C. O. PEARSON.

CONTROLLER FOR INTERNAL COMBUSTION ENGINES.

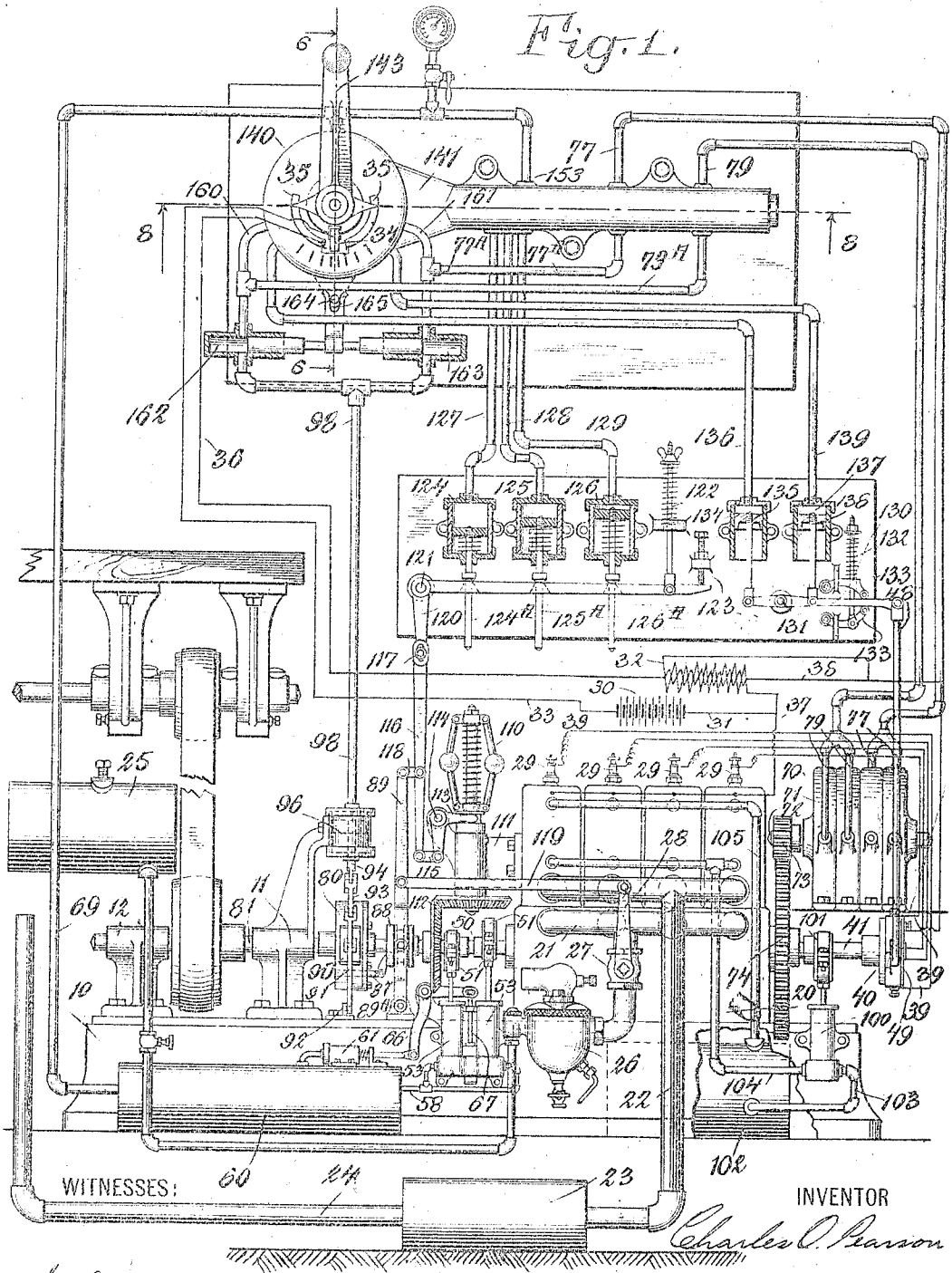
APPLICATION FILED AUG. 17, 1908.

1,156,430.

Patented Oct. 12, 1915.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

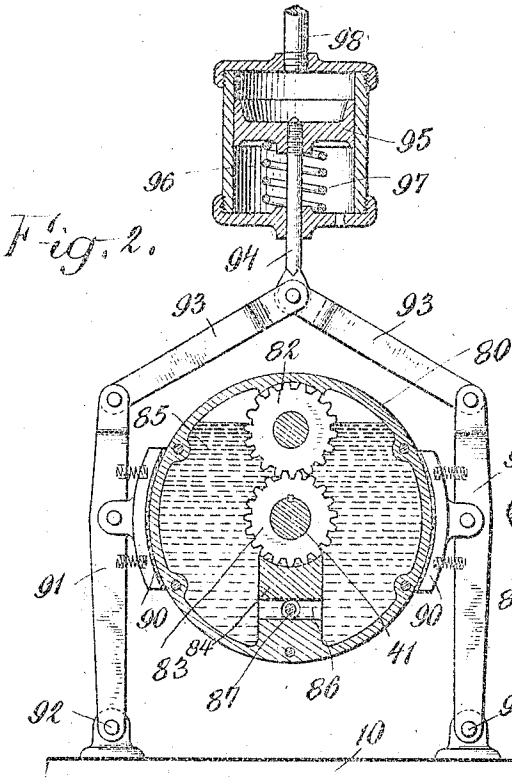


Fig. 3.

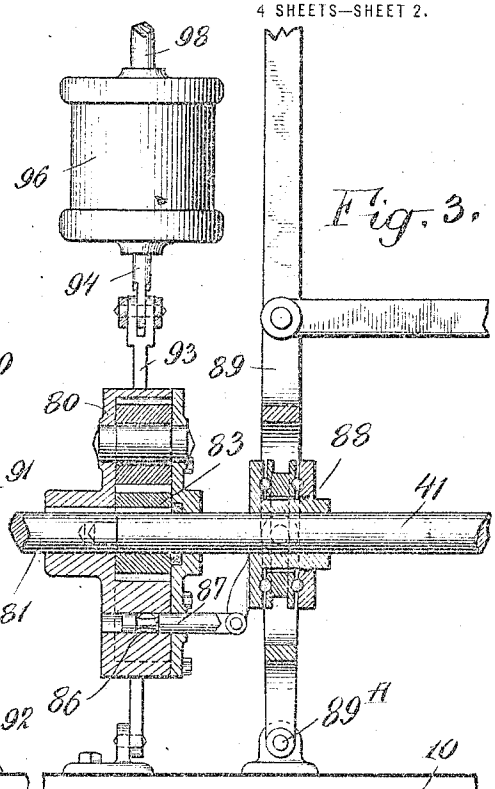


Fig. 4.

