H. H. CUTLER & F. S. WILHOIT.

ELECTROMECHANICAL VARIABLE SPEED DEVICE.

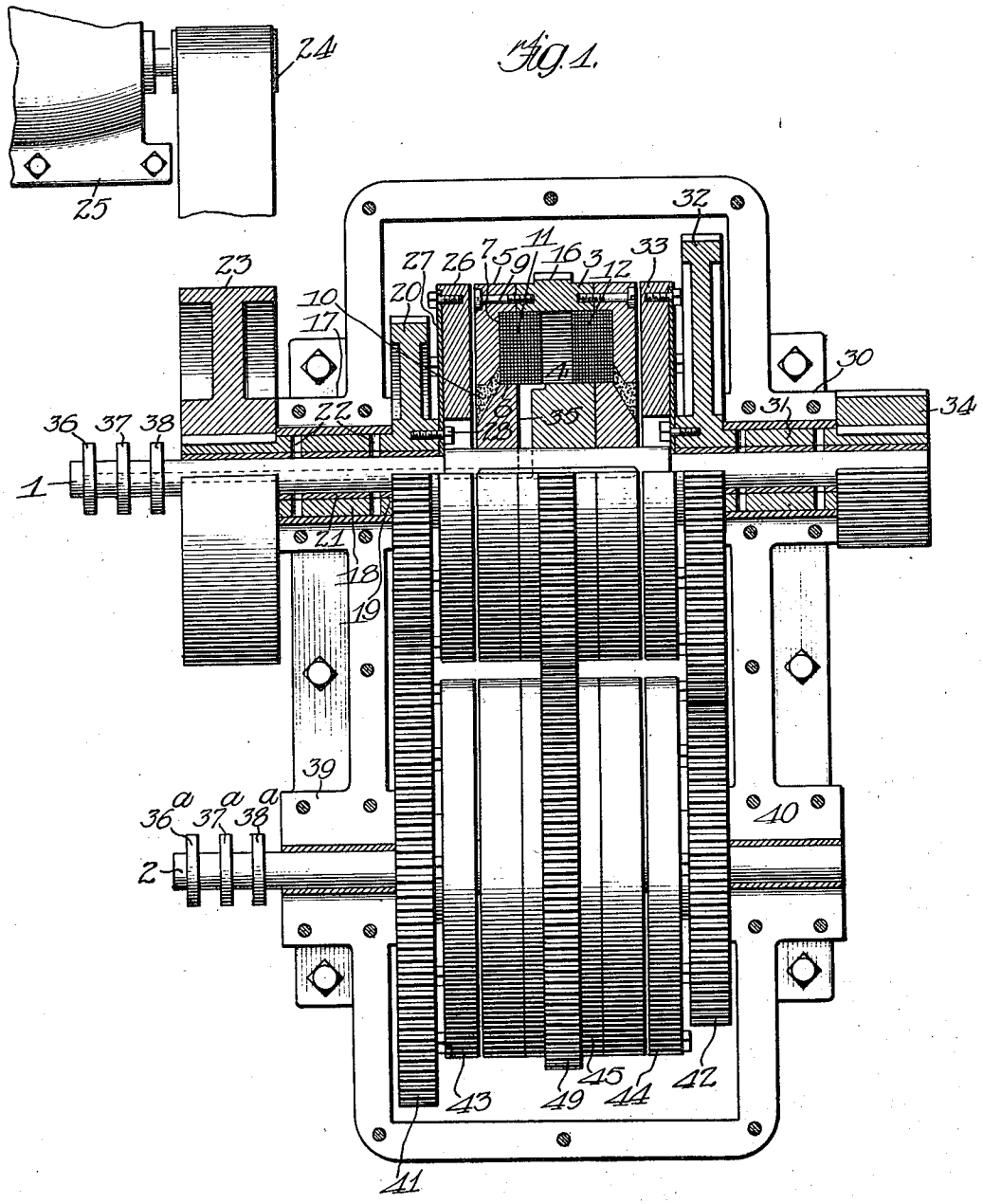
APPLICATION FILED NOV. 30, 1908.

1,122,483.

Patented Dec. 29, 1914.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Robert A. Weir

Frank H. Hubbard

Inventor:

Henry H. Cutler and

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By: Edwin B. H. Tower, Jr.

Atty.

