

Sept. 9, 1952

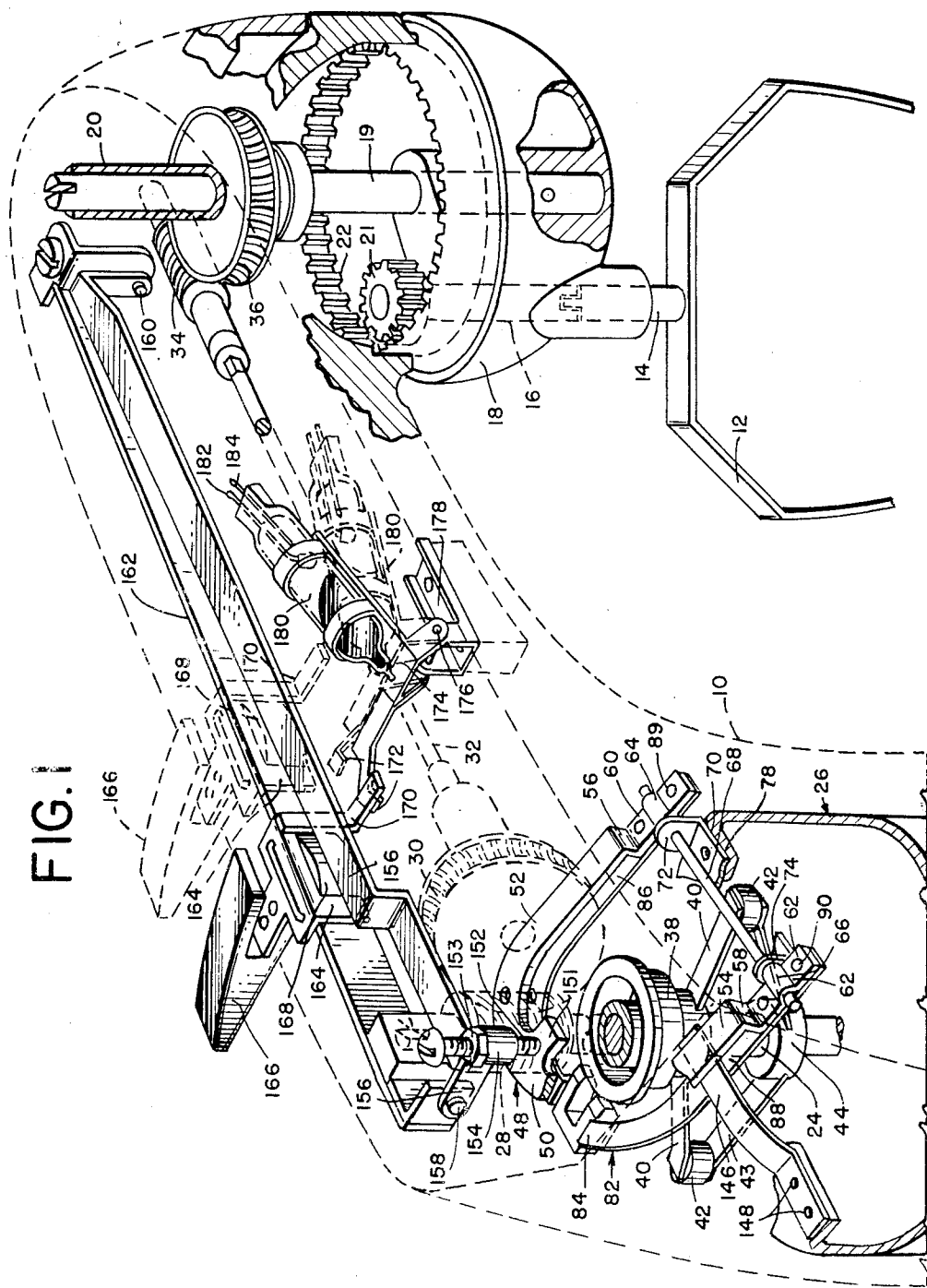
W. VAN GUILDER

2,610,269

GOVERNOR SWITCH MECHANISM

Filed Feb. 27, 1950

2 SHEETS--SHEET 1



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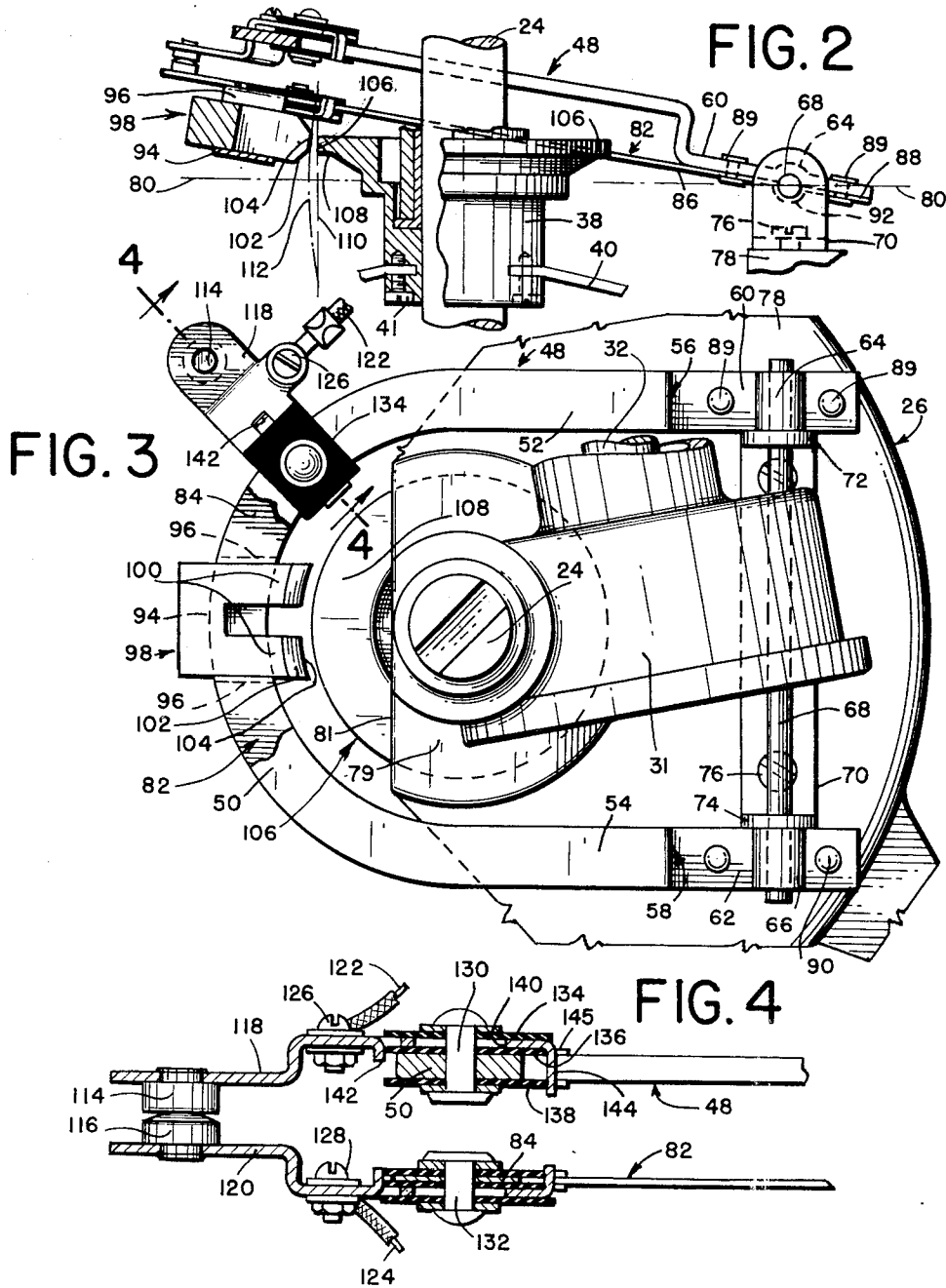
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE

2,610,269

GOVERNOR SWITCH MECHANISM

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12 Claims. (Cl. 200—80)

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This application relates to improved speed control mechanism for a rotating shaft, and more particularly to improved governor switch mechanism for use in a household food mixer or other appliance.

