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2,997,559

GOVERNOR

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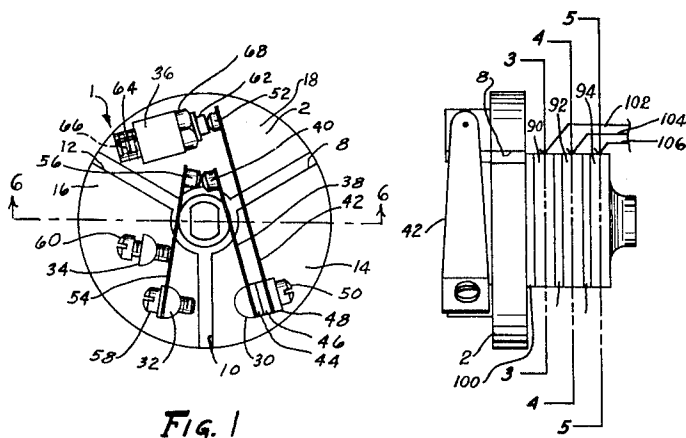


Fig. 1

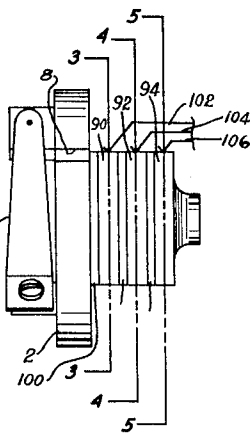


Fig. 2

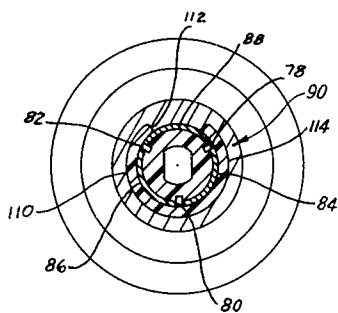


Fig. 3

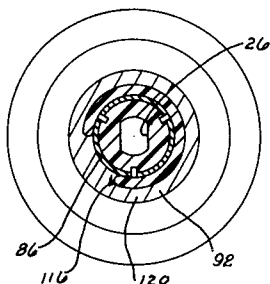


Fig. 4

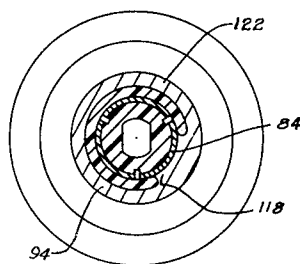


Fig. 5

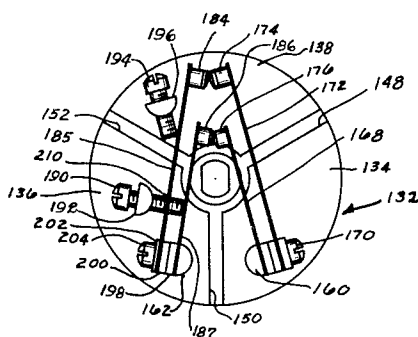


Fig. 6

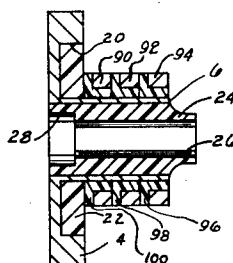


Fig. 7

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2,997,559
GOVERNOR

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This invention relates to an improved speed regulating device or governor for a motor. The invention is more particularly concerned with the provision of an improved speed regulating device which is capable of causing the motor to run at any one of several pre-selected speeds.

Various devices have been suggested to govern a motor at several different speeds. In one of such devices, springs or reed members have been employed which carry one of a pair of contact members, and which are adapted to swing out of contact under the action of centrifugal forces. By arranging a plurality of such contact elements on a rotating disc mounted on the end of a motor, and by employing springs having varying strengths; the governor has been capable of controlling the speed of the motor at several levels, in dependence upon the varying strengths of the spring contact members. Such an arrangement has placed the pairs of contact members at the same radial distance from the axis of rotation of the disc. Once the spring members are selected and mounted in the governor unit, the various levels of speed at which the governor operates are fixed, and the control speeds cannot be adjusted other than by switching a different pair of contact members in the governing circuit or else by disassembling the unit and substituting different spring members for those previously assembled.

