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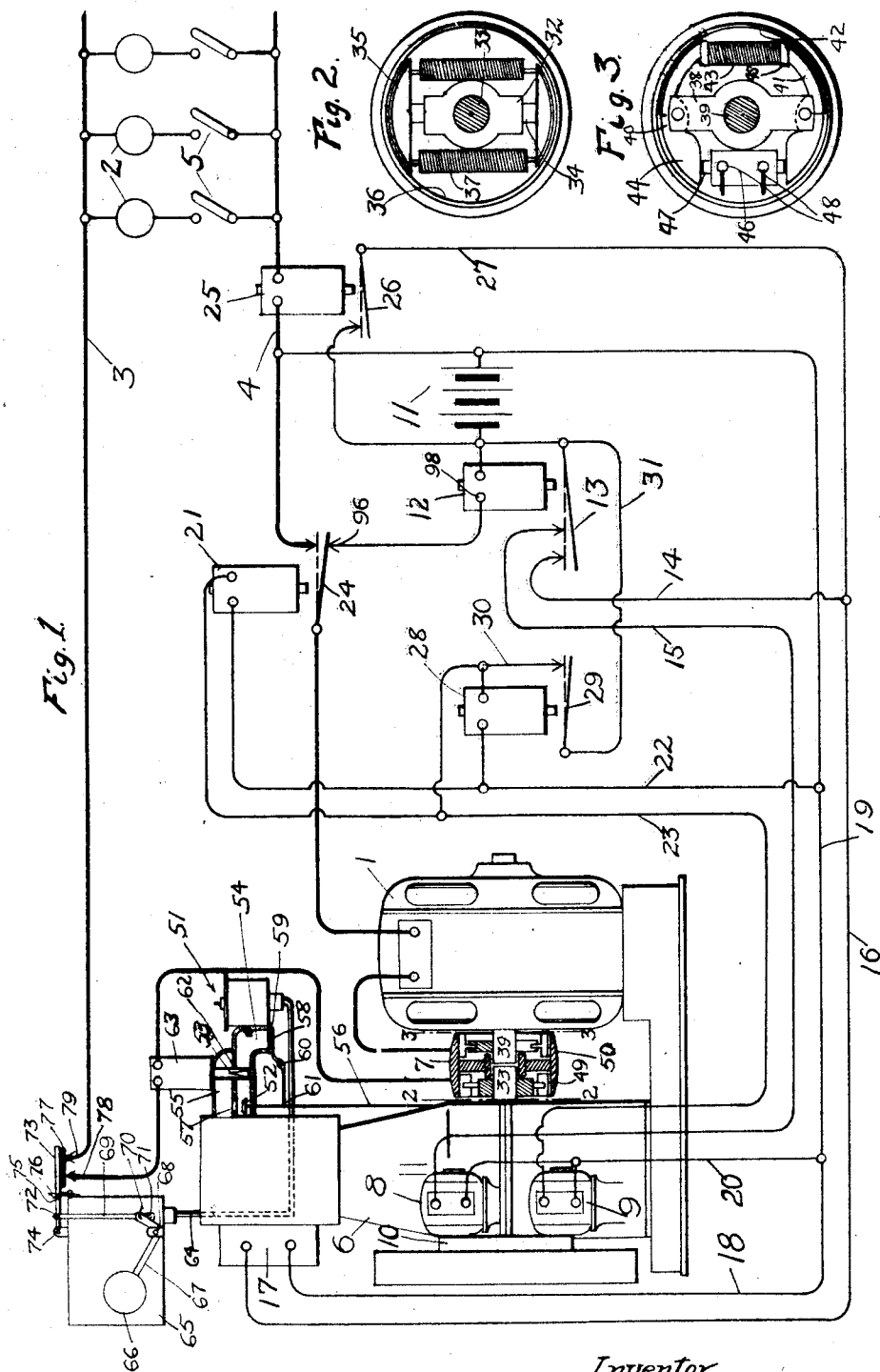
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1,774,492