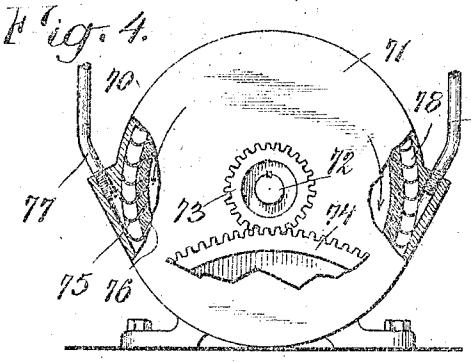
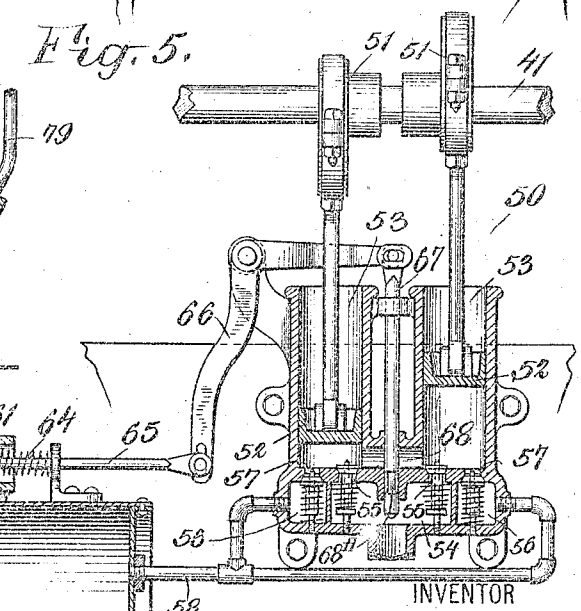


Fig. 5.



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4 SHEETS—SHEET 3.

Fig. 6.

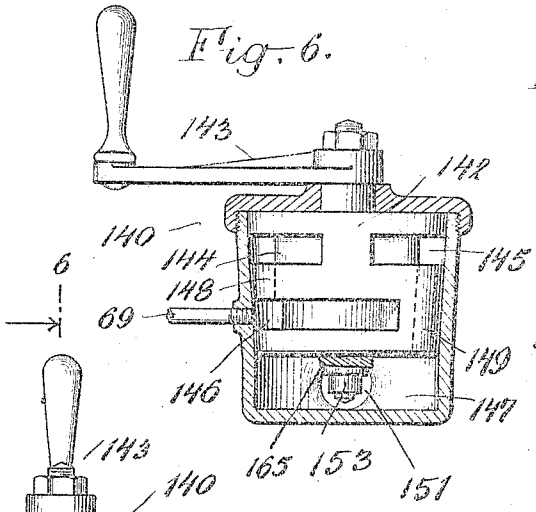


Fig. 7.

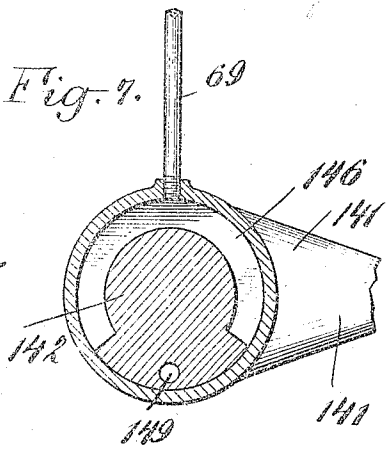


Fig. 8.

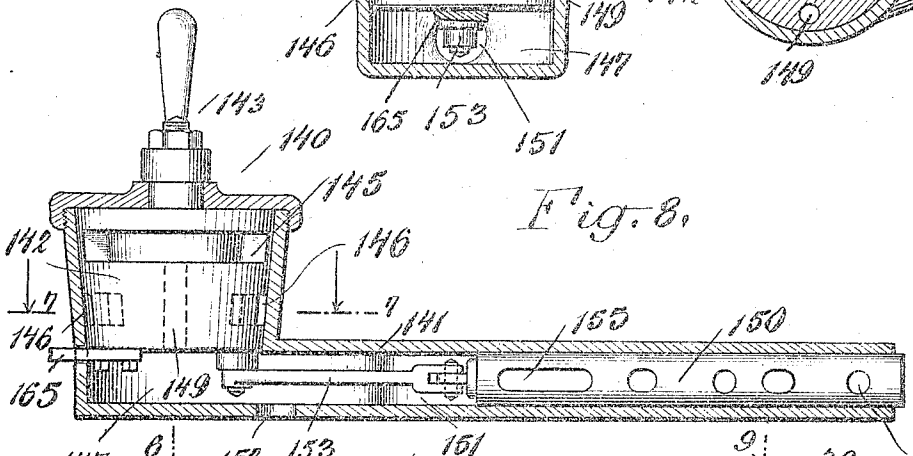


Fig. 9.

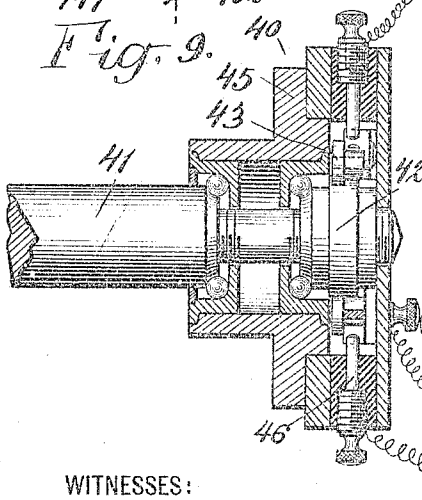
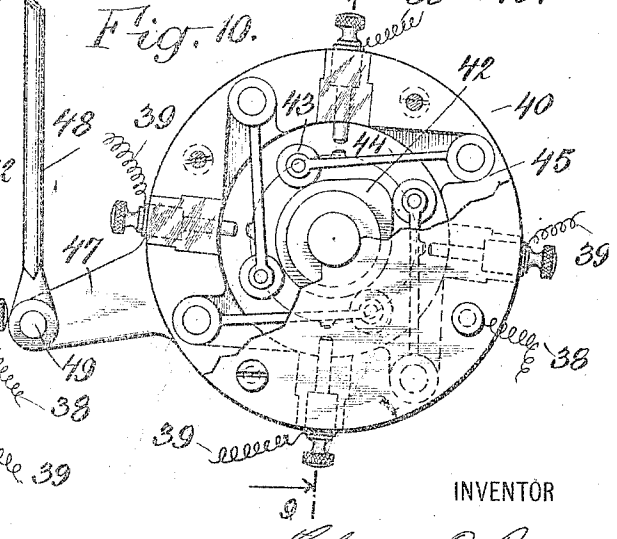


Fig. 10.



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4 SHEETS—SHEET 4.

Fig. 11.

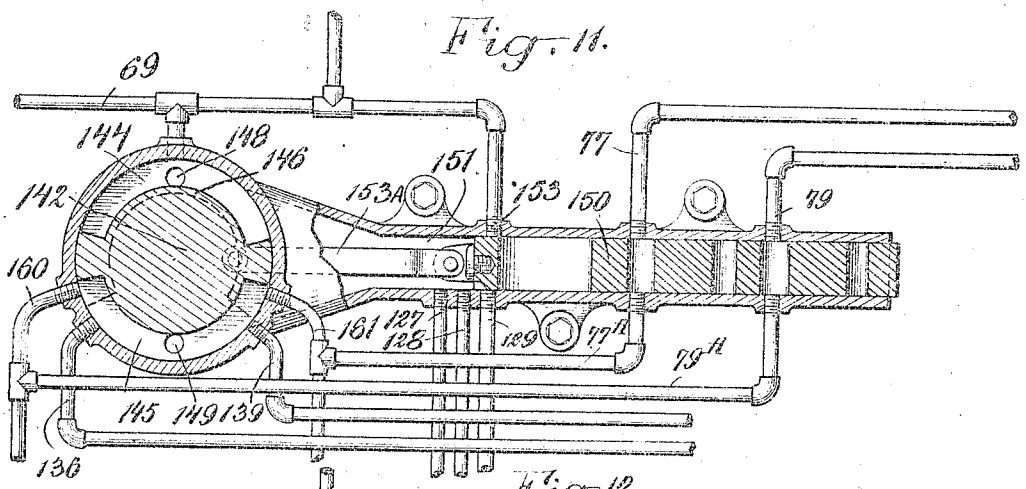


Fig. 12.