Many constructions have been proposed in the past for controlling the energization of a power source, such as an electric motor, in order to maintain the speed of rotation of a power or motor shaft at the desired point. Such control devices have generally been constructed in one of two types. In the first type, centrifugally displaceable members have been mounted directly on the rotating shaft to be controlled and the particular electric switch mechanism designed to effect the control has also been mounted on one of the rotating parts. Such an arrangement necessitates the use of brushes and collector rings to complete the electrical circuit between the switch contacts on the rotating shaft and the stationary parts of the motor circuit.

In the second type of construction a relatively displaceable governor member on the motor shaft has engaged directly against a movable speed control member mounted on an adjacent stationary part. In this case the separately mounted speed control member is utilized to control the desired switch contacts. In this type of construction there has been the definite problem of securing efficient mechanical coupling between the governor member on the motor shaft and the separately mounted speed control member, without at the same time encountering the disadvantages of undesirable friction and wear of the parts, particularly where the shaft is designed for high speed operation.

With these problems of the prior art in mind, it is accordingly one object of the present invention to provide an improved governor or speed control mechanism.

Another object is the provision of a speed control mechanism for a rotatable shaft, in which a relatively displaceable governor member on the rotating shaft is magnetically coupled to an independently mounted speed control member adjacent the shaft.

A still further object is the provision of a governor mechanism in which a displaceable member on the rotating shaft is effectively coupled to an independently mounted speed control member without actual physical contact or friction between the parts.

A further object is the provision of an improved governor mechanism embodying magnetic coupling between the parts and in which the

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structural arrangement and location of the parts contribute to the efficiency and ease of construction of the device.

Another object is the provision of an improved combination of working parts in a governor or speed control mechanism.

Other objects and advantages will be apparent from the following specification in which a preferred embodiment of the invention is described.

In the drawings forming a part of this application,

Figure 1 is a schematic perspective view (with certain portions broken away and other parts shown only in dotted outline for clearness) of a portion of a household food mixer embodying speed control mechanism according to the invention.

Fig. 2 is a partial side view, with certain portions broken away, showing details of the coupling between the movable governor member on the motor shaft and the independently mounted speed control member.

Fig. 3 is a partial top view of the governor mechanism of Figs. 1 and 2, and

Fig. 4 is a sectional view on the line 4—4 of Fig. 3.

As shown in the drawings, the invention has been illustrated in connection with a household food mixer which includes a casing 10 on which a suitable beater 12 is supported. In the present case the shaft 14 of beater 12 is coupled in driving engagement with a planetary shaft 16 rotatably mounted in an offset position on the planetary head 18 carried by vertical shaft 19. Shaft 19 is supported in bearings 20 in the casing 10. A pinion 21 on the beater drive shaft 16 engages a fixed internally toothed gear 22 in the casing to provide the desired rotation of beater 12 while the beater shaft 14 also revolves around the axis of shaft 19.

Shaft 19 is operatively connected to the shaft 24 of a suitable electric motor or similar power source 26 located in another portion of the casing. While any desired mechanical coupling may be provided between the parts, Fig. 1 shows schematically and in dotted outline the provision of a suitable worm 28 on the motor shaft cooperating with a gear 30 on an intermediate shaft 32. Gears 28 and 30 are housed within a suitable gear casing 31 above the motor and within the main casing 10 of the mixer. Shaft 32 in turn carries a worm 34 in driving engagement with a further gear 36 on shaft 19. Thus the rotation of motor shaft 24 is transmitted, with suitable

speed reduction, to the main shaft 19 of the planetary head.

The motor shaft 24 in this instance constitutes the rotatable shaft, the speed of which is to be controlled according to the present invention. On this shaft a governor member 38 is mounted for relative displacement in accordance with the different speeds of rotation of the shaft. In the preferred form of the invention, this governor member 38 is designed for relative axial movement along the shaft in response to changes in speed. For this purpose the governor member 38 is carried by radial arms 40 to which it is fastened by screws 41 (Fig. 2). As shown in Fig. 1, the outer ends of the arms 40 are connected to the governor weights 42. The weights 42 are further connected by additional arms 43 to a collar 44 which rotates with motor shaft 24 and is fixed longitudinally with respect to the shaft.

