C. W. WEISS.

INTERNAL COMBUSTION ENGINE.

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1,254,097.

Patented Jan. 22, 1918.

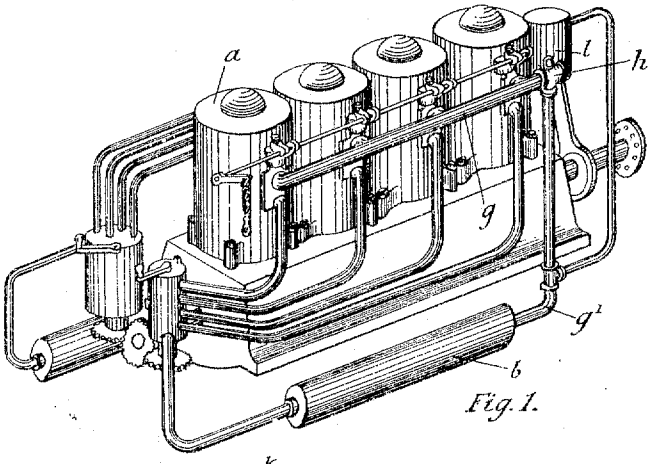


Fig. 1.

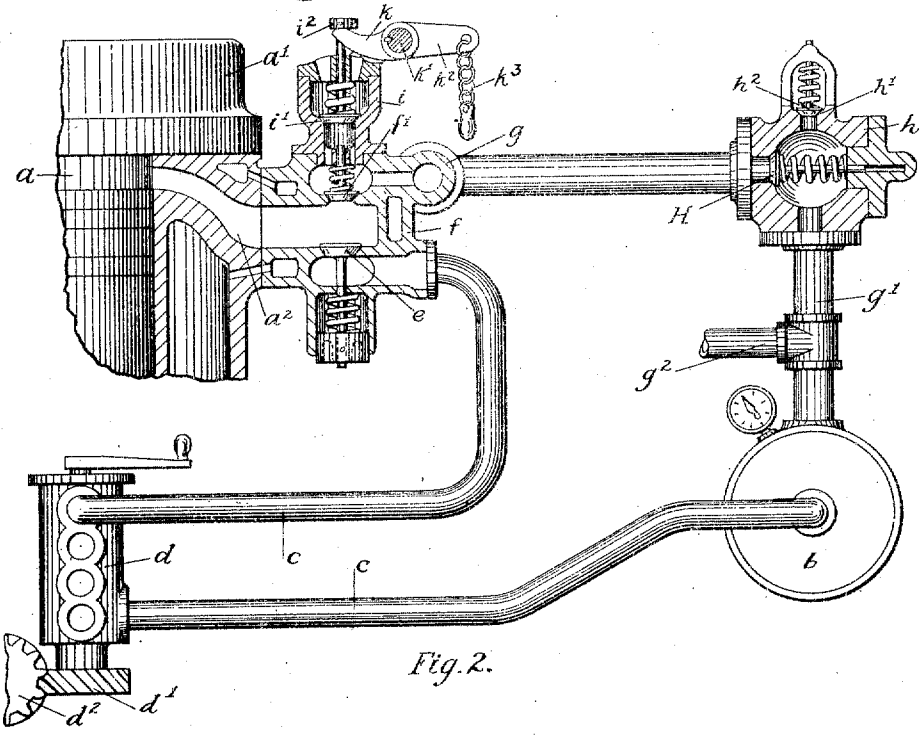


Fig. 2.

ATTEST:
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INTERNAL-COMBUSTION ENGINE.

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To all whom it may concern:

Be it known that I, CARL W. WEISS, a citizen of the United States, residing in the borough of Brooklyn of the city of New York, in the State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to internal combustion engines, particularly those of the multi-cylinder oil burning type, and is concerned especially with the starting and reversing mechanism therefor where the starting and reversing is effected by a compressed medium such as air. In oil burning engines, it is the common practice to lead the air from a reservoir through a distributer and into the cylinders, but no provision has been made for a return connection between the cylinders and the reservoir by which excessive pressures within the cylinders might be availed of to replenish the pressure within the reservoir, and in which suitable automatic and manual relief valves might be disposed for the relief of the excessive pressures within the cylinders without, however, relieving the stored pressure of the air in the reservoir. The object of the present invention is to provide in association with compressed air starting mechanism of known type suitable automatic and manual relief devices for pressures within the cylinders which devices shall be disposed operatively in a return connection between the cylinders and the compressed air reservoir and shall be so related to the reservoir and to the cylinders as to insure their functioning in the intended manner under all conditions of use. The details of the invention will appear in connection with the following description of the preferred embodiment of the invention shown in the accompanying drawings, in which—

Figure 1 is a view in perspective of an engine equipped with the improved mechanism.

Fig. 2 is a detail view on a somewhat larger scale, partly in section and partly in elevation, showing the operative relation between the engine and the starting mechanism illustrated in Fig. 1.

