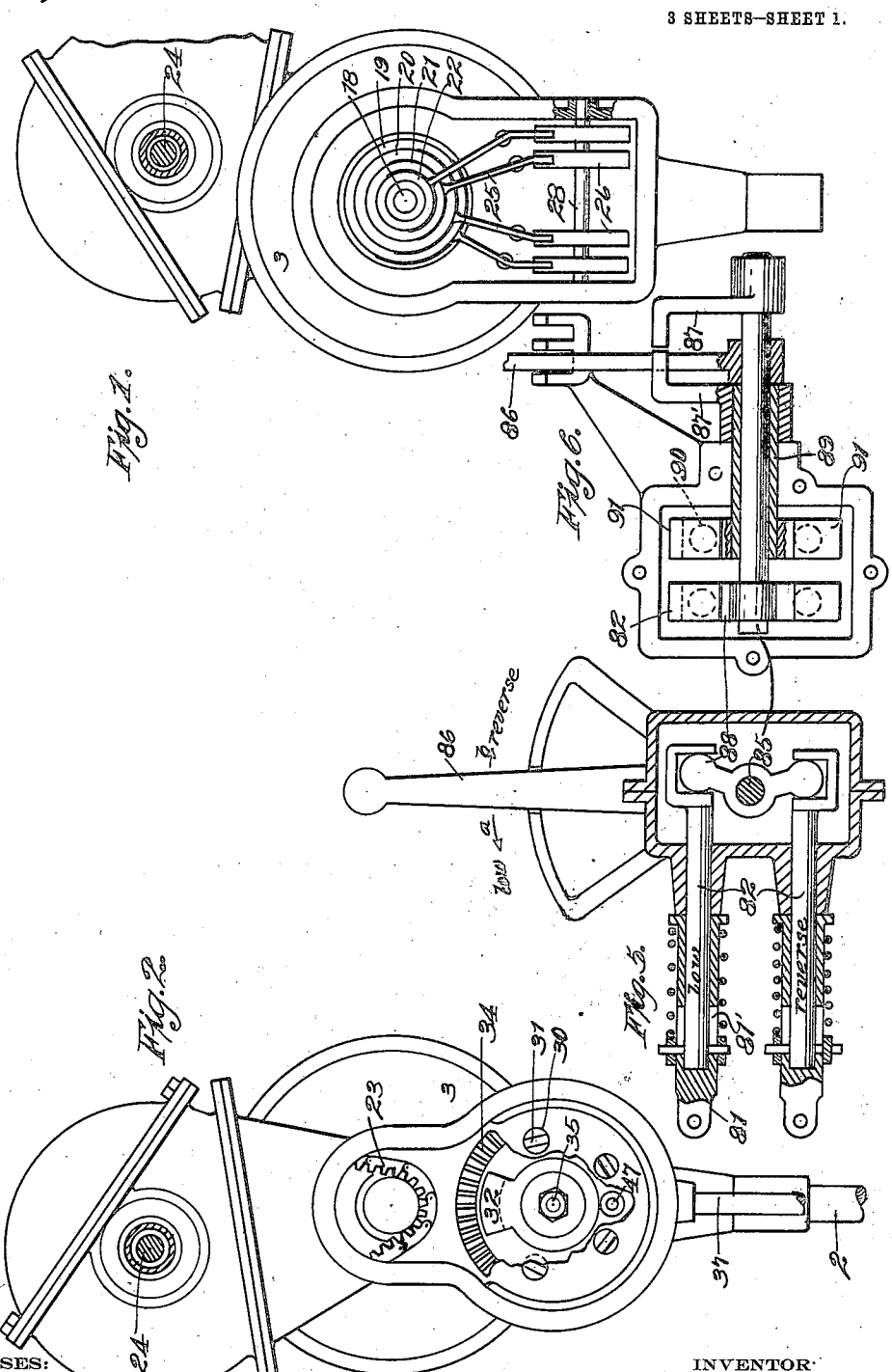
H. G. BALDWIN.

ELECTRICALLY CONTROLLED CHANGE SPEED MECHANISM.