In another governor unit which effects the governing of a motor at a plurality of selectively adjustable speeds, a similar plurality of spring contact members were mounted at equal radial distances from the axis of rotation of a rotative disc, mounted on the end of a motor; and the various springed elements were adjusted to separate at different speeds by adjusting the flexural stress on the spring by means of a set screw which bears against the spring member. In such a device the range of speeds is relatively limited since the amount of flexure which can be imparted to the spring element is restricted due to the possibility of the spring member assuming a set when it is held flexed beyond a certain limit for an undue period of time.

It is therefore one object of the invention to provide a governor unit, especially adapted for governing motors at several pre-selected speeds, wherein the range of speeds capable of being governed are adjustable over a wide range. A further object of the invention is to provide a novel commutator construction for a governor unit. Another object of the invention is to provide a speed governor for electric motors of the automatic breaker type which is simple in construction and efficient in operation. Other objects and advantages of the present invention will become readily apparent upon reference to the detailed description following hereinafter and also to the accompanying drawings, in which:

FIGURE 1 is a top view of one embodiment of the governor unit;

FIGURE 2 is a side view of the governor unit of FIGURE 1;

FIGURES 3-5 are sectional views taken along lines 3-3, 4-4, and 5-5 of FIGURE 2, respectively;

FIGURE 6 is a cross-sectional view taken along lines 6-6 of FIGURE 1; and

FIGURE 7 is a top view, similar to FIGURE 1, but of another embodiment of the invention.

In the governor unit of the invention a plurality of contact elements, one of each elements including a springed member bearing a contact at one end thereof; are mounted

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so that the contact sections of each pair of contact elements are disposed at differing radial distances from the axis of rotation of the member upon which they are mounted. In this manner, the contacts will separate at different rotational speeds in view of the fact that differing centrifugal forces are being applied to cause the contact elements to separate due to their different radial positions with respect to the center of rotation of the governor disc.

The governor is generally designated by the reference numeral 1 in FIGURE 1. The governor comprises a generally disc-like member 2 which is adapted to be mounted upon the shaft of a motor, or other rotating shaft, whose speed is to be governed, wherein the rotation is controlled by electrical means. The disc-like member 2 comprises a body of electrically conductive material, having an upper flange portion 4 and a depending skirt or cylindrical sleeve portion 6 (see FIGURE 6). The member 2 is slotted in three places, as at 8, 10 and 12; and these slots electrically isolate the segments 14, 16 and 18, one from the other. The slots 8, 10 and 12 extend partially into the skirt portion 6. A recess or cut-away portion 20 is formed on the underside of the flange 4, and an electrically non-conductive material is molded or otherwise integrally formed in this cavity 20. This material 22 fills the cavity 20, the slots 8, 10 and 12, and also forms in inner substantially cylindrical portion 24. The center of the portion 24 may be formed in an irregular manner (see FIGURES 1 and 3-5) so as to provide a mounting and gripping surface for the shaft of a motor or other device upon which the governor is mounted. A recess 28 is formed during this molding operation to enable the end of the mounting shaft to pass through the sleeve portion 24 and into the recess 28 where appropriate retaining means may be mounted on the end of such shaft to retain the governor thereon. Integrally formed on the flange 4 are the posts 30, 32, 34 and 36. The post 30 is in electrical communication with the segment 14, the posts 32 and 34 are in electrical communication with the segment 16, and the post 36 is in communication with the segment 18. Mounted on the post 30 is a spring or reed member 38, the outer end of which carries a contact element 40. Also mounted on the post 30 is another spring or reed member 42, which is spaced from the reed 38 by one or more spacers 44 and 46, and the member 42 is retained on the post 30 by a spacer 48. The screw 50 or other fastening means holds the two reeds 38 and 42 onto the post 30. The reed 42 carries at its outer end a contact element 52.

Mounted to the post 32 of the segment 16 is another reed or spring member 54, which carries at its outer end a contact member 56. The reed 54 is mounted to the post 32 by a screw or other fastener 58. The contact member 40 and 56 are juxtaposed to be in engagement. The flexure of the spring member 54 is controlled by a set screw or other fastener 60, which is threaded through the post 34 on the segment 36, the inner end of the screw 60 bearing against the spring member 54. As is readily understood, when the screw 60 is advanced or retracted, the flexural stress on the spring 54 is altered so that the speed-setting of the pair of contacts 56, 40 may be adjustable.

