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 MEANS FOR CHARGING THE CYLINDERS OF AN INTERNAL COMBUSTION ENGINE WITH
 EXPLOSIVE GAS.

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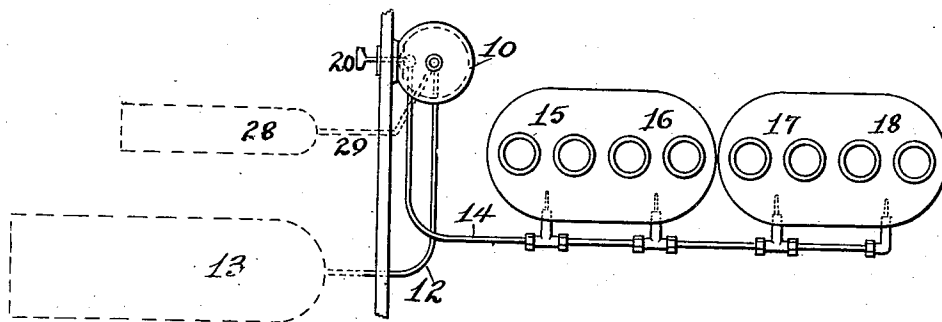


Fig. 1.

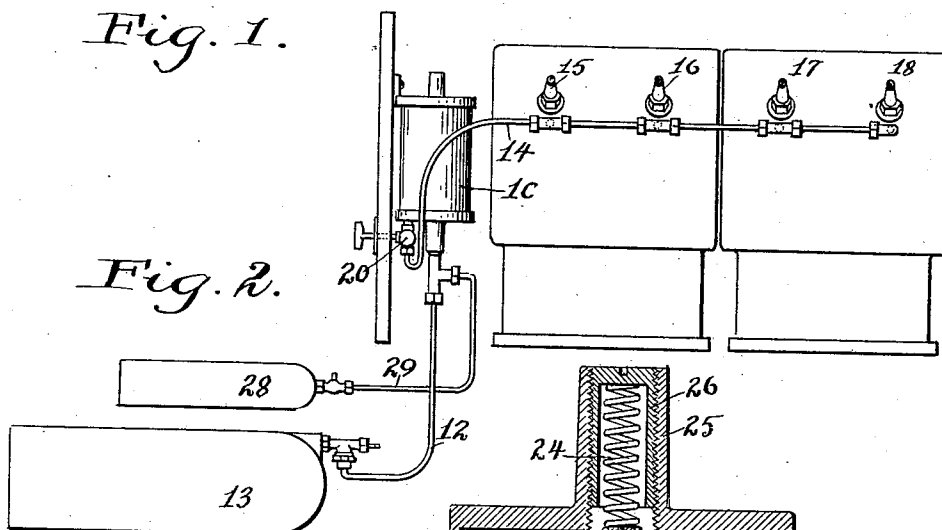
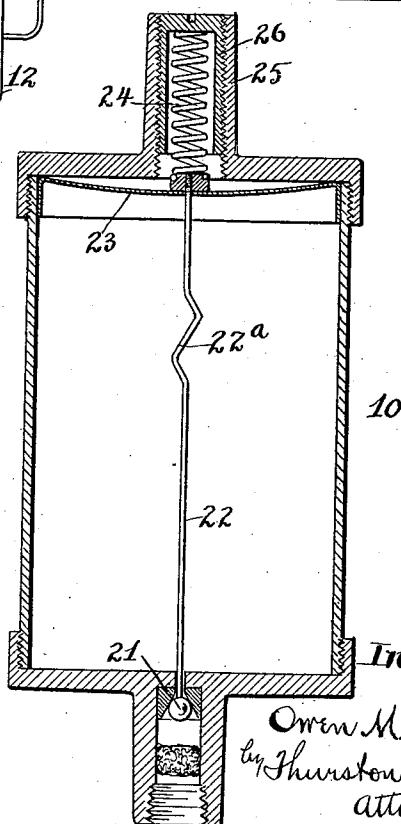


Fig. 2.

Fig. 3.



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MEANS FOR CHARGING THE CYLINDERS OF AN INTERNAL-COMBUSTION ENGINE WITH EXPLOSIVE GAS.