AUTOMATIC POWER SYSTEM

Filed July 31, 1919

2 Sheets-Sheet 1



Inventor.
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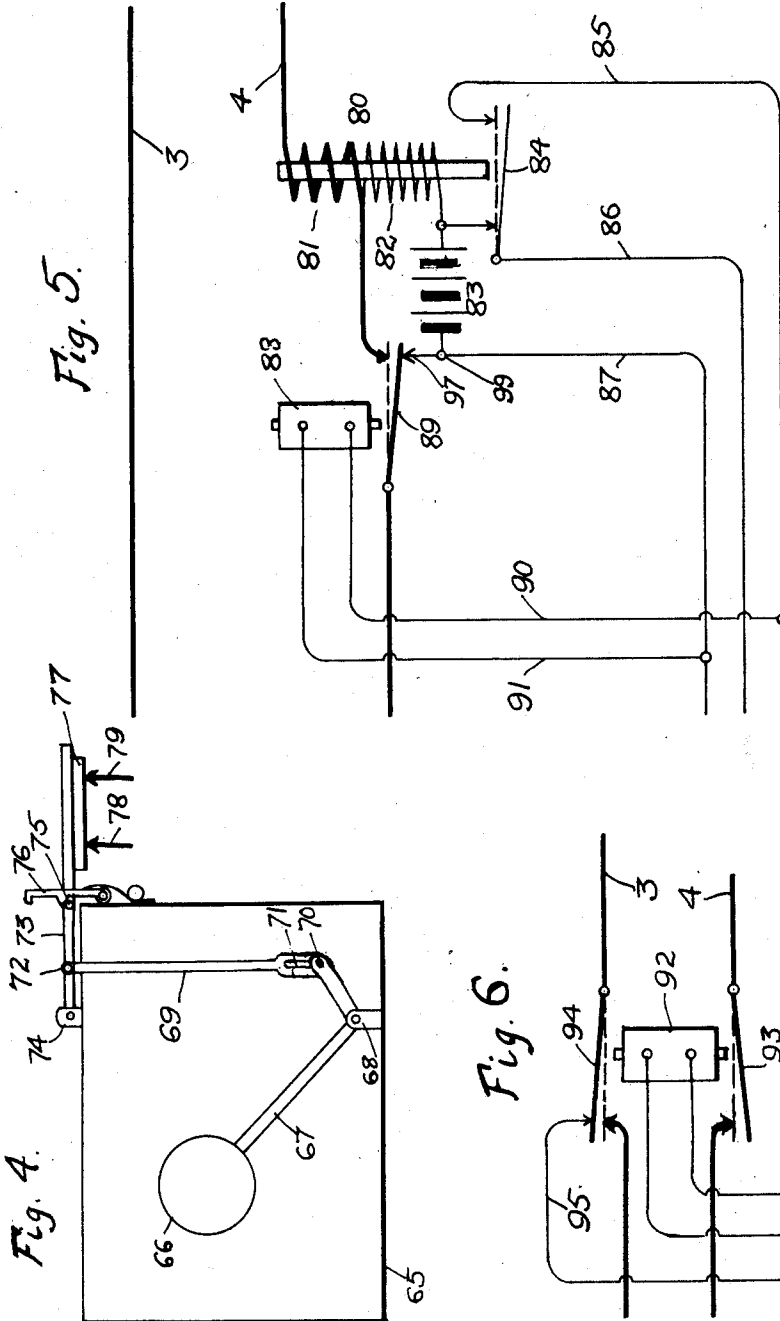
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UNITED STATES PATENT OFFICE

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AUTOMATIC POWER SYSTEM

Application filed July 31, 1919. Serial No. 314,534.

This invention relates to systems of automatic electrical power distribution and forms a continuation in part of the subject-matter of application Serial No. 271,432, filed January 16, 1919.

