 1, but showing the coupling broken and the shaft and rotatable member of the motor forced to the right; Fig. 5 is a plan view of the outboard bearing of the machine as shown in Fig. 4; and Fig. 6 is an end view of such bearing.

The wound rotor 10 of an induction motor is mounted on the shaft 11 to rotate within the stator and housing 12. The shaft 11 is mounted in two bearings 13 and 14, and is connected by a coupling 15 to the shaft 16, which may be the driving shaft of the rolls of a rolling mill or may be connected to any other desired load. The group of collector rings 17, here shown as three in number, is mounted on the sleeve 18, and each collector ring is connected by a flexible connection 19 to the proper point or points on the winding of the rotor 10. The sleeve 18 fits loosely on the shaft 11, a feather 20 or other suitable means being provided whereby the sleeve and rings may slide longitudinally of the shaft but must rotate therewith.

A plate 21 is normally held against the outer end of the shaft 11 by means of bolts 22 supported on either side of the bearing 14 by lugs 23, and in the normal operation of the machine prevents the shaft 11 from having more than the proper amount of end-play. These bolts 22 are made smaller at the centers 22^a, so that in case of an excessive end thrust on the shaft 11 and against the plate 21, the bolts 22 will break at such centers. On the inner side of the bearing 14 are mounted arms 24, which carry the brush studs 25 for the brushes 26 which coact with rings 17, and also carry a ring 27 having several inwardly projecting arms 27^a which at their inner ends carry rollers 28. The rollers 28 project into a groove 29 in the sleeve 18. If desired, the ring 27 itself may be made to fit into the groove 29.

In the normal operation of the machine the parts are substantially as shown in Fig. 1. However, in case of a too heavy load on the shaft 16 the coupling 15 breaks. This break is always with a rough or uneven surface and is generally somewhat diagonal. The continued turning of the rotor 10 and shaft 11 forces the two parts of the coupling 15 apart and this forces the rotor 10 and shaft 11 endwise, as shown in Fig. 4. As the shaft 11 is forced endwise it carries the plate 21 with it, breaking the rods 22 at their centers 22^a. However, although the rotor 10 and shaft 11 have moved to the right, the arms 27^a and rollers 28 have maintained the sleeve 18 in the same axial position relative to the stator 12 as it was before the breaking of the coupling 15. Thus there is no relative axial movement between the slip-rings 17 and the brushes 26. The endwise movement of the shaft 11 is limited by the engagement of the shoulder 30 on the shaft 11 with the inner end of the bearing 14. But such engagement does not take place until there has been sufficient movement of the shaft 11 to allow the two parts of the broken coupling 15 to clear each other. Upon the substitution of a new coupling 15 and new rods 22 for those which were broken, the shaft 11 and rotor 10 may be forced to the left in any desired manner into the position shown in Fig. 1, and the motor is again ready for normal operation.

Although my invention is here shown as applied to a rotor wound induction motor, it is also especially applicable to other forms of motors or indeed to generators in which slip-rings are used as the current collecting device for the rotating member. It may be also used to advantage in dynamo-electric machines where the collecting device of the rotating member is a commutator.

Many modifications may be made in the precise arrangements shown and described and all such which do not involve a departure from the spirit and scope of my invention I aim to cover in the following claims.

What I claim as new is:—

1. In a dynamo-electric machine, a fixed element, a rotatable element axially movable relatively to said fixed element, and a collecting device rotatable with said rotatable element but substantially axially fixed relatively to said fixed element.

2. In a dynamo-electric machine, a fixed element, a relatively rotatable element, said rotatable element being slidable axially relatively to said fixed element, means for preventing such relative sliding save upon the occurrence of predetermined abnormal conditions, a collecting device rotatable with said rotatable element, brushes fixed relatively to said fixed element and coöperating with said collecting device, and means for preventing relative movement of said collecting device and said brushes when said rotatable element is moved axially relatively to said fixed element.

