J. C. LINCOLN.

CONVERTIBLE MOTOR.

APPLICATION FILED JUNE 26, 1909.

1,018,833. Patented Feb. 27, 1912.

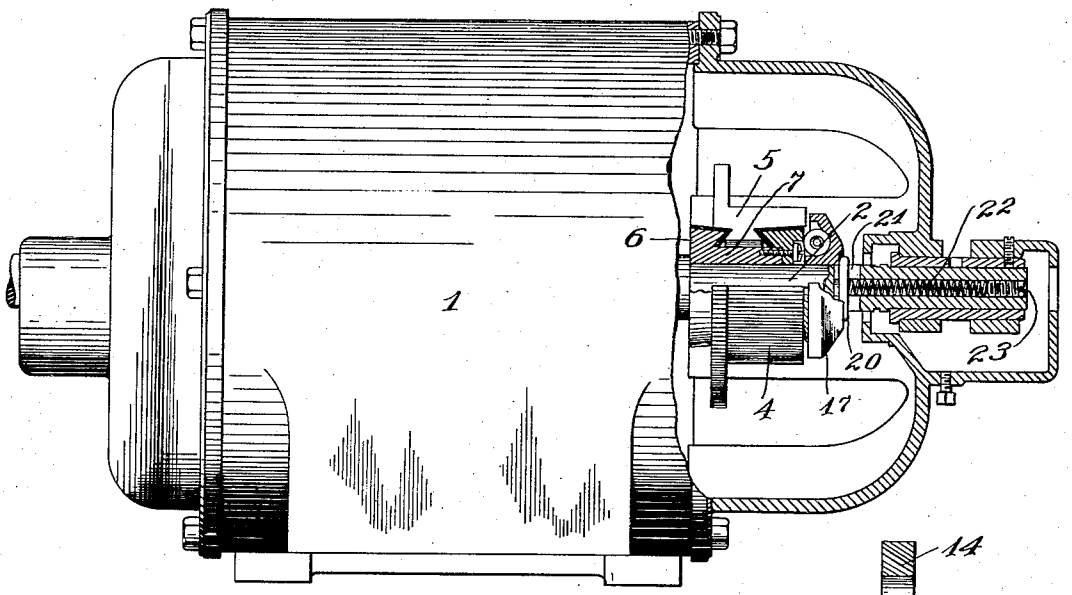

Fig. 1

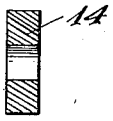

Fig. 4

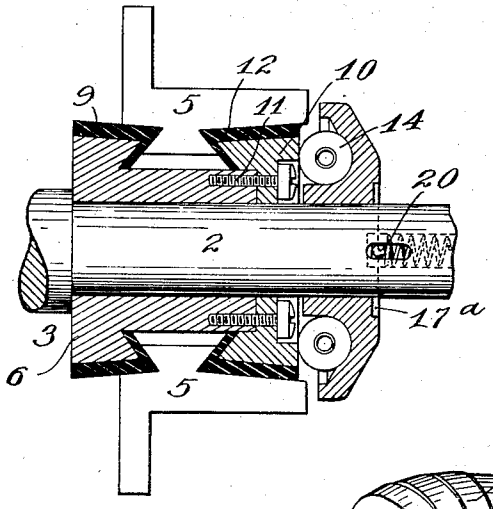

Fig. 2

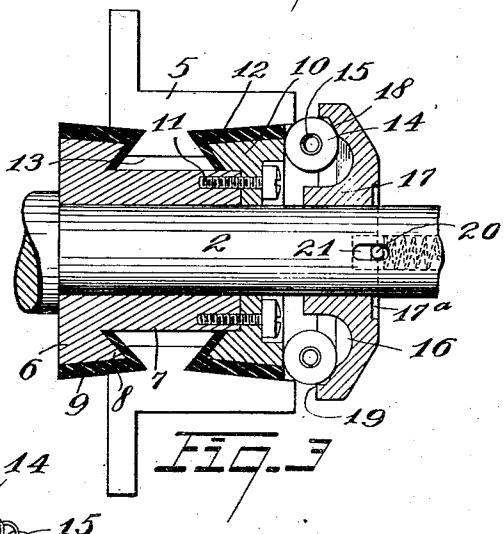

Fig. 3

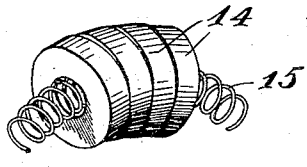

Fig. 5

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CONVERTIBLE MOTOR.

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To all whom it may concern:

Be it known that I, JOHN C. LINCOLN, a citizen of the United States, residing at East Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Convertible Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to motors, and more especially to single-phase motors wherein the principles of repulsion start and induction operation are utilized for the purpose, on the one hand, of obtaining a very powerful starting torque and, on the other hand, after attaining full load speed, of maintaining such speed constant under varying conditions of load. It has been proposed to provide motors of this type with centrifugal governing devices whereby, when the motor has been brought up to the desired speed, by operating on the so-called repulsion principle, it may be automatically transformed to a motor of the so-called induction type.

It is the purpose of this invention to provide a form of governing device which will be so constructed as to permit of a considerable variation in the speed of the motor, after it has been transformed into the so-called induction type, before it is again transformed into the so-called repulsion type.

A further object of the invention is to provide simple and efficient means for adjusting or varying the conditions under which the governor will operate to make the conversion from one type of motor to the other; also to provide a particularly efficient form and construction of device by means of which the commutator may be short-circuited.

With the above objects in view, the invention may be defined further as consisting of the combinations of elements embodied in the claims hereto annexed and illustrated, in one exemplification, in the drawings forming a part hereof, wherein—