The invention deals with improvements in prime mover dynamo plants comprising dynamos connected with internal combustion engines to be driven thereby. In this combination there is provided a suitable centrifugal clutch in the connection between the machines, whereby the engine may run idly until it maintains sufficient speed to properly drive the dynamo, thus eliminating the necessity of starting under load. There is also provided in this connection, a centrifugal speed regulator for connecting the dynamo to the engine whereby the dynamo may be driven at an even speed which may be somewhat less than the speed of the engine for reasons to be hereinafter set forth. Such a connection not only affords means for low starting power and a constant and even speed of the dynamo, but also a flexible connection between the machines.

The power mains from the dynamo machines are connected with relays and various control devices, whereby when a circuit is closed across them as through translating devices, circuits will be closed for applying starting energy and ignition current to the internal combustion engine; when the circuit across the power mains is opened the ignition circuit will be broken and stop the engine.

A switch may also be in the circuit of the power mains connected with the fuel chamber in such a manner as to open circuit the mains in case the fuel supply should be low. An electromagnetic control device for acting upon the centrifugal speed regulator in the connection between the machines may be inserted in the power mains in series with the translating devices, whereby all current consumed by the load may flow through the device so that the speed of the dynamo may be increased as the load increases.

The internal combustion engine may be provided with two throttle valves, one of which remains wide open until the engine has

started and thereafter is closed by a speed responsive device connected with either the engine or dynamo; the other throttle valve is normally closed or nearly closed and is opened in proportion to the amount of current flowing through the translating devices by an electromagnetic control device in the circuit. The connection with the first throttle valve may also be operatively connected with a suitable choke for enriching the fuel mixture during the starting of the engine.

The fuel supply tank may also be provided with a switch operating mechanism which will render the system inoperative in case there is insufficient fuel to start the engine and thus avoid deterioration of the starting means.

This invention further provides for using a single or double unit electric starting and charging unit with electromagnetic means connected with the charging unit for operatively connecting the power mains with and disconnecting them from the dynamo independent of the dynamo itself.

Further objects and details of the invention will appear, as described in connection with the accompanying drawings, and hereinafter set forth and claimed.

In the drawings,

Figure 1 is a diagrammatic representation of my invention;

Figures 2 and 3 are detail views on an enlarged scale partly in section taken on lines 2-2 and 3-3 of Figure 1;

Figure 4 is an enlarged diagrammatic representation of the fuel tank;

Figure 5 is a diagram representing a modification of my invention in which a single unit starter may be employed; and,

Figure 6 is a fragmentary diagram showing a slight change in connections.

In Figure 1 of the drawing, the power generator 1 for supplying current to the translating device, represented at 2 through mains 3 and 4 when switches 5 are closed, may be either a direct or alternating current generator, and may be coupled with an internal combustion engine 6, by means of a centrif-

gal clutch and centrifugal speed regulator connection 7.

An electric starting motor 8 and charging generator 9 are suitably connected with the internal combustion engine. As illustrated a casing 10 is provided for enclosing the driving connections between the internal combustion engine, charging generator and motor; any suitable form of connection may be employed, for the motor and generator which are part of a "double unit" starting and charging system.

The storage battery 11, adapted to operate the starting unit, also provides an initial potential across the power mains 3 and 4, such as to pass a current through a suitable relay 12, which will be termed a "starting relay" when a translating device switch 5 is closed. This completes the circuit from the battery through main 4, relay 25, switch 5, translating device 2, main 3 on through the generator 1, armature 24, relay 12 and back to the battery. Energizing relay 12 causes its armature 13 to rise and connect the battery 11 with conductors 14 and 15. Connecting the battery with conductor 14 completes the circuit through conductors 14 and 16, the ignition system 17, and conductors 18 and 19, to the battery again. The circuit is also made through conductor 15, starting motor 8, and conductors 20 and 19 to the battery. This causes the motor to turn the engine over for starting and renders the ignition system, which may be of any desired form, operative for running the engine.

