No. 831,685. PATENTED SEPT. 25, 1906.

G. B. ROSSMAN.

VARIABLE SPEED DEVICE.

APPLICATION FILED SEPT. 29, 1903.

2 SHEETS—SHEET 1.

Fig. 2.

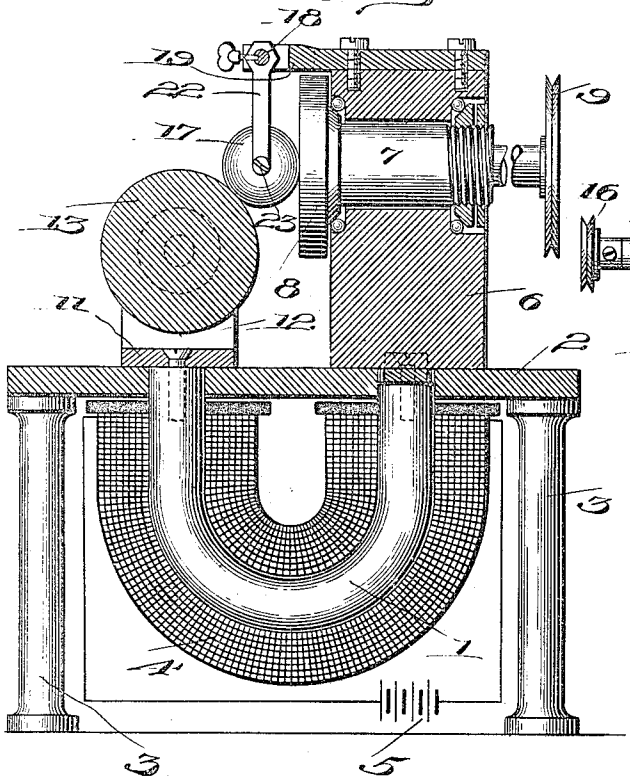



Fig. 3.

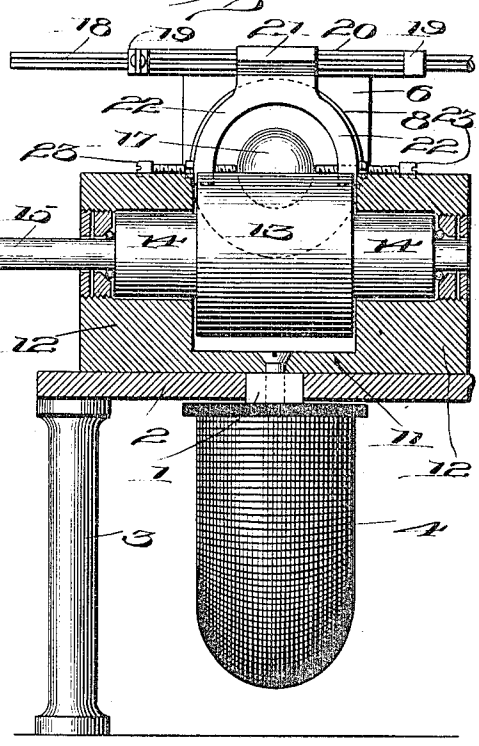
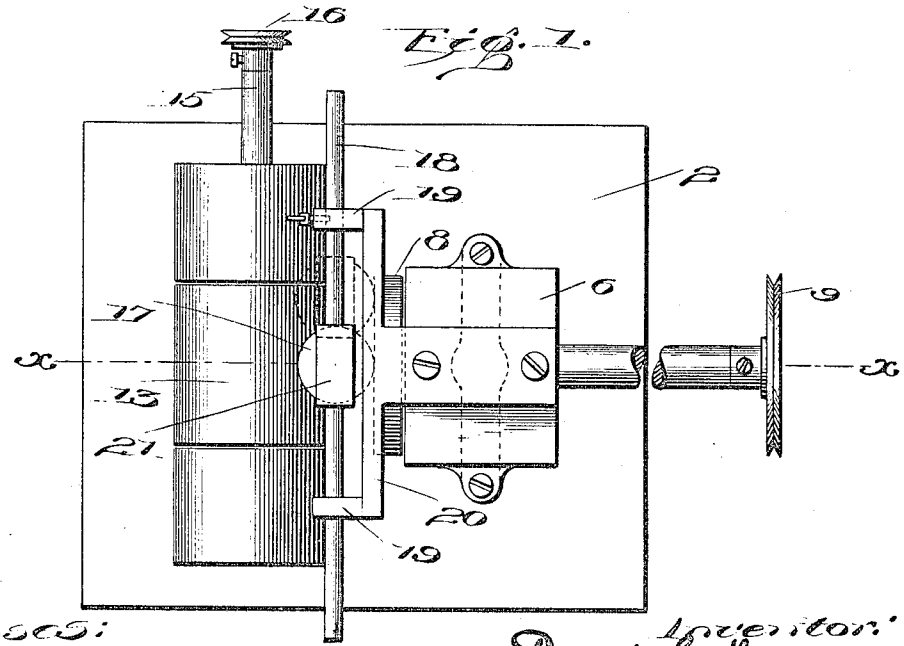