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To all whom it may concern:

Be it known that I, OWEN M. NACKER, a citizen of the United States, residing at Flint, in the county of Genesee and State of Michigan, have invented a certain new and useful Improvement in Means for Charging the Cylinders of an Internal-Combustion Engine with Explosive Gas, of which the following is a full, clear, and exact description.

The object of this invention is to provide simple and cheap mechanism which will operate with certainty to deliver to the cylinders of a stopped internal combustion engine suitable charges of explosive gas, so that when these charges are ignited in proper sequence, the engine will start itself.

The invention includes as an essential characteristic an auxiliary gas tank adapted for connection with a tank containing combustible gas under pressure, and having its inlet controlled by a valve which will automatically close when the gas pressure within said auxiliary tank reaches a predetermined maximum.

The invention embodied in the best form known to me is shown in the accompanying drawings, and is hereinafter described and definitely pointed out in the appended claims.

In the drawing, Figure 1 is a plan view, somewhat diagrammatic in character, of the invention applied to a motor car which has a four cylinder internal combustion engine. Fig. 2 is a side elevation, also somewhat diagrammatic, of the same mechanism; and Fig. 3 is a central vertical section through the auxiliary gas tank which is an essential part of said apparatus.

Referring to the parts by reference characters 10 represents an auxiliary gas tank which may be secured to the front side of the dash of a motor car. This auxiliary tank has a valve controlled inlet which is adapted for connection, through pipe 12, with a main gas tank 13, in which is a combustible gas, such as acetylene gas, under pressure which will vary from time to time according to the amount of gas which has been withdrawn from said main tank. The auxiliary tank 10 has also a valve controlled outlet with which the branched gas delivery pipe 14 is connected. Branches of this pipe

are to be severally connected with the cylinders 15, 16, 17 and 18 of an internal combustion engine so that they will discharge directly into these cylinders between the pistons and the heads of the cylinders. The valve 20 of this gas delivery pipe may be of any suitable sort which an operator may open and close as required. The inlet valve 21, however, is automatic in its action. It stands normally in the open position, and is associated with mechanism whereby it will be positively closed when the gas pressure within the auxiliary tank reaches a predetermined maximum. The specific construction shown includes a ball valve 21 attached to the lower end of a rod 22 whose upper end is fixed to a flexible diaphragm 23. This diaphragm extends across the auxiliary tank and is normally bent inward, as shown. The pressure of gas in the tank 10 as it increases, will straighten this diaphragm and thereby, through the rod 22 will close valve 21. The straightening of this diaphragm may be resisted by a supplemental spring 24 in spring barrel 25; and the tension of said spring may be adjusted by means of a nut 26. In practice the valve closing mechanism should be adjusted so that the valve will close when the pressure in the supplemental tank is about four pounds to the square inch. It will be noted that the valve rod 22 is bent as at 22^a. This is so that if there should be any excess of gas pressure in the supplemental tank the rod will not be pulled loose either from the diaphragm or the valve when the latter has been drawn closed; but, on the contrary, the valve rod will simply be straightened more or less.

The described mechanism is intended to perform its functions in the following manner: The operator will open the valve of the main gas tank 13 for a brief period, and will then close it. While this valve is open gas will flow into the auxiliary tank 10 until the pressure therein reaches the predetermined maximum, whereupon the inlet valve 21 will close automatically. The operator will then open the outlet valve 20. The gas in the tank 10 will flow through the gas delivery pipe 14 into the several cylinders of the engine. Then the valve 12 should be closed under ordinary conditions. The charges of gas which have been delivered into the cyl-

inder will, because of the described construction be uniform at all times; and, if the valve closing mechanism is properly adjusted, the charge of gas so delivered to the
 5 cylinders will be suitable for the work they are to do. It is now necessary to ignite these explosive charges in proper sequence. There are numerous devices known for first producing an igniting spark in that cylinder
 10 whose piston has started on its explosion stroke. If with some such mechanism a spark is produced in this cylinder the explosive charge will be ignited, and the engine will start. Thereafter, under ordinary
 15 conditions, the ordinary ignition system associated with the engine will explode the charges in proper sequence; and the engine being so started will thereafter draw its explosive charges from the associated carbureter.
 20

