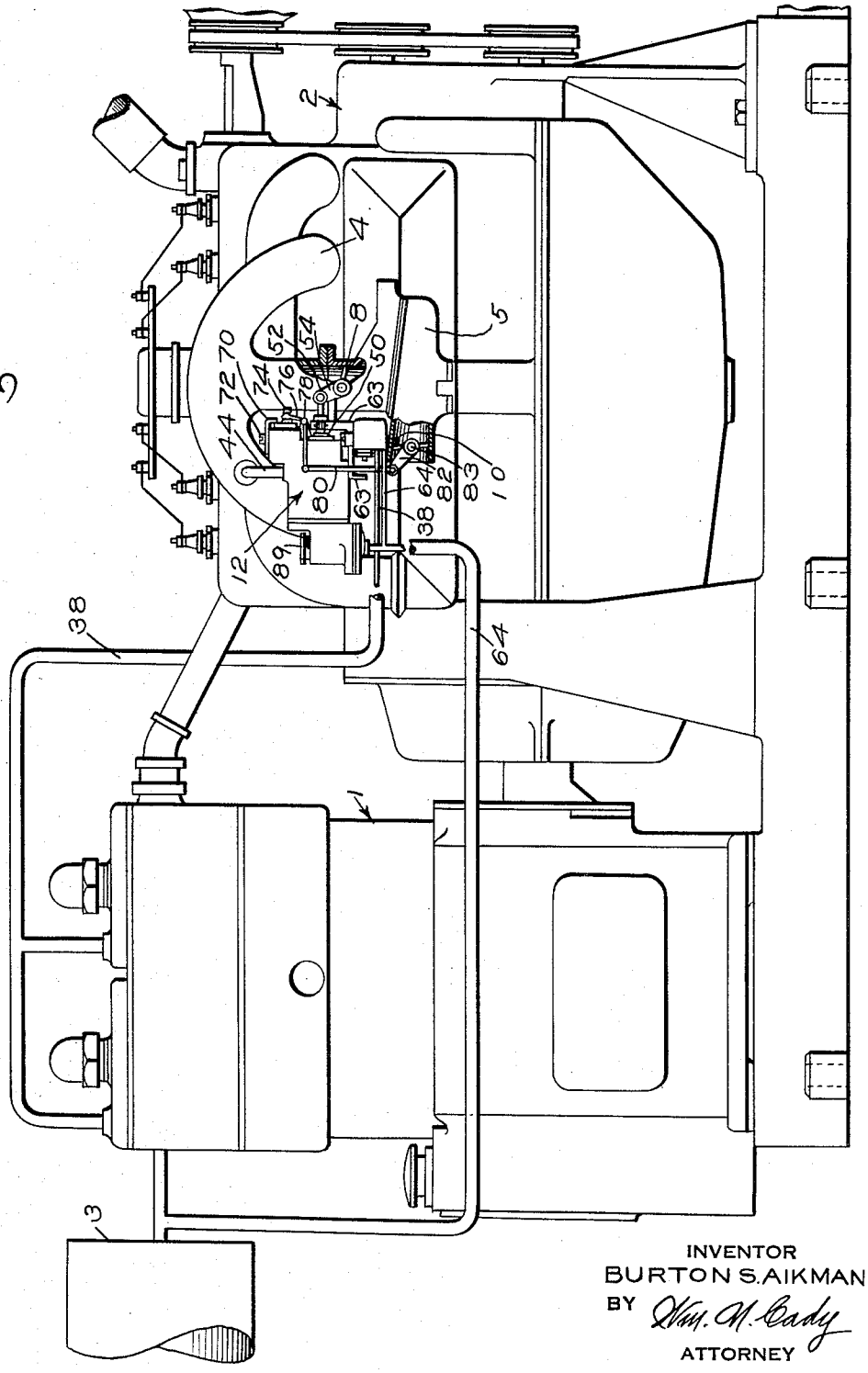
Feb. 28, 1939. B. S. AIKMAN 2,148,719

COMPRESSOR CONTROL SYSTEM

Filed Dec. 18, 1936 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
BURTON S. AIKMAN
BY Wm. M. Cady
ATTORNEY