After the engine has started and the charging generator is driven with sufficient speed to generate the required potential, relay 21 with which it is connected by conductors 20, 19, 22 and 23 will be energized. The armature 24 of relay 21 will rise and connect main 4 with the power generator 1, which will also be driven at sufficient speed to supply the proper current to the translating devices 2. When the armature 24 rises it opens the circuit of the battery 11 through the starting relay 12, de-energizing the same. However, the ignition system will remain operative since a relay 25 connected in main 4 will be energized as long as current flows through it and the translating devices from the generator 1. Energizing relay 25 will cause its armature 26 to rise and connect the battery 11 with conductor 27 which connects with conductor 16 in the same manner as conductor 14; thus the circuit from the battery for rendering the ignition system operative is maintained closed after the starting relay is de-energized.

It will be seen by these connections that when the relay 21 operates the starting relay is de-energized and current will no longer be supplied to the starting motor; in this way the current will only be supplied to the motor as long as necessary for starting the engine

and is thereafter cut off. Thus the connection of the starting motor with the engine (not shown) may be rendered inoperative as well as the current supplied to it being cut off.

In order to recharge the battery 11 a relay 28 operative only at a higher voltage than the E. M. F. of the battery 11 is connected with conductors 22 and 23, whereby the charging generator 9, which is connected with these conductors will operate this relay when it is generating sufficient potential. When the armature 29 of relay 28 rises, the circuit is closed from the generator 9 through conductors 23, 30 and 31, battery 11, conductors 19 and 20, back to the generator; thus rendering the generator operative for charging the battery.

When all the switches 5 are opened so that no current will flow from the generator 1, relay 25 will be deenergized, its armature 26 will fall, opening the circuit operating the ignition system, and the engine will stop. As the speed of charging generator decreases and consequently its potential, armature 24 of relay 21 will fall opening the circuit of the power main 4, and armature 29 of relay 28 will fall disconnecting the battery 11 from the generator. The switches and relay armatures will all be in their open or normal inoperative positions, as shown in full lines in the drawings, and ready to automatically start the engine whenever a circuit is closed across the power mains 3 and 4.

In large installations it is desirable to provide means whereby the engine can be started with a minimum amount of power, therefore it is advisable to provide a centrifugal clutch in the connection 7, whereby the engine may be started and operate on its own power at a low speed and the clutch will operate to connect the engine with the generator as the speed increases. Any desirable form of centrifugal clutch may be employed for this purpose, but in the drawings a compact connection including a centrifugal clutch and centrifugal speed regulator is shown.

The centrifugal clutch part of the connection 7, shown in Figures 1 and 2, comprises a suitable supporting member 32, in the form of a collar conveniently fastened upon the internal combustion engine shaft 33. This supporting member is provided with driving rods 34 on opposite sides of the engine shaft upon which are slidingly mounted the clutch shoes 35. The clutch shoes are provided with the usual gripping surfaces which are adapted to coact with the inner cylindrical surface 36 of the connection 7, and are provided with tension springs 37 for normally maintaining them out of engagement when the engine is not operating, or is operating at a low speed.

In order to maintain the generator 1 at a constant and even speed when driven by the internal combustion engine a centrifugal

speed regulator of any desired form is provided. The speed regulator illustrated in Figs. 1 and 3 in the connection 7 comprises a supporting member 38 mounted on the generator shaft 39 in a manner similar to supporting member 32 of the clutch on the engine shaft. This supporting member provides means for pivotally mounting the clutching members 40 on opposite sides of the generator shaft. These clutching members are each provided at adjacent ends with gripping shoes 41 normally tightly pressed into engagement with the inner cylindrical surface 42 of the connection 7 by means of a compression spring 43. The opposite ends of the clutching members are in the form of weights 44, adapted to be thrown out and release the engagement of the gripping shoes 41 and surface 42, by centrifugal force, should the speed of dynamo become too great. The speed for the operation of the speed regulator may be once adjusted to the proper speed and then assembled, or any form of adjusting means may be employed for changing the speed at which the device is operative to declutch, as for example, adjustable end pieces 45 for the compression spring which may be screwed into and out of the ends of the gripping shoes for varying the amount of compression on the spring 43.