In this standard type of governor arrangement, the weights 42 tend to move radially outwardly as the speed of rotation of shaft 24 is increased. This outward movement of the weights 42 then draws the governor member 38 axially down toward the fixed collar 44 on shaft 24. The governor arms 40 are spring biased so that as the speed is reduced, the governor member 38 is resiliently urged back up along the shaft to its normal or rest position.

A first speed control member designated generally at 48 is independently mounted near the motor shaft and governor member in the following manner. In its preferred form the first speed control member 48 includes a base portion 50 located close to the governor member 38 and two legs 52 and 54, respectively, extending from the base portion on each side of the motor shaft 24. Thus the speed control member is substantially U-shaped. The ends of legs 52 and 54 are downwardly offset as shown at 56 and 58 and terminate in portions 60 and 62, respectively, which are parallel to but spaced slightly below the main portions of the legs. These end portions 60 and 62 are provided with half bearing portions 64 and 66 for engagement with a supporting shaft 68. Shaft 68 in turn is mounted on a supporting bracket 70 which has upwardly turned lugs or ears 72 and 74 provided with openings through which shaft 68 passes. The bracket 70 is fastened by means of screws 76 to the flat top portion 78 of the motor and governor casing or to any desired supporting portion within the casing 10. Above the casing 78 the central portion is extended or projected as shown at 79 (Fig. 3) to enclose the governor member 38. One side of this upwardly projecting casing portion 79, however, is left open as shown at 81 (Fig. 3) so that one edge of the governor member 38 may project in operative relation toward the base of the U-shaped speed control member 48.

As shown in Figs. 1-3, inclusive, the axis of supporting shaft 68 for speed control member 48 is spaced a substantial distance away from motor shaft 24. This pivotal axis also lies in a plane which is substantially perpendicular to the motor shaft, this plane being indicated by the line 80-80 in Fig. 2. The purpose and advantages of this particular arrangement of the pivotal axis of speed control member 48 will be described below.

Mounted on the first speed control member 48 is a second speed control member designated generally at 82. This second speed control member or contact arm 82 includes a base portion 84 and

legs 86 and 88 projecting on each side of the motor shaft. Thus the second speed control member or contact arm 82 is also substantially U-shaped and has its base portion and legs located parallel to and just below the corresponding portions of the first speed control member 48. The ends of legs 86 and 88 are riveted at 89 and 90 to the lower surface of the respective ends 60 and 62 of the speed control member. These ends of the contact arm 82 are also provided with corresponding half bearing portions 92 which cooperate with the bearing portions 64 and 66 of the first speed control member to constitute a complete clamp or bearing area for engagement with shaft 68 to support the two speed control members. Member 48 is relatively rigid, while speed control member 82 is somewhat resilient, so that it can be flexed relatively to member 48. In practical effect, however, both speed control members may be regarded as pivotally mounted on the common shaft or axis 68.

In order that the relative axial displacement of the governor member 38 on shaft 24 may be transmitted to the second speed control member or contact arm 82, a magnetic drive connection has been provided according to the present invention. Thus at the base portion 84 of the speed control member 82 there is a downwardly offset supporting portion 94 joined to the rest of the base portion 84 by shoulders 96. Portions 94 and 96 constitute a supporting seat for a small permanent magnet 98 having poles 100 directed inwardly toward the governor member 38. The inner ends of these poles are tapered as shown at 102 to provide relatively narrow vertical faces 104. Immediately opposite the narrow faces or ends 104 of the magnet poles 100, the governor member 38 has a projecting annular portion 106 of good magnetic permeability and low retentivity, which has a vertical rim 108 of substantially the same vertical thickness as the vertical thickness of the pole faces 104. As indicated in Fig. 3, the pole faces 104 are also arcuately shaped in a transverse plane, to correspond to the curvature of the rim 108 of the annular governor portion 106.

As illustrated in Fig. 2, the arrangement and operation of this portion of the mechanism are as follows: Governor member 38 is shown in Fig. 2 in its normal or rest position, i. e., the position which it occupies when shaft 24 is stationary.