As pointed out hereinbefore the present improvements are designed primarily with reference to their application to multi-cylinder oil burning engines, but it is to be understood that the invention is not to be limited to such specific application, but is intended, in scope, to include all applications in which its advantages are desirable and are realized. The accompanying drawings illustrate a four-cylinder oil burning engine, into the cylinders a of which fuel may be injected in any desired manner. In the walls of each of the cylinders a, preferably near the head a', is formed a port a^2 for the admission of compressed air which is led to the ports from a reservoir b through pipes c and a distributer d, past a check valve e seated in a manifold f which is provided for each of the cylinders a. The distributer d may be driven through a spiral gear d' by a gear d^2 on the crank shaft of the engine whereby air is led from the reservoir b into the cylinders a in proper sequence for driving according to the desired direction of rotation of the crank shaft. The mechanism thus far described may be considered as typical of compressed air starting devices for oil engines. In such devices, however, no provision has been made for the replenishing of the pressure within the reservoir b directly from the engine cylinders a, nor has any relief been provided for excessive pressures within the cylinders a or in the reservoir b. Again, no means for relieving pressures within the cylinders a, as when it is desired to admit compressed air for starting the engine, under the ready control of the operator, is generally included in mechanism of this character. In accordance with the present invention there is provided a return connection g, g' from each of the manifolds f of the respective cylinders a to the reservoir b. Between the two sections g, g' of this return connection, there is interposed a valve cage h in which is seated a spring-pressed check valve H which is normally held seated under the pressure of the air in the reservoir b. Between each of the manifolds f and the common return pipe g, there is interposed a spring-pressed check valve f' which opens under the pressures within the cylinders a. On each of the manifolds f there are mounted separate valve cages i in each of which is seated a spring-pressed check valve i' which is subjected to pressure within the return pipe g, but is protected from the direct pressure within the cylinders

a by the corresponding check valve f' in its manifold f. The valves i' may open freely under the influence of excessive pressures in the return pipe g and may be opened manually by means of rocker arms k carried on a rocker shaft k' and adapted to engage, respectively, collars i^2 carried on the ends of the valve stems. The rocker shaft k' may be journaled on the valve cages i and provided at one end with a rocker arm k^2 and pull cord k^3 disposed within reach of the operator whereby upon rocking of the shaft k' all of the valves i' are lifted simultaneously. In the valve cage h is formed a seat h' for a spring-pressed safety valve h^2 which is subjected directly to the pressure of the air in the reservoir b but is not normally subjected to the direct pressure in the return pipe g by reason of the interposition of the check valve H.

The air in the reservoir b may be forced therein under pressure by means of a suitable compressor l geared to the crank shaft of the engine and communicating with the reservoir through a pipe g^2 which is connected to the section g' of the return pipe at some point between the reservoir and the cage h.

For an understanding of the importance of the improvements it is necessary to consider the running conditions of the motor and the unsatisfactory, if not dangerous, conditions which may arise by reason of the relation of the starting mechanism to the engine. In the first place, it is evidently desirable that when the compressed air is admitted to the cylinders, these cylinders shall be free from any air which might exert a counter pressure on the starting air and so oppose the starting, whatever be the direction. To permit the ready relief of such stored pressures within the cylinders the rocker arms k in their operative relation to the respective check valves i' are provided. The operator by grasping the pull cord k^3 may lift all of the check valves i' from their seats and so permit pressures within the cylinders a to escape past the check valves f and the said relief valves i'. Other conditions than those required for starting may make it desirable to provide this quick manual release of the pressures within the cylinders. After starting it may be assumed that the air is cut off from the cylinders whereupon the compressor l will constantly force air into the reservoir b. At the same time, part of the pressure within the cylinders may be communicated to the reservoir b past the check valves f', H, until the pressure within the reservoir b has reached its maximum. During this time the return of such pressure to the cylinders is prevented by means of the check valve H. When the pressure in the reservoir b has reached its maximum and further pressure is applied thereto, such further pressure may be relieved automatically through the safety valve h^2 which is subjected directly to the pressure of the reservoir. If the pressure within the cylinders a builds up further and exceeds a safe maximum represented by the pressure in the cage h plus the pressure of the springs on the check valves f', H such excess pressure may be relieved automatically past the check valves i'. The devices for operating the check valves manually do not interfere with the automatic unseating of these valves under excessive pressures. Again, a dangerous condition may arise in the cylinders by reason of careless control of the air and its admission to the cylinders with fuel and at such times as to bring about an excessive increase in the mean effective pressures within the cylinders. It is conceivable that these pressures might arise to a dangerous point and to meet this situation automatically the relief valves i', h^2 are so located as to open automatically at any desired predetermined pressure depending on the adjustment of their springs. The conditions described herein are merely illustrative of those which it is desirable to meet by means of the present improvements to the starting apparatus but it is to be understood that other conditions may arise in which the automatic and manual reliefs herein disclosed, are of equal importance.

I claim as my invention:

1. In an internal combustion engine in combination with a working cylinder, a source of compressed starting medium, a valve to control the admission of the medium to the cylinder, a return connection from the cylinder to the source, a check valve to prevent the return flow of the compressed medium through said connection from the source, and a manual relief valve communicating with said connection at a point between the said check valve and the cylinder.

2. In an internal combustion engine in combination with a working cylinder, a source of compressed starting medium, a valve to control the admission of the medium to the cylinder, a return connection from the cylinder to the source, a check valve to prevent the return flow of the compressed medium through said connection from the source and a combined automatic and manual relief valve communicating with said connection at a point between the said check valve and the cylinder.

3. In a multicylinder internal combustion engine in combination with the working cylinders thereof, a source of compressed air, a valve to control the admission of the air to the cylinders, a common return connection from the cylinders to the source, two check valves interposed in said connection to prevent the return flow of the air through the

connection to the cylinders and a combined automatic and manual relief valve in the connection between said check valves.

4. In a multicylinder internal combustion engine in combination with the working cylinders thereof, a source of compressed air for starting, a valve to control the admission of the air to the cylinders, a common return connection from the cylinders to the source, two check valves in the connection to prevent the return flow of compressed air through the connection to the cylinders, a combined automatic and manual relief valve communicating with the connection at a point between said check valves and an independent safety relief valve interposed in the connection between the source of compressed air and that check valve which is subjected to the direct pressure thereof.

This specification signed this second day of March, A. D. 1917.

CARL W. WEISS.