Figure 1 represents a side elevation of a motor having my invention applied thereto, part of the motor casing being broken away; Figs. 2 and 3 represent sectional details of the rotor shaft, commutator and governing device, showing the latter device in the two extreme positions which it assumes; Fig. 4 is a sectional detail of one of the disks making up the short-circuiting ring, and Fig. 5 a detail in perspective of a portion of such ring.

Describing the parts by reference numerals, 1 denotes the casing of a motor of the single-phase type. The motor may be of any standard construction, and details of the same are not illustrated herein.

2 denotes the rotor shaft and 3 a ring or collar thereon which carries the commutator 4, said commutator being made up of a suitable number of segments 5. The collar 3 is made of two parts, one part comprising an integral head 6 and hub 7, the head overhanging the hub, as shown at 8 and being provided with insulating material 9 covering its outer surface and the surface which overhangs the hub.

10 denotes a head, similar to the head 6, which is detachably secured to the end of the hub, as by means of screws 11. The head 10 is constructed similarly to head 6 and is provided with insulating material 12. The heads 6 and 10 provide a dove-tailed annular recess in which the similarly shaped inner ends of the segments 5 fit, an air gap 13 being provided between the inner ends of the segments and the hub 7. By means of the insulating material 8 and 12 and these air gaps, the commutator segments are insulated from the collar 4 and the rotor shaft 2.

As is well known with motors of the type referred to hereinbefore, when the brushes (not shown) are taking current from the commutator, the motor is acting on the so-called repulsion principle and when the commutator is short-circuited the motor is operating mainly on the so-called induction principle. For the purpose of short-circuiting the commutator and causing the motor to operate on the latter principle when it has reached a predetermined speed, I employ the automatic governor shown herein. This governor comprises generally a device arranged to be operated by centrifugal action to short-circuit the commutator, with means for not only retaining said device but for preventing its operation until the speed which would otherwise be necessary to operate the same has been considerably exceeded; also with means for varying the speed at which the device will be so operated. The construction and operation of this governor will now be described.