APPLICATION FILED JULY 15, 1913.

1,130,134. Patented Mar. 2, 1915.

3 SHEETS—SHEET 1.



WITNESSES:

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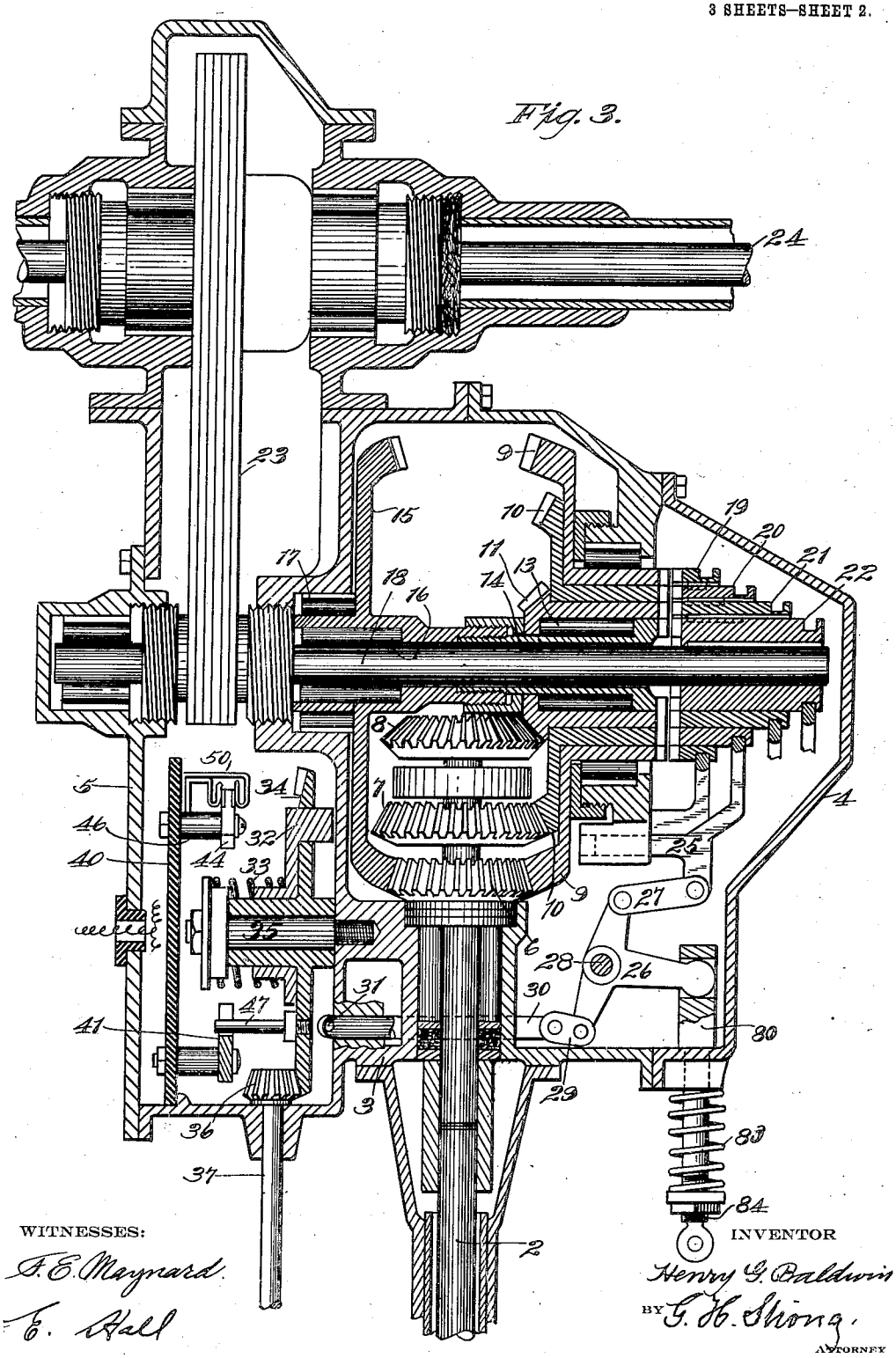
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Fig. 3.