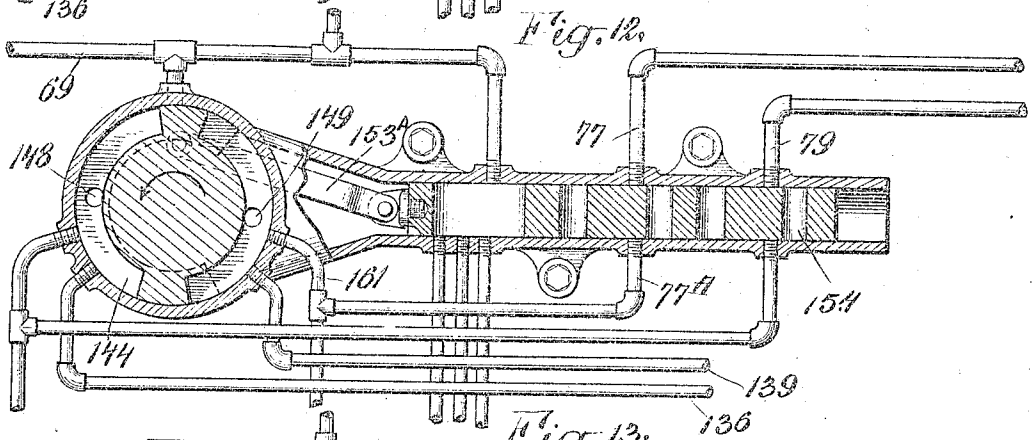
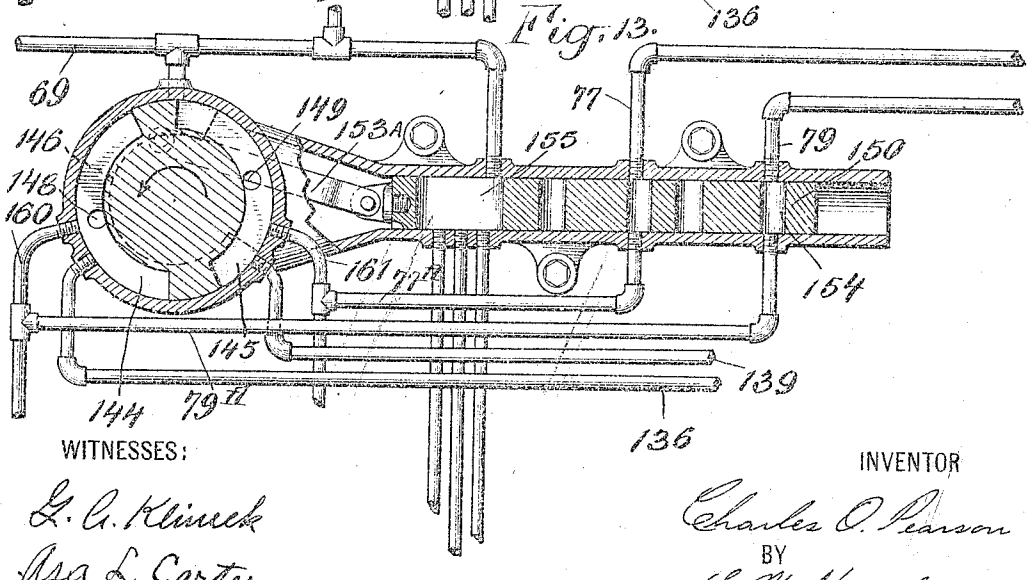


Fig. 13.



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CONTROLLER FOR INTERNAL-COMBUSTION ENGINES.

1,156,430. Specification of Letters Patent. Patented Oct. 12, 1915.

Application filed August 17, 1908. Serial No. 448,876.

To all whom it may concern:

Be it known that I, CHARLES O. PEARSON, a citizen of the United States, and a resident of the borough of Brooklyn, in the county of Kings, in the city and State of New York, United States of America, have invented certain new and useful Improvements in Controllers for Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in controllers for internal combustion engines, and its object is to provide means whereby an internal combustion engine may be started, stopped, reversed, and its speed and power controlled either at the engine or from a distant point.

Its object is more specifically to arrange a system of engine control in which fluid pressure, which may be generated by the engine itself, is used for the above purpose.

Further objects and purposes of my invention will appear in the following specification in which I will describe the construction and arrangement of certain apparatus and devices which may be used to carry out the invention, and the novel features of the invention will be set forth in the appended claims.

Referring to the drawings Figure 1 is a side elevation of an internal combustion engine with associated mechanisms connected together so as to illustrate my invention. Some of the parts in this figure are shown in cross-section and some are shown in more or less diagrammatic form. Fig. 2 is a sectional end view, and Fig. 3 a side elevation, partly in section, of an improved clutch and brake mechanism. Fig. 4 is an end elevation of a fluid pressure starting device which I use in carrying out the invention. In this figure certain parts are broken away to more clearly show the construction of the device. Fig. 5 is a sectional side elevation of the pressure pump and its connected parts. Fig. 6 is a sectional end elevation of the controlling valve or switch, the section being taken on the line 6—6 of Fig. 1. Fig. 7 is a sectional front elevation of a portion of the controlling valve, the section being taken on the line 7—7 of Fig. 8. Fig. 8 is a bottom plan view, in section, of the controlling valve, the section being taken on the line 8—8 of Fig. 1. Fig. 9 is a sectional side elevation, and Fig. 10 is an end elevation of a spark-timing mechanism. The section in Fig. 9 is taken on the line 9—9 of Fig. 10. Figs. 11, 12 and 13 are sectional elevations of the controlling valve showing the parts thereof in different relative positions for the purpose of illustrating the operation of the valve and the parts with which it is connected.

Like characters of reference designate corresponding parts in all of the figures.

10 designates a base upon which certain of the parts I am about to describe are mounted.

20 designates an explosive or internal combustion engine of any preferred form or construction. In this particular case it is shown as a four-cylinder two-cycle engine, of which 21 is the intake or supply pipe and 22 the outlet or exhaust pipe. The exhaust, after passing through a muffler 23, may be led off by a pipe 24 to a stack or chimney, or some other desired place.

25 is a gasolene tank which is connected with the carbureter 26, and the latter is connected through a throttle or regulating valve 27 with the engine intake 21.

28 is a lever arranged to adjust the position of the throttle valve 27.

29 designates the sparking plugs of the engine.

30 designates an electric battery. One of its leads 31 is connected with the primary of an induction coil 32. Its other lead 33 is connected with a contact blade 34 upon the handle 143 of the controlling valve.