The device which is operated by centrifu-

gal action consists of a plurality of disks or members 14 of conductive material, each having a central perforation for the reception of a spiral spring 15 which is threaded through the perforations and holds the disks together while not interfering with their movement toward and away from the rotor shaft. These disks with the annular trough-like retaining collar 17 constitute a conducting ring flexible in part. When the shaft 2 is rotated at relatively low speed the disks are held within the annular groove 16 of the retainer. This groove conforms in shape to the ring formed by the disks 14 and merges at its outer periphery with an inclined surface 18 bounded by an external flange 19. The retainer 17 is pressed toward the commutator and the head 10 by means of a pin 20, which is mounted in a slot 21 in the rotor shaft 2, the pin being retained in a recess 17[a] in the retainer by means of a spring 22 mounted in a bore in said shaft, said bore being provided with a screw 23 by means of which the compression of the spring may be varied.

In starting the motor, it will act on the so-called repulsion principle until the speed of the rotor shaft is sufficiently great to throw the disk ring out of the groove 16. The force tending to hold the short-circuiting ring in the position shown in Fig. 2 is much greater than the force tending to collapse the ring when the parts are in the positions shown in Fig. 3, due to the action of the recess 16. For example in a motor designed for a maximum speed of 1800 revolutions per minute, the shape of the recess 16 and the pressure of the spring 22 may be such that the ring will move out to the short-circuiting position shown in Fig. 3 when a speed of approximately 1600 revolutions is reached and remain in such position until the speed drops to approximately 1200 to 1400 revolutions per minute. This action is advantageous in providing a range of variation in the speed of the rotor shaft 2 in which range the motor may operate on the so-called induction principle without being transformed so as to operate on the so-called repulsion principle.

By adjusting the tension of the spring 22, the speed at which the ring will move outwardly can be correspondingly varied without affecting the variations in speed permitted the motor, after the ring has moved out, before the conversion to the original type will occur. As the brushes are left on the commutator when the ring moves out to the position shown in Fig. 3, the motor will really operate as a combined repulsion and induction motor when the commutator is short-circuited, although the induction motor action will then be greater than the repulsion motor action.

It will be observed that the flange 19 is quite short and that the adjacent ends of the commutator segments overhang the head 10. This insures a contact at two points between the disks comprising the short-circuiting ring and the segment ends. Furthermore, the length of the slot 21 is such as to limit the movement of the pin 20 and retainer 17 away from the commutator and prevent the disks 14 of the short-circuiting ring from moving out farther than shown in Fig. 3.

Having thus described my invention, what I claim is:

1. In a motor, the combination of a rotor shaft, a commutator, a retainer on said shaft having an annular recess or groove therein and a seat outside said groove, and a centrifugal device adapted to be seated in said groove and to move outwardly into said seat and into contact with said commutator.

2. In a motor, the combination of a rotor shaft, a commutator, a retainer on said shaft having an annular recess or groove and a space beyond or outside of said groove, and a flexible conducting ring adapted to be seated in said groove and to be carried into the space outside of the groove and into contact with the commutator by centrifugal action.

3. In a motor, the combination of a rotor shaft, a commutator, a retaining device on said shaft having an annular recess or groove and a seat beyond or outside of said groove and merging with the groove above the bottom thereof, and a conductor adapted to be seated in said groove and to be carried into the seat outside of the groove and into contact with the commutator by centrifugal action.

4. In a motor, the combination of a rotor shaft, a commutator thereon, and means for short-circuiting said commutator, said means comprising a retaining device slidably mounted on the shaft, a spring pressing said device toward said commutator, and a ring interposed between said device and said commutator and adapted to be carried out by centrifugal action to close the circuit between the commutator and the retaining device, there being means whereby such movement of the ring will be prevented until the speed at which the movement would otherwise occur has been materially exceeded.

5. In a motor, the combination of a rotor shaft, a commutator on said shaft, a cage on said shaft adjacent said commutator and provided with an annular groove between the shaft and the commutator, a flexible ring adapted to seat in said groove, means yieldingly pressing said cage toward said commutator, and a retaining flange located externally of said groove and adapted to retain the ring in contact with the commutator.