3. In a dynamo-electric machine, a shaft axially movable under predetermined conditions, a rotatable element fixed on said shaft, a sleeve on said shaft, a collecting device fixed on said sleeve and electrically connected to said rotatable element, a feather between said sleeve and shaft, brushes cooperating with said collecting device, and means for preventing axial movement of said sleeve and collecting device upon axial movement of the shaft and rotatable element.

4. In a dynamo-electric machine, a shaft, a rotatable element mounted on said shaft, a sleeve on said shaft, a collecting device fixed on said sleeve and electrically connected to said rotatable element, a mechanical connection between said sleeve and shaft which allows them to move relatively only axially of the shaft, brushes coöperating with said collecting device, and means for preventing axial movement of said sleeve upon axial movement of the shaft and rotatable element.

5. In a dynamo-electric machine, fixed and rotatable elements, a collecting device electrically connected to the rotatable element, a shaft carrying said rotatable element and said collecting device and slidable endwise relatively to said fixed element and said collecting device, and means for preventing the shaft from so sliding save under predetermined conditions.

6. In a dynamo-electric machine, a stator, a rotor, and a plurality of slip-rings connected to said rotor windings and movable only axially relatively to the rotor and only rotatively relatively to the stator.

7. In a dynamo-electric machine, a stationary element, a relatively rotatable element, a collecting device rotatable with said rotatable element, means for preventing

axial movement of said rotatable element under normal conditions, said means being inoperative under predetermined abnormal conditions, and means for preventing axial movement of said collecting device when the rotatable element moves axially.

8. In a dynamo-electric machine, fixed and rotatable elements, a collecting device, a shaft, said rotatable element and said collecting device being mounted on said shaft to rotate therewith, means for preventing endwise movement of said shaft save upon a predetermined abnormal end thrust thereon, and means for preventing endwise movement of said collecting device when said shaft moves endwise.

9. A dynamo-electric machine comprising fixed and rotatable elements, a collecting device, and a shaft, said rotatable element and said collecting device being mounted on said shaft to rotate therewith, in combination with a second shaft which is arranged to break at a predetermined excessive torque, a coupling between said two shafts, means for normally preventing endwise movement of said first shaft, said preventive means becoming inoperative upon the breaking of said coupling, and means for preventing an endwise movement of said collecting device though the shaft carrying it moves endwise.

10. In an electric motor, a stator, a rotor, slip-rings, a shaft, said rotor and slip rings being carried by said shaft and rotatable therewith, means for preventing endwise movement of said shaft save on a predetermined end thrust thereon, and means for preventing endwise movement of said slip-rings when said shaft moves endwise.

11. An electric motor, comprising a stator, a rotor, slip-rings, a shaft, said rotor and slip-rings being carried by said shaft and rotatable therewith, in combination with a second shaft, a coupling between said two shafts which is arranged to break at a torque less than that at which the shafts would break, means for normally preventing endwise movement of said first shaft, said means becoming inoperative upon the breaking of said coupling, and means for preventing endwise movement of said slip-rings when said first shaft moves endwise.

12. In a dynamo-electric machine, the two relatively rotatable elements thereof, and a collecting device axially fixed relatively to one of said elements and rotatively fixed relatively to the other.

13. An electric motor, comprising a stator, a rotor, slip-rings, and a shaft, said rotor and slip-rings being carried by the shaft and rotatable therewith, in combination with a second shaft, a coupling between said two shafts which is arranged to break at a predetermined abnormal torque, a thrust bearing for preventing movement of said first shaft and arranged to yield if the coupling between the two shafts breaks and produces an excessive end thrust, and means for preventing an endwise movement of the slip-rings when said shaft moves endwise.

In testimony whereof I affix my signature, in the presence of two witnesses.

ROBERT B. WILLIAMSON.

Witnesses:
GEO. B. SCHLEY,
FRED J. KINSEY.