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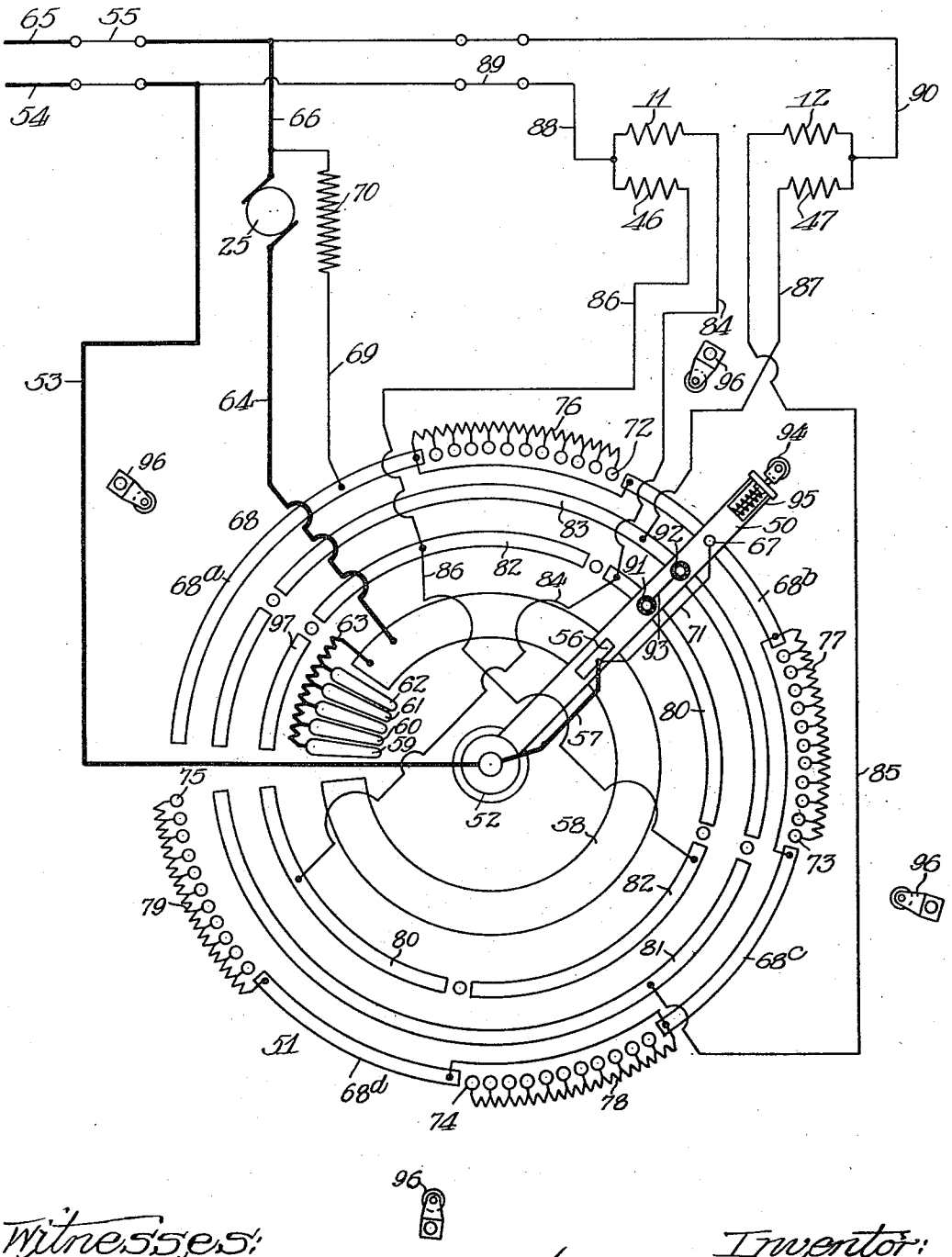
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3 SHEETS—SHEET 2.

Fig. 2.



Witnesses:

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3 SHEETS—SHEET 3.

Fig. 3.