6. In a motor, the combination of a rotor

shaft, a commutator thereon, a slidable retainer, a centrifugally operative device cooperating therewith and adapted to be moved outwardly to short-circuit said commutator, there being an obstruction past which such device moves for preventing such outward movement of the said device until the speed of rotation at which it would otherwise operate has been materially exceeded.

7. In an electric motor, the combination of a rotor shaft, a commutator, and a device coöperating with said commutator and adapted to be moved radially outward by centrifugal action to short-circuit the commutator, said device comprising a plurality of disks of conductive material, and a retainer having a surface on which said disks may roll outwardly.

8. In a motor, the combination of a rotor shaft, a commutator, and a device adapted to be moved radially outward to short-circuit the commutator, said device comprising a series of perforated disks surrounding said shaft, and a spiral spring extending through the perforations and flexibly connecting said disks, and a retainer having a surface on which said disks may roll outwardly.

9. In a motor, the combination of a rotor shaft, a commutator, a retainer adjacent to said commutator, a short-circuiting device interposed between said retainer and said commutator and adapted to be moved outwardly by centrifugal action to short-circuit the commutator, a spring pressing said retainer toward said commutator, and means for varying the tension of said spring.

10. In a motor, the combination of a rotor shaft, a collar on said shaft, commutator segments on said collar having ends overhanging said collar, a retainer on said shaft, a short-circuiting device interposed between said retainer and said collar and arranged to be moved outwardly by centrifugal action, to engage the overhanging ends of the commutator segments, a spring resisting the movement of the retainer away from the commutator, and means for limiting such movement of the retainer.

11. In a motor, the combination of a rotor shaft, a collar thereon, a commutator on said collar, said commutator comprising a plurality of segments having their ends overhanging said collar, a movable collar on said shaft, said movable collar having a retaining flange projecting toward said commutator, a short-circuiting device interposed between the movable collar and the commutator and arranged to be moved outwardly by centrifugal action to engage the projecting ends of the commutator segments and the flange, a spring forcing said movable collar toward the commutator, and means limiting the movement of the collar away from the commutator against the action of the spring.

12. In a motor, the combination of a rotor shaft, a commutator thereon, a collar on said shaft, a short-circuiting device interposed between the collar and the commutator and arranged to be moved outwardly by centrifugal action to short-circuit the commutator, said shaft being provided with a bore and a transverse slot extending across said bore, a pin in said slot engaging said collar, a spring in the bore operatively engaging the pin, and means for adjusting the tension of said spring.

13. In a motor, the combination of a rotor shaft, a commutator thereon, a collar on said shaft, a short-circuiting device interposed between the collar and the commutator and arranged to be moved outwardly by centrifugal action to short-circuit the commutator, means carried by the collar for limiting the outward movement of the said device, and means limiting the movement of the collar away from the commutator.

14. The combination of a rotor shaft, a commutator thereon, a plurality of short circuiting members adapted to be moved centrifugally to short circuit the commutator, a longitudinally slidable collar on the shaft restraining such centrifugal movement, said collar having a hump on which such members must climb to effect the short circuiting.

15. The combination of a rotor shaft, a commutator thereon, a plurality of members adapted to be moved outwardly by centrifugal force to short circuit the commutator, a spring constrained collar engaging said members and restraining their outward movement, means carried by said collar for augmenting such restraint.

16. The combination of a rotor shaft, a commutator thereon, a plurality of members adapted to be moved outwardly by centrifugal force to short circuit the commutator, a spring constrained collar engaging said members and restraining their outward movement, said collar having an annular recess which said members may occupy, and an annular rib in such recess augmenting the restraining action of said members.

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

JOHN C. LINCOLN.

Witnesses:
J. B. HULL,
A. J. HUDSON.