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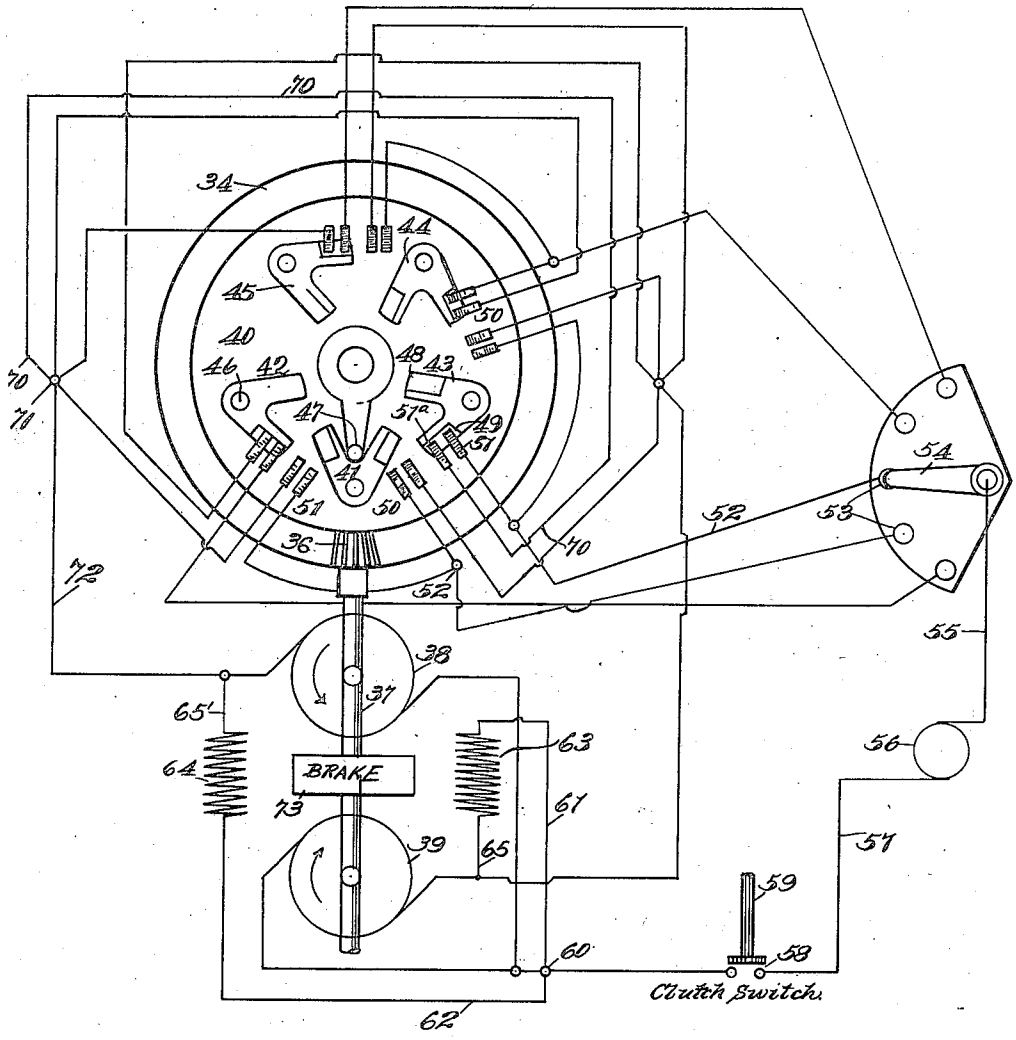


Fig. 4.

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HENRY G. BALDWIN, OF SAN FRANCISCO, CALIFORNIA.

ELECTRICALLY-CONTROLLED CHANGE-SPEED MECHANISM.

1,130,134. Specification of Letters Patent. Patented Mar. 2, 1915.

Application filed July 15, 1913. Serial No. 779,106.