35, 35 are contact plates insulated from but mounted upon the face of the controlling valve and with which this blade coacts to close the battery circuit through the primary winding of the induction coil whenever the controlling valve handle is moved to one side or the other. The contact plates 35, 35 are for this purpose connected together and to the induction coil 32 by conductor 36. One of the leads 37 of the secondary winding of the induction coil is grounded to the engine and its other lead 38 is connected with the spark-control mechanism or timer 40.

39 are the leads from the timer to the spark plugs 29.

In Figs. 9 and 10 the spark-control mechanism or timer 40 is shown. In these figures 41 is the shaft of motor 20. To the end of this shaft a cam 42 is affixed. A plurality

of rollers 43, corresponding with the number of cylinders of the engine, bear upon the surface of the cam and are arranged to be moved thereby. Each of these rollers is mounted upon the end of an arm such as 44, the other end of which is affixed to a metallic housing 45 and which is arranged to be moved into contact with an insulated contact pin 46 by the cam 42. Each of these contact pins is connected with one of the spark plugs 29 of the engine by means of one of the conductors 39. The housing itself is rotatable a certain limited amount about the axis of shaft 41 for the purpose of advancing or retarding the time of the spark in relation to the piston movement of the engine. An arm 47 projecting from one side of the housing has an adjusting rod 48 pivotally connected with it at 49.

The pressure pump is designated by 50 and is shown somewhat in detail in Fig. 5. A pair of eccentrics 51, 51 are affixed to the motor shaft and arranged to reciprocally drive pistons 52, 52 within cylinders 53, 53. 54 is an inlet chamber from which ports 55, 55 lead into the cylinders 53. In these ports are check-valves arranged to prevent air or other fluid from passing out of the cylinder through them. 56, 56 are outlet chambers connected with the cylinders by ports 57, 57 in which are check valves arranged to prevent air or other fluid from passing into the cylinders through them. 58 is a pipe which leads from the pressure pump to a pressure supply tank 60.

The pressure regulator which is shown in the drawings comprises a cylinder 61, one end of which is closed and connected with the tank 60 by pipe 62. A piston 63 within the cylinder is arranged to be moved by the pressure against the action of a compression spring 64. 65 is the piston rod which is connected by a bell-crank lever 66 with a valve rod 67. When the fluid pressure is lower than required this valve rod closes a passage 68 between the lower portions of the pressure pump cylinders 53, 53, but when the pressure has reached the desired amount, the regulator piston 63 will be pushed forward thereby and, through the connections above pointed out, will raise the valve rod until a portion of it, 68^A, which is cut away for this purpose is in line with the passage 68. It may be seen that this movement opens the passage 68 so that the fluid driven out of cylinders 53 through the downward movement of its piston, will fill the other cylinder while its piston is moving upward, which occurs at the same time, so that no pressure will be applied to the pressure tank until the pressure therein drops and the valve rod 67 is moved down again. 69 designates a supply pipe from the pressure tank to the other parts of the apparatus. The arrangement above described for opening the passage between the two cylinders of the pressure pump will at the same time allow the pistons 52 to move freely so that the only energy consumed by this apparatus when not applying fluid under pressure is the small amount required to overcome the friction of its moving parts.

The form of starting device 70 which is shown in Figs. 1 and 4 is a reversible fluid pressure turbine. 71 is its casing; 72 its shaft upon which is affixed a pinion 73. 74 is a gear keyed or otherwise attached to the engine shaft 41 and in mesh with the pinion 73. 75 designates a plurality of impact blades mounted upon the periphery of a wheel 76 which is affixed to the shaft 72. 77 is a pressure pipe through which fluid is arranged to flow against the blades 75 to impart rotations to the wheel 76 and to the shaft 72 in the direction indicated by the arrow on the left of Fig. 4. 78 designates another set of impact blades affixed about the periphery of another portion of the wheel 76 or a similar wheel mounted upon shaft 72. These blades are set in the opposite direction and are arranged to drive the shaft 72 in the opposite direction or that indicated by the arrow on the right of Fig. 4 when fluid pressure is admitted through a supply pipe 79. From Fig. 1 it may be seen that the supply pipes 77 and 79 may, if desired, be divided so that each of them may supply more than one port to the impact blades. It is evident that any movement imparted to the shaft 72 will be transmitted to the engine or motor shaft 41 but at a reduced rate of speed through the pinion 73 and the gear 74. It may be seen that the wheel 76, through its connection with the engine shaft, forms a balance-wheel for the engine and acts as such while the engine is running.

In Figs. 1, 2 and 3 a fluid pressure controlled brake and clutch device which may be used in carrying out the invention is illustrated. This comprises a circular housing 80 rotatably mounted upon a power shaft 81 which is in alinement with the engine shaft 41. These shafts may be maintained in alinement with each other by having a hub on the end of one project into a corresponding opening in the end of the other as shown in Fig. 3. 82 is a gear rotatably supported by the housing and surrounded thereby. On the end of shaft 41 and keyed thereto is a similar gear 83, which is in mesh with the gear 82. 84 is an inwardly projecting portion of the housing which extends to and partially surrounds the teeth of gear 83. This projecting portion and the gears 82 and 83 divide the interior of the housing into two chambers. These chambers are inclosed and are filled or partially filled with oil or other fluid 85. 86 is a passage between the two chambers formed as above described and this passage

is controlled by a piston valve 87. 88 is a collar loosely mounted upon the shaft 41 and connected with the piston valve 87. 89 is a lever pivoted at 89A and connected with the collar 88. It is arranged to slide the collar longitudinally upon the shaft 41 and to thereby control the position of the piston valve 87. The operation of this device is as follows: When the shaft 41 is rotated the gears 83 and 82 will be driven. If the passage 86 is open this rotation of the gears will cause the oil to be driven through the gears and through the passage 86 and will have no effect upon the housing, but if the passage 86 is closed the oil cannot circulate so that the gears which are oil tight will be locked together by the oil and will cause the housing to rotate with the shaft 41. This effect will take place gradually so that the driven mechanism will be smoothly accelerated up to a speed approximately equal to that of the engine.

90, 90 designates a pair of brake-shoes bearing upon the outer surface of housing 80. These are supported upon brake levers 91 which are pivoted to stationary brackets on the base 10 at 92. Their upper ends are connected by levers 93, 93 which are pivoted to the brake levers and to a piston rod 94. This piston rod is affixed to a piston 95 within a cylinder 96. A spring 97 pushes the piston and its connected parts upward to apply the brake-shoes. A pipe 98 is arranged to admit fluid pressure to the upper end of the cylinder to push the piston downward against the spring 97 to release the brake-shoes. This brake will hold the shaft 81 when the latter is disconnected from the engine.

100 is a water supply pump for the cooling jacket of the engine. It is driven by an eccentric 101 upon shaft 41. 102 is a water tank which is connected with the pump by a pipe 103. A pipe 104 leads from the pump to the water jacket of the engine, and a pipe 105 leads from the water jacket back to the tank 102.

110 is a centrifugal speed governor mounted upon bracket 111 on the side of the engine and driven through bevel gears 112 from the engine shaft 41.

113 is a bell-crank lever pivoted at 114 to the bracket 111. The lower end of this bell-crank lever is connected by a link 115 to the lower end of a vertically disposed lever 116, the upper end of which is connected at 117 with the vertical arm of a bell-crank lever 120. It is also connected at an intermediate point by a link 118 with lever 89.