The speed regulator may be adjusted so that the generator 1 will be driven at a lower speed than the engine at no load and an electromagnetic device may be provided in one of the power mains from the generator which will act upon the speed regulator in a manner to cause the engine to drive the generator at a higher speed as the current increases in the power mains. In Figures 1 and 3, a solenoid 46 is represented mounted between the weights 44 of the clutching members and adapted to operate plungers 47 attached to the weights in a manner to decrease the effective force with which the weights act to declutch the gripping elements. The electrical connections 48 of the solenoid may be suitably connected in one of the power mains leading from the generator 1, as by slip rings (not shown). Thus as the load on the generator increases, consequently the current in the solenoid 46, the effectiveness of the weights will be decreased and the generator 1 will be driven at a greater speed.

It will be noted that the connection 7 forming drums for the clutch and speed regulator has a flange 49 midway between its ends and a collar member 50 which forms a spacing element between the supporting elements on the shafts and also a bearing for the ends of the shafts. This assists in properly aligning the machines and it will also provide a driving connection between them even if they should not be exactly in alignment. This connection with the clutch and speed regulator provides means for driving the generator

at a constant and even speed irrespective of the variations in speed and jerks, etc., which may occur in the prime mover since the two clutching devices form a double frictional driving engagement between the machines and any irregularities which may occur will be overcome by the yielding of these devices.

To facilitate starting of the engine, means may be provided whereby the throttle may be fully opened upon starting, and, if desired, the carbureter may be choked. In accomplishing this the carbureter 51 in Figure 1 of the drawing is represented as having two throttle valves 52 and 53, for communications between the mixing chamber 54 and the intake manifold 55. The valve 52 has an operating rod 56 for closing its port 57 between the chambers by means of a speed responsive device (not shown) driven from the shaft of the engine or of the dynamo adapted to thrust the rod up to close the valve when the engine has begun to operate on its own power. A choking valve 58 adapted to normally close or nearly close the air port 59 of the mixing chamber when the engine is not running may be suitably pivoted at 60 and connected at 61 to the operating rod 56, whereby it will be withdrawn from the air port when the engine starts.

The other valve 53 is designed to normally close or nearly close the aperture 62 and to be operated by means of a solenoid 63 connected in one of the power mains from the generator 1. When current flows from generator 1 through solenoid 63 and the translating devices, the solenoid tends to increase the size of the opening or the throttle through aperture 62; valve 53 may be so designed as to vary the amount of fuel mixture passing through in proportion with the load or to increase the speed proportionally as the load current increases. Thus the generator may be driven at a constant speed or a proportionally greater speed. The speed regulator in the connection 7 may be regulated to drive the engine at substantially the same speed as the internal combustion engine at all loads and do away with any unnecessary wear between the friction elements due to variation in speeds of the engine and generator.

As shown in Figure 1 of the drawing, liquid fuel may be supplied to the carbureter 51 through a tube 64 leading from the fuel tank 65. In this tank is shown a float 66 attached to a lever 67 which is pivoted in the tank at 68. A link 69 is connected with the other end of lever 67 by a pin and slot connection 70 and 71, as better shown in Figure 4 of the drawing. This link 69 extends upward through the top of the tank 65 and is connected at 72 with a suitable switch lever 73 which is pivoted at 74 to a suitable support which may be in a casing (not shown) adjacent the top of the fuel tank. The lever 73

may be provided with a pin or roller 75 adapted to be engaged by a spring pressed cam 76, which may be part of the spring itself, if desired, for the purpose of maintaining the switch lever 73 positively in its upper or lower positions; for purposes of illustration this spring pressed cam is in the position shown however it may be placed in any position along the switch lever desired, as for instance to engage an extension of the lever to the left of the pivot 74. The switch lever is provided with a contact piece 77 suitably mounted thereon and adapted to engage terminal contacts 78 and 79 arranged in one of the power mains from generator 1.