Feb. 28, 1939. B. S. AIKMAN 2,148,719

COMPRESSOR CONTROL SYSTEM

Filed Dec. 18, 1936 2 Sheets-Sheet 2

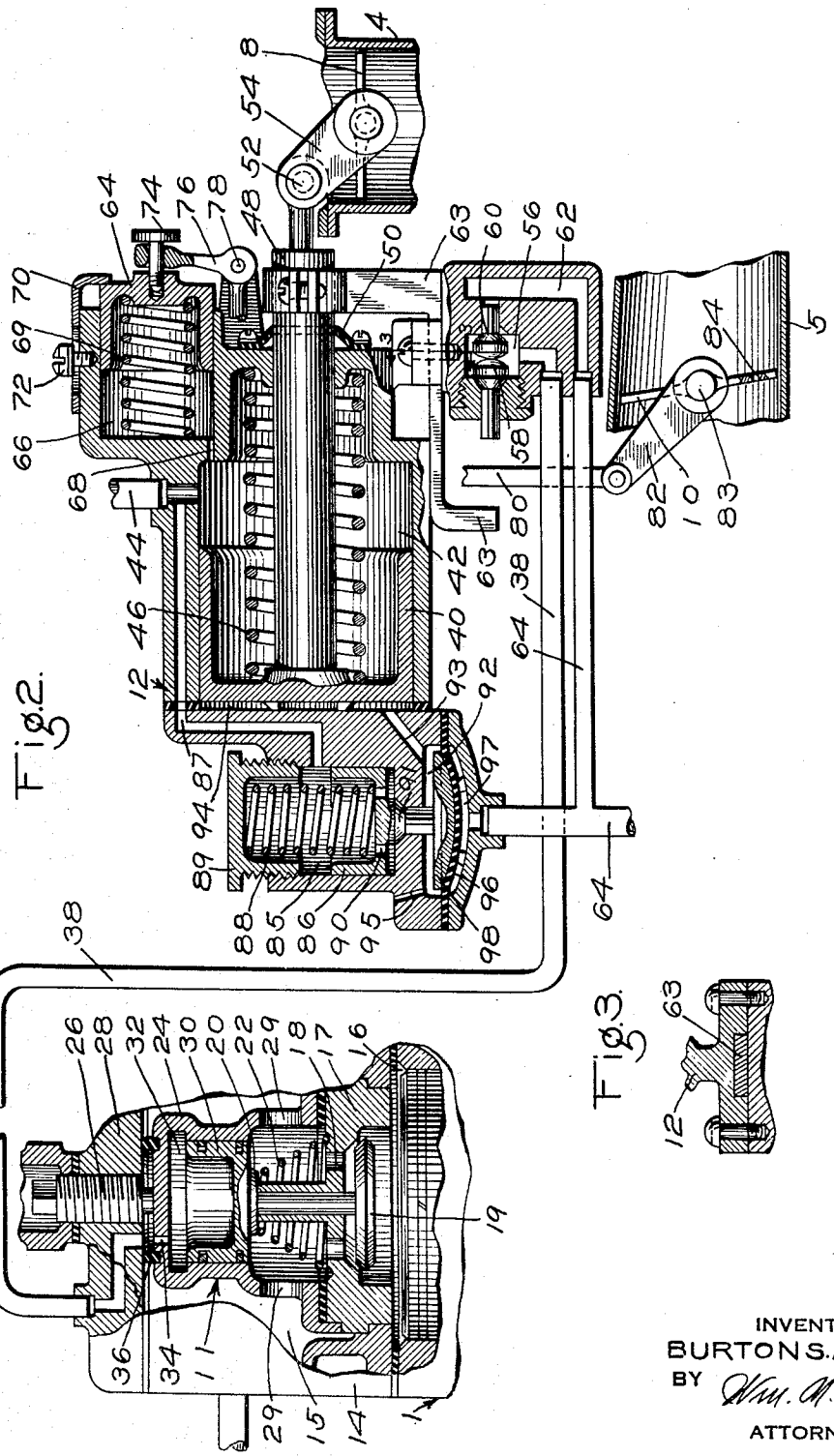


Fig. 2.

Fig. 3.

INVENTOR
BURTON S. AIKMAN
BY Wm. M. Cady
ATTORNEY

Patented Feb. 28, 1939 2,148,719

UNITED STATES PATENT OFFICE

2,148,719

COMPRESSOR CONTROL SYSTEM

Burton S. Aikman, Wilkinsburg, Pa., assignor to Westinghouse Air Brake Company, Wilmerding, Pa., a corporation of Pennsylvania

Application December 18, 1936, Serial No. 116,473

12 Claims. (Cl. 230—3)

This invention relates to a compressor control system, and particularly to means responsive to the pressure of the fluid compressed by a compressor for effecting loading and unloading of the compressor, and for also controlling the driving means for the compressor.

