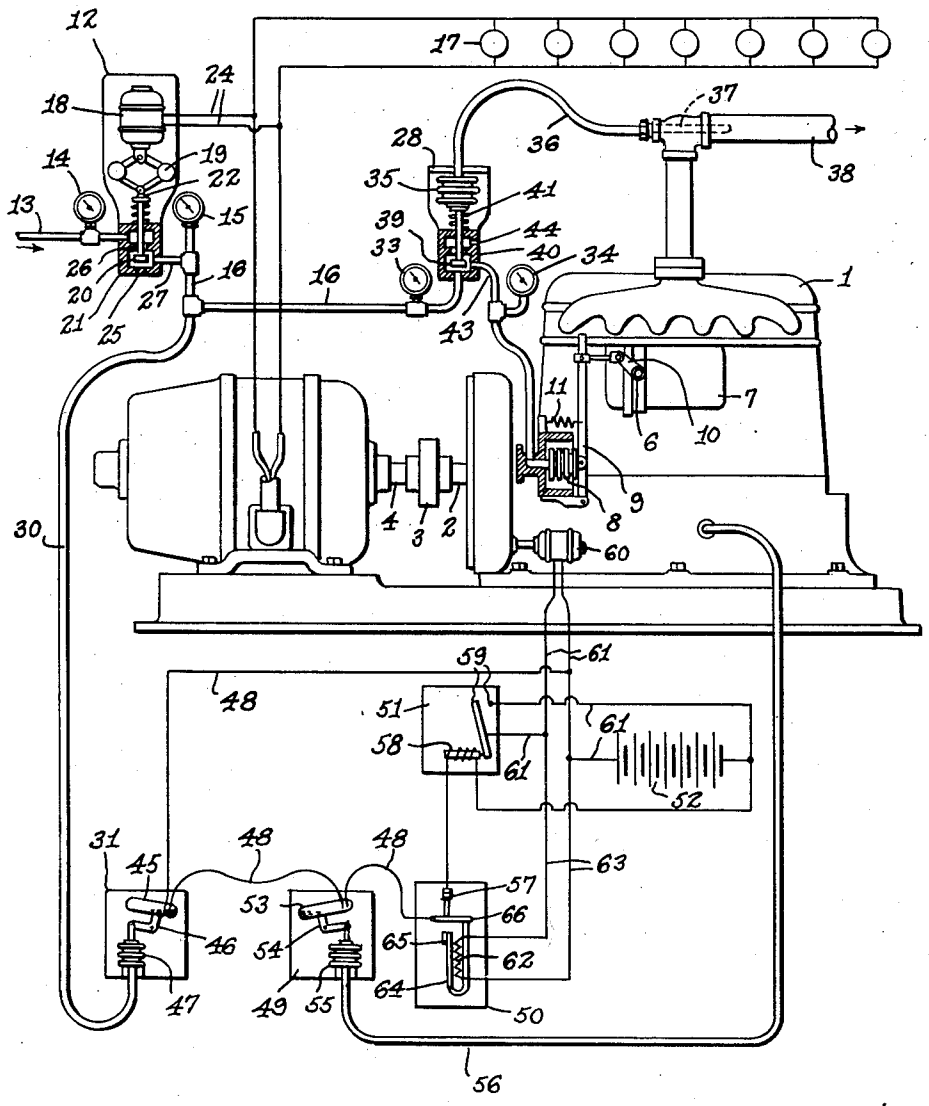
Dec. 12, 1939. G. B. BAILEY 2,183,364

CONTROL MEANS FOR A PLURALITY OF POWER UNITS

Original Filed April 13, 1936 3 Sheets-Sheet 1

Fig. 1.