It will be seen, by this construction, that the contact piece of the switch lever will be urged by the spring pressed cam 76 into engagement with the terminal contacts 78 and 79 until it has been disengaged by the link 69, when it will open with a snap movement, and prevent any arcing between the contacts. In Figure 1 of the drawing the float 66 is represented near the bottom of the tank in which position the pin 70 engages the top of slot 71 in link 69 where it will remain until the fuel lowers sufficiently for the weight of the float to overcome the spring pressed cam 76 whereupon it will force the switch open. In Figure 4 the float is represented in a position with its pin 70 near the bottom of slot 71, which position it takes when sufficient fuel has been poured into the tank to cause the float to operate the link 69 to close the switch. The slot 71 in the link permits the float 66 to operate through a greater distance than a tight connection would allow and also permits the spring pressed cam member 76 to perform its function with greater freedom.

Figure 5 of the drawing illustrates the circuits employed for a "single unit" starting system which will operate to start the engine and connect the power mains with the generator. In this modification, the power mains 3 and 4 are connected with the generator and translating devices which are not necessary to be illustrated, since they are fully shown in Figure 1, also in the prior application heretofore referred to. Relay 80 is similar to the relays of said prior application and may be one relay having low resistance winding 81, and in series therewith, a high resistance winding 82 or the windings 81 and 82, may be used on two separate relays as fully set forth in the prior application. Connected with relay 80 is the storage battery 83 which is adapted to energize it when a circuit is made across the power mains 3 and 4. When relay 80 is energized armature 84, will be raised and connect the battery with the conductors 85 and 86. Thus the ignition system (not shown) which is connected with conductors 86 and 87, will be rendered op-

erative and the battery will be connected with the starting and charging dynamo (not shown), which is connected with conductors 85 and 87. Relay 88 which operates its armature 89 to connect the power generator directly through winding 81 of relay 80 is connected by conductors 90 and 91 with conductors 85 and 87 which in turn are connected with the starting and charging dynamo and battery 83. This relay is so designed as to operate, similar to relay 28, in Figure 1, at a higher potential than the E. M. F. of the battery whereby it will close the circuit only while the starting and charging dynamo is generating sufficient potential.

The operation of this modification is the same as the operation of the generator and prime mover of Figure 1. When a circuit is made across the power mains 3 and 4, battery 83 will energize relay 80 and connect the battery with the starting and charging dynamo, and the ignition system. Upon the engine reaching its proper speed relay 88 will connect the power generator through winding 81 of relay 80 and the power mains 3 and 4. Winding 81 maintains relay 80 energized as long as current flows through the power mains and when the current ceases the armature 84 will fall opening the circuits from the battery to the ignition system and to the starting and charging dynamo.

In Figures 1 and 5 of the drawings, relay 21 of Figure 1 and corresponding relay 88 of Figure 5 are illustrated as operating an armature establishing a circuit from the generator 1 to power main 4, however, this could operate to connect either or both power mains with the generator 1 as desired. In the claims the terminology "connecting the power mains with the generator" is construed broadly to contemplate this matter, either or both power mains. For purposes of illustration Figure 6 shows an arrangement of relay 92 corresponding to relays 21 and 88 for operating to connect both power mains 3 and 4. Relay 92 is shown as having two armatures 93 and 94 for convenience of illustration, for connecting the mains with the generator. Armature 93 corresponds with armatures 24 and 89 in Figures 1 and 5 and armature 94 is shown as normally in an upper position to be drawn down to connect the power main. In the normal upper position of armature 94 it connects main 3 with conductor 95 which serves to make a complete circuit for starting when a translating device switch is closed in the manner as the generator 1 does in Figures 1 and 3. In this form of connections the lower contacts 96 and 97 for armatures 24 and 89 are omitted and conductor 95 may be connected with the relay 12 at 98 and battery 83 at 99. The operation of the devices when so connected is the same as in the case of only one main being disconnected at the relay.

In Figure 1 it is pointed out that relays 21 and 28 are represented as separate relays, however, these could be combined into one relay adapted to perform the same functions.