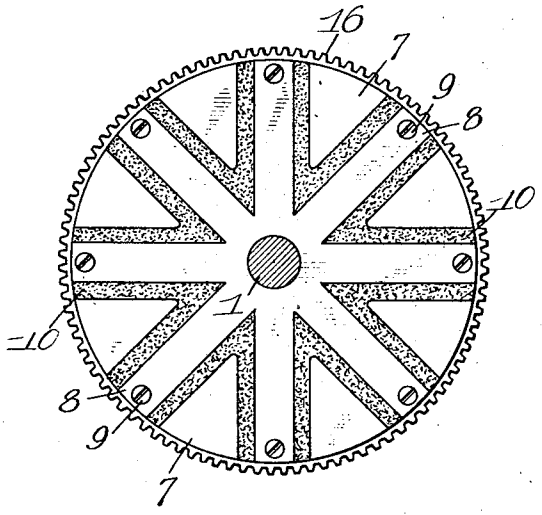


Fig. 4.

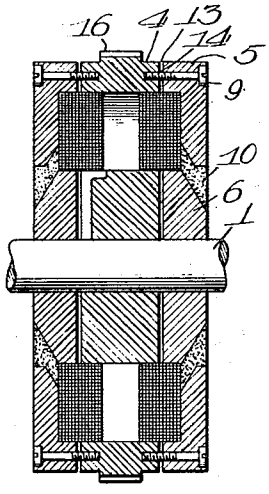
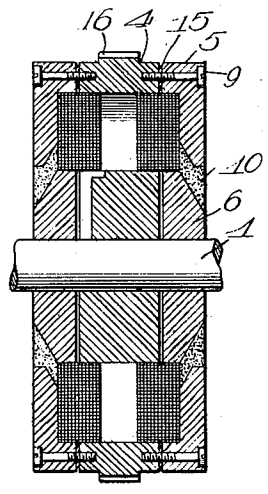


Fig. 5.



Witnesses:
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UNITED STATES PATENT OFFICE.

HENRY H. CUTLER AND FREDERIC S. WILHOIT, OF MILWAUKEE, WISCONSIN.

ELECTROMECHANICAL VARIABLE-SPEED DEVICE.

1,122,483. Specification of Letters Patent. Patented Dec. 29, 1914.

Application filed November 30, 1908. Serial No. 465,165.

To all whom it may concern:

Be it known that we, HENRY H. CUTLER and FREDERIC SHELTON WILHOIT, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Electromechanical Variable-Speed Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to improvements in magnetic clutch power transmitting apparatus, as set forth in our original application, Serial No. 215,198, filed July 2, 1904.

One object of our invention is to provide improved means whereby power may be transmitted from a suitable driving mechanism to the driven mechanism in an efficient and economical manner.

A further object of our invention is to provide means for driving a driven mechanism at several fundamental speeds, differing from each other by comparatively large increments, and a still further object is to provide means whereby we may provide for finer gradations of speed between the fundamental speeds obtained.

The preferred manner in which we accomplish the several objects of our invention is by the provision of a peculiar form of magnetic clutch for changing from one combination of gears to another, and to accomplish the finer gradations of speeds we preferably drive the machine by a motor of any standard make and increase the speed of said motor above the normal by shunt field resistance.

In a patent granted to Henry H. Cutler, April 5, 1905, No. 786,411, is described and claimed an improved form of magnetic clutch or accelerator, which, when used in this device, provides a clutch in which, with the driving member operating at its maximum speed, the driven member under full load may be started from rest and accelerated up to synchronism with the driving member without strain or jar to the machinery.

In the drawings, in which like figures refer to like parts throughout the several figures, Figure 1 is a plan view of our device, showing a portion of the clutch in section; Fig. 2 is a diagrammatic view of the circuits employed in a device of this character; Fig. 3 is a face view of one of the clutch members; Fig. 4 is a sectional view of a modification of the clutch; and, Fig. 5 is a sectional view of still another modification.

In the structure which we have worked out as being the preferred embodiment of our invention, the variable speed device consists of two shafts, 1 and 2, mounted in suitable journals with the several gears, and magnetic clutches mounted thereon. Upon the shaft 1 and suitably keyed thereto is mounted a primary member 3 of a double magnetic clutch. The primary member 3 of the clutch is provided with two magnetic field members, and each field member is of the same general construction as the structure set forth in the patent granted to Henry H. Cutler, before mentioned, consisting briefly of a back plate 4, suitably keyed to the shaft 1, and to the back plates are secured a pair of rings 5 and 6, the ring 5 having inwardly extending polar projections 7 and the ring 6 having outwardly extending polar projections 8, the two sets of poles being arranged in overlapping positions and held in position against the back plate 4 by bolts or screws 9. The space between the pole pieces are filled with non-magnetic material 10, which may be Babbitt metal or other equivalent material. An annular channel is formed in each face of the back plate, and the two sets of rings, 5 and 6, in connection therewith form annular channels for the reception of the annular windings 11 and 12 of the two field magnets. Upon the outer periphery of the back plate 4 are formed gear teeth 16.