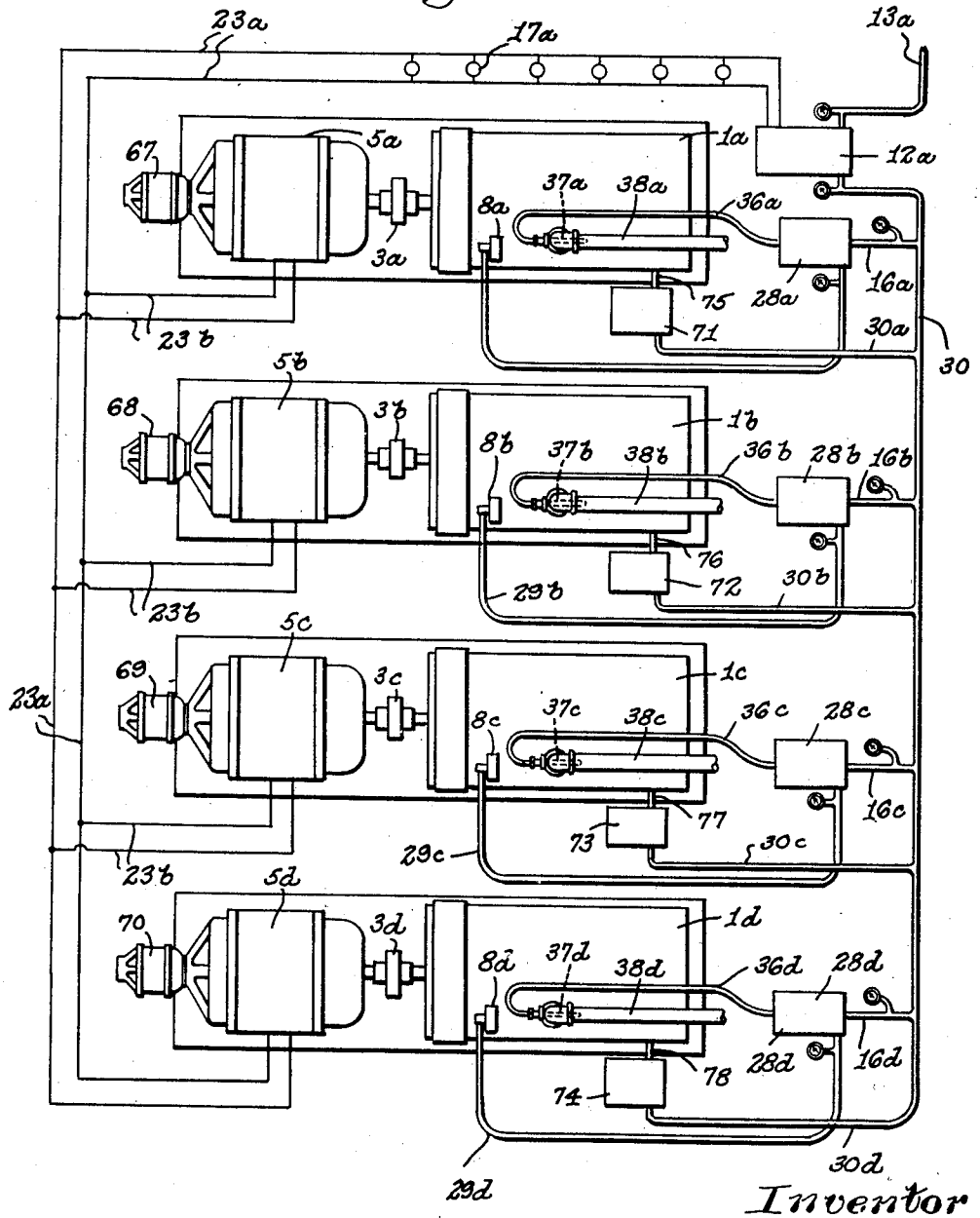
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CONTROL MEANS FOR A PLURALITY OF POWER UNITS

Original Filed April 13, 1936 3 Sheets-Sheet 2

Fig. 2.



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CONTROL MEANS FOR A PLURALITY OF POWER UNITS

Original Filed April 13, 1936 3 Sheets-Sheet 3

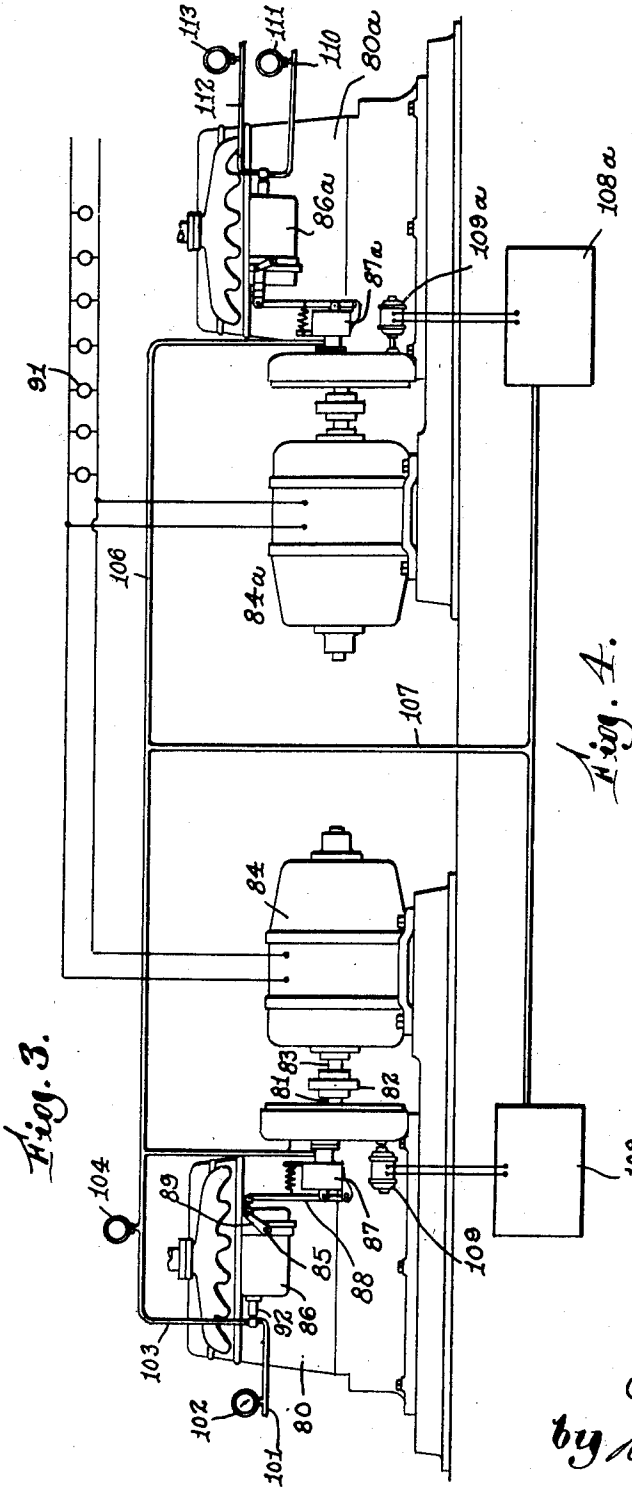


Fig. 3.