It is an object of this invention to provide an improved compressor control system adapted for use on a fluid compressor driven by an internal combustion engine.

A further object of the invention is to provide a compressor control system, which operates to maintain the pressure of the fluid compressed by the compressor within desired values.

Another object of the invention is to provide a compressor control system which operates to maintain the compressor unloaded until the driving engine has reached substantially its normal speed.

A further object of the invention is to provide a compressor control system which operates to effect unloading of the compressor in the event the driving means ceases to drive the compressor.

Another object of the invention is to provide a control system of the type described which operates to control the throttle valve and the choke valve associated with the carburetor of the compressor driving engine to provide the best starting conditions for the engine.

A further object of the invention is to provide an improved compressor control system.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawings, in which,

Fig. 1 is a view showing a compressor and a driving engine therefor equipped with the control system provided by this invention,

Fig. 2 is an enlarged fragmentary sectional view of the control means shown in Fig. 1 of the drawings, and

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 2.

Referring to Fig. 1 of the drawings there is illustrated therein a fluid compressor 1 which is driven by an internal combustion engine 2. The engine 2 may be of any well known construction and has an inlet manifold 4 through which fuel is supplied to the cylinders of the engine from a carburetor 5, which may also be of any well known construction. A throttle valve 8 is interposed in the inlet passage at a point intermediate the carburetor 5 and the engine to control the supply of fuel from the carburetor to the engine, while a choke valve 10 is provided to control the flow of air from the atmosphere to the carburetor.

As shown in the drawings the compressor 1 has a pair of cylinders, and they are provided with unloading means, indicated generally by the reference numeral 11, and adapted to maintain the inlet valves thereof in the open position to unload the compressor, while the carburetor 5 of the engine 2 has a control device, indicated generally by the reference numeral 12, associated therewith to control the supply of fluid under pressure to and the release of fluid under pressure from the unloading means 11 associated with the cylinders of the compressor 1, and to also control the throttle valve 8 and the choke valve 10 of the carburetor 5.

The construction of the unloading means 11 for the cylinders of the compressor 1 is best shown in Fig. 2 of the drawings where it will be seen that the compressor 1 has a head 14 detachably secured to the body thereof, while this head has an inlet chamber 15 formed therein in which are mounted the inlet valves and the unloading means for the cylinders of the compressor. The head 14 has a passage therein opening to the compression chamber 16 of one of the cylinders, while a seat member 17 is secured in this passage. The seat member 17 has a plurality of passages 18 extending therethrough, while an inlet valve 19 is provided and is adapted to engage a seat formed on the seat member 17 surrounding the passages 18. The inlet valve 19 has a stem formed integral therewith which has secured on the end thereof a spring seat 20, while a coil spring 22 extends between the spring seat 20 and the seat member 17 and yieldingly presses the valve 19 into engagement with its seat.

A body 24 is provided, while a screw 26 is mounted in a cover plate 28 and operates through the body 24 to hold the seat member 17 in engagement with the head 14.

The body 24 is of hollow construction and has passages 29 extending through the wall thereof to permit fluid to flow from the inlet chamber 15 to the passages 18 leading to the compression chamber 16 of the cylinder.

The body 24 has a bore therein in which is mounted a piston 30, which is subject on one side to the pressure of the fluid in a chamber 32, while the other face of the piston is engaged by the spring seat 20 associated with the inlet valve 19. The wall of the body 24 has a passage 34 extending therethrough and communicating with the chamber within an annular gasket 36 which is positioned in an annular groove in the face of the body 24 and is engaged by the cover 28. The

cover 28 has a passage formed therein and communicating with the chamber within the gasket 36, while this passage is connected by way of a pipe 38 with the control device 12.

The control device 12 comprises a body having a bore therein in which is mounted a piston 40 having at one side thereof a chamber 42, which is constantly connected by way of a pipe 44 with the inlet manifold 4 at a point therein intermediate the throttle valve 8 and the cylinders of the engine 2. A spring 46 is positioned in the chamber 42 and yieldingly urges the piston 40 to the left, as viewed in the drawings, while the piston 40 has a stem 48 formed integral therewith and extending through the end wall of the chamber 42. A flexible gasket indicated at 50 is secured on the body of the control device surrounding the stem 48 to seal the opening through which the stem extends to prevent the flow of air from the atmosphere to the chamber 42.

The stem 48 is pivotally connected by means of a pin 52 to an arm 54 which is secured on the shaft on which the throttle valve 8 is mounted.