The magnet is thus so constructed that the energizing winding is entirely surrounded by iron. Consequently, when the circuit through said winding is completed, the current through the winding and consequently the strength of the magnetic field in the inducing or primary member is retarded, due to the large amount of inductance. The strength, therefore, of the field will increase slowly and thus prevent the sudden acceleration of the driven member of the clutch which has caused such serious objections to magnetic clutches of the ordinary types. Furthermore, the arrangement of the outer and inner rings 5 and 6 provides a field magnet, which is subdivided into a large number of individual magnetic circuits, which aid in causing a rapid disappearance of the residual magnetism in the

armature member. This is due to the fact that the magnetic flux, when the current is admitted to the energizing windings, will start from the poles, which are arranged to have the same polarity, say, the inwardly extending pole pieces, and pass into the armature member, dividing into two parts which flow in opposite directions. One-half of the flux will flow through the outwardly extending pole pieces on one side of the inwardly extending pole pieces and the other half will flow through the outwardly extending pole pieces on the opposite side, and from the pole pieces back to the starting point. The armature member then has flux flowing in adjacent parts in opposite directions, which meet and pass down through the pole pieces without interfering as long as the magnetizing force continues. However, as soon as this force is withdrawn by opening the circuit, the two oppositely flowing fluxes will meet in the armature member in opposition to each other and thereby neutralize each other, causing the residual magnetism to rapidly disappear and the clutch members to instantly release. However, in a clutch of this character, the time lag after current has been cut off, is great enough to make it frequently desirable to eliminate even this small lag and have the clutch release instantaneously, in which case the field magnets are constructed as shown in Figs. 4 and 5, which show a modification of the primary member of our clutch. By interposing an air gap 13 between the back plate 4 and the rings 5 and 6, which may be accomplished in any way, such as the interposition of small washers 14 between the rings, and the contact plate, a magnetic reluctance is inserted in the magnetic circuit whereby the residual magnetism will be caused to instantly disappear when the current is cut off from the energizing coils. Another means for accomplishing this same result is shown in Fig. 5, in which we have shown a thin layer 15 of non-magnetic material or magnetic material of low permeability which will act in the same general manner as the air gap, causing a magnetic reluctance in the magnetic circuit and thereby insuring a quick disappearance of the residual magnetism when the current is cut off from the coils. We have shown in the drawings, the air gap and the layer of non-magnetic material as being greatly enlarged for the purpose of illustration, as in actual practice the air gap of the strip need only be one sixty-fourth of an inch in thickness, which would be sufficient thickness to eliminate the residual magnetism and yet would not be great enough to have any but a very slight effect in decreasing the power of the clutch.

It will be noted that during the operation of the clutch illustrated, the armature rests in mechanical contact with the face of the field magnet member and the air gap is thus entirely eliminated and the reluctance of the magnetic circuit is reduced to a minimum. A continuous frictional surface is thus presented to the armature and, therefore, besides the inductive influence of the field magnet member upon the armature member, a frictional turning effect is also given.

Within the journal 17 of the shaft 1 is mounted a hollow quill 18, through which the shaft 1 passes and which forms a part of the hub 19 of the gear wheel 20. A suitable brass bushing 21 is inserted between the quill 18 and shaft 1, to provide a wearing surface therefor, and openings 22 are formed in the quill for lubricating purposes. Upon the outer portion of the quill 18 is keyed a suitable pulley 23, which is connected by a belt with a pulley 24, mounted on the shaft of the motor 25.

An armature member 26, which in the present instance is of annular form, is secured to one face of a steel disk 27, the inner edge of which is secured by bolts 28 to the hub 19 of the gear wheel 20. Suitably mounted upon the opposite side of the double magnetic clutch, in the bearing 30 of the shaft 1, is a second quill 31 of the same general construction as that just described, which is a part of the hub of the gear wheel 32 and secured to said gear wheel in the same manner as the armature 26 is an armature member 33. Upon the outer end of said quill is mounted a suitable pulley 34, which is adapted to be connected in any manner with the driven mechanism.