Fig. 1.




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2 SHEETS—SHEET 2.

Fig. 4.

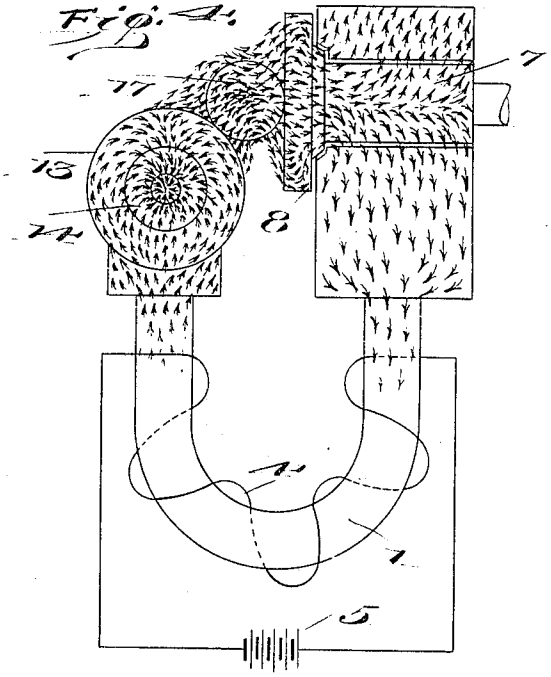
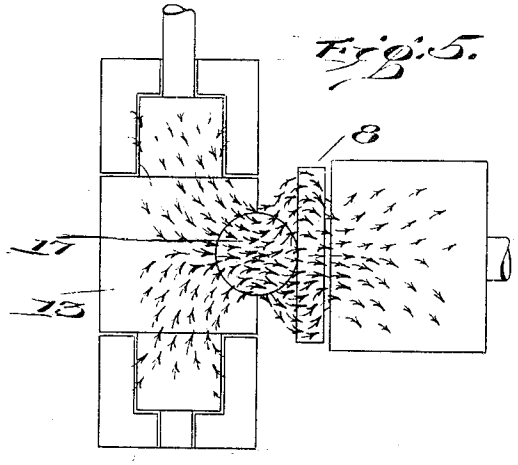



Fig. 5.




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# UNITED STATES PATENT OFFICE.

GRANT B. ROSSMAN, OF NEW YORK, N. Y.

## VARIABLE-SPEED DEVICE.

No. 831,685. Specification of Letters Patent. Patented Sept. 25, 1906.

Application filed September 29, 1903. Serial No. 175,045.

*To all whom it may concern:*

Be it known that I, GRANT B. ROSSMAN, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Variable-Speed Devices, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to variable-speed friction-gears. Its object, in general, is to improve the efficiency and certainty of such variable-speed gears.