The body of the control device 12 has a chamber 56 formed therein to which is connected the pipe 38 leading from the unloading means 11 for the cylinders of the compressor 1. A release valve 58 is mounted in the chamber 56 and controls communication between the chamber 56 and the atmosphere, while a supply valve 60 is also mounted in this chamber and controls communication between the chamber 56 and a chamber 62 which is constantly connected by way of a pipe 64 with the reservoir 3.

The release valve 58 has a fluted stem which projects from the face of the body of the control device 12 and is adapted to be engaged by the end of a member 63, which is secured to the stem 48 of the piston 40, and which is guided by an opening between sections of the body of the control device 12, as is best shown in Fig. 3 of the drawings.

The body of the control device 12 has, in addition, a bore therein in which is mounted a piston 64, which is subject on one side to the pressure of the fluid in a chamber 66, which is constantly connected by way of a restricted passage 68 with the chamber 42, and thereby through the pipe 44 to the inlet manifold 4 of the engine 2. A spring 69 is mounted in the chamber 66 and yieldingly urges the piston 64 to the right, as viewed in the drawings, while a stop 70 is adjustably secured on the body of the control device 12 by means of a screw 72, and limits movement of the piston 64 by the spring 69.

The piston 64 has a screw 74 secured in the end thereof, and this screw loosely extends through an opening in the end of an arm of a bell crank 76, which is pivotally supported on the body of the control device 12 by means of a pin 78. The other arm of the bell crank 76 has pivotally connected thereto a link 80, while the other end of this link is pivotally connected to the end of an arm 82, which is secured on the shaft 83 on which the choke valve 10 is mounted. The various parts of the equipment are arranged so that when the piston 64 is in the position determined by the stop 70, the choke valve 10 will be held substantially in its closed position. The choke valve 10 has a restricted opening 84 extending therethrough to permit a restricted flow of air from the atmosphere to the carburetor 5 when the choke valve is in its closed position.

The body of the control device 12 has a bore therein in which is mounted a plunger 86. This bore is constantly connected by way of a passage 87 with the pipe 44, and thereby with the inlet manifold 4 of the engine 2. A spring 88 is provided and extends between the plunger 86 and an adjustable spring seat 89, while the plunger 86 has passages indicated at 90 extending therethrough to permit communication between the chambers at the opposite faces thereof.

The plunger 86 has a valve indicated at 91 formed thereon, and adapted to engage a seat on the body of the control device 12 surrounding a passage communicating with the chamber 85 and a chamber 92, which is connected by way of a passage 93 with the chamber 94 at the face of the piston 40. The chamber 92 is also connected by way of a restricted passage 95 with the atmosphere. A flexible diaphragm 96 is subject on one face to the pressure of the fluid in the chamber 92 and is subject on the other face to the pressure of the fluid in a chamber 97, which is constantly connected by way of the pipe 64 with the reservoir 3. The diaphragm 96 is engaged by a follower 98, which is adapted to engage the end of the stem of the valve 91 to move this valve away from its seat against the opposing force of the spring 88 at certain times, as will hereinafter more fully appear.

The equipment is shown in Fig. 2 of the drawings in the position which it assumes when the compressor and the engine are idle, and the pressure of the fluid in the reservoir 3 is less than that which the control device is intended to maintain.

At this time the piston 40 of the control device 12 is held at one end of its range of movement by the spring 46, and the member 63 is held away from the release valve 58, with the result that fluid under pressure supplied to the chamber 62 from the reservoir 3 holds the supply valve 60 away from its seat to permit fluid under pressure to flow to the chamber 56, while the release valve 58 is held in the seated position to prevent the escape of fluid from the chamber 56 to the atmosphere.

Fluid under pressure supplied to the chamber 56 flows therefrom by way of the pipe 38 to the chambers 32 in the unloading means 11 associated with the cylinders of the compressor 1, and operates through the pistons 30 to hold the intake valves 19 away from their seats against the springs 22 to thereby unload the compressor.

At this time, as the engine 2 is not operating, the fluid in the inlet manifold 4 thereof will be substantially at atmospheric pressure, and accordingly the chamber 66 in the control device 12 will be at atmospheric pressure, and the piston 64 will be held against the stop 70 by the spring 69, while this piston will operate through the bell crank 76 and the link 80 to hold the choke valve 10 in its closed position to cut off the flow of air from the atmosphere to the carburetor 5. At this time the piston 40 is held by the spring 46 at one end of its range of movement and the stem 48 maintains the throttle valve 8 substantially in the closed position, as shown in Fig. 2 of the drawings.