The magnet pole faces 104 are attracted to the rim 108 of the governor member 38 due to the magnetic permeability of the material from which the rim portion is made. Thus the magnet 98, together with its contact arm or speed control member 82, tends to assume a position in which the magnet is at the closest possible point to the rim 108. This position is illustrated in Fig. 2. Upon the start of rotation of shaft 24 and the gradual increase in speed of rotation of the shaft, the governor member 38 will move axially downwardly as already described, so that the rim 108 of the governor member will move along the path 110 parallel to the axis of shaft 24. Because of the attraction between the pole faces 104 and the rim portion 108, the magnet 98 will tend to follow the control member. Since the speed control member 82 is, in effect, pivoted at the axis of supporting shaft 68, the magnet pole faces 104 will follow a slightly arcuate path as indicated by the dotted line 112.

By location of the axis 68 a substantial distance away from shaft 24, the arcuate path 112 can be made substantially flat so that speed

control member 82 and its magnet 98 can move vertically through a relatively large distance corresponding to the relative displacement of the governor member 38, without critical variations in the air gap between the pole faces 104 and the annular magnetic rim 108. With the initial location of the parts as shown in Fig. 2, the air gap will of course increase slightly as the shaft begins to rotate. As the speed of the shaft 24 is increased, the air gap will reach a maximum at some intermediate speed of the shaft, i. e., where the rim of the governor member reaches the plane 80—80 of axis 68. As the speed increases to a still greater extent, the air gap tends to be reduced slightly.

Obviously the width of this air gap, and the relative spacing of axis 68 from the shaft 24 must be so chosen that the air gap will never be reduced to zero, i. e., the magnet must never come in direct contact with the rim 108, at any point within the operating range of displacement of the governor member 38. Thus the use of a magnetic drive as the sole connection between the governor member 38 and the speed control member 82 provides a construction in which the relative displacement of the governor member can be transmitted to the speed control member with maximum efficiency, but without actual physical engagement between the parts which would cause friction or wear.

While any desired mechanism may be utilized to control the motor shaft speed in accordance with the relative displacement of the governor member 38 and control member 82, the use of an electric switch for this purpose is preferred. This switch includes contacts 114 and 116 located on the respective first and second speed control members 48 and 82. These contacts are carried by brackets 118 and 120 supported on the speed control members at the points where the base of each U-shaped member joins the legs 52 and 86. Contact brackets 118 and 120 are connected to leads 122 and 124 by terminals 126 and 128, respectively. These contact brackets are supported on the speed control members by rivets 130 and are suitably insulated from the rivets and from the speed control members by intermediate layers of electrically non-conducting material.

As shown in Fig. 4, three layers of insulation are provided at each point of connection and are designated 134, 136, and 138, respectively. Layers 134 and 136 are located on opposite sides of the contact bracket 118 and protect the bracket from engagement with either the speed control member 48 or the head of the rivet 130. The additional insulation layer 138 on the lower side of speed control member 48 assists in positioning the contact bracket 118 and prevents electrical contact with it.

The bracket 118 has a relatively large opening 140 at the point through which rivet 130 passes, so that there will be no possibility of electrical contact between the bracket 118 and rivet 130. To insure the maintenance of the proper relative location of the bracket 118 with respect to rivet 130, the bracket carries downwardly extending lugs 142 and 144 which engage notches 145 in one or more of the insulating members or layers 136 and 138. Since these layers have central openings which closely fit the rivet 130, any possibility of relative slippage between the contact bracket 118 and the rivet 130 is avoided. Thus the speed control member 48 is effectively insulated from the contact bracket 118 through-

out operation of the mechanism. Since a similar construction is used for the contact bracket 120 and its support on speed control member 82, the details of construction need not be repeated.