119 designates a rod connecting lever 89 with the arm 28 which is connected with and controls the throttle valve 27.

The bell-crank lever 120 which is pivoted at 121 forms a part of a governing device. A spring 122 is arranged to raise the horizontal arm of the bell-crank lever up against an adjustable stop 123.

124, 125 and 126 are governing cylinders similar in construction to the brake controlling cylinder 96.

127, 128 and 129 are fluid pressure pipes each communicating with the upper end of one of these governing cylinders. The pistons within the governing cylinders are connected by piston rods 124A, 125A and 126A with the horizontal arm of bell-crank lever 120 and arranged to push the latter down against the action of spring 122 a greater or lesser degree, according to which of the pistons is actuated, and also whether one or more of them is actuated.

The upper end of the spark adjusting rod 48 is pivotally connected with an arm 130 which is pivoted at 131 and which is normally maintained in horizontal position by means of a spring 132 and a pair of centering fingers 133, 133.

134 is a cylinder inclosing a piston 135, the rod of which is connected with the pivoted arm 130 at one side of the pivot 131.

136 is the pressure supply pipe to cylinder 134. 137 is a similar cylinder within which is a piston 138 which is connected with the arm 130 at the other side of its pivot. 139 is the pressure supply pipe to this cylinder.

140 designates a manually operated valve or switch by means of which the control of the engine is affected. This valve comprises a casing 141 by means of which a rotary valve member 142 and a piston valve 150 are inclosed. 143 is a handle by means of which these valves are moved. In describing the construction of the valve 140 I will point out its connection with the other parts of the apparatus and describe the operation of the control system. The rotary member 142 is so constructed that near the forward portion it has two annularly disposed chambers designated in the drawings by 144 and 145. Back of these chambers and in alinement with the pressure supply pipe 69 is another chamber 146. Back of the rotary valve member the casing is open to form a chamber 147 which communicates with a cylindrical portion 151. These parts are open to the air through a port 152. The cylindrical portion of the casing holds the slidable piston valve 150. 148 designates a passage in the rotary valve member between the chambers 144 and 146, and 149 designates a similar passage between the chambers 145 and 147. The slidable piston valve is connected with the rotary valve member by a connecting rod 153A so that it slides in or out whenever the rotary valve member is turned in one direction or the other. When the valve handle is in its central position all of the pipes which are connected with the valve are open to discharge through the

port 152, with the exception, of course, of the pressure pipe 69. The pressure supply pipe 69 is connected with the upper part of the valve casing which contains the rotary valve member opposite the chamber 146, and at 153 to the cylindrical member of the casing which contains the piston valve. The other pipe connections which have been herein pointed out are connected with the valve casing 140 at the various points indicated in the drawings. When the handle 143 is in central position the apparatus is at rest and the parts of the valve are in the positions as shown in Figs. 1 and 11 of the drawings. The air supply is cut off from the various leads and pipes because that part which communicates with chamber 144 through chamber 146 and passage 148 has no outlet. The port 153 is at the same time closed by the piston 150. Now, if an operator turns the handle over to the left as far as it will go, the parts of the valve will assume the positions in which they are shown in Fig. 13. Now, the fluid pressure supply entering through chamber 146, passage 148 and chamber 144, will pass through the pipes 160 and 98 to the brake cylinder 96. The brake will be released thereby. The fluid pressure will also pass through the pipe 79A, port 154 in piston valve 150, and the pipe 79 to the fluid pressure starting device which is connected with the engine in the manner previously described. This will rotate the engine in one direction. The actuation of the engine will cause it to draw in a charge of explosive mixture through the carbureter 26 and the spark ignition device previously described will at the required time ignite the charge and cause it to drive the engine. This will be repeated until the engine is running under its own power.

The piston valves 162 and 163 are interposed in the pipes 160 and 161, respectively, and arranged to be actuated by a pin 164 which is connected to move with the operating handle of the valve and which engages with a forked bracket 165 to slide these piston valves over to one side or the other. When the handle 143 has been moved to the left as above described, the valve 163 will be moved to close the passage between the pipes 98 and 161. When the valve has been thrown over to the position shown in Fig. 13 the pressure supply will also be connected through pipe 136 with cylinder 134 which, through its mechanical connections, will shift the spark timer to advance the spark and thereby increase the speed of the engine. Connections will at the same time be made through port 155 with the pipes 127, 128 and 129, and through them with their respective governing cylinders 124, 125 and 126. These, through their mechanical connections, will actuate the clutch within housing 80 and will open the throttle valve 27. It may be seen that the centrifugal governor mechanism is associated with the connections with the clutch, and with its throttle valve so that it controls and governs the operation of both of these parts. It is so arranged that whenever the engine attains undue speed, the piston valve 87 of the clutch will be partly opened to allow slippage of the clutch and the throttle valve will be partly closed to slow down the engine. When the engine has attained its normal speed the operator may move the handle 143 back until the parts are in the positions shown in Fig. 12, when the port 154 is moved out of line with the pipes 79A and 79 so that the pressure supply is shut off from the starting device, after which the engine will run under its own power until stopped by the operator. This may be done by returning the handle 143 to its central position when the contact plate 34, which has been moved onto contact plate 35 by the previously described operation, will be removed therefrom by this movement of handle 143 and will thereby disconnect battery 30 from the sparking mechanism; at the same time the brake will be applied and the clutch released. Of course the controlling valve may be moved to intermediate positions to energize one or more of the governing cylinders which will alter the amount of opening of the clutch valve and of the throttle valve so that the speed of the driven shaft 81 may be controlled thereby. If it is desired to start the engine in the opposite direction, the handle 143 of the controlling valve may be turned to the right, in which case operations similar to those above described will take place, but the starting device will be energized through the pipes 77A and 77 and the engine will be driven in the opposite direction.

Internal combustion engines depend upon a fluid supply and means for igniting the supply. Their running can be primarily controlled only by regulating this supply or changing the time of igniting the charge relative to its revolutions. The energy which is used to control the engine may be generated by the engine itself. It may be used to assist the engine in driving its load whenever its load becomes excessive, as well as to control the starting and stopping of the engine and its driven shaft. But more than this, the energy is used to regulate the vital elements of the engine which produce its motive power, so that its explosive charge may be modified at will, and its ignition mechanism regulated to suit variable conditions. Controlling the action of an engine, in the sense this expression is used herein, broadly includes starting it in both directions, controlling its speed and the power which it may develop in both directions, and stopping it. If the action of such

an engine is to be controlled from a distance, it is important that all of the above functions should be under full control of an operator. In my improved devices I have shown suitable means for accomplishing this result from a distance, and certain auxiliary pilot devices which correspond in action and communicate between a manually operated switch and the starting, reversing, controlling and stopping means. I have also shown automatic controlling devices which coact with the manually operated switch and the auxiliary devices. These devices are so arranged that an unskilled operator may, by the simple manipulation of a lever, fully control the action of the engine. This provides a simple system by means of which an internal combustion engine, such, for example, as a gasolene engine, may be readily controlled from any convenient point, and as this has hitherto been difficult or almost impossible, the invention should be given a broad interpretation, and the claims which are appended are intended to cover other arrangements and means for producing this result than those which I have herein described as a specific illustration of one manner in which my invention may be carried into effect. The usefulness of this invention is unlimited as it removes the most objectionable features of engines of this type which are otherwise efficient and desirable.