In addition, at this time, as the pressure of the fluid in the reservoir 3 is at a value less than that which the control device 12 is intended to maintain, the force exerted by the fluid under pressure in the chamber 97 at the face of the diaphragm 96 is insufficient to overcome the opposing force of the spring 88, with the result

that the valve 91 is held in the seated position, while the chambers 92 and 94 are at atmospheric pressure since the valve 91 is seated and the chamber 92 is open to the atmosphere by way of the restricted port 95.

The engine 2 may be started readily at this time as the choke valve 10 of the carburetor 5 is closed, and when the engine is cranked, a relatively rich mixture of fuel will be supplied to the engine. In addition, the compressor 1 is unloaded at this time so that the load on the engine is at a minimum.

As soon as the engine 2 starts to operate there will be a reduction in the pressure of the fluid in the inlet manifold 4 of the engine as the result of operation of the engine. Fluid will flow to the inlet manifold through the pipe 44 from the chamber 42 of the control device 12, and also at a restricted rate through the passage 68 from the chamber 66 of this control device to gradually reduce the pressure therein. On a reduction in the pressure of the fluid in the chamber 66, the piston 64 is gradually moved by the higher atmospheric pressure against the spring 69, and by this movement force is exerted through the bell crank 76 and the link 80 to turn the arm 82 and thereby move the choke valve 10 towards its open position. The choke valve 10, therefore, will be automatically opened as the engine 2 accelerates in speed.

On a reduction in the pressure of the fluid in the chamber 42, the piston 40 is moved against the spring 46 by the fluid in the chamber 94, which is supplied with fluid from the atmosphere at a restricted rate through the passage 95. The piston 40 will be gradually moved against the spring 46, therefore, its rate of movement being determined by the rate of flow of fluid through the restricted passage 95, and on this movement of the piston 40 force is exerted through the stem 48 to gradually move the throttle valve 8 towards its open position.

When the throttle valve 8 is opened, the engine 2 will operate at a higher speed because of the greater rate of supply of fuel thereto, and will drive the compressor 1 at a faster speed. When the piston 40 has been moved against the spring 46 almost to the end of its range of movement, the member 63 will have been moved far enough to engage the end of the stem of the release valve 58, while the throttle valve 8 will have been moved almost to the full open position, with the result that the engine will be operating substantially at its full speed.

On slight further movement of the piston 40, force is exerted through the member 63 to press the release valve 58 away from its seat and to move the supply valve 60 to the seated position, thereby cutting off the supply of fluid under pressure from the reservoir 3 to the chamber 56 and releasing fluid under pressure from this chamber. On the release of fluid under pressure from the chamber 56, fluid flows thereto by way of the pipe 38 from the chambers 32 in the unloading means 11 associated with the cylinders of the compressor 1. On a reduction in the pressure of the fluid in these chambers, the inlet valves 19 are moved to their seated positions by the springs associated therewith, thereby effecting loading of the compressor. As the compressor 1 is being driven by the engine 2 at this time, the compressor will operate in the usual manner to compress fluid under pressure into the reservoir 3.

On an increase in the pressure of the fluid in the reservoir 3 there will be a similar increase in the pressure of the fluid in the chamber 97 at the face of the diaphragm 96, and when the pressure of the fluid in this chamber has increased to a predetermined value, dependent upon the adjustment of the spring 88 of the control device 12, the diaphragm 96 will be moved upwardly, and will move the valve 91 away from its seat against the spring 88.

When the valve 91 is moved away from its seat communication is established between the chamber 85, which is connected to the inlet manifold 4 by way of the passage 87, and the chamber 92 at the face of the diaphragm 96 through which fluid under pressure may flow from the chamber 92 to the chamber 85 at a rate substantially more rapid than fluid may flow from the atmosphere to the chamber 92 through the restricted passage 95.

As the engine is being operated at this time, the pressure of the fluid in the inlet manifold 4 is at a value substantially less than the atmosphere, and when the valve 91 is unseated fluid flows to the chamber 85 from the chamber 94 at the face of piston 40, and from the chamber 92 at the face of the diaphragm 96 to reduce the pressure of the fluid in these chambers.