The post 36 on the segment 18 carries a contact element 62 which is adapted to engage the element 52 mounted on the reed 42. This contact element 62 is adjustable towards or away from the contact 52 by being mounted at the end of an externally threaded member 64, which can be advanced or retracted through the post 36 by means of an appropriate tool which enters a recess 66 at the outer end of the member 64. A lock nut 68 is mounted on the inner end of the member 64 to enable the retention of the contact 62 in the adjusted

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position after the element 64 is moved into the desired position. The contacts 52 and 62 make up the second set of contact elements. The segment 14 is electrically connected to be common to both sets of contacts 52-62 and 40-56. When the governor is used in connection with a motor the segment 14 is electrically connected to one of the motor armature brushes. The contact 56 is electrically connected to the segment 16 through the reed 54, and the contact 62 is electrically connected to the segment 18 through the post 36.

The electrical current is conducted to and away from the pairs of contact members by a novel commutator means. As indicated previously, the disc 2 bearing the electrically separated segments 14, 16 and 18 is formed integral with an electrically non-conductive material 22 which fills the recess 20, the inner portion of the sleeve 6, and also the slots 8, 10 and 12 which extend partially down into the sleeve 6. After the electrically non-conductive material 22 is formed integral with the electrically conductive material comprising the disc 2, additional slots 78, 80 and 82 are formed in the composite sleeve or hub formed by the elements 6 and 24. These slots 78, 80 and 82 are interconnected with the slots 8, 10 and 12, respectively. Therefore, the commutator body 2 is comprised of the three electrically separated segments 14, 16 and 18 from which extend three electrically separated sleeve portions 84, 86 and 88. Three commutator rings 90, 92 and 94 are mounted on this sleeve-like extension of the disc body 2. These commutator rings are electrically separated from each other and from the disc 2 by electrically non-conductive material which forms washer-like portions 96, 98 and 100. Bearing against the surfaces of the commutator segments 90, 92 and 96 are brushes 102, 104 and 106, respectively. The brushes are only schematically shown in FIGURE 2, and any form of brushes which are per se well known in the art may be employed for this purpose.

The commutator portions may be formed integrally as a unit, or may be separately formed as three identically formed commutator elements wherein an inner surface of each of the commutator elements is arranged to contact one of the segment portions 84, 86 or 88. In the following description the commutator structure is described in connection with the modification wherein the commutator segments are formed in washer-like manner and are then assembled on the sleeve 6 by pressing them thereon. However, it is to be understood that the commutator segments may be integrally formed as one unit. In FIGURE 3 the commutator segment 90 is shown as consisting of an outer electrically conducting portion 110 which has an inwardly extending portion 112, which is adapted to engage one of the segments of the sleeve 6 which are interconnected to the segments 14, 16 and 18 (in this case the segmental sleeve 88 which is an electrical communication with the segment 18). A material 114 which is electrically non-conductive is integrally formed with the electrically conductive material 110 and serves to electrically isolate or space the portion 110 from the remaining electrically conducted segmental portions 84 and 86. FIGURES 4 and 5 show the arrangement of the other two commutator elements wherein the commutator 92 is adapted to be in electrical connection with the segmental skirt portion 86 by means of an inwardly extending portion 116 of the electrically conducting portion 120. Similarly, as shown in FIGURE 5, the commutator 94 is adapted to be in electrical connection with the segmental skirt portion 84 by means of an inwardly extending portion 118 of the electrically conducting portion 122.

It is thus readily seen that when the governor 1 is mounted upon the shaft of a governed unit and the governor rotated, the contacts 52 and 62 will be caused to separate at a given lower speed by centrifugal action and the contacts 40 and 56 will be caused to separate at a higher rotative speed of the disc 2. The unit is adapted to enable the selection of a wide range of speeds

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since the relative radial positions of the contact sections between the contacts 40 and 56 and the contacts 50 and 62 from the axis of rotation of the disc 2 may be changed. Also the strength of the reeds or springs 42, 38 and 54 may be selected. In addition by adjusting the element 60 the flexure on the reed 54 may be adjusted, resulting in a different speed setting. Also, by adjusting the position of contact 62, the speed at which the governor is adapted to govern the motor may be made adjustable.