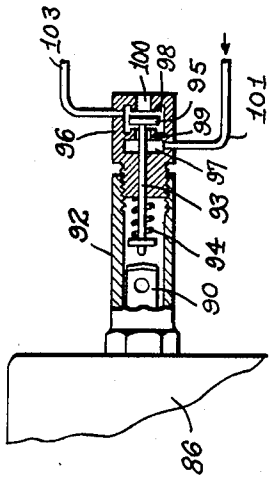


Fig. 4.

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UNITED STATES PATENT OFFICE

2,183,364

CONTROL MEANS FOR A PLURALITY OF POWER UNITS

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Original application April 13, 1936, Serial No. 74,017, now Patent No. 2,122,402, dated July 5, 1938. Divided and this application July 2, 1938, Serial No. 217,213

11 Claims. (Cl. 290—30)

This invention relates to an improved control means for a plurality of power units, such as internal combustion engines whereby operative control of the same may be effected in correspondence with the power output.

One object of the invention is to provide an improved control means for internal combustion engines of the Diesel type.

A further object of the invention is to provide novel means for coupling together a plurality of internal combustion engines and control the operation of the same in such a manner as to prevent overloading of any engine and effect an automatic control of certain of the engines from the operation of one or more of the remaining engines.

A further object of the invention is the provision of simple and efficient mechanism for coupling together and controlling automatically the operation of internal combustion engines or other prime movers by means which is a function of the power output of the system or of one prime mover of the system by means of control mechanism operatively connecting the prime movers included in the system and effective for controlling the governing instrumentalities of said prime movers.

Other objects and advantages of the invention will appear from the following detailed description and appended drawings of certain forms of the invention shown as applied to internal combustion engines for driving electrical generating units, although it is to be understood that the application and use of the control means shown and described are not limited in their operation to utilization with electric generators but may be employed in connection with any other suitable types of power driven mechanisms.

In co-pending applications Serial No. 15,166, filed April 8, 1935, upon which Letters Patent No. 2,142,102, was granted January 3, 1939, and Serial No. 74,017, filed April 13, 1936, upon which Letters Patent No. 2,122,402, was granted July 5, 1938, are shown and described certain features of the invention as disclosed herein, and this application is a continuation in part of said application Serial No. 15,166 and a division of application Serial No. 74,017.

In the present invention I am disclosing improved means for automatically coupling and controlling prime movers, such as internal combustion engines, for single or multiple operation, for the purpose of controlling the power output in such a way that with a varying demand upon the system, the voltage, pressure or speed delivered may be maintained substantially uniform by means of the operation of a varying number of prime movers or internal combustion engines included in the operating series effected through the operation of suitable control mechanisms.

An advantage of my invention is that it makes possible the coupling up in parallel operation, electrically or mechanically, any number of internal combustion engine driven power units, at the same time providing full automatic control. This results in saving in first cost because of application of standardized high speed units of low cost, saving in operating cost due to elimination of attendants and increased efficiency, minimizing the chance of complete failure in a multiple unit application, etc.

In the accompanying drawings the principles of my invention are illustrated in their application of driving dynamos singly and in multiple. While the best mode in which I have contemplated applying the principle of my invention is shown in the accompanying drawings, these are to be taken as merely illustrative, for it is intended that the patent shall cover by suitable expression in the appended claims, whatever features of patentable novelty exist in the invention as a whole.

Figure 1 is a diagrammatic showing of apparatus embodying certain features of my invention;

Figure 2 is a diagrammatic illustration of a multiple arrangement of power driven units, of the type shown in Figure 1, illustrating diagrammatically the manner of interconnecting the control means to provide for a controlled operation of the system;

Figure 3 is a diagrammatic showing of a somewhat modified control means as applied to a multiple arrangement of power driven units such as may be of the type illustrated in my Letters Patent Nos. 2,142,102 and 2,122,402 above mentioned; and

Figure 4 is a detailed view, partially in section, of a portion of the injection pump showing the rack and rack operated control mechanism.

Referring more particularly to Figures 1 and 2 of the drawings, there is disclosed in Figure 1 a Diesel internal combustion engine 1 as representative of any prime mover whose drive shaft 2 is suitably connected to coupling 3 which, for the purpose of illustration, may be taken as an automatic clutch. It is to be noted that the coupling can be solid, flexible or automatic; the latter being adapted for use in multiple unit application where it is desirous to keep the driven

member rotating but, at the same time, allowing the slowing down or stopping of the prime mover. Coupling 3 is, in turn, connected through shaft 4 to dynamo 5 which, for the purpose of illustration, may be of the shunt or compound wound direct current type. It is well known that such a generator will deliver a current, having a desired, substantially uniform voltage at a substantially uniform speed. Heretofore, the maintaining of a substantially constant speed and, therefore, a substantially constant voltage, has been accomplished by control of the fuel delivered to the engine by a standard governor mechanism 6, operation of which is a function of the engine speed and which may be incorporated on a Diesel engine with the fuel injection pump 7, it being adjusted to maintain substantially uniform the speed at which the dynamo 5 will deliver a substantially constant voltage.