What I claim is:—

1. An internal combustion engine, a pressure pump arranged to be driven thereby, a starting device for the engine, a throttle valve and a spark mechanism for controlling the speed of the engine, and manual means for directing the pressure generated by said pump and causing said pressure to actuate the starting device, the throttle valve and to control the spark mechanism.

2. An internal combustion engine, a centrifugal governor and intermediate mechanical connections between the engine and the governor arranged to automatically control the speed of the engine, and a manually controlled fluid pressure actuator arranged to shift the relative positions of said connections step by step to thereby modify the effect of the governor and to cause the engine to run at a desired rate of speed.

3. An internal combustion engine, a starting device therefor, means driven by the engine for obtaining a fluid pressure supply, a centrifugal governor arranged to control the speed of the engine, and manually operated means for directing the fluid pressure and causing said pressure to actuate the starting device, and to modify the effect of the centrifugal governor.

4. An internal combustion engine, a pressure pump arranged to be driven thereby, a starting device for the engine, a centrifugal governor arranged to control the speed of the engine, and a valve; and connections between the pump, the valve, the starting device, and the governor whereby the pressure may be directed from a point removed from the engine to cause said pressure to actuate the starting device and to modify the effect of the centrifugal governor.

5. An internal combustion engine, a pressure pump arranged to be driven thereby, a starting device for the engine, a speed controlling mechanism comprising a centrifugal governor, a manually operated valve, and connections between the pump, the valve, the starting device, and the speed controlling mechanism whereby the pressure may be directed to cause said pressure to actuate the starting device and to modify the effect of the centrifugal governor.

6. A reversible internal combustion engine, a pressure pump arranged to be driven thereby, a reversible starting device for the engine, a speed controlling mechanism comprising a centrifugal governor and a throttle valve, intermediate connecting mechanism between the centrifugal governor and the throttle valve, a manually operated valve, and connections between the pump, the valve, the starting device, and the speed controlling mechanism whereby the pressure may be directed to cause said pressure to actuate the starting device to start the engine in either direction, and to shift the connecting mechanism to modify the effect of the governor.

7. An internal combustion engine, a starting device therefor, means driven by the engine for generating a fluid pressure supply, a power transmission shaft, a clutch for connecting said shaft with the engine, and manually operated means for actuating the starting device and the clutch by means of said fluid pressure.

8. An internal combustion engine, a starting device therefor, a pressure pump driven by the engine for generating a fluid pressure supply, a speed controlling mechanism, a power transmission shaft, a clutch for connecting said shaft with the engine, and manually operated means for actuating the starting device and the clutch and modifying the effect of the speed controlling mechanism by means of said fluid pressure.

9. An internal combustion engine, a fluid pressure actuator arranged to control the speed thereof, a power transmission device, a clutch arranged to connect said device with the engine, a brake arranged to connect said device with the engine, a brake for the transmission device, said clutch and brake being arranged to control the speed of the transmission device, and manual means for controlling said actuator, the clutch, and the brake from a point removed from the engine.

10. An internal combustion engine, means

for controlling the engine, a power transmission device, a clutch, and a brake for said device, and fluid pressure means for together actuating the engine controlling means and clutch, and releasing the brake.

11. An internal combustion engine, a starting device therefor, independent means driven by the engine for generating a fluid pressure supply, a power transmission shaft, a clutch and an independently operated brake for said shaft, and manually controlled means for actuating the starting device and the clutch, and releasing the brake by means of said fluid pressure.

12. An internal combustion engine, a starting device therefor, a pressure pump driven by the engine, a speed controlling mechanism, a power transmitting shaft, a clutch and brake for said shaft, and manual means for directing the pressure generated by the pump and causing said pressure to actuate the starting device, the speed controlling mechanism and the clutch, and to release the brake.

13. An internal combustion engine, a pressure pump arranged to be driven thereby, a starting device for the engine, a speed controlling mechanism comprising a centrifugal governor and a throttle valve, intermediate connecting mechanism between the centrifugal governor and the throttle valve, a power transmission shaft, a fluid clutch and a brake for said shaft, a manually operated valve, and connections between the pump, the valve, the starting device, and the speed controlling mechanism whereby the pressure may be directed to cause said pressure to actuate the starting device, to shift the connecting mechanism to modify the effect of the centrifugal governor, to actuate the fluid clutch, and to release the brake.

14. An internal combustion engine, a pressure pump arranged to be driven thereby, a starting device for starting the engine in either direction, a throttle valve and a spark mechanism for controlling the speed of the engine, a power transmission shaft, a clutch and a brake for said shaft, a manually operated valve, and connections between the pump, the valve, the starting device, the throttle valve and spark mechanism, and the clutch, whereby the pressure may be directed to cause said pressure to actuate the starting device, the throttle valve, the throttle valve and spark mechanism, and the clutch, and to release the brake from a point removed from the engine.

15. An internal combustion engine, a fluid pressure turbine arranged to start the engine, an independent pressure pump driven by the engine, a speed controlling mechanism for the engine, a single manually operated valve, and connections between the pump, the valve, the turbine, and the speed controlling mechanism whereby the pressure may be directed to actuate the turbine and the speed controlling mechanism.

16. An internal combustion engine, a fluid pressure turbine arranged to start the engine in either direction, an independent pressure pump driven by the engine, a pressure supply tank connected with the pump, a fluid pressure actuator for controlling the speed of the engine, a single manually operated valve, and connections between the pressure tank, the valve, the turbine, and said actuator, whereby the pressure from said tank may be directed to cause said pressure to actuate the turbine and the speed controlling actuator.

17. An internal combustion engine, a fluid pressure turbine arranged to start the engine in either direction, a pressure pump driven by the engine, a pressure supply tank connected with the pump, a speed controlling mechanism for the engine comprising a centrifugal governor and a fluid pressure actuator for modifying the effect of the governor, a manually operated valve, and connections between the pressure tank, the valve, the turbine and said actuator whereby the pressure from said supply tank may be directed to cause said pressure to actuate the turbine and the actuator.

18. An internal combustion engine, a fluid pressure turbine arranged to start the engine in either direction, a pressure pump driven by the engine, a pressure supply tank connected with the pump, a speed controlling mechanism for the engine comprising a centrifugal governor and a fluid pressure actuator, said actuator having a plurality of cylinders arranged to modify the effect of the governor step by step, a manually operated valve, and connections between the pressure tank, the valve, the turbine and said actuator cylinders whereby the pressure from said supply tank may be directed to cause said pressure to actuate the turbine and the fluid pressure actuator to cause the engine to run at a desired speed.

19. An internal combustion engine comprising a sparking device, a fluid pressure starting device for the engine, means driven by the engine for generating a fluid pressure supply, mechanism for shifting the sparking device, a pressure cylinder connected with said shifting mechanism, and manually operated means for directing the pressure and causing the pressure to actuate the starting device and the sparking device shifting mechanism.

20. An internal combustion engine comprising a sparking device, a fluid pressure device for starting the engine in either direction, a pressure pump driven by the engine, mechanism for shifting the sparking device, a pressure cylinder connected with said shifting mechanism, a centrifugal gov-

ernor arranged to automatically control the speed of the engine, a fluid pressure actuator comprising a plurality of cylinders arranged to modify the effect of the governor, and manual means for directing the pressure and causing said pressure to actuate the starting device, and to energize the cylinders of the sparking device shifting mechanism and of the fluid pressure actuator.