In the modified form of the invention shown in FIGURE 7, a disc 132 is formed into three segments 134, 136 and 138 which are electrically separated by electrically non-conducting material filling the slots 148, 150 and 152. A post 160 integrally formed with the segment 134 has the two reeds or spring-like members 168 and 172 mounted thereon, and fastened thereto by means of a fastener 170. The reeds 172 and 168 carry contact elements 174 and 176 at the outer ends thereof, respectively. The contact 174 is adapted to engage the contact 184, which is mounted at the outer end of a spring or spring-like element 185. The contact element 176 is adapted to engage another contact element 186 which is mounted at the outer end of a reed or spring-like element 187. The flexure of the ring 187 is adapted to be adjusted by means of a screw 190 mounted through a post 192 which is electrically in connection with the segment 136. The inner end of the screw 190 bears against the reed 187. Similarly, the reed 185 is adapted to have its flexure adjusted by means of a screw 194 mounted on a post 196 which is in electrical connection with the segment 138. The inner end of the screw 194 is adapted to abut against the reed 185. In this modification the reed 187 is in electrical connection with the segment 136 also through the post 162. However, the washers 198, 200 and 202 are of electrically insulating material, and also the reed 185 is electrically separated from the screw 204 by appropriate electrical insulating means. Therefore, the reed 185 is not in electrical communication with the segment 136 through the post 162. The reed 185 has a slot or other opening 210 which is in alignment with the screw 190 to permit ready access thereto and to enable the adjustment of the flexure of the reed 187. The commutator elements used in connection with the embodiment shown in FIGURE 7 may be identical to the commutator arrangement previously described. It is believed that the operation of the governor unit is readily apparent from the description given above, and although the further electrical circuit, in which the contacts are elements in connection with motor elements, is not described in detail, such circuit is deemed to be conventional and no further description thereof is considered necessary.

The invention has been described above in connection with certain specific embodiments, however, it will be obvious to those skilled in the art that modifications may be made thereof without departing from the spirit and scope of the invention.

What I claim is:

1. A governor unit adapted to maintain the speed of a governed unit at one of a plurality of pre-selected speeds, comprising a rotative member, a plurality of pairs of contact members mounted thereon, at least one contact member of each of said pairs being mounted so as to be responsive to centrifugal forces, said pairs of contact members being mounted so that their respective contact sections are disposed at varying radial distances from the axis of rotation of said rotative member.

2. A governor unit adapted to maintain the speed of a governed unit at one of a plurality of pre-selected speeds, comprising a rotative member, a plurality of pairs of contact members mounted thereon, at least one contact member of each of said pairs being mounted so as to be responsive to centrifugal forces, said pairs of contact members being mounted so that their respective contact sec-

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ions are disposed at varying radial distances from the axis of said rotative member, and a commutator means electrically arranged to cooperate with said pairs of contact members comprising a plurality of commutator rings one larger in number than the number of pairs of contact members, each commutator ring including a substantially washer-shaped electrically conductive member, substantially the entire internal diameter of each of which is covered by an electrically non-conductive material but leaving a minor portion of its inner surface exposed for engagement with a conducting member, said rings being out of electrical communication with each other.

3. The governor unit of claim 2 wherein the exposed inner surfaces of the commutator rings are arranged in staggered relationship with respect to each other.

4. A governor unit adapted to maintain the speed of a governed unit at one of a plurality of pre-selected speeds, comprising a rotative member, a plurality of pairs of contact members mounted thereon, at least one contact member of each of said pairs being mounted so as to be responsive to centrifugal forces, said pairs of contact members being mounted so that their respective contact sections are disposed at varying radial distances from the axis of rotation of said rotative member, said rotative member being formed into a plurality of spaced sectors and a conductor sleeve extending therefrom formed into an equal plurality of longitudinally extending spaced sections, a plurality of rings, each including a substantially washer-shaped electrically conductive member, substantially the entire internal diameter of each of which is covered by an electrically non-conductive material but leaving a minor portion of its inner surface exposed for engagement with a section of said conductor sleeve, said rings being out of electrical communication with each other.

5. The governor unit of claim 4 wherein the several rings are integrally formed as a unit and the exposed inner surfaces of the commutator rings are arranged in staggered relationship with respect to each other.

6. A commutator for a governor unit comprising a conductor sleeve formed into a plurality of peripherally spaced-apart longitudinal electrically conducting sections, a plurality of discrete rings mounted upon the sleeve, each ring including a substantially washer-shaped electrically conductive member, substantially the entire internal diameter of each of which is covered by an electrically non-conductive material but leaving a minor portion of its inner surface exposed for engagement with a section of said conductor sleeve.

7. The commutator according to claim 6 wherein the exposed inner surfaces of the commutator rings are arranged in staggered relationship with respect to each other and upon the conductor sleeves, with each exposed inner surface of a ring being in contact with a different longitudinal sleeve section.