To all whom it may concern:

Be it known that I, HENRY G. BALDWIN, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Electrically-Controlled Change-Speed Mechanism, of which the following is a specification.

This invention relates to power transmitting mechanism, and particularly to an electrically-controlled and operated selecting mechanism for change speed and reversing gear.

It is among the objects of the present invention to provide, in combination with a driving shaft and a driven part, a variable speed and reversing gear with means for electrically selecting one of the change speed or reverse gears, as may be desired.

It is a further object of the present invention to provide, in combination with a change speed and reversing gear consisting of a plurality of individual gears, a driver for the gears and part to be driven, and a mechanism selectable and operable electrically, for the coupling of one of the gears to the driven part or an intermediate connection therewith.

Another object of the present invention is to provide, in combination with a variable speed and reversing mechanism, means for electrically selecting and coupling elements of the mechanism, for the transmission of power, and means for manually selecting and operating elements of said mechanism independently of the electrical means.

Other objects and functions of the invention in its entirety and details will be made manifest hereinafter.

The invention consists in the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a side elevation of the device partly in section and with the under cover removed. Fig. 2 is an elevation of the opposite side of the device. Fig. 3 is a horizontal central section through the mechanism and casing. Fig. 4 is a diagrammatic view showing the electrical circuit and switch panel with the switches in elevation. Fig. 5 is a detail section in elevation of the manually-operable transmission controlled lever. Fig. 6 is a detail sectional view longitudinally through the lever-operated mechanism.

In its illustrated form the invention involves a driving shaft or part 2, entering and suitably journaled in a casing 3, having on one side a removable cover 4 and on the opposite side a removable bearing and panel member 5, the casing with its cap and panel being substantially liquid-tight for containing a lubricant in which may run the transmission gearing. On the inner end of the shaft 2 there is keyed a plurality of pinions 6—7 and 8, of suitable proportions, each respectively engaging change speed gears 9—10 and 11 of successive decreasing diameter; the gear 9 being the low speed gear, gear 10 being the intermediate, and gear 11 the high speed. Each of these gears is provided with elongated hubs 12, concentrically telescoped and bearing upon each other, the innermost hub 12 running upon anti-friction bearings 13 interposed between the inner hub and a tubular shaft 14 carrying on one end the reverse gear 15 which meshes constantly with the pinion 6 on the shaft 2 and runs constantly in an opposite direction to the gears 9—10 and 11, which also are constantly in mesh with their respective pinions. The gear 15 runs upon sets of anti-friction bearings 16—17, the former embracing a transversely arranged shaft 18 passing through the tubular shaft 14 of the gear 15 and carrying on one end, adjacent to the hubs 12, a series of telescoped, relatively longitudinally-slidable, automatically-retracting clutch rings 19—20—21 and 22, the latter being splined upon the shaft end 18, and being capable of moving to bring its clutch face into intermesh with the complementary end of the tubular sleeve 14; the clutch ring 21 is movable into driving engagement with the lowermost change high-speed gear 11; the intermediate clutch ring 20 is interchangeable with its companion intermediate gear 10 and the outermost clutch ring 19 is interchangeable with the low-speed gear 9. The several clutch rings 19—20—21 and 22 are keyed together for the transmission of rotation from one to the other, and each is capable of independent sliding motion with relation to the other, so that any one of the series may be shifted to bring it into driving engagement with

one of the gears 9—10—11 of the shaft end 14, so that power being derived from the shaft 2 and through the gears 6—7 and 8, and these each transmitting it through the change speed or reverse gears, will impart its rotary motion to the complementary coupled clutch ring, and this latter will transmit its motion through the series of relatively-keyed, concentrically-arranged clutch members to the transverse shaft 18, which may be utilized directly as the driven member for the application of power, or may be an intermediate member and transmit its power to another part, as for instance by a sprocket chain and wheel construction 23, for imparting power to a more distant shaft, as the driving shaft 24 of a vehicle.