In order that the operating speed at which the switch contacts 114 and 116 will disengage may be predetermined, suitable means are provided for adjusting the initial position of speed control member 48. These means include a resilient member biasing the speed control member in one direction axially of the shaft in combination with an adjustable stop limiting the relative movement in that direction. The resilient member consists of a flat spring 146 engaging the lower surface of one leg 54 of the first speed control member 48 and urging the member 48 resiliently upwardly as illustrated in Fig. 1. This spring member 146 is riveted or otherwise fastened at 148 to the top of the motor casing 26, or to a suitable bracket or ledge in the casing 10. The base portion 50 of the first speed control member 48 includes a projection 151 which is engaged by an adjustable stop 152. This stop is shown in the form of a screw which is threaded in a supporting portion 154 of a longitudinally extending bracket member 156. The actual position of screw 152 may be adjusted for factory or manufacturing purposes by a lock nut 153.

The member 155 is pivoted at 158 and 160 to suitable portions of a longitudinally extending slide 162. The location and orientation of pivots 158 and 160 are such that the main body portion of member 155 is slightly angularly disposed longitudinally with respect to the slide 162.

A manual operating member 164 having a finger piece 166 and a cam surface 168 is mounted on slide 162 and engages the edge of member 156 to rock it about its pivots 158 and 160 upon longitudinal movement of the finger piece 166. This rotation of the member 156 on its pivots 158 and 160 will cause vertical movement of the bearing portion 154 and the screw or stop 152, to predetermine the position of the speed control member 48 which is held against the stop by spring 146. This portion of the control mechanism for predetermining the position of stop 152 is similar to that shown and claimed in my prior copending application, Serial No. 136,572, filed January 3, 1950. Obviously any other form of adjustable stop could be utilized with the present invention to predetermine the position of speed control member 48.

The operating member 164 includes a projection 170 for engagement with a lever arm 172 on a switch supporting bracket 174 pivoted at 176 to a supporting frame 178. A liquid contact switch 180 on the pivoted bracket 174 serves as an "on-off" switch for the motor 26, to which it is connected by suitable leads 182 and 184.

Operation of the present device will be apparent from the foregoing description. Adjustment of the finger piece 166 will determine the vertical position of adjustable stop 152. This in turn will predetermine the position of the relatively rigid speed control member 48 and its contact 114. By the same token, it will also predetermine the initial position of the second speed control member or resilient contact arm 82 which is normally biased upwardly toward the first speed control member with contact 116 against contact 114. Upon energization of the motor circuit and increase in speed of shaft 24, the governor member 38 will be drawn axially downwardly until it reaches a point where its annular rim 108 is opposite the pole faces 104 of magnet 98. Further increase in speed of the motor shaft 24

will then result in downward movement of the magnet 98 and speed control member 82 and will thus move the contact 116 away from contact 114 to break the circuit.

This separation of the contacts 114 and 116 is utilized in any desired fashion to control the motor speed as, for example, by cutting an additional resistance into the motor circuit. As the speed of shaft 24 then decreases slightly, the governor member 38 can move upwardly and the magnet 98 will follow this movement and permit the resilience of member 82 to reclose the switch contacts 114 and 116. Thus the motor will operate at a predetermined speed determined by the initial adjustment of the speed control member 48 and its contact 114.

The construction described above accomplishes the objects of the present invention and has the advantages of efficient operation, absence of friction and wear of the parts, and relative simplicity of construction.

Since minor variations and changes in the exact details of construction will be apparent to persons skilled in this field, it is intended that this invention shall cover all such changes and modifications as fall within the spirit and scope of the attached claims.

Now, therefore, I claim:

1. Governor mechanism comprising a shaft rotatable at different speeds, an annular collar of magnetically permeable material of low retentivity concentrically mounted on the shaft and movable axially thereof in response to changes in the speed of rotation of the shaft, a speed control member independently mounted adjacent the shaft for movement substantially parallel to and coextensive with the range of movement of the collar, means for manual adjustment of the speed control member along said range of movement, a contact arm mounted on the speed control member for relative movement along said range parallel to said shaft, a magnet mounted on the contact arm and having its poles opposite the collar, movement of the collar in response to changes in shaft speed causing corresponding movement of the magnet and contact arm, and a switch having first and second contacts, one of which is located on the contact arm while the other is located on the control member.

2. Governor mechanism according to claim 1 in which the speed control member includes parallel legs on opposite sides of the shaft pivoted at one end on a common axis which is spaced from the shaft and which lies in a plane perpendicular to the shaft with a base portion joining the other ends of the legs on the side of the shaft opposite said axis, and the contact arm includes a similarly oriented base portion and a pair of legs the ends of which are secured to the legs of the control member near said axis, the magnet being mounted on the base portion of the contact arm.