However, in my invention the governor mechanism 6 is supplemented with further control mechanism such as diaphragm motor 8 which, through lever linkage 9 controls the adjustment of governor mechanism 6 through throttle lever 10. This throttle lever 10 is standard equipment on commercial Diesel engines and will control the speed and, therefore, the power input of the engine by adjusting the governor 6, all the way from full speed, and therefore full power input, down to a minimum speed and finally to a point where it cuts off fuel supply completely, thus stopping the engine.

Diaphragm motor 8 may be operated and thus control the governor adjustment or throttle lever by any suitable medium such as compressed air, water pressure, vacuum, etc. For the purpose of illustration it will be assumed that compressed air is used. It is to be noted that diaphragm motor 8 will react to the air pressure in such a way that an increase in air pressure will cause the lever linkage 9 to move which, in turn, causes throttle lever 10 to move say in a direction to increase the speed of the engine. On a decrease in air pressure, spring 11 will pull the lever linkage 9 and, therefore, the throttle lever 10 back into a closed position. It is obvious that by using springs of various tension at 11 the diaphragm motor mechanism can be made to react at various pressure differentials say, for instance, (*a*) 0 lbs. pressure to be closed, 6 lbs. to be fully opened, (*b*) 4–10 lbs., (*c*) 6–12 lbs., (*d*) 8–14 lbs. etc.

As shown, compressed air is delivered at a pressure say of 30 lbs. from a pressure source to voltage control 12, through supply tubing 13 and supply pressure gauge 14. Voltage control 12 is connected to the control system through controlled pressure gauge 15 and controlled pressure line 16, and is so designed that it will cause an increase in pressure in the control system on a decrease in voltage due say to an increase in load 17, or decrease the pressure in the control system on an increase in voltage.

Voltage control 12 may consist of a small motor 18, speed of which is a function of the voltage, connected to and driving centrifugal ball governor 19 which, in turn, is connected to double disc 20 of three-way valve 21 through stem 22. Motor 18 is connected across the main electric line 23 through wires 24. A decrease in voltage caused by an increase in load 17 results in slowing up of motor 18 and governor 19, action of which causes disc 20 to restrict or close vent port 25, at the same time opening pressure supply port 26 and allowing compressed air to pass through controlled pressure port 27, to controlled pressure line 16, thereby increasing pressure in control system. An increase in voltage causes a reverse action to take place; i. e., motor 18 and governor 19 speed up; double disc 20 restricts or closes pressure supply port 26; vent port 25 is opened allowing air to escape from control system, thereby decreasing pressure in same.

Controlled pressure tubing 16 is connected to diaphragm motor 8 through an exhaust temperature control 28 and tubing 29 and may also be connected through tubing 30 to as many diaphragm motors and pressure switches 31 as there may be units in the system, or a separate voltage control mechanism may connect each power unit with the next succeeding power unit to cut in the next power unit when the preceding one is overloaded.

Exhaust temperature control instrument 28 may be air operated, equipped with air supply gauge 33 and controlled pressure gauge 34. As shown, it may consist of a bellows 35 which is connected to, through tubing 36, and operates cooperatively with thermostatic bulb 37 placed in engine exhaust 38. Bellows 35 is connected to double disc 39 of three-way valve 40, through stem 41. Ports 42 and 43 of three-way valve 40 are connected to the controlled pressure tubing 16 through supply gauge 33 and diaphragm motor 8 through tubing 29 respectively. Port 44 is a vent to the atmosphere. The action of temperature control 28 is such that it will pass air from the control system to the diaphragm motor 8 so long as the exhaust temperature is below that for which the instrument is set. However, if the exhaust temperature starts to exceed the temperature for which it is set, it reduces the pressure in tubing 29 and, therefore, on diaphragm motor 8. It accomplishes this through the movement of disc 39 by bellows 35. An increase in the exhaust temperature beyond that for which the instrument is adjusted reacts on thermostatic bulb 37, causing bellows 35 to expand which, in turn, causes disc 39 to restrict or close air pressure supply port 42, open vent port 44, thereby allowing air to escape from diaphragm valve 8 through tubing 29 and port 43. Conversely, a decrease in temperature will cause bellows 35 to contract, in which case disc 39 will restrict or close vent port 44 and open supply port 42, allowing air to pass through port 43 into tubing 29 and increase pressure on diaphragm 8.