8. In a governor unit having a disc formed into a plurality of spaced sectors and a conductor sleeve extending therefrom formed into an equal plurality of longitudinally extending spaced sections, a plurality of rings, each including a substantially washer-shaped electrically conductive member, substantially the entire internal diameter of each of which is covered by an electrically non-conductive material but leaving a minor portion of its inner surface exposed for engagement with a section of said conductor sleeve, said rings being out of electrical communication with each other.

9. The governor unit of claim 8 wherein the several rings are integrally formed as a unit.

10. A governor unit adapted to maintain the speed of a governed unit at one of a plurality of pre-selected speeds, comprising a rotative member formed into at least three electrically conductive sectors out of electrical communications with one another, at least two pairs of contact members being mounted on said rotative member with one contact member of each pair being in electrical

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communication with the same sector and the remaining contact member of said pairs of contact members being in electrical communication each with a different sector, at least one contact member of each of said pairs consisting of a cantilevered flexible element bearing a contact section at its outer end which is thus responsive to centrifugal forces, said pairs of contact members being mounted so that their respective contact sections are disposed at varying radial distances from the axis of rotation of said rotative member.

11. The governor unit of claim 10 wherein at least one pair of contact members consisting of a pair of cantilevered flexible elements each bearing a contact section at its outer end with one flexible element so mounted as to be responsive to centrifugal forces, and the other flexible element being restrained against movement in response to centrifugal forces.

12. The governor unit of claim 11 wherein both pair of contact members consist of a pair of cantilevered flexible elements each bearing a contact section at its outer end with one flexible element so mounted as to be responsive to centrifugal forces, and the other flexible element being restrained against movement in response to centrifugal forces.

13. The governor unit of claim 10, having in combination therewith a commutator means cooperating with said pairs of contact members, comprising a plurality of commutator rings equal in number to the number of sectors of said rotative member, each commutator ring including a substantially washer-shaped electrically conductive member, substantially the entire internal diameter of each of which is covered by an electrically non-conductive material but leaving a minor portion of its inner surface exposed for engagement with a conducting member, said rings being out of electrical communication with each other.

14. The governor unit of claim 13 wherein the exposed inner surfaces of the commutator rings are arranged in staggered relationship with respect to each other.

15. The governor unit of claim 13 including a conductor sleeve extending from said rotative member and formed into a plurality of longitudinally extending spaced sections, a plurality of rings, each including a substantially washer-shaped electrically conductive member, substantially the entire internal diameter of each of which is covered by an electrically non-conductive material but leaving a minor portion of its inner surface exposed for engagement with a section of said conductor sleeve, said rings being out of electrical communication with each other.

16. The governor unit of claim 15 wherein the several rings are integrally formed as a unit, and the exposed inner surfaces of the commutator rings are arranged in staggered relationship with respect to one another.

17. A governor unit adapted to maintain the speed of a governed unit at one of a plurality of pre-selected speeds, comprising a rotative member formed into at least three electrically conductive sectors out of electrical communication with one another, at least two pairs of contact members being mounted on said rotative member with one contact member of each pair being in electrical communication with the same sector and the remaining contact member of said pairs of contact members being in electrical communication each with a different sector, at least one contact member of each of said pairs consisting of a cantilevered flexible element bearing a contact section at its outer end which is thus responsive to centrifugal forces, said pairs of contact members being mounted so that their respective contact sections are disposed at varying radial distances from the axis of rotation of said rotative member, said sectors including a conductor sleeve extending from said rotative member and formed into a plurality of longitudinally extending spaced sections.

18. A commutator ring, comprising a thin substantially

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washer-shaped discrete member, the outer circumference thereof being formed of a continuous annulus of electrically conductive material, substantially the entire internal diameter of which is formed of an electrically non-conductive material, the conductive material extending radially inward to occupy a minor portion of the internal diameter of said ring and adapted for conductive engagement with an electrically conducting member.

19. A commutator segment comprising a plurality of stacked integrally formed commutator rings, each ring comprising a thin substantially washer-shaped discrete member, the outer circumference thereof being formed of a continuous annulus of electrically conductive material, substantially the entire internal diameter of which is formed of an electrically non-conductive material, the conductive material extending radially inward to occupy a minor portion of the internal diameter of said ring and adapted for conductive engagement with an electrically conducting member, said rings being out of electrical communication with one another.

20. The commutator segment of claim 19 wherein the conductive portions of the inner surfaces of the commu-

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tator rings are arranged in vertically staggered relationship with respect to each other so that no two of such inner surface portions lie vertically above each other.

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