It is an important feature of my present invention to provide means whereby any one of the clutch rings 19, 20, 21 or 22 may be electrically selected and operated to carry it into driving engagement with its companion driving gear or part, and also to provide manually-operable means for shifting any of the clutch rings independently of the electrically-operated means. The primary function of the present invention being the provision of an electrically-operated clutch mechanism, I have shown a form of clutch mechanism which consists in a plurality of shifters 25, one for each of the slidable clutch rings, the shifters having yoke portions embracing or partly embracing their respective clutch rings for circumferential movement, and each shifter having a suitable bearing in which it may be reciprocated, so as to shift its so-called clutch ring. The shifters 25 are here shown as each respectively connected to a lever 26 by a link 27, the several levers 26 being freely tiltable about a fixed support or rod 28, appropriately disposed in the casing 3, each lever 26 having a link connection 29 with a push-rod 30 slidably mounted in a bearing, formed in the casing 3, and carrying at its outer end a cam roller 31, arranged in the path of a rotary slidable cam 32, suitably supported and thrust forward by a spring 33. The cam 32 is mounted upon a gear 34, journaled upon a stud spindle 35 of the casing. There is a push-rod 30, having its roller 31 arranged in the path of the revolving cam 32, for each of the shifter levers 26, and during the rotation of the gear wheel 34 the cam 32 will be carried toward and depress a push-rod 30, thus resulting in the rocking movement of the lever 26 which is translated into a sliding movement by the shifter 25, with the resulting longitudinal shifting of the respective clutch ring, to carry it into mesh with its coördinate gear. The purpose of the yieldable support or spring 33 for throwing the cam 32 forwardly is to provide for the event that upon the engagement of the cam 32 with any of the push-rods 30, the associated clutch ring of which may be momentarily so disposed that its clutch face was not in proper registration with the clutch face of its respective gear, that injury to the parts would be prevented by the yielding movement of the cam 32 against the spring 33 until such time that due to the rotation relatively of the change gear and its coördinate clutch ring the proper meshing position would be obtained. The gear 34, which carries the presser cam 32, is shown as intermeshed with a driving gear or device 36 of suitable type, which is here shown as secured upon the shaft 37 of electrically-driven, reversely-rotating motors 38 and 39, which when energized drive the shaft 37 in the pinion 36, and therefore in turn operate the gear 34.

For controlling the direction of rotation of the motor shaft 37 by the selection and energization of one or the other of the motors 38 and 39, there is provided a suitable electrically-controlled system with such circuits and switches as will control the energization of either of the motors. One form of the electrical system is shown diagrammatically in Fig. 4, as involving a switch-board or panel 40, preferably disposed within the casing under the cover 5, and upon which are suitably mounted a plurality of switches as, 41 the neutral switch, 42 the reverse speed switch, 43 the low speed switch, 44 the intermediate speed switch, and 45 the high speed switch. These switches are turnably supported upon suitable posts 46 and are substantially V-shaped, as shown in Fig. 4, with the crotch disposed toward the center of the panel 40, so as to be engaged by a controller 47, comprising an arm or pin projecting from the gear wheel 34, and which arm is thereby carried around as the gear is revolved. Upon the ends of the V-shaped switches, and insulated therefrom, are secured circuit-closing plates 48—49, which are adapted to be thrown into electrical contact with respective electric terminal clips 50 and 51, disposed on opposite sides of the posts 46, about which the several switches are adapted to rock. Thus it will be seen by taking the switch 43 for example, when the arm or controller 47 moves downwardly past the post 46, it will swing the switch 43 into a position to close it upon the contacts 51, closing the circuit at this point, and the further movement of the controller 47 carries it into engagement with the V-shaped switch 41, which is then carried to an intermediate position as between its respective contact clips 50—51. The circuit clips 50—51 are branches of a line joining at 52, for instance, which runs to one of the posts, as 53, of a switch-board, on which there is