Suitable channels 35 are formed in the clutch member, and in the shaft 1, through which the coils 11 and 12 are connected with suitable collecting rings 36, 37 and 38, mounted upon the outer end of the shaft 1.

Preferably mounted in the journals 39 and 40 of the shaft 2 are suitable quills (not shown) of the same structure as those previously described, to which are secured the gears 41 and 42, having secured thereto, as above described, armature members 43 and 44, adapted to be respectively attracted to the primary members of a second double clutch 45, having the same general construction as the primary member 3, and keyed to the shaft 2. The clutch has suitable energizing windings 46 and 47 formed therein, as on the first described primary member. Suitable collecting rings 36^a, 37^a, and 38^a are mounted upon one end of the shaft 2 to which are connected conductors for conveying the current to the magnetic windings 46 and 47 of the double magnetic clutch 45. The member 45 has also formed thereon gear teeth 49.

In Fig. 2 is shown a diagrammatic view of the circuit arrangements for a speed changing device of this character. The op-

erating lever 50 of a controller 51 rotates about a hub 52, which is electrically connected by conductor 53 with the main 54 through a suitable knife switch 55. Carried upon the operating lever 50 is a brush 56, which is electrically connected with the hub 52 by conductor 57, and adapted to bear upon the contact ring 58 and the starting contacts 59 to 62, which contacts are suitably connected with a resistance 63. The contact ring 58 is connected by conductor 64 with one terminal of the motor 25, the opposite terminal thereof being connected with the main 65 by conductor 66. A second brush 67 is mounted upon the lever 50 and adapted to bear upon shunt field contact ring 68, which is connected by conductor 69 with one terminal of the shunt field winding 70, the opposite terminal thereof being connected directly to the main 65 as indicated. The brushes 56 and 67 are electrically connected by conductor 71, and are, therefore, connected with the positive side of the line through conductor 53. The contact ring 68 is divided into sections 68^a, 68^b, 68^c and 68^d, and arranged between the segments are sets 72, 73, 74 and 75, of contact buttons which are connected with segments of the ring 68 through suitable starting resistance 76, 77, 78 and 79, respectively.

The inner terminal of the clutch coils 11, 12, 46 and 47, are connected with contact segments 80, 81, 82 and 83, respectively, the inner terminals of the winding 11 being connected with contacts 80, by conductor 84, the inner terminal of the winding 12 being connected with contact 81 by conductor 85, the inner terminal of the winding 46 being connected with contact 82, by conductor 86, and the inner terminals of the winding 47 being connected with the contact 83 by conductor 87, respectively. The outer terminals of the clutch coils 11 and 46 are connected together and to the main 54 by conductor 88 through the knife switch 89, and the outer terminals of the clutches 12 and 47 are also connected together and with the main 65 by conductor 90 through the knife switch 89. Suitable brushes 91 and 92, connected together by conductor 93, are mounted upon the lever 50, but are insulated therefrom and serve to close the circuits through the respective energizing windings.

In order to prevent the operator from stopping the lever 50 with the brushes 91 and 92 between the several contact segments and thus allow the driven machine to come to rest, the outer end of the lever is provided with a roller 94, having a suitable coil spring 95 for normally pressing the same outwardly. The roller 94 is adapted to engage rollers 96, 96, mounted upon the base upon which the controller is carried, and when the lever 50 engages the same it will be stopped momentarily, just before the brushes 91 and 92 leave one contact ring and as the lever is moved it will then be thrown quickly to the next contact as the roller 94 passes the rollers 96, due to the action of the spring 95.

When the main knife switch 55 is closed, and the lever 50 in such a position that the brush 56 bears upon the first contact 59, current may be traced from the main 54, through conductor 53 to the hub 52 of the lever through the conductor 57 to the brush 56, contact 59 through the resistance 63 to contact ring 58, and thence by conductor 64 through the armature of the motor 25 to the opposite main 65 by conductor 66. At the same time current will flow through the conductor 71, brush 67, contact segment 68^a, conductor 69 through the shunt field winding 70, and thence to the opposite side of the main 65. This starts the motor with all the resistance 63 in series therewith, and as the contact arm 50 is moved in a clock-wise direction, the starting resistance 63 is gradually cut out, as the brush 50 passes successively over the contacts 59 to 62, until the motor will be operating at full normal speed on full field strength. While the brush 56 is being moved over the segments 59 to 62, and until it makes contact with the segment 58, the brushes 91 and 92 will bear upon the insulated segments 97 and none of the clutches will be energized, therefore, with the brush 56 resting on the contact 62, the motor will run at its normal speed without driving the machinery to which the same is geared.