A specific object is to increase the efficiency of the device or the transmission ratio thereof by subjecting the contacting frictional members to the influence of a magnetic pull, thereby increasing the friction.

Further objects and advantages will be in part obvious from the following description and in part pointed out.

The invention consists in the features of construction, combinations of elements, arrangement of parts, and means for the utilization of principles, which will be hereinafter fully described, and the novel features thereof pointed out in the claims.

In the accompanying drawings, which illustrate a preferred embodiment of the invention, Figure 1 is a top plan of my improved variable-speed gear. Fig. 2 is a section on line *x x* of Fig. 1. Fig. 3 is an end elevation looking from the left of Fig. 1, with certain parts shown in section. Figs. 4 and 5 are diagrammatic views showing the direction of the lines of force developed by the construction illustrated.

Similar reference characters refer to similar parts throughout the several views.

In the embodiment illustrated in the drawings the invention proposes four main elements of the variable-speed device—to wit, a driving member, a driven member, an intermediate or idler member, and a magnetic circuit. The magnetic circuit is provided by an electromagnet having a U-shaped core 1, suitably supported from a bed-plate 2, which may be mounted on standards 3 if desired, the coil 4 of the electromagnet being supplied with current from a battery 5, or in any other desired way. Mounted above and forming a continuation of the pole of the magnet is a standard 6, which provides a bearing for the spindle 7, carrying a disk 8, which forms the driving member of the variable-speed device. This spindle and disk may be driven by power applied through a sheave 9 or in any other desired way. Mounted above and forming a continuation of the other pole of the magnet is a substantially U-shaped block, the lower cross member 11 of which rests upon the base-plate and the end of the core, while the upright members 12 12 are provided with bearings for the ends of the cylinder which forms the driven member of the variable-speed device. This cylinder is provided with a section 13 of relatively large diameter, sections 14 14 adapted to be journaled in the bearings in the parts 12, and terminates at one end in a spindle 15, carrying a sheave 16, through which or in any other desired way power may be transmitted from the variable-speed device. The third or idler member of the variable-speed device is in the form of a ball 17, which is mounted between the face of the disk and the enlarged section of the cylinder, and may be traversed therealong while being left free to rotate through the movement of a sliding rod 18, mounted in guides 19, carried by a frame 20, secured to the top of the standards 6, such slide-rod carrying a cross head 21, the lower end of which is forked, as at 22 22, to encircle the ball 17, which is held therein, so as to be free for universal rotation, preferably by set-screws 23 23, passing through the legs 22 22.

The operation of such a variable-speed device, which is illustrated only as an embodiment of one of various forms of such devices which might be used, is well understood. Either the cylinder or the disk may be considered the driving member, and power supplied thereto will be transmitted to the other through the intermediate ball, which may be moved to and fro along the face of the disk to vary the effective radius, and when it passes across center to vary the direction, the disk and cylinder being so supported in bearings that the face of the disk is parallel to the axis of the cylinder. It will be seen that through the mounting of the disk and cylinder upon the opposite poles of the magnet said disk and cylinder, which with the various connected parts are of some suitable magnetic material, are magnetized in opposite polarities, the magnetization of the part 13 of the cylinder through the mounting described being such as to give such cylinder a consequent pole, as illustrated by the diagram of Fig. 5, showing the path of the lines of force, such consequent pole causing the lines of force to emerge from the cylinder in the portion where