Likewise, relay 25 and solenoid 63 could be combined into one electromagnetic device to perform the functions of both of them, if desired. Further, relays 21 and 28 could be dispensed with altogether and a speed responsive device driven from either the engine or dynamo shaft could be used to mechanically operate to establish the connections made by these relays. Likewise, solenoids 46 and 63 could be replaced by devices responsive to the torque between the engine and dynamo for accomplishing their respective functions.

It is also pointed out that the connections illustrated in Figure 5 may be utilized in a double unit starting system as well as in a single unit system, since the two units may be connected with the conductors 85 and 87 with a suitable switch connected with the generator unit for connecting it with these conductors and disconnecting the motor from them.

It will be understood that the forms of relays and other apparatus shown in the diagrams is merely for the purpose of illustrating the principles of this invention and that any desired suitable types of relays and other apparatus may be used.

I do not wish to limit myself to any of the specific constructions or modes of operation described above in this specification for purpose of giving examples or illustrations of employment of my invention, for it will be obvious that wide departure from the above may be made without departing from the spirit and scope of my invention, which is as set forth in the following claims.

What I claim is:

1. The combination of a dynamo with a prime mover for driving the same, and external power mains for supplying current to translating devices, means for starting the prime mover when a translating device is connected with said power mains, storage means connected with the external power mains for supplying energy to said starting means, means for disconnecting said storage means from the external power mains after the prime mover has started, and means for supplying energy to said storage means and operating to connect the supply mains with said dynamo during the operation of the prime mover.

2. The combination of a dynamo and a prime mover for driving the same, starting and charging apparatus for starting the prime mover, a starting relay for said apparatus, and a relay operated by the charging means of said apparatus for eliminating the starting relay after the prime mover has started.

3. The combination of a dynamo and a

prime mover for driving the same, starting and charging apparatus for starting the prime mover, a starting relay for said apparatus, a relay operated by the charging means of said apparatus for operatively connecting the dynamo with its load circuit after the prime mover has started.

4. An automatic electric power system comprising a dynamo with a prime mover and electric starting and charging means connected therewith, a system including relays connected so as to start the prime mover when a circuit is closed across power mains from the dynamo and to open the same to stop the prime mover when the circuits across said power mains are open, and electromagnetic means operated by the charging means for connecting the power mains with the dynamo during the operation of the prime mover.

5. An automatic electric power system comprising a dynamo with a prime mover and electric starting and charging means connected therewith, an external circuit for said dynamo, means operated by the charging means for connecting said external circuit with the dynamo, a circuit including a battery for said starting and charging means, a connection between said circuits whereby when said first circuit is closed said second circuit will be closed and when said first circuit is opened said second circuit will be opened.

6. The combination with a dynamo, of a prime mover for driving the same, electric starting and charging means for starting said prime mover, electric power mains from said dynamo, a relay operated by the charging means for making the connection between the dynamo and the power mains, and a relay arranged to be operated when a circuit is closed across said power mains for starting the prime mover.

7. An automatic electric power system comprising a dynamo with a prime mover and electric starting and charging means connected therewith, two relay windings in one of the power mains from the dynamo, and means operated by the charging means for excluding one of said windings from the circuit of said power main.

8. The combination of a dynamo and a prime mover for driving the same, and external power mains for supplying current to translating devices, a connection between said dynamo and prime mover, comprising a centrifugal clutch and a centrifugal speed regulator, electro-magnetic means connected with one of the power mains adapted to act on said centrifugal speed regulator in proportion to the current flowing in said mains.

9. The combination of a dynamo and a prime mover for driving the same, and external power mains for supplying current to translating devices, a connection between

said dynamo and prime mover including a centrifugal speed regulator, electro-magnetic means connected with one of the power mains adapted to act on said centrifugal speed regulator in proportion to the current flowing in said mains, and means to increase the speed of the prime mover as the current flowing in the mains increases.