On the reduction in the pressure of the fluid in the chamber 94 there is a corresponding reduction in the force exerted by this fluid on the piston 40, and the spring 46 moves the piston 40 to the left, as viewed in Fig. 2 of the drawings, while the stem 48 moves the member 63 away from the end of the stem of the release valve 58 after a small amount of movement of the piston 40 by the spring 46. Fluid under pressure supplied to the chamber 62 from the reservoir 3 thereupon moves the supply valve 60 away from its seat to permit fluid to flow to the chamber 56, while the release valve 58 is moved to the seated position to cut off the release of fluid from this chamber. On the supply of fluid under pressure to the chamber 56 fluid flows therefrom by way of the pipe 38 to the unloading means 11 associated with the cylinders of the compressor 1 to unload the compressor.

It will be seen that the unloading means for the compressor cylinders are operated to unload the compressor on the initial movement of the piston 40, and that the compressor is unloaded so as to relieve the engine of its driving load before the throttle valve 8 has been moved a substantial distance from the full open position towards the closed position.

On further movement of the piston 40, the stem 48 operates to move the throttle valve 8 to the closed position to reduce the speed of the engine 2.

At this time, as the engine 1 continues to be operated, although at a reduced speed, there continues to be a partial vacuum in the intake manifold 4 of the engine, and there will be a similar partial vacuum in the chamber 66 of the control device 12. As a result, therefore, the higher atmospheric pressure will hold the piston 64 against the spring 69, and this piston will operate through the bell crank 76 and the link 80 to maintain the choke valve 10 in the open position.

On the reduction in the pressure of the fluid in the chamber 92 at the face of the diaphragm 96, as a result of the opening of the valve 91, as explained above, there is a reduction in the force exerted on this diaphragm in opposition to the fluid under pressure in the chamber 97. The spring 88, therefore, will be unable to move the valve 91 to the seated position until the pressure

of the fluid in the reservoir 3 and in the chamber 97 has reduced to a value somewhat less than that required to move the valve 91 away from its seat.

When the pressure of the fluid in the reservoir 3 and in the chamber 97 at the face of the diaphragm 96 has been reduced to a predetermined value, the force exerted thereby is insufficient to maintain the diaphragm 96 against the opposing force of the spring 88, and the diaphragm will thereupon be moved downwardly by the spring 88 operating through the plunger 86, the valve 91, and the follower 98, while the valve 91 will be moved to the seated position to cut off the flow of fluid from the chambers 92 and 94 to the chamber 85, and thence to the inlet manifold of the engine 2.

When the flow of fluid from the chamber 92 to the chamber 85 is cut off there is a gradual increase in the pressure of the fluid in the chamber 92 as a result of the flow of fluid thereto through the restricted passage 95, and on this increase in the pressure of the fluid in the chamber 92 there is a corresponding increase in the force exerted on the diaphragm 96 in opposition to the force exerted thereon by the fluid under pressure in the chamber 97.

As a result when the valve 91 is moved substantially to the closed position there will be an increase in the force exerted thereon, and the valve will thereafter be quickly moved to the seated position to cut off the flow of fluid from the chamber 92 to the chamber 85.

After the valve 91 is moved to the seated position, the flow of fluid from the atmosphere through the restricted passage 95 increases the fluid present in the chamber 92, while fluid flows from the chamber 92 by way of the passage 93 and increases the fluid pressure in the chamber 94 at the face of the piston 40. On an increase in the pressure of the fluid in this chamber, the piston 40 is gradually moved against the spring 46 and force is exerted through the stem 48 and the arm 54 to move the throttle valve 8 from the closed position to the full open position.

When the piston 40 has been moved nearly to the end of its range of movement against the spring 46, the member 63 is moved to a position in which it engages the end of the stem of the release valve 58, and upon further movement of the piston 40 the release valve 58 is moved away from its seat, while the supply valve 60 is moved to the seated position to cut off the supply of fluid from the reservoir 3 to the chamber 56. On movement of the release valve 58 away from its seat, fluid is released from the chamber 56 and fluid flows thereto and thence to the atmosphere from the chambers in the unloading means 11 associated with the cylinders of the compressor 1. The unloading means 11 associated with the compressor 1 thereupon operate, as described above, to again effect loading of the compressor, and the compressor again operates to compress fluid into the reservoir 3.

It will be seen that this control system operates on a predetermined increase in the pressure of the fluid compressed by the compressor to unload the compressor, and to thereafter close the throttle valve and reduce the speed of the engine. It will be seen also that the control system operates on a predetermined reduction in the pressure of the fluid compressed by the compressor to open the throttle valve to permit the engine to operate at its normal speed, and to thereafter effect loading of the compressor.