their pull is desired. It will also be noted that during the movement of the ball, which, magnetically considered, is an armature or keeper extending between the cylinder and disk, such ball remains in substantially an equipotential field and accordingly meets with no magnetic resistance to such movement. Thus the power which provides pressure essential to the driving function of the machine—in other words, the magnetic pull upon the friction elements—is obtained without harmful resistance to the movement constituting the speed-varying function, which harmful resistance would be present if the movement of the ball were not in such an equipotential field. It should be noted also that in this construction I provide for increase of the friction at the surfaces of driving contact without increasing the detrimental friction on the journals of the elements. This is illustrated in Fig. 4, wherein it is shown by the arrows representing the line of force that the pull upon the journals, both at the spindle 7 and at the journals 14, is balanced in all directions. By this construction I am enabled to locate the driving elements of the gear in a field of force, which will very materially increase the friction between such driving elements and the effective transmission ratio thereof without causing any detrimental effect or friction upon the journals of said elements which would reduce the efficiency of the device, while the freedom from resistance to the movement of the idler member, whereby speed variation is secured, gives great scope to the application of the invention.

I believe the enunciation and application of the principles set forth above to be broadly new, and as the result obtained—to wit, the transmission of a substantial percentage of the power supplied, coupled with great facility of speed variation—is very important and represents a marked advance over devices intended to accomplish the same result I am entitled to a broad interpretation of terms both of the specification and claims and the full benefit of all equivalents and variations falling within the extreme scope of the invention. A construction accomplishing to an extent the same results through a different mechanical embodiment is disclosed in my pending applications, Serial Nos. 138,697 and 138,698, both filed on January 12, 1903, but is not claimed therein.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a variable-speed device, a driven member, a driving member provided with a spherical surface, means whereby said driving member may be moved with relation to said driven member in a direction parallel to the axis thereof and magnetic means for holding such members in contact.

2. In a variable-speed device, a driving member and a driven member, one of said members being provided with a curved surface contacting with the other member, and means for rolling one of said members on the other in a substantially equipotential plane of a magnetic field.

3. In a variable-speed device, in combination, a member magnetized to a given polarity, a member magnetized to the opposite polarity, and a member acting as an armature for such members and movable with relation thereto.

4. In a variable-speed device, a driving member, a driven member, means for moving one of said members to vary the speed transmitted, and means for maintaining a substantially equipotential plane of a magnetic field within which such movement takes place.

5. In a variable-speed device, in combination, a driving member, a driven member, and magnetic means for increasing the friction therebetween, said magnetic means exerting substantially equal and opposite forces upon the journals of said members.

6. In a variable-speed device, a member adapted to be driven at a variable speed, a cylinder driven thereby and in contact therewith, and means for setting up a consequent pole in such cylinder such that there may be a magnetic force between said cylinder and driving member.

7. In a variable-speed device, a driving disk, a ball movable across the face of said disk, a cylinder adapted to be driven by said ball supported in a forked bearing, and an electromagnet having one pole contacting with the journal of said disk and the other contacting with said cylinder-bearing.

8. In a variable-speed device, a plurality of relatively movable members having an operative connection therebetween and positioned in a closed magnetic circuit.

9. In a variable-speed device, in combination, a plurality of relatively movable members having an operative connection therebetween and positioned in a closed magnetic circuit, and means whereby said circuit may be magnetized.

10. In a variable-speed device, in combination, a plurality of relatively movable members having an operative connection therebetween and positioned in a closed metallic magnetic circuit, and means whereby said circuit may be magnetized.

11. In a variable-speed device, in combination, a member magnetized to a given polarity, a member magnetized to the opposite polarity and a member acting as an armature for such members and movable with relation thereto and adapted to transmit power from one to the other thereof.

12. In a variable-speed device, in combination, a member magnetized to a given polar-

ity, a member magnetized to the opposite polarity and a member acting as an armature for such members and laterally movable with relation thereto and adapted to transmit power from one to the other thereof.

13. In a variable-speed device, in combination, a driving member and a driven member having an operative connection and positioned in a closed metallic magnetic circuit.

14. In a variable-speed device, in combination, a driving member, a driven member and a member adapted to make an operative mechanical connection between said members, said members being positioned in a closed metallic magnetic circuit.

15. In a variable-speed device, in combination, a rotatable driving member, a rotatable driven member and a movable idler interposed therebetween adapted to contact with said driving member at a variable distance from its axis and simultaneously contact with said driven member a constant distance from its axis.