As the lever 50 is moved in a clock-wise direction the brushes 91 and 92 will make contact with the rings 82 and 83, and circuit may then be traced from the main 54 through knife switch 89 through conductor 88, energizing windings 46, conductor 86, contact ring 82, brush 91, conductor 93, brush 92, contact ring 83, conductor 87, through the energizing windings 47, conductor 90, knife switch 89, back to the opposite main 65. With current passing through the energizing coils 46 and 47, the magnetic fields thereof will be energized and the armatures 43 and 44 will be attracted thereto, in which instance the motor 25 will operate the pulley 23 and the gear 20, which in turn will drive the gear 41, and through the double magnetic clutch 45, the gear 42. The gear wheel 42 meshes with the gear 32 and drives the same and the pulley 34 mounted on the hub thereof. Operating in this manner, the slowest speed at which the driven machinery may be operated by the motor 25 is obtained. As the lever 50 is moved still farther in a clock-wise direction, it will successively pass over the set of contacts 72, inserting a resistance 76 in the shunt field circuit of the motor, and thereby increasing the speed of the motor, until at the last contact of this series

the motor will be operating at its maximum speed on weakened field, but still upon the first gear combination. As the lever 50 is moved still farther in the clock-wise direction, the brush 67 will move off the last of the series of contacts 72, and upon the contact segment 68^b, thereby cutting out all shunt field resistances and leaving the motor operating upon normal field strength. At the same time the brush 91 breaks contact with the ring 82, opening the clutch coil circuits and disconnecting the gearing from the motor momentarily, but at the next instant the brush 91 makes contact with the contact segment 80, the brush 92 still being in contact with the segment 83, current will flow from the main 54 through the knife switch 98, through conductor 88, through the clutch windings 11, conductor 84, contact ring 80, brush 91, conductor 93, brush 92, contact ring 83, conductor 87, through the clutch winding 47, and by conductor 90 and switch 89 back to the opposite side of the main 65. With the coils 11 and 47 energized, the armatures 26 and 44 will be attracted to their respective primary members, and, as the motor continues to operate, the gear 20 will be operated by the pulley 23, said gear meshing with the gear 41 will drive the same. However, this gear being loosely mounted upon the shaft 2 will be allowed to rotate loosely thereon and not operate said shaft. Since the armature 26 has been attracted by the energized coil 11, the clutch member 3 and the shaft 1 will thereby be driven at the same speed as that at which the gear 20 is operating. Consequently, the gear 16 meshing with the gear 49 will operate the same together with the clutch member 45 and the shaft 2. Since the winding 47 is energized the armature 44 has been attracted, and the pinion 42 will be driven at the same speed as the shaft 2 and will transmit its motion to the gear wheel 32 and pulley or gear wheel 34, giving a speed somewhat faster than the one previously described. To increase the speed of the driven mechanism with this combination of gears, the operating lever 50 is moved still farther in a clock-wise direction, and the brush 67 is adapted to pass over the second series of terminals 73, thereby inserting the resistance 77 in the shunt field circuit and increasing its speed until the motor again attains its maximum operating speed on weakened field with the brush 67 upon the last of the series of contacts 73. Upon a further movement of the lever 50 the brush 67 will move off of the last of the series of contacts 73 and onto the segment 68^c, thereby cutting out the resistance in the shunt field circuit and the brushes 91 and 92 will break contact with the rings 83 and 80 and make contact with the rings 82 and 81. With the lever in this position circuit may then be traced from the main 54 through the switch 89, conductor 88, through the winding 46, conductor 86, contact 82, brush 91, conductor 93, brush 92, contact 81, conductor 85, through winding 12, and thence by conductor 90 through the switch 89 to the opposite main 65. This closes the circuit through the windings 46 and 12 and causes the armatures 43 and 33 to be attracted to their respective primary members. With the armature members 43 and 33 attracted to their respective primary members, the pulley 23 will operate the gear 20, which in turn will drive the gear 41, which through the clutch 45 will operate the gear 49, transmitting motion to the gear 16, and thence by the attracted armature member 33 to the pulley 34, which will drive the machine at its third speed. The motor will now be operating the machine at an increased speed, that is, at an increased speed through the combination of gears, but the motor itself will be operating at a normal speed. Therefore, when the lever 50 is moved still farther in a clock-wise direction it will pass over the series of contacts 74, inserting resistance 78 in the shunt field circuit, thereby increasing the speed of the motor until finally all the resistance 74 is in the shunt field circuit and the motor will be operating at its highest speed. Upon a still further movement of the lever 50 the brush 67 will pass off the last of the series of contacts 74 and onto the segments 68^d, cutting out the resistance in the shunt field winding and the motor will again be operating at its normal speed. At the same time the brush 91 will pass off contact 82 and engage contact 80 and the circuit may be traced from the main 54 through the switch 89, through conductor 88, through winding 11, through conductor 84, contact 80, brush 91, conductor 93, brush 92, contact 81, thence by conductor 85 through the windings 12, and from thence by conductor 90 and the switch 89 to the opposite main 65. The circuit through the coils 11 and 12 now being completed, the armatures 26 and 33 will be attracted to the primary members and the driven mechanism will be operated at the highest speed attainable through the last combination of gears, the motor driving the pulley 34 directly through the first clutch member 3. Upon a still further movement of the lever 50, the brush 67 will pass over the series of contacts 75, thereby inserting the resistance 79 in the shunt field circuit and the motor will operate at its highest speed.