10. The combination of a dynamo and a prime mover for driving the same, a centrifugal speed regulator for driving the dynamo at a constant speed when the current from the dynamo is constant, means for increasing the speed at which said centrifugal speed regulator drives the dynamo as the current from it increases, and means for increasing the speed of the prime mover as the current from said dynamo increases.

11. The combination of a dynamo and a prime mover for driving the same, a centrifugal speed regulator for driving said dynamo from said prime mover at a constant speed when the current from the dynamo is constant, and means for increasing the speed at which said centrifugal speed regulator drives the dynamo as its current increases.

12. The combination of a prime mover and a driven member, a centrifugal speed regulator for driving the driven member at a constant speed under a constant load, means for increasing the speed at which the centrifugal speed regulator drives the driven member as its load increases, and means for increasing the speed of the prime mover as its load increases.

13. The combination with a driving member and a driven member, each having a shaft, of a coupling element for connecting the driving and driven members including a centrifugal clutch to be connected to the shaft of the driving member, and a centrifugal speed regulator to be connected to the shaft of the driven member, and means for regulating the speed at which the speed regulator drives said driven shaft responsive to variations in load on the driven shaft during period of operation of the machines.

14. The combination with a driving member and a driven member, each having a shaft, of a coupling element for connecting the driving and driven members including a centrifugal clutch to be connected to the shaft of the driving member, a centrifugal speed regulator to be connected to the shaft of the driven member, and an electro-magnetic device adapted to act upon said centrifugal speed regulator in a manner to vary the operation of the speed regulator.

15. The combination with a driving member and a driven member, each having a shaft, of a coupling member for said shafts including a centrifugal speed regulator to be connected by a shaft of the driven member, and means for increasing the speed at which the speed regulator drives said shaft

responsive to an increase in the load on said shaft during the operation of the machines.

16. The combination with a driving member and a driven member, each having a shaft, of a coupling element for connecting the driving and driven members including a centrifugal clutch to be connected to the shaft of the driving member, a centrifugal speed regulator to be connected to the shaft of the driven member, means for adjusting the speed at which the speed regulator will drive said driven shaft, and means for increasing the speed at which the speed regulator drives said shaft responsive to an increase in the load on said shaft during the operation of the machines.

17. The combination with a driving member and a driven member, each having a shaft, of a coupling element for connecting the driving and driven members including a driving element in the form of a cylindrical housing having a partition therein between its ends and a bearing element carried by the partition which is adapted to form a bearing and alining element for the ends of the shafts of the driving and driven members, and means within and on opposite sides of the partition of said driving element for transmitting the rotation of the driving shaft to the driven shaft.

18. The combination of a dynamo and a prime mover for driving the same, power mains for supplying power to translating devices, a battery providing an initial potential across said power mains, starting and charging means for starting the prime mover and charging the battery, and electro-magnetic means operated by the charging means for connecting the power mains with the dynamo after it has started.

19. The combination of a dynamo and a prime mover for driving the same, and external power mains for supplying current to translating devices, a connection between said dynamo and prime mover including a centrifugal speed regulator, and electro-magnetic means connected with one of the power mains for acting on said speed regulator in proportion to the current flowing in said mains.

20. The combination of a dynamo with a prime mover for driving the same, and external power mains for supplying current to translating devices, means for starting the prime mover when a translating device is connected with the power mains, storage means for supplying energy to said starting means, means for supplying energy to said storage means and operating to connect the supply mains with said dynamo and disconnect said starting means during the operation of the prime mover.

21. The combination with a prime mover and a driven member having their respective driving and driven shafts in substan-

5 tially endwise alinement with their ends adjacent to each other, of driving means between the prime mover and driven member consisting of a coupling member extending over the adjacent ends of said shafts, a centrifugal clutch on the driving shaft of the
10 prime mover operable to engage said coupling member after the prime mover has started, and a centrifugal speed regulator on the shaft of the driven member in engagement with said coupling member but operable to disengage said coupling member in the event that the coupling member is driven at too high a speed.

15 HAROLD C. THORNE.