16. In a variable-speed device, in combination, a rotatable driving member, a rotatable driven member and a movable idler interposed therebetween adapted to contact with said driving member at a variable distance from its axis and simultaneously contact with said driven member a constant distance from its axis said parts being positioned in a closed metallic magnetic circuit.

17. In a variable-speed device, in combination, a rotatable driving member, a rotatable driven member, a member adapted to rest in contact with said members and transmit power from one to the other thereof, and a core connecting the bearings of said first and second members said parts forming a closed metallic magnetic circuit.

18. In a variable-speed device, in combination, a driving member, a driven member the axis of which is at substantially right angles to that of said driving member, a member adapted to make simultaneous connection between portions of one of said members at variable distances from the axis thereof and varying portions of the other of said members at a constant distance from its axis, and magnetic means whereby the pressure between said members is increased.

19. In a variable-speed device, in combination, a driving member, a driven member the axis of which is at substantially right angles to that of said driving member, a member adapted to make simultaneous connection between portions of one of said members at variable distances from the axis thereof and portions of the other of said members at a constant distance from its axis, and means connecting said driving and said driven members, said members and said means forming a closed metallic magnetic circuit.

20. In a variable-speed device, in combination, a driving member having a disk the surface of which is substantially at right angles with the axis thereof, a cylindrical driven member the axis of which is at an angle with that of said driving member, a spherical member resting in contact with said disk and said cylindrical member, means whereby said spherical member may be moved with respect to the axis of said driving member and simultaneously contact portions of said disk at variable distances from the axis of said driving member and contact said driven members at a substantially constant distance from the axis thereof, and means whereby said driving member, driven member and spherical member are connected in a closed metallic magnetic circuit.

21. In a variable-speed device, in combination, a driving member having a disk the surface of which is substantially at right angles with the axis thereof, a cylindrical driven member the axis of which is at an angle with that of said driving member, a spherical member resting in contact with said disk and said cylindrical member, means whereby said spherical member may be moved with respect to the axis of said driving member and simultaneously contact portions of said disk at variable distances from the axis of said driving member and a substantially constant distance from the axis of said driven member, means whereby said driving member, driven member and spherical member are connected in a closed metallic magnetic circuit, and a coil whereby said circuit may be magnetized the movement of said spherical member being in a substantially equipotential plane of the field of said core.

22. In a variable-speed device, in combination, a driving member, a driven member in operative relation thereto, and magnetic means adapted to increase the forces with which said members contact, said driving member being adapted to rotate in two planes, rotation in one of which will drive said driven member and rotation in the other of which will vary the speed at which said last-mentioned member is driven.

23. In a variable-speed device, in combination, a shaft, a driven member, means adapted to transmit power from said shaft to said driven member, said means being adapted to roll into a position in which the relative angular velocities of said shaft and said driven member are changed, and means adapted to develop a magnetic field passing through said driven member and said first-mentioned means.

24. In a variable-speed device, in combination, a shaft, a driven member, means adapted to transmit power from said shaft to said driven member, said means being provided with a spherical surface engaging said driving member, and means adapted to develop a magnetic field passing through said driven member and said first-mentioned means.

25. In a variable-speed device, in combination, a driving member having a spherical surface, a driven member adapted to coact therewith, means adapted to develop a magnetic field passing through said driving and driven members, and means adapted to roll said driving member in a direction transverse to the magnetic flux passing therethrough.

26. In a variable-speed device, in combination, a rotary driving member, a cylindrical driven member, a spherical member interposed between said driving and said driven members and adapted to transmit power from one to the other thereof, means adapted to roll said spherical member toward and away from the axis of rotation of said driving member, and means adapted to develop a magnetic field passing through said spherical member in a direction transverse to that of said rolling movement.

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

GRANT B. ROSSMAN.

Witnesses:
H. M. SEAMANS,
J. B. KNOX.