21. An internal combustion engine, means driven by the engine for generating a fluid pressure supply, a sparking device for the engine, an electrical supply for said device, and a single manually operated device for conjunctively controlling the fluid pressure supply and the electrical supply for stopping the engine, or starting the engine in both directions.

22. An internal combustion engine, means driven by the engine for generating a fluid pressure supply, a fluid pressure motor positively connected with the engine, a sparking device for the engine, an electrical supply for said device; and manual means for connecting and disconnecting the fluid pressure with and from the motor, and conjunctively connecting and disconnecting the electrical supply with and from the sparking device for starting and stopping the engine.

23. An internal combustion engine, a pressure pump driven thereby and arranged to generate a fluid pressure supply, a fluid pressure control system for the engine comprising supply and exhaust pipes for said fluid pressure supply, and a single manually operated valve for controlling the connections of said pipes, said control system being arranged to cause the pressure supplied by said pump to start the engine in either direction and to control the speed thereof.

24. An internal combustion engine, a pressure pump connected therewith, a fluid pressure motor connected with the engine, a sparking device for the engine, a speed controlling mechanism comprising a centrifugal governor, a throttle valve, and a shifting mechanism for the sparking device; intermediate connections between the governor and the throttle valve, a manually operated valve at a point removed from the engine, and connections between the pump, the valve, the motor, the throttle valve connections and the spark-shifting mechanism whereby the pressure generated by the pump may be directed to cause said pressure to actuate the motor, to actuate the throttle valve connections, and to actuate the spark-shifting mechanism.

25. An internal combustion engine, a pressure pump connected therewith, a reversible fluid pressure motor connected with the engine, a sparking device for the engine, an electrical supply for said device, a speed controlling mechanism comprising a centrifugal governor, a throttle valve, and a shifting mechanism for the sparking device, intermediate connections between the governor and the throttle valve, a manually operated valve at a point removed from the engine, connections between the pump, the valve, the motor, the throttle valve connections and the spark-shifting mechanism whereby the pressure generated by the pump may be directed to cause said pressure to actuate the motor, to actuate the throttle valve connections, and to actuate the sparking device shifting mechanism in either direction, to thereby control the speed of the engine; and a switch associated with the manually operated valve for controlling the electrical supply to the spark mechanism.

26. An internal combustion engine, a pressure pump connected therewith, a reversible fluid pressure motor connected with the engine, a sparking device for the engine, a speed controlling mechanism comprising a centrifugal governor, a throttle valve, and a shifting mechanism for the sparking device, intermediate connections between the governor and the throttle valve; a power transmission shaft, a clutch arranged to connect said shaft with the engine, a brake for the transmission shaft, said clutch and brake being arranged to control the speed of the transmission shaft; a manually operated valve, and connections between the pump, the valve, the motor, the clutch, the brake, the throttle valve connections and the spark-shifting mechanism whereby the pressure generated by the pump may be directed to cause said pressure to actuate the motor, the clutch, and the brake, and to actuate the throttle valve connections and the spark-shifting mechanism.

27. An internal combustion engine comprising a sparking device, a reversible fluid pressure motor positively connected with the engine, a pressure pump driven by the engine for generating a fluid pressure supply, an electrical supply for the sparking device, mechanism for shifting the sparking device, a speed controlling mechanism for the engine comprising a centrifugal governor and a fluid pressure actuator, said actuator having a plurality of cylinders arranged to modify the effect of the governor step by step, a throttle valve, intermediate connections between the governor and the throttle valve, and a shifting mechanism for the sparking device; a power transmission shaft, a clutch arranged to connect said shaft with the engine, a brake for the transmission shaft, said clutch and brake being arranged to control the speed of the transmission shaft; a manually operated valve at a point removed from the engine, and connections between the pump, the valve, the motor, the throttle valve connections, the spark-shifting mechanism, and the clutch and brake, whereby the pressure generated

by the pump may be directed to cause said pressure to actuate the motor to start the engine in either direction, to actuate the throttle valve connections and the sparking device shifting mechanism in either direction to thereby control the speed of the engine, and to actuate the clutch and the brake for the transmission shaft; and a switch associated with the manually operated valve for controlling the electrical supply for the spark mechanism.

28. An internal combustion engine, a starting device and controlling devices therefor, a single manually operated controlling valve at a point removed from the engine, and intermediate pilot mechanisms connected with said starting and controlling devices whereby the engine may be started, stopped and its action controlled from said single controlling valve.

29. An internal combustion engine, a controller therefor comprising a manually operated controlling valve at a point removed from the engine, a plurality of intermediate fluid pressure pilot mechanisms arranged to control the action of the engine, fluid pressure means controlled by said controlling valve for actuating said mechanisms in one direction, and mechanical means for actuating said mechanisms in the opposite direction.

30. An internal combustion engine, a controller therefor comprising a manually operated controlling valve at a point removed from the engine, a throttle valve and an ignition apparatus, intermediate pilot mechanisms arranged to control said throttle valve and ignition apparatus, fluid pressure means controlled by said controlling valve for actuating the pilot mechanisms, the throttle valve and the ignition apparatus in one direction, and mechanical means for actuating said parts in the opposite direction.

31. An internal combustion engine, a controller therefor, comprising a manually operated controlling valve, a throttle valve, intermediate pilot mechanism comprising means whereby the throttle valve may be moved in a plurality of steps, fluid pressure means controlled by said controlling valve for actuating said mechanism and the throttle valve in one direction, and mechanical means for actuating said parts in the opposite direction.

32. An internal combustion engine, a controller therefor comprising a manually operated controlling valve, an ignition apparatus, a throttle valve, intermediate pilot mechanism comprising means whereby the throttle valve may be moved from closed to open position in a plurality of steps, fluid pressure means controlled by said controlling valve for actuating said mechanism, the throttle valve and ignition apparatus, a spring, and mechanical means for bringing said parts back to their central position.

33. An internal combustion engine, mechanism driven thereby, a brake for said mechanism, a controlling device for the engine, comprising a manually operated controlling valve, an intermediate pilot mechanism for moving the brake, fluid pressure means controlled by said controlling valve for actuating said mechanism to release the brake, and mechanical means for actuating said mechanism in the opposite direction.

34. An internal combustion engine, an ignition apparatus therefor, a circuit for said apparatus, manually operated means for closing and opening said circuit, fluid pressure means for moving said apparatus in either direction from its central position from the same manually operated means, and a spring for returning the ignition apparatus to its central position before said circuit is opened.

35. An internal combustion engine, a fuel supply therefor, an ignition apparatus for the engine, a circuit for said apparatus, manually operated means for closing said circuit, fluid pressure means for advancing said apparatus and regulating the fuel supply to increase the speed of the engine, said fluid pressure means being controlled from the same manually operated means.

36. An internal combustion engine, a fuel supply therefor, an ignition apparatus for the engine, a circuit for said apparatus, manually operated means for closing and opening said circuit, fluid pressure means for moving said apparatus in either direction from its central position, and for increasing the fuel supply to the engine to increase the speed of the engine, mechanical means for returning the ignition apparatus to its central position and for decreasing the fuel supply when the manually operated means is actuated to open the circuit to stop the engine.