3. Governor mechanism according to claim 2 in which the contact arm is resiliently biased toward the control member, and said means for adjustment of the control member includes a manually adjustable stop on the side of the control member opposite the contact arm, and means resiliently biasing the control member against the stop.

4. Governor mechanism comprising a shaft rotatable at different speeds, an annular collar of magnetically permeable material concentrically mounted on the shaft and movable axially thereof in response to changes in the speed of

rotation of the shaft, a speed control member independently mounted adjacent the shaft for movement substantially parallel to and coextensive with the range of movement of the collar, a magnet mounted on the speed control member and having its poles located opposite the collar, movement of the collar axially of the shaft in response to changes in shaft speed causing corresponding movement of the control member substantially parallel to the shaft, and a switch having a first contact mounted on the control member for movement therewith, a second contact, and means for relative manual adjustment of the second contact with respect to the shaft in a direction parallel to the shaft.

5. Governor mechanism comprising a shaft rotatable at different speeds, a governor member of magnetically permeable material mounted on the shaft and movable axially of the shaft in response to changes in the speed of rotation of the shaft, a speed control member independently mounted adjacent the shaft for movement substantially parallel to said shaft, and a magnet mounted on the speed control member and having its poles closely adjacent the governor member, movement of the governor axially of the shaft in response to changes in shaft speed causing corresponding movement of the control member parallel to the shaft to effect the desired control.

6. Governor mechanism according to claim 5 in which the control member includes a base portion extending transversely of the shaft adjacent the governor member and a pair of legs extending from the base member, one on each side of the shaft, the ends of the legs being pivoted on a common axis spaced beyond the shaft and lying in a plane perpendicular to the shaft, the magnet being located on the base portion.

7. Governor mechanism according to claim 6 in which the magnet poles are spaced from each other in a direction parallel to said common axis, and the governor member includes an annular rim immediately adjacent the poles.

8. Governor mechanism comprising a shaft rotatable at different speeds, a governor member mounted on the shaft for relative displacement in a predetermined path relative to the shaft in response to changes in shaft speed, a speed control member independently mounted adjacent the shaft and governor member for movement substantially parallel to said path, and magnetic drive means constituting the sole driving connection between the governor and speed control members and actuating the speed control member in direct dependence on the shaft speed and in the same direction as the resulting displacement of the governor member.

9. Governor mechanism according to claim 8 in which the governor member is mounted for relative axial displacement on the shaft.

10. Governor mechanism according to claim 9 in which the speed control member is U-shaped, with the legs of the U extending on opposite sides of the shaft and pivoted on an axis spaced from the shaft and lying in a plane perpendicular to the shaft, and with the base of the U adjacent the governor member and on the opposite side of the shaft from said axis, the magnetic drive means being located between the base of the U and the governor member.

11. Governor switch mechanism comprising a shaft rotatable at different speeds, a governor member mounted on the shaft for relative displacement in a predetermined path with respect

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to the shaft in response to changes in shaft speed, a speed control member mounted adjacent the shaft and governor member for movement substantially parallel to said path, switch contacts controlled by movement of the speed control member, and magnetic drive means constituting the sole driving connection between said governor and speed control members and actuating the speed control member and at least one switch contact in direct dependence on the relative displacement of the governor member and in the same direction.

12. Governor mechanism comprising a shaft rotatable at different speeds, a governor member mounted on the shaft for relative displacement along a predetermined path in response to different shaft speeds, a speed control member independently mounted adjacent the shaft for movement substantially parallel to the path of said relative displacement, one of said members having a magnetically permeable portion and the other having magnetic means cooperating with

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said portion but spaced slightly therefrom to constitute the sole driving connection between the members, said magnetic driving connection effectively moving the speed control member along said path in the same direction as the governor member in response to changes in shaft speed, a pair of switch contacts, the position of one of which is controlled by the position of the control member, and means for manual adjustment of the position of the other contact to predetermine the shaft speed at which the switch will operate.

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