In addition, it will be seen that the control means provided by this invention incorporates a movable abutment subject to the pressure of the fluid in the inlet manifold of the driving engine for the compressor for controlling the choke associated with the carburetor of this engine. This abutment operates when the engine is functioning in the normal manner to maintain the choke in the full open position. If, however, the engine should fail to function as intended, or should be stopped, either intentionally or otherwise, the pressure of the fluid in the inlet manifold will increase, and this abutment will be operated to move the choke to the closed position to facilitate starting of the engine.

In addition, the means for controlling the loading and unloading of the compressor is responsive to pressure conditions in the intake manifold of the driving engine for the compressor, and if the engine is stopped, either intentionally or otherwise, the control device will operate automatically to unload the compressor and thereby relieve the engine of this load so that it may be readily started.

While one embodiment of the improved compressor control system provided by this invention has been illustrated and described in detail, it should be understood that the invention is not limited to these details of construction, and that numerous changes and modifications may be made without departing from the scope of the following claims.

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

1. In combination, a fluid compressor having unloading means associated therewith, an internal combustion engine for driving the compressor, said engine having a carburetor for supplying fuel thereto, an inlet manifold through which fuel is supplied to the engine by the carburetor, a choke valve for controlling the flow of fluid from the atmosphere to the carburetor, means responsive to the pressure of the fluid in the inlet manifold for controlling said choke valve, means subject to the pressure of the fluid in a chamber for controlling operation of the compressor unloading means, and responsive to the pressure of the fluid compressed by the compressor for controlling communication between the inlet manifold and said chamber.

2. In combination, a fluid compressor having unloading means associated therewith, an internal combustion engine for driving the compressor, said engine having a carburetor for supplying fuel thereto, an inlet manifold through which fuel is supplied to the engine by the carburetor, a choke valve for controlling the flow of fluid from the atmosphere to the carburetor, means responsive to the pressure of the fluid in the inlet manifold for controlling said choke valve, means subject to the pressure of the fluid in a chamber for controlling operation of the compressor unloading means, means responsive to the pressure of the fluid compressed by the compressor for controlling communication between the inlet manifold and said chamber, a throttle valve controlling the supply of fluid from the carburetor to the engine through said inlet manifold, and means responsive to the pressure of the fluid compressed by the compressor for operating the throttle valve.

3. In combination, a fluid compressor, an internal combustion engine for driving the compressor, a carburetor associated with said engine,

the engine having an inlet manifold through which fuel is supplied thereto from the carburetor, a throttle valve for controlling communication through said manifold, a movable abutment subject to the opposing pressures of the fluid in the inlet manifold and of the fluid in a control chamber for operating said throttle valve, means for supplying fluid from the atmosphere to said control chamber at a predetermined rate, and means responsive to the pressure of the fluid compressed by the compressor for establishing a communication between said control chamber and the inlet manifold through which fluid may flow at a rate more rapid than said predetermined rate.

4. In combination, a fluid compressor, an internal combustion engine for driving the compressor, a carburetor associated with said engine, the engine having an inlet manifold through which fuel is supplied thereto from the carburetor, a throttle valve for controlling communication through said manifold, a movable abutment subject to the opposing pressures of the fluid in the inlet manifold and of the fluid in a control chamber for operating said throttle valve, means for supplying fluid from the atmosphere to said control chamber at a predetermined rate, means responsive to the pressure of the fluid compressed by the compressor for establishing a communication between said control chamber and the inlet manifold through which fluid may flow at a rate more rapid than said predetermined rate, and means yieldingly urging said abutment to a position to close the throttle valve.

5. In combination, a fluid compressor, an internal combustion engine for driving the compressor, a carburetor associated with said engine, the engine having an inlet manifold through which fuel is supplied thereto from the carburetor, a throttle valve for controlling communication through said manifold, a movable abutment subject to the opposing pressures of the fluid in the inlet manifold and of the fluid in a control chamber for operating said throttle valve, means for supplying fluid from the atmosphere to said control chamber at a predetermined rate, means responsive to the pressure of the fluid compressed by the compressor for establishing a communication between said control chamber and the inlet manifold through which fluid may flow at a rate more rapid than said predetermined rate, and means controlled by said abutment for unloading the compressor.