The exhaust temperature of a Diesel engine increases with the load and it is generally accepted that with an exhaust temperature of 700° F. a Diesel engine is fully loaded. Therefore, with an arrangement as described, it can be readily seen that the engine cannot become overloaded if its temperature controller is set for a temperature of 700° F. or less, due to the fact that as soon as the temperature for which it is set is reached, pressure on the diaphragm 8 is decreased, resulting in a decrease in the power input of the engine with accompanying lowering of exhaust temperature. It might be stated here that a continuance of exhaust temperature in excess of 700° F. will result in excessive valve burning and lowered efficiency. It is to be noted that by adjusting this controller, the operator can definitely set the maximum percentage of the total power that any one engine will deliver. For instance, an exhaust temperature of 640° F. represents 90% full load capacity; an exhaust temperature of 580° F. represents 80% full load capacity; etc.

Pressure switch 31 may be of the single circuit

mercury tube type with mercury tube 45 being operated through lever linkage 46 by bellows 47, its function being to automatically start the engine on a predetermined pressure in the air pressure control system, by closing the electric circuit consisting of connecting wires 48, pressure switch 49, thermostatic time switch 50, solenoid switch 51 and storage battery 52. Pressure switch 49 may also be of the single circuit mercury tube type with mercury tube 53 being operated through lever linkage 54 by bellows 55 which, in turn, is actuated by the lubricating oil pressure in the engine lubricating oil circuit, being connected to same through tubing 56. Pressure switch 49 is normally closed during the starting operation, its function being to break the electric starting circuit after the engine gets to operating. Thermostatic time switch 50 is also of the single circuit type, its contact points 57 being normally closed during the starting operation.

The closing of the electric circuit described energizes solenoid coil 58, causing solenoid switch contacts 59 to close which, in turn, closes an electric circuit consisting of electric starting motor 60 mounted on engine 1, storage battery 52 and connecting electric wires 61. This not only throws the current through the starter motor but also throws current through the resistance 63 in thermostatic time switch 50, the resistance 62 being connected in parallel with starter motor 60 through wires 63. Resistance 62 immediately starts to heat up and affect U-shaped thermostatic control metal element 64, which is fixed on one side at 65, causing it to expand at a definite rate. One of the contact points 57 of thermostatic time switch 50 is mounted on lever linkage 66 which, in turn, is supported on that part of the U-shaped thermostatic metal element 64 which is free to move. If, for any reason, the engine fails to start, thus causing the starting circuit to remain closed for too long a period, the expanding U-shaped thermostatic element 64 reaches the end of lever linkage 66 ceasing to support same, causing contact point 57 to open, thus breaking the starting circuit.

Pressure switch 31 is so adjusted as to operate at a pressure in the air pressure control line which, also, is such that governor adjustment lever 10, due to the action of diaphragm motor mechanism 8, is in a position where fuel will be delivered to the cylinders and, therefore, the engine will be started. As soon as the engine is started the lubricating oil pressure in the lubricating oil circuit immediately starts to rise, due to the operation of the lubricating oil circulating pump which is built into the engine. Pressure switch 49 is so adjusted that an increase in the oil pressure breaks the electric starter circuit. It is to be noted that in the event the engine fails to start and thermostatic time switch 50 breaks the circuit the circuit will remain broken until the time switch 50 is manually adjusted, at which time the trouble will be attended to.

In Figure 2 I have illustrated a plurality of four engines 1a, 1b, 1c and 1d connected through automatic or over-running clutches 3a, 3b, 3c and 3d to dynamos 5a, 5b, 5c and 5d which are synchronous, single phase alternating current generators with direct connected exciters 67, 68, 69 and 70, all feeding into main bus wires 23a through wires 23b to variable load 17a. Each engine is equipped with its own diaphragm motor mechanism 8a, 8b, 8c and 8d respectively, each motor mechanism being controlled by and through its own exhaust temperature controller 28a, 28b, 28c, and 28d respectively, through tubing lines 29a, 29b, 29c and 29d respectively; all in turn being controlled by speed regulator 12a. Controllers 28a, 28b, 28c and 28d are the same type of instruments as temperature control 28, Figure 1, which has already been fully described; while speed regulator 12a is the same as voltage control 12 Figure 1, which also has been fully described, except that it may be equipped with a synchronous motor, speed of which is a function of the speed of the synchronous alternating current generators.

The temperature controllers 28a, 28b, 28c and 28d are connected to their respective thermostatic bulbs 37a, 37b, 37c, 37d located in engine exhausts 38a, 38b, 38c and 38d through tubings 36a, 36b, 36c and 36d. Each engine is equipped with its own automatic starting instruments all housed in cabinets 71, 72, 73, 74, each cabinet containing the same instruments connected electrically and otherwise as previously described and illustrated in Figure 1; i. e., pressure switch 31, pressure switch 49, and thermostatic time switch 50. These, in turn, are connected to solenoid switch and starter mounted on engine, similar to solenoid switch 51 and electric starting motor 60 in Figure 1 through cables 75, 76, 77 and 78. The automatic starting instruments in the cabinets are connected to the control line 30 through tubing 30a, 30b, 30c and 30d. Temperature controls 28a, 28b, 28c and 28d are connected to the control line 30 through tubing lines 16a, 16b, 16c and 16d.