provided a post for each of the switches 41—42—43—44 and 45, and a circuit-closing lever 54 is movable over any one of the circuit posts 53 to close the circuit, the switch being directly connected by a lead 55 to a source of electrical energy, as a battery or generator, indicated at 56, the return lead 57 of which is provided with a switch 58 which is controlled by and operates simultaneously with a part 59 of the clutch lever of the power-transmitting mechanism to which the driving shaft 2 may be applicable; and so long as the clutch carrying the member 59 is closed so that power is transmitted to and by the shaft 2, the automatic switch 58 is open and breaks the electric circuit of the clutch-controlling mechanism herein involved. When the clutch carrying the member 59 is released to disconnect the shaft 2, the switch 58 then closes the circuit in the line 57, which line is connected to a distributer post 60, from which there are run two branches 61 and 62, each of which is provided for energizing respective brake coils 63 and 64, which are respectively connected in parallel, as at 65—65′, to their coördinate motor circuits in which are mounted one or the other of the motors 38—39.

The operation of the circuit of the mechanism in diagram in Fig. 4 is as follows: Assuming that the controller 47 has been stopped so that the switch 41 is in a neutral position as between its respective terminals 50 and 51, then, if it is desired to throw in the low speed gear as by coupling the gear 9 by means of its clutch 19, the operator moves the switch lever 54 over to the proper button 53, designated "Low," whereupon a circuit will commence from the source of supply 56, and passing through the lead 55, the switch-arm 54, the button 53, and into the line 52, would thence pass into the circuit clip at 51, and since the low speed switch 43 is contacting with the clip 51, the circuit would continue through the block 49 into a clip 51ª, and follow a line 70, as shown, which is joined to a distributer 71, from which runs a motor circuit line 72, joined to the motor 38, and from which line 72 there is branched the coil line 65′ energizing the electric brake-coil 64 to release a brake 73 on the shaft 37, the current from the coil 64 passing along the line 62 to the distributer connection 60, thence through the switch 58, which would be closed by reason of the normal operation of releasing the clutch member 59 to which the switch 58 is secured, thence passing through the switch 58 along the line 57 to the source 56. From this it will be seen that as soon as the switch lever 54 is moved on to the button 53 of the low-speed gear, a circuit will be completed through the motor 38 and shunted through the magnetic coil 64 to release the brake 73, whereupon the motor would drive the shaft 37, and this, in turn, carrying the pinion 38, would revolve the gear 34, which would turn the controller 47 toward the switch 43, and by doing so the switch 41 would be swung down to close the circuit at its clip 50; the continued movement of the controller 47 swinging the switch 43 out of the clips 51—51ª and breaking the circuit thereat, whereupon the motor 38 would be cut out and the coil 64 deënergized, and the brake 73 applied to stop further movement of the shaft 37 and likewise the controller 47, leaving the switch 43 in neutral position as between its circuit clips 50—51. A similar circuit is created and broken for every movement of the hand-switch 54, to or from any of the circuit-closing contact buttons 53 of the controller switch. The primary switch of the system may be considered the switch 58, which is controlled by the movement of the clutch connection 59, so that unless the clutch member 59 is moved to such position as will disconnect the shaft 2, the switch 58 will be in open position; but as the clutch member 59 is moved with the release of the clutch, the switch 58 will be closed, whereupon in conjunction with the proper movement of the manually-operated switch lever 54 a desired circuit may be closed, and one after the other of the clutches 19—20—21—22 be mechanically shifted by the power derived from the motor 38 or 39, as may be the case.

In order that the change speed mechanism may be controlled entirely independent of the electric-selecting and controlling system, I have provided a manually-controlled and independently-operable mechanism whereby the several shifter levers 26 may be individually actuated, and this means is shown as comprising link connections 80 for each lever 26, the links being respectively connected to couplers 81, shown as socket members, Fig. 5, in which are reciprocable plungers or actuators 82. The link members 80 project through suitable bearings in the case 3 and are normally, automatically projected by springs 83, the tension of which may be adjusted by adjustable collars 84; the functions of the springs 83 being to normally hold the several clutch rings 19—20—21—22 disengaged from their respective companion gears by rocking the levers 26 to shift the shifters 25 outwardly. The links 80 are pivotally or otherwise suitably connected to the couplers 81, which have a free movement in one direction with respect to their actuators 82 when the levers 26 are operated by the electric control, including the gear 34 and the push-rods 30, which would cause the links 80 to be drawn inwardly, whereupon the couplers 81 would slide along the actuators 82, this movement being permitted by the slot 81′ in the cou-