37. An internal combustion engine, a fuel supply therefor, a fluid pressure supply, conduits therefor, a fluid pressure starting device for the engine, a mechanism arranged to be driven thereby, a brake for said mechanism, an ignition apparatus for the engine, a circuit for said apparatus, a throttle device for controlling the fuel supply to the engine, a centrifugal governor connected therewith, a manually operated controlling device arranged to close said circuit and connected with said conduits whereby the fluid pressure supply may be directed to start the engine, to release the brake, to advance the ignition apparatus, and to open the throttle valve to increase the speed of the engine.

38. An internal combustion engine, a fuel supply therefor, a fluid pressure supply, con-

duits therefor, a fluid pressure starting device for the engine, a mechanism arranged to be driven thereby, a brake for said mechanism, an ignition apparatus for the engine, a circuit for said apparatus, a throttle device for controlling the fuel supply to the engine, a centrifugal governor connected therewith, a manually operated controlling device arranged to close said circuit and connected with said conduits, whereby the fluid pressure supply may be directed to start the engine, to release the brake, to advance the ignition apparatus, and to open the throttle valve to increase the speed of the engine; mechanical means for applying the brake, closing the throttle valve and retarding the ignition apparatus, said mechanical means being brought into action upon the manually operated controlling device being actuated to open the ignition apparatus circuit to stop the engine.

39. An internal combustion engine, a fuel supply therefor, a centrifugal governor arranged to control said supply, an ignition apparatus for the engine, a circuit therefor, a manually operated circuit-closer, and fluid pressure means controlled by said circuit-closer and arranged to shift the mechanical connections of said governor to thereby cause the effect of said governor upon the fuel supply to be modified at will.

40. An internal combustion engine, a fluid pressure control system therefor, a manually operated controlling device at a point removed from the engine, a mechanism arranged to be driven by the engine, a brake therefor, means combined with said engine control system whereby the brake may be conjunctively controlled with the engine from said manually operated controlling device to release the brake when the engine is started and to apply the brake to hold said mechanism independently of the engine when the engine is stopped.

41. An internal combustion engine, fluid pressure means for controlling said engine, mechanism arranged to be driven by the engine, a coupling between the engine and the mechanism, said coupling comprising a fluid power transmission device, and means actuated by the engine controller for causing said fluid to be stored gradually under pressure within the coupling and to accelerate the driven member up to practically the speed of the engine.

42. An internal combustion engine, a fluid pressure control system therefor comprising means for starting the engine in either direction, mechanism arranged to be driven by the engine, a coupling between the engine and the mechanism, said coupling comprising a fluid power transmission device, means actuated by the engine controller for causing said fluid to be stored gradually under pressure within the coupling and to accelerate the driven member up to practically the speed of the engine in either direction, and manual means for controlling the engine control system and said coupling.

43. An internal combustion engine, mechanism arranged to be driven thereby, a fluid pressure actuator for controlling the speed of the engine step by step, a fluid coupling device between the engine and said mechanism, a manually operated device for controlling said actuator and said coupling device, and a centrifugal governor arranged to govern the speed of the engine and to act upon said fluid coupling device to cause a slip whenever the speed of the driven mechanism becomes too great.

44. An internal combustion engine, mechanism arranged to be driven thereby, a fuel supply for the engine, a throttle valve for controlling said supply, a fluid pressure actuator for moving said throttle valve step by step to control the speed of the engine, a fluid coupling device between the engine and said mechanism, a manually operated device for controlling said actuator and said coupling device to regulate the speed of the engine and to cause said mechanism to be connected with the engine when the engine has reached any desired one of its speeds, and a centrifugal governor arranged to act upon said throttle valve to govern the speed of the engine and to act upon the fluid coupling device to release said device whenever the speed of the driven mechanism becomes too great.

45. A reversible internal combustion engine, mechanisms for starting the engine in either direction and for controlling the speed and power thereof, a fluid pressure supply, a single manually operated valve having a plurality of ports, and pipe connections between said starting and controlling mechanisms and said ports whereby the control of the engine may be effected from said valve.

46. An internal combustion engine, a member arranged to be driven thereby, a fluid pressure transmission device operatively connecting said engine and driven member; mechanisms for controlling the action of said engine and for controlling said transmission device, a fluid pressure supply, a manually operated valve at a point removed from the engine, said valve having a plurality of ports, and pipe connections between said mechanisms and said ports whereby the control of the engine and the connecting mechanism may be effected from said valve.

47. An internal combustion engine, a sparking mechanism therefor, mechanical means for automatically actuating said sparking mechanism in one direction, fluid pressure means for actuating said sparking mech-

anism in the opposite direction, and a manually operated valve for controlling fluid pressure for actuating said fluid pressure means.

48. An internal combustion engine arranged to run in either direction, a sparking mechanism therefor, mechanical means for automatically centering said sparking mechanism, and manually controlled fluid pressure means for shifting said sparking mechanism in one direction or the other.

49. An internal combustion engine arranged to run in either direction, a sparking mechanism therefor, mechanical means for automatically centering said sparking mechanism, fluid pressure actuating means for shifting said sparking mechanism in one direction or the other, and a manually operated valve having ports for connecting and disconnecting the fluid pressure to and from said actuating mechanism.

50. An internal combustion engine, a fuel supply therefor, a single controlling device situated at a distance from the engine, a fluid pressure supply controlled thereby arranged to control the action of the engine in both directions of rotation, a sparking mechanism for the engine, a circuit therefor, and means in said controlling device for connecting and disconnecting the circuit for said sparking mechanism.

51. An internal combustion engine, a fuel supply therefor, a valve for controlling the fuel supply, a centrifugal governor and fluid pressure actuated means arranged to conjunctively move said valve, and a manual device for controlling the fluid pressure means.

52. An internal combustion engine arranged to run in either direction, a fuel supply therefor, a valve for controlling the fuel supply, a centrifugal governor arranged to automatically control said valve, and a manually controlled fluid pressure actuated mechanism connected with said valve arranged to control the speed of the engine in conjunction with said centrifugal governor.

53. An internal combustion engine, a fuel supply therefor, a valve for controlling the fuel supply, a centrifugal governor and a device actuated in one direction by fluid pressure arranged to conjunctively control said valve, and mechanical means for moving the fluid pressure device in the other direction.

54. An internal combustion engine, a member arranged to be driven thereby, means for connecting said member with the engine, a centrifugal governor arranged to control the speed of the engine and to automatically actuate said connecting means when the engine comes up to a predetermined speed, and a means for controlling the engine and the governor.

55. An internal combustion engine, a member arranged to be driven by the engine, a liquid actuated clutch for connecting said member with the engine, a centrifugal governor arranged to control the speed of the engine and to actuate said clutch when the engine reaches a certain predetermined speed, and a means for controlling the engine and the governor.

56. An internal combustion engine, a fuel supply therefor, a valve for controlling said fuel supply, a fluid pressure controlling system for the engine, comprising a single manually operated valve, and an actuator for moving said valve in a plurality of steps for controlling the admission of said fuel supply to the engine.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES O. PEARSON.

Witnesses:
ERNEST W. MARSHALL,
ELLA TUCH.