There are some conditions in which the engine may be stopped in which the apparatus, to the extent described, may not be efficient. For example, if the engine is
 25 stalled or choked after an explosion in one cylinder, and before the piston in that cylinder has moved far on its explosion stroke, this cylinder will be full of dead gas which does not contain enough oxygen to mix with
 30 the acetylene gas delivered to that cylinder to form an explosive mixture. To overcome this difficulty the tank 28 of compressed air is provided. It is connected with the inlet of the auxiliary gas tank by a pipe 29.
 35 Now, if after charging the cylinders with acetylene gas by the described mechanism, and causing a spark in the proper cylinder there is no initial explosion the operator may open the valve of the air tank, and fill
 40 the auxiliary tank with air. Then, after closing this air valve, he may open the outlet valve from the auxiliary tank, whereupon air will be delivered into the cylinders so as to mix with the acetylene and form explosive
 45 mixture therein. It may possibly be desirable to repeat this operation of delivering air to the cylinders before again attempting to produce the initial explosion.

While the primary function of this device
 50 is to give to each of the cylinders one initial charge of explosive mixture, it is nevertheless possible to use the apparatus so as to supply the charges for running the engine for a considerable time. This may be desirable
 55 if the engine has been subject for a long time to low temperature so as to substantially congeal the oil and render the movement of the parts of the engine difficult. In order that the device may be operated
 60 in this manner it is necessary to leave open slightly the valve of the main gas tank, and to also leave wide open the valve controlling passage of gas from the auxiliary tank to the gas distributing pipe. When the parts
 65 are so adjusted, the device will supply com-

bustible mixtures serially to the several cylinders until the engine gets so well warmed up that it will suck in its explosive mixture from the regular carbureter.

Having described my invention, I claim: 70

1. In means for charging the cylinders of an internal combustion engine with explosive gas, the combination of an auxiliary gas tank having a gas inlet adapted for connection with a source of combustible gas under pressure, and a gas distributing pipe which is connected with said auxiliary tank and is constructed to discharge into the several cylinders of the engine, a normally open valve in the inlet to said auxiliary air tank, means operable by the pressure in said auxiliary tank for closing said inlet valve, and a valve operable at will controlling the flow of gas from said auxiliary tank through said gas distributing pipe. 75

2. The combination with a main tank adapted to contain a combustible gas under pressure, and an internal combustion engine, of an auxiliary tank having an inlet which is connected with the main gas tank, a gas distributing pipe leading from said auxiliary tank and discharging into the several cylinders of the engine, a valve controlling the flow of gas from said auxiliary tank through said gas distributing pipe, a valve controlling the admission of gas to said auxiliary tank, a diaphragm in said tank and adapted to be moved by the gas pressure therein, and a rod connecting said valve and diaphragm, the rod being of such length that the valve will be held open when the diaphragm is in its normal position. 80

3. The combination with a main tank adapted to contain a combustible gas under pressure, and an internal combustion engine, of an auxiliary tank having an inlet which is connected with the main gas tank, a gas distributing pipe leading from said auxiliary tank and discharging into the several cylinders of the engine, a valve controlling the flow of gas from said auxiliary tank through said gas distributing pipe, a valve controlling the admission of gas to said auxiliary tank, a diaphragm in said tank and adapted to be moved by the gas pressure therein, and a rod connecting said valve and diaphragm, the rod being of such length that the valve will be held open when the diaphragm is in its normal position, an auxiliary spring opposing that movement of the diaphragm which will be produced by gas pressure in the auxiliary tank, and means for varying the tension of said spring. 85

4. The combination with a main tank adapted to contain a combustible gas under pressure and an internal combustion engine, of an auxiliary tank having an inlet which is connected with the main gas tank, a gas distributing pipe leading from said auxiliary tank and discharging into the several 90

cylinders of the engine, a valve controlling the flow of gas from said auxiliary tank through said gas distributing pipe, a valve controlling the admission of gas to said
5 auxiliary tank, a diaphragm in said tank and adapted to be moved by the gas pressure therein, and a crooked rod connecting said valve and diaphragm, the rod being of such length that the valve will be held open when the diaphragm is in its normal position. 10

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

OWEN M. NACKER.

Witnesses:

WM. AVERY BRUSH,
MURRAY G. GOLDBERG.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."