The diaphragm motors 8a, 8b, 8c and 8d are each equipped with a spring similar to spring 11, Figure 1. For the purpose of illustrating the operation of this plant, it is to be understood that the tension of these springs are all different. It is obvious that if pressure is introduced to the control system the first diaphragm motor to operate would be the one equipped with the spring of least tension. The starting pressure switch of each unit would be so adjusted that it would close the starter circuit at a pressure which would be such that its respective diaphragm motor mechanism with which it is cooperating would have its respective governor adjustment in such a position that when the engine is turned over fuel would be injected to the cylinders and therefore the engine would start.

Let it be assumed that diaphragm motor 8a on engine 1a in Figure 2 is equipped with the spring of the least tension, with diaphragm motors 8b, 8c and 8d of engines 1b, 1c and 1d equipped with springs of increasingly greater tension respectively. This being the case, with controller 12a arranged to introduce air pressure from supply tubing 13a to the control system through header 30 engine 1a will be the first one to start. All the generators would be connected across the line and all of them would come up to speed as engine 1a brings generator 5a up to speed, due to the fact that they are free to turn because of the automatic clutches 3b, 3c and 3d. This illustrates a decided advantage of connecting the generators to the engine through automatic clutches. In bringing the generators in an alternating current generating system to speed in said manner, no synchronizing equipment is necessary.

As soon as the proper speed is reached speed control 12a will, if there is a tendency for the speed to increase beyond the desired speed, let

air pass out of the control system, thus reducing the pressure on diaphragm motor 8a, retarding governor position until the desired speed is reached. If, on the other hand, the variable load 17a is increased, the power input of engine 1a will be increased by increasing the speed setting of the governor of that engine. Overloading of engine 1a is, of course, prevented by its exhaust temperature control 28a operating in the manner previously described for temperature control 28 in Figure 1. If the load increases beyond the capacity of engine 1a, pressure in control system will continue to increase through the action of speed control 12a, with a result that engine 1b will be started up and will deliver power into the system due to the fact that its diaphragm motor 8b will be the next one to be affected by the increase in pressure, being equipped with a spring of less tension than that on diaphragm motors 8c and 8d on engines 1c and 1d, although greater in tension than that on diaphragm motor 8a on engine 1a. In the same manner, a further increase in the load will cause a still further increase in pressure, with the result that engines 1c and 1d will be brought into operation in the order named. In each instance, their overloading is prevented by the action of their respective exhaust temperature controls 28c and 28d.

It can be seen that speed controller 12a in the alternating current system described and illustrated in Figure 2, not only functions to start and stop the various engines upon an increase or decrease in demand, but also acts as a master governor operating cooperatively with each of the individual engine governors to maintain a more nearly constant speed. Constant speed characteristics in an alternating current generating system are important in order to maintain constant cycling. The ordinary engine governor being dependent upon a speed variation as its source of force to move the fuel control throttle, may give a variation of 5% or higher in speed between no load and full load, with the result that the cycles vary in the same proportion. However, with the master speed controller 12a operating cooperatively with the engine governor constantly adjusting it, it can be seen that the uniformity of speed or cycles is limited only by the accuracy of the master controller 12a. This type of instrument can be made extremely sensitive. For instance, it can be designed so that its air pressure pilot valve control mechanism will operate over the full control pressure range of 15 lbs. by a variation of not over one-half of one per cent of speed.

It might be noted that an advantage of the multiple unit arrangement of synchronous, alternating current generators as shown in Figure 2, is the fact that those generators that are not supplying power will be floating on the line or operating as synchronous motors under no load, or synchronous condensers. As such, they will correct the power factor in the system, with a resulting increase in over-all efficiency.

In that form of the invention shown in Figure 3 of the drawings, a suitable prime mover, such as a Diesel internal combustion engine 80, has its drive shaft 81 connected by means of a coupling 82, which may be in the form of an automatic or overrunning clutch, with the shaft 83 of a dynamo 84, which may be of a shunt or compound wound direct current type or an alternating current generator capable of synchronous operation. The internal combustion engine 80 may be provided with a standard governor mechanism 85 operatively associated with a fuel injection pump 86, as is usual in devices of this character, and which may be adjusted to maintain the speed of the generator substantially uniform for the delivery of a substantially constant voltage.

In this form of the invention, however, the governor mechanism 85 is supplemented by a further control mechanism, such as a diaphragm motor 87, which through lever linkage 88 controls the operation of the governor mechanism 85 by means of the throttle lever 89. The throttle lever is adapted for controlling completely the operation of the engine throughout its entire operating range. The diaphragm motor 87 may be operated by any suitable medium, such as, compressed air, water pressure, vacuum, etc., for controlling the governor adjustment or throttle lever, and in the present instance the same may be assumed to be operated by compressed air supplied thereto at a pressure appropriate for the purpose.

In internal combustion engines of the type shown herein the governor adjustment mechanism 85 regulates the speed through control of the fuel injection by the pump 86 through operation of an engine governor (not shown), and thereby controls the fuel injection of the injection pump 86 by means of a rack 90 slidably mounted in the fuel injection pump 86. This mechanism has not been shown in detail since it is conventional in devices of this character and well-known to those skilled in the art. Since the quantity of fuel being supplied is a function of the power output of the engine and is related directly with the movement of the rack 90, the rack 90 may be employed as a control means for multiple engine operation, similar in general to that represented in Figures 1 and 2 of the drawings by the voltage control 12, as responsive to engine output or load conditions as impressed upon a power operated instrumentality, such as the line load 91, by the power output of the system.