pler. Should it for any reason become necessary or desirable to shift the clutch rings 19—20—21—22 manually and independently of the electric control, then the actuators 82 would be forced inwardly to move their respective links 80 and rock the levers 26. Any suitable means may be employed for operating the actuators 82, and in the present instance I have shown a rocker shaft 85, upon which is slidable a lever 86, which may be moved toward a dog 87, keyed on the outer end of the shaft 85, and by which when engaged with the lever 86, would be tilted forwardly or rearwardly, as the case may require, coincidently forcing one or the other of the rods 82 into operative engagement with its coupler 81, and thereby the proper link 80 would be depressed to rock its coördinate lever 26. Suitable connection is had as between the rocker shaft 85 and the actuators 82 by means of a lever 88 extending diametrically across the shaft 85 and engageable with the adjacent ends of the actuators 82. When the hand-lever 86 is shifted on the shaft 85 into mesh with the dog 87, and then thrown in the direction indicated by the arrow *a*, Fig. 5, the upper actuator 82 will engage and shift the coupler 81 with its connected link 80, to rock its lever 26 and throw the clutch ring 19 into mesh with the low-speed gear 9; and as the upper end of the lever 88 forces the upper actuator 82 inwardly, the lower actuator 82 is retracted from its respective coupler 81, each of the couplers 81 being shown as slotted at 81′ to allow the necessary forward play of its actuator 82 independently. So long as the lever 86 is shifted laterally into engagement with the dog 87 and the lever 86 rocked rearwardly, as at *a*, or forward, as at *b*, then the rocker shaft 86 is actuated, and when it is desired to disconnect the dog 87 the operator shifts the lever 86 laterally, bringing it into mesh with another dog 87′, which is secured upon a tubular shaft 89, Fig. 6, which carries a diametrically-extending lever 90 engaging respective actuators 91, and which controls the rocking of the respective levers 26 and the movement of the intermediate speed clutch and the high speed clutch.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is:

1. The combination in power-transmitting apparatus, of driving and driven elements, gearing for varying the speed of or for reversing the driven element, and electrically-operated clutch mechanism comprising a cam for coupling said gearing to said elements.

2. A change speed and reversing gearing comprising clutches for interlocking engagement with respective members of said gearing, an electrically-operated cam for shifting said clutches, and an electric system including a manually-operable lever for controlling the operation of said cam.

3. A change speed and reversing gearing comprising, a series of clutches engageable with respective elements of said gearing, means for shifting said clutches positively in one direction to engage said gearing, means for automatically retracting the clutches, and electrically operated instrumentalities for actuating the clutch-shifting means.

4. A change speed and reversing gearing comprising a series of clutches engageable with respective elements of said mechanism, means for shifting said clutches positively in one direction, means for automatically retracting the clutches, electrically-operated instrumentalities for actuating the clutch-shifting means, said electric instrumentalities comprising a motor-driven shaft with a gear and a cam member driven by said gear for actuating progressively parts of said shifting means, and a switch-board with respective circuits for controlling the direction and degree of rotation of said cam.

5. A power-transmission mechanism comprising a driving shaft and a driven part, a plurality of gears substantially constantly intermeshed, deriving power from said shaft, a series of clutches adapted to be shifted into operative engagement with respect to said gears, and having driving connection with the driven part, shifting levers for said clutches, a cam for progressively operating said shifting levers, electrically-operated means for actuating said cam, and a manually-controlled electrical system for the cam actuating means.