To reduce the speed of the driven member from the maximum to the minimum, the operating lever 50 is simply moved backward in a counter clock-wise direction when the various combinations hereinbefore specified will take place in just the reverse order, reducing the speed of the motor from the maximum to normal as the shunt field re-

sistance is gradually cut out of circuit, and reducing the gear speed combination as the different combination of clutch circuits are successively made.

If it is desired to stop the driven tool, for any reason, while operating at any speed, it is simply necessary to open the switch 89 which opens the clutch circuits, demagnetizing the clutches that at the time are energized, and releasing the driven tool from the motor. The motor continues to operate on no load until the switch 89 is again closed when the driven tool is again connected to the motor through the clutch and gear equipment. If the tool, while driven at any particular speed, has been stopped by opening the knife switch 89, the controller lever 50 may be moved to such position as will result in the tool being driven at a faster or slower speed, as desired, before the switch 89 is again closed.

With the equipment as described above, it is possible to start the driving motor up from rest to its normal speed without load upon the same, and then connect the driven tool to the motor by means of the magnetic clutches and gears, beginning with the minimum gear speed combination and then gradually increasing the speed of the driven tool to its maximum without having to stop the motor or tool while making the changes in speed. It is also possible to start and stop the tool without the necessity of the operator moving the controlling lever, and while we have only shown one switch for accomplishing this result, it will be understood that if the driven mechanism is of very large proportion, a number of stopping switches can be located at the convenient points about the device, from either of which the operator can start and stop without having to go to the controller.

While we have shown, as the preferred arrangement of connection for a device of this character, the two-clutch coils which are energized at the same time for any given speed combination connected across the line in series, it will be understood that we also contemplate to have the four-clutch coils, each connected directly across the line for the different speed combinations. We have merely shown this one way, as for some reasons it is desirable, as, for instance, the coils can be wound with coarser wire, but it will be understood that various other arrangements may be made without departing from the spirit of our invention.

By the use of the magnetic clutch set forth we are enabled to change from one speed combination to another without strain upon the motor or upon the numerous gears. The gradual acceleration of speed produced by said clutch permits the driven part to come up to speed without the consequent jars and shocks so noticeable in most machines of this character, and by the provision of the clutch the different parts release instantly when a change is made from one combination of gears to another, and the parts do not pull against one another as would be the case if the released parts were not disconnected immediately.

It will be understood that while the primary members are shown and described as being the center members of the clutches, we do not wish to limit ourselves to this arrangement, as the outer members of the clutches may be constructed as the primary members and the central members be arranged as armature members.

Having described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a variable speed mechanism, in combination, a driving member and a driven member and means including a plurality of electromagnetic clutch devices for operatively connecting said members to cause said driven member to be operated at any one of a predetermined number of speeds, said clutch devices being adapted to act independently of one another to produce certain speed variations and to act conjointly to produce other speed variations.

2. In a variable speed mechanism, in combination, a driving member and a driven member and a plurality of electromagnetic clutch devices for operatively connecting said members to cause said driven member to be operated at any one of a predetermined number of speeds, said clutch devices being adapted to act independently of one another to produce certain speed variations and to act conjointly to produce other speed variations, said clutch devices having their corresponding members operatively connected together.