In order to utilize the rack 90 as a control element, a housing 92 is provided adjacent to the free end of the rack 90 which supports a valve stem 93 slidably mounted therein and normally maintained in its inwardly extended position by means of a coiled spring 94. A valve 95 carried by the valve stem 93 is mounted for movement in an air pressure casing 96, which may form a part of the housing 92, and which contains air chambers 97 and 98 connected by a port 99. An exhaust port 100 is formed in the chamber 98 in position to be opened or closed by movement of the valve 95. An air pressure tubing 101, provided with a pressure indicator 102, communicates with the air chamber 97; and an air supply tubing 103, provided with a pressure gauge 104, connects the air chamber 98 with a diaphragm motor 87 carried by the engine 80, and a continuation 106 of the air supply line or tubing 103 connects the air chamber 93 with the diaphragm motor 87a carried by the next internal combustion engine 80a of the series. A branch line 107 of the air supply tubing 103 has branches operatively connecting with pressure operated switch or starting mechanisms 108 associated with internal combustion engine 80 and 108a associated with internal combustion engine 80a. In this form of the invention the exhaust temperature control means shown in Figures 1 and 2 is eliminated and the pressure control as developed from movement of the rack 90 actuates the diaphragm motors 87—87a etc. directly, and the pressure operated switches 108, 108a, etc., through a branch air supply line or pressure tubing.

The engine 80a may be provided with a rack operated control mechanism similar to that designated by reference characters 90—100, previously described, to which may be connected a pressure supply pipe 110 provided with a pressure gauge 111. An air supply tubing 112 provided with a pressure gauge 113 extends therefrom and may be connected with the diaphragm motor 87a of the engine 80a and extend to and control the diaphragm motor and pressure operated switch or starting mechanism of the next succeeding engine of the series.

In the operation of the control means by the rack 90, as the engine approaches some predetermined limit of its operating capacity, the rack 90 as seen in Figure 4, will move to the right into position to engage and displace the valve stem 93 so as to move the valve 95 outwardly from the port 99 and into position to close the exhaust port 100. In this position of the parts the air pressure from the supply tubing 101 enters the air chamber 97 and passes freely through the port 99 to enter the air line tubing 103 and its associated branches for operating the diaphragm motors 87 and 87a as well as for actuating the pressure operated switches or starting mechanisms 108 and 108a.

The diaphragm motors of the system shown in Figures 3 and 4, of which 87 and 87a are examples, may be similar in all respects in construction and operation with those designated as 8, 8a, etc., as more particularly shown and described in Figures 1 and 2 of the drawings. The pressure operated switches or starting mechanisms 108 and 108a and 109—109a, as indicated diagrammatically in Figure 3, may include the mechanisms and arrangement of parts as shown more particularly in Figure 1 of the drawings, and may be similar thereto in their modes of operation. It is to be understood that each pressure operated switch or starting mechanism 108, 108a etc., may be so constructed as to be provided with a manually operated switch element or starting means for initiating the operation of each internal combustion element through manually controlled operation of the parts whenever found desirable.

This invention may be embodied in a system in which two or more prime movers, such as internal combustion engines, are connected directly with a generator or other power operated instrumentality, as is shown more particularly in Letters Patent No. 2,142,102, or a system in which two or more prime movers are connected individually with generators or power operated instrumentalities, as is shown more particularly in Letters Patent No. 2,122,402, and includes a control mechanism interconnecting the prime movers and responsive to a load factor for bringing one or more additional units into power supplying relation with said power operated instrumentality, or eliminating one or more units from power supplying relation with said power operated instrumentality in response to changing factors of engine operation having a direct relationship with the power output of a unit or the power output of the system. In either case, the power operated instrumentality of which a load factor may be taken as a means for actuating the control mechanism may be that to which power is supplied by all of the generators or direct actuating power operated instrumentalities included in the system, which in the present form of the invention may be the line load indicated by the reference characters 17, 91, or may be the power developed by one prime mover or supplied by one generator of the series. In either case the ultimate power operated instrumentality to which power is supplied from all of the power units making up the system may be an electric circuit, a pressure or pumping system, or any other group or series of power operated mechanisms suitably connected for receiving power from the various power units forming the system. The load factor relied upon for initiating the operation of one or more prime movers or removing them from operation in the system may be represented by some direct function of the power output, as the voltage in an electric circuit, as indicated in the form of the invention illustrated in Figures 1 and 2, supplemented or modified by an exhaust factor of an engine or prime mover, or may be represented by factors responsive to fuel consumption of an engine or prime mover, as is indicated in that form of the invention illustrated in Figure 3 of the drawings. In the form of invention shown in Figure 3 of the drawings, the movement of the rack 90 longitudinally of its extent corresponds with the quantity of fuel being consumed by the prime mover and represents in consequence in its change of position a function of the power output of the prime mover.

In this case the operation of the diaphragm motors 87, 87a and other operating elements through means actuated by movement of the rack 90 may be unmodified by any other operating factor, such as the engine exhaust, since the engine exhaust is a factor of the engine operation which is in substantial correspondence with the movement of the rack 90.