6. A power transmission mechanism comprising a driving shaft and a driven part, a plurality of gears substantially constantly intermeshed, deriving power from said driving shaft, a series of clutches having driving connection with the driven part, mechanism for shifting said clutches into operative engagement with respect to said gears, a mechanism comprising a cam for progressively operating elements of said shifting mechanism to throw in the clutches, means for automatically retracting the clutches, electrically operated means for actuating the cam, a series of circuits with switches automatically actuated by the electrically operated mechanism, and a manually operable switch-lever movable to engage contacts in the several circuits of which said switches form parts.

7. A change speed and reversing gearing comprising a driving part, a part to be driven and clutches for operatively connecting said parts, an electric control and clutch-operating system comprising rotatable mechanism for shifting the clutches, an electrically-operated driver for rotating

said mechanism, and electric circuits for controlling the movement of the driver step by step and for reversing the same.

8. In combination with a change speed and reversing power-transmitting mechanism, comprising a driving part, a part to be driven and clutches for connecting said parts, an electric control and clutch-operating system comprising mechanism for shifting the clutches, an electrically-operated driver for actuating said mechanism, electric circuits for controlling the movement of the driver step by step and for reversing the same, each of said circuits including a switch member automatically operated by said driver, so as to break certain of said circuits and close others, and a manually-operated switch lever movable to engage terminals of the circuits so that the circuits closed by the automatically-operated switches can be completed to cause the movement of the electrically-operated driver.

9. A change speed and reversing gearing comprising a driving part, a part to be driven and clutches for operatively connecting said parts, an electric control and clutch-operating system comprising mechanism for shifting the clutches, an electrically-operated driver for actuating said mechanism, electric circuits for controlling the movement of the driver step by step and for reversing the same, each of said circuits including a switch member automatically operated by said driver, so as to break certain of said circuits and close others, a manually-operable switch lever movable to engage terminals of the circuits so that the circuits closed by the automatically-operated switches can be completed to cause the movement of the electrically-operated driver, and a primary switch controlling the closing of said circuits.

10. A change speed and reversing gearing comprising a driving part, a part to be driven and clutches for operatively connecting said parts, an electric control and clutch-operating system comprising mechanism for shifting the clutches, an electrically-operated driver for actuating said mechanism, electric circuits for controlling the movement of the driver step by step and for reversing the same, each of said circuits including a switch member automatically operated by said driver, so as to break certain of said circuits and close others, a manually-operated switch lever movable to engage terminals of the circuits so that the circuits closed by the automatically-operated switches can be completed to cause the movement of the electrically-operated driver, and a primary switch controlling the closing of said circuits, said primary switch being operable conjunctively with a suitable mechanism.

11. In a power-transmitting change speed and reversing gearing, a driver, a part to be driven, a plurality of change speed and reverse gears constantly rotated by the driver for the transmission of power therefrom, and a series of electrically shiftable and independently movable concentric clutches severally engageable with respective of said gears, said clutches being operably connected to the parts to be driven.

12. In a power-transmitting change speed and reversing gearing, a driver, a part to be driven, a plurality of change speed and reverse gears constantly driven by the driver for the transmission of power therefrom, a series of substantially concentric interconnected and relatively slidable clutches having their operating faces in a common plane severally engageable with respective of said gears, said clutches being operably connected to the part to be driven, and electrically controlled mechanism for shifting said clutches.

13. In a power-transmitting change speed and reversing gearing, a driver, a part to be driven, a plurality of change speed and reverse gears constantly driven by the driver for the transmission of power therefrom, a series of substantially concentric interconnected and relatively slidable clutches having their operating faces in a common plane severally engageable with respective of said gears, said clutches being operably connected to the part to be driven, and an electric shifting mechanism for operating said clutches.

14. In a power-transmitting change speed and reversing gearing, a driver, a part to be driven, a plurality of change speed and reverse gears constantly driven by the driver for the transmission of power therefrom, a series of substantially concentric interconnected and relatively slidable clutches having their operating faces in a common plane severally engageable with respective of said gears, said clutches being operably connected to the part to be driven, a shifting mechanism for operating said clutches, and an electrically-controlled and operated driver for actuating said mechanism.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HENRY G. BALDWIN.

Witnesses:
IRVINE SINNETT,
W. W. HEALEY.