6. In combination, a fluid compressor, an internal combustion engine for driving the compressor, a carburetor associated with said engine, the engine having an inlet manifold through which fuel is supplied thereto from the carburetor, a throttle valve for controlling communication through said manifold, a movable abutment subject to the opposing pressures of the fluid in the inlet manifold and of the fluid in a control chamber for operating said throttle valve, means for supplying fluid from the atmosphere to the control chamber at a predetermined rate, means responsive to the pressure of the fluid compressed by the compressor for establishing a communication between said control chamber and the inlet manifold through which fluid may flow at a rate more rapid than said predetermined rate, means operated on an increase in fluid pressure for unloading the compressor, and means operated by said abutment for controlling the supply of fluid under pressure to and the release of fluid under pressure from said unloading means.

7. In combination, a fluid compressor, an internal combustion engine for driving the compressor, a carburetor associated with said engine, the engine having an inlet manifold through which fuel is supplied thereto from the carburetor, a throttle valve for controlling communication through said manifold, a movable abutment subject to the pressure of the fluid in a control chamber for controlling said throttle valve, means for supplying fluid to said chamber from the atmosphere at a predetermined rate, and a movable abutment subject to the opposing pressures of the fluid compressed by the compressor and of the fluid in said control chamber and controlling a communication between said control chamber and the inlet manifold through which fluid may flow at a rate more rapid than said predetermined rate.

8. In combination, a fluid compressor, an internal combustion engine for driving the compressor, a carburetor associated with said engine, the engine having an inlet manifold through which fuel is supplied thereto from the carburetor, a throttle valve for controlling communication through said manifold, a movable abutment subject to the pressure of the fluid in a control chamber for controlling said throttle valve, means for supplying fluid to said control chamber from the atmosphere at a predetermined rate, a movable abutment subject to the opposing pressures of the fluid compressed by the compressor and of the fluid in said control chamber and controlling a communication between said chamber and the inlet manifold through which fluid may flow at a rate more rapid than said predetermined rate, and means operated by said abutment for controlling unloading of the compressor.

9. In combination, a fluid compressor, an internal combustion engine for driving the compressor, the engine having an intake manifold through which fuel is supplied to the engine, and means for controlling the operation of said engine including a movable abutment subject to the opposing pressures of said manifold, and a chamber open to the atmosphere through a restricted port and a control governor comprising a movable abutment subject to the opposing pressures of said chamber and the pressure of fluid compressed by the compressor, and a valve operated by said governor abutment upon a predetermined increase in the pressure of fluid compressed by the compressor for connecting said chamber with said intake manifold.

10. In combination, a fluid compressor, an internal combustion engine for driving the compressor, the engine having an intake manifold through which fuel is supplied to the engine, and means for controlling the operation of said engine including a movable abutment subject to the opposing pressures of said manifold and a chamber open to the atmosphere through a restricted port, and a control governor comprising a spring, a movable abutment subject on one side to the pressure of fluid compressed by the compressor and on the opposite side to the pressure in said chamber and the pressure of said spring, and a valve operated by said governor abutment upon a predetermined increase in the pressure of fluid compressed by the compressor for connecting said chamber with said intake manifold.

11. In combination, a fluid compressor having unloading means associated therewith, an internal combustion engine for driving the compres-

sor, a carburetor associated with said engine, the engine having an inlet passage through which fluid is supplied thereto from the carburetor, a throttle valve controlling the flow of fluid through said passage, a movable abutment subject to the opposing pressures of the fluid in the inlet passage and of the fluid in a control chamber open to the atmosphere through a restricted port for operating said throttle valve, yielding resistance means urging said abutment to a position to close said throttle valve, means operated by said abutment only on a predetermined movement thereof against said spring to open said throttle valve for effecting operation of said unloading means to load the compressor, and means responsive to the pressure of the fluid compressed by the compressor for establishing communication between said control chamber and said inlet passage.

12. In combination, a fluid compressor having unloading means associated therewith, an internal combustion engine for driving the compressor, a carburetor associated with said engine, the engine having an inlet passage through which fluid is supplied thereto from the carburetor, a throttle valve controlling the flow of fluid through said passage, a movable abutment subject to the opposing pressures of the fluid in the inlet passage and of the fluid in a control chamber open to the atmosphere through a restricted port for operating said throttle valve, yielding resistance means urging said abutment to a position to close said throttle valve, means operated by said abutment only on a predetermined movement thereof against said spring to open said throttle valve for effecting operation of said unloading means to load the compressor, and means subject to the opposing pressures of the fluid compressed by the compressor and of the fluid in said control chamber for establishing communication between said control chamber and said inlet passage.

BURTON S. AIKMAN.