What I claim is:

1. A control mechanism for a series of internal combustion engines each of which is connected for the delivery of power to a common power operated instrumentality comprising, a governor mechanism for controlling the operation of each said internal combustion engine, and pressure control means operatively connected with the governor mechanism of each said engine and responsive both to variations in power supplied to said common power operated instrumentality and the operating ratio of the engine with respect to its operating capacity for actuating the governor mechanism of said engines to increase or decrease the power output of one or more of said engines relative to another of said engines.

2. A control mechanism for a series of internal combustion engines each of which is connected for the delivery of power to a common power operated instrumentality comprising, a governor mechanism for controlling the operation of each said internal combustion engine, control means operatively connected with the governor mechanism of each said engine and operable upon the increase or decrease of power supplied to said common power operated instrumentality for actuating the governor mechanism of said engines to increase or decrease the power output of one or more of said engines relative to another of said engines, and means operatively associated with each said engine for modifying the action of said control means to limit the power output of such engine to a predetermined ratio of its operating capacity.

3. In a control mechanism for a series of internal combustion engines each of which is connected for the delivery of power to a common power operated instrumentality, a governor mechanism for controlling the operation of each

said internal combustion engine, and mutually interdependent co-operatively modifying control means for each said internal combustion engine operatively connected with its governor mechanism and effective for controlling the operation of said engine at lower power delivery ratios of said engine and operative at a power delivery ratio of said engine approaching the limit of its operating capacity for controlling the operation of one or more other engines of the series.

4. In a control mechanism for a series of internal combustion engines each of which is connected for the delivery of power to a common power operated instrumentality, a governor mechanism for controlling the operation of each said internal combustion engine, mutually interdependent co-operatively modifying control means for each said internal combustion engine operatively connected with its governor mechanism and effective for controlling the operation of said engine at lower power delivery ratios of said engine and operative at a power delivery ratio of said engine approaching the limit of its operating capacity for controlling the operation of one or more other engines of the series, and means forming a part of said control means for making the operating control of said last named engines effective successively and in a predetermined order.

5. In a control mechanism for a series of internal combustion engines each provided with a starter mechanism and each connected for the delivery of power to a common power operated instrumentality, control means operatively associated with one of said internal combustion engines effective for controlling the operation of said engine throughout its operating range and having a power delivery ratio component responsive to a predetermined power delivery ratio of said first engine and operatively connected with the starter mechanism of another engine of said series effective at a power delivery ratio of said first named engine approaching the operating capacity of said engine to start said second named engine.

6. In a control mechanism for a series of internal combustion engines, each provided with a governor mechanism and a starter mechanism, and each connected for the delivery of power to a common power operated instrumentality, control means for one of said engines effective for controlling the operation of said engine throughout its operating range and having a power delivery ratio component responsive to a predetermined power delivery ratio of said first engine operatively connected with the starter mechanisms of the remaining engines of the series effective at a power delivery ratio of said first named engine approaching the operating capacity of said engine for starting one or more of said remaining engines, and means operatively connected with the governor mechanisms of said remaining engines for regulating the order of starting said remaining engines.

7. In a control mechanism for two or more internal combustion engines, each provided with a governor mechanism and a starter mechanism, and each connected for the delivery of power to a common power operated instrumentality, control means for controlling the operation of one of said engines throughout its range of operation and operative at an operating ratio of said engine approaching its operating capacity for actuating the starter mechanism of another of said engines, and control means interdependently associated with the control means of each of said engines for limiting the power output of said engine relative to the operating capacity of said engine.

8. In a power system including a series of power units each comprising a prime mover and a generator operatively connected thereto, all of said generators being connected for the delivery of power to a common power operated instrumentality, a master control means common to all said prime movers and operable in direct relation with the power effectively supplied to said power operated instrumentality for regulating the operation of said prime movers, and a control means for each prime mover all operatively connected with said master control means and mutually modifying the control exerted upon each of said prime movers by said master control means.

9. In an automatic control mechanism for a series of internal combustion engines connected for supplying power to a common power operated instrumentality, a fluid pressure system, means comprising a thermostatic device operative for changing the fluid pressure in said system upon change of the exhaust temperature in one of said engines, and means actuated by a change of fluid pressure in said system to vary the power output of one or more of said engines.

10. In a power system, a plurality of internal combustion engines one or more of which is connected for the delivery of power to a common power operated instrumentality independently of or in co-operation with one or more of the remaining engines of the system, a governor mechanism for each said internal combustion engine, control means for each said governor mechanism actuable by means representing a load factor of said engine, and a master control means operatively connected with each said first named control means actuable in terms of the power supplied to said common power operated instrumentality for modifying the operation of each said first named control means.

11. In a control mechanism for two or more internal combustion engines, each provided with a governor mechanism and a starter mechanism, and each connected for the delivery of power to a common power operated instrumentality, control means for said engines comprising a fluid pressure system, means operable in response to variations of pressure in said fluid pressure system for actuating said governor and starter mechanism, and means for varying the effective pressure in said fluid pressure system in response to variations in the power supplied to said common power operated instrumentality by said engines.

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