3. In a variable speed mechanism, in combination, a driving member and a driven member and a plurality of electromagnetic clutch devices for operatively connecting said members to cause said driven member to be operated at any one of a predetermined number of speeds, said clutch devices being adapted to act independently of one another to produce certain speed variations and to act conjointly to produce other speed variations, one of said clutch devices having certain of its members operatively connected to said driving and driven members and each of its members geared to the corresponding member of the other clutch device.

4. In a variable speed mechanism, in combination, a driving member, a driven member, a gear connected to the driving member, another gear meshing therewith, a gear connected to the driven member, another gear meshing therewith and two electromagnetic clutch devices having simultaneously revoluble parts and other parts connected to said

gears, said clutch devices being adapted to be operated to cause said driving member to operate said driven member at any one of a number of speeds equal to the number of said gears.

5. In a variable speed mechanism, in combination, a driving member, a driven member, a gear operatively connected to each of said members, an electromagnetic clutch device having two of its members provided with gears each meshing with one of said first mentioned gears, a second electromagnetic clutch device having two members each operatively connected to one of said first mentioned gears and a third member geared to the corresponding member of said first mentioned clutch device and means for controlling said clutches to cause the same to vary the speed of said driven member relative to the speed of said driving member in four stages.

6. In combination, a driving member, a driven member, and driving connections between the same including a plurality of clutches each having two relatively movable members and a third member adapted to engage either of said relatively movable members, the corresponding members of said clutches being connected.

7. In a variable speed mechanism, in combination, a pair of simultaneously revoluble shafts arranged substantially parallel to one another, a pair of transmitting wheels loosely mounted on each of said shafts, and clutches for causing either or both of the transmitting wheels on each shaft to revolve therewith.

8. In a variable speed mechanism, in combination, a pair of simultaneously revoluble shafts arranged substantially parallel to one another, a pair of transmitting wheels loosely mounted upon each of said shafts, said transmitting wheels having different speed ratios, and magnetic clutches for causing either or both of the transmitting wheels on each shaft to rotate therewith.

9. In a variable speed mechanism, in combination, a pair of simultaneously revoluble shafts arranged substantially parallel to one other, a pair of transmitting wheels loosely mounted on each of said shafts, said transmitting wheels having different speed ratios, a driving member connected to one of said transmitting wheels, a driven member connected to another of said transmitting wheels, electromagnetic clutches for causing either or both of the transmitting wheels on each shaft to rotate therewith, and means for energizing the windings of said clutches in a definite sequence to gradually increase the speed of said driven member.

10. In a variable speed mechanism, in combination, a pair of simultaneously revoluble shafts arranged substantially parallel to one another, a driving member and a driven member loosely mounted on one of said shafts, each of said members being provided with a gear wheel, a pair of gear wheels loosely mounted on the other of said shafts and arranged to mesh with said first mentioned gear wheels, said gear wheels having different speed ratios, and clutches for causing either or both of the gear wheels on each shaft to revolve therewith.

11. In a variable speed mechanism, in combination, a pair of simultaneously revoluble shafts arranged substantially parallel to one another, a driving member and a driven member loosely mounted on one of said shafts, each of said members being provided with a gear wheel, a pair of gear wheels loosely mounted on the other of said shafts and arranged to mesh with said first mentioned gear wheels, said gear wheels having different speed ratios, and a double magnetic clutch secured to each of said shafts, said clutches being adapted to cause either or both of the gear wheels on each shaft to revolve therewith.

12. In a variable speed mechanism, in combination, a pair of simultaneously revoluble shafts arranged substantially parallel to one another, a driving member and a driven member loosely mounted on one of said shafts, each of said members being provided with a gear wheel, a pair of gear wheels loosely mounted on the other of said shafts and arranged to mesh with said first-mentioned gear wheels, said gear wheels having different speed ratios, a double magnetic clutch secured to each of said shafts, said clutches being adapted to cause either or both of the gear wheels on each shaft to revolve therewith, and means for energizing the windings of said clutches in a definite sequence to gradually increase the speed of said driven member.

In witness whereof, we have hereunto subscribed our names in the presence of two witnesses.

HENRY H. CUTLER.
FREDERIC S. WILHOIT.

Witnesses:
S. W. FITZGERALD,
FRANK H. HUBBARD.