June 30, 1931. I. L. DUNN ET AL 1,812,088

MEANS FOR REGULATING A GAS MIXTURE FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 2, 1926

Fig. 1.

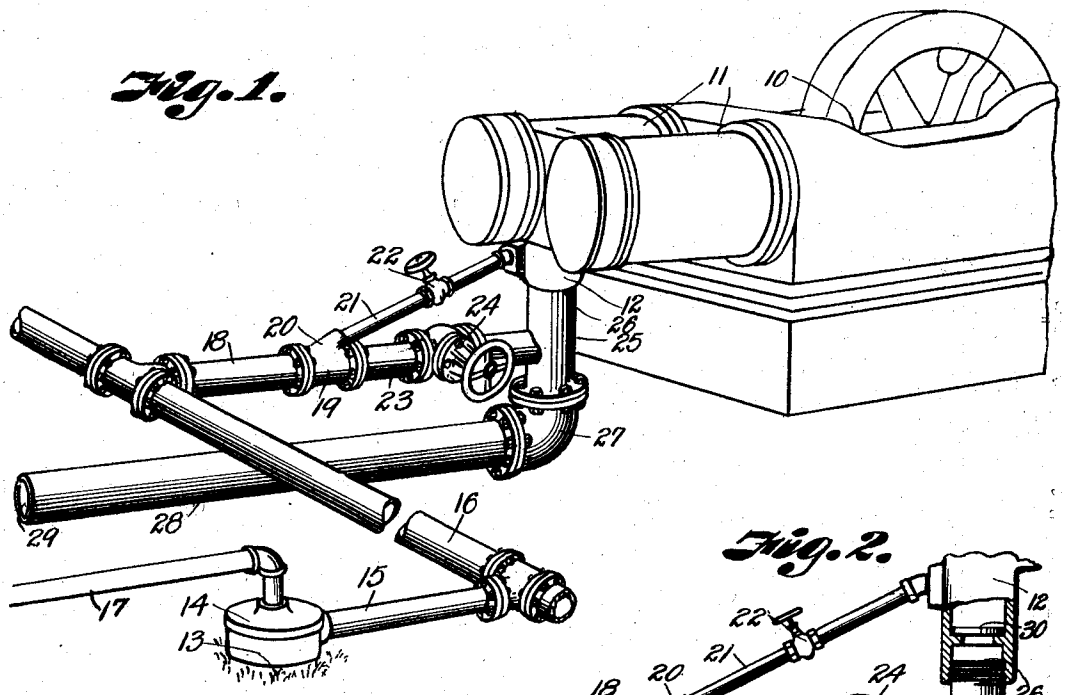


Fig. 2.

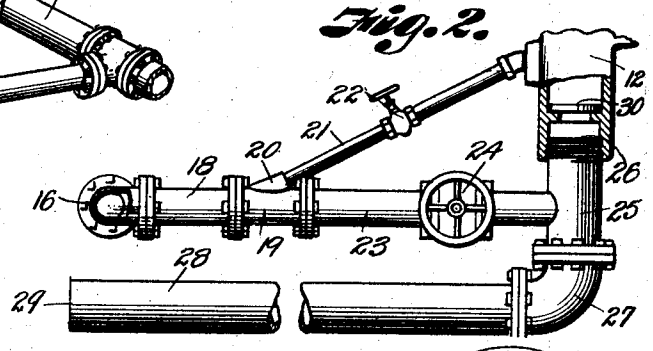
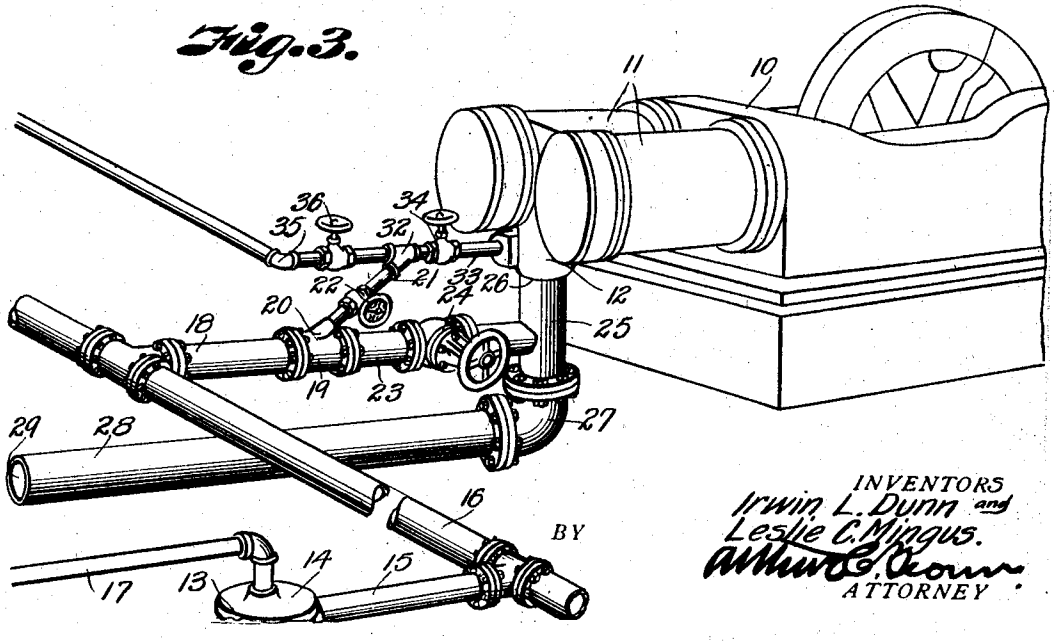


Fig. 3.



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Patented June 30, 1931 1,812,088

UNITED STATES PATENT OFFICE

IRWIN L. DUNN AND LESLIE C. MINGUS, OF TULSA, OKLAHOMA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO DUNN & LEWIS, OF TULSA, OKLAHOMA, A PARTNERSHIP COMPOSED OF IRWIN L. DUNN AND JAMES O. LEWIS

MEANS FOR REGULATING A GAS MIXTURE FOR INTERNAL COMBUSTION ENGINES

Application filed August 2, 1926. Serial No. 126,565.

Our invention relates to internal combustion engines and more particularly to means for regulating the richness of the explosive mixture in such engines.

It is the purpose of our invention to provide means for supplementing or supplanting the mixing device commonly employed in connection with gas engines, said means compensating for the variable percentage of combustible gas in gas mixtures used in such engines, particularly where the gas is obtained directly from wells that are being supplied with a fluid pressure medium including air to cause the same to flow.

Under ordinary conditions where the gas that is supplied from wells that have a compressed fluid medium applied to the oil sand to cause the flow of gas and oil from the sand to the well, the mixture of gas and air is sufficiently rich to provide for efficient operation of the engine by the addition of air thereto in the usual manner. It often happens, however, that when gas is used from an oil well from which air is passing mixed with the gas, due to the application of compressed air to the oil sand, the gas is weakened to such an extent that it becomes necessary to provide means for compensating for the leanness of the gas mixture and it is a purpose of our invention to provide such means.

Preferably our improved means for compensating for the variation in the richness of gas mixtures comprises a connection leading from the gas supply pipe to the air intake pipe supplemental to the ordinary connection between the gas supply pipe and the intake chamber of the internal combustion engine. The connection between the gas supply pipe and the air intake pipe is preferably provided with a valve whereby the amount of gas passing through said connection may be varied in accordance with the richness of the gas mixture in the gas supply pipe. The valve, in other words, may be entirely closed when the richest mixture is obtainable and may remain closed until the mixture reaches such a stage that the ordinary valve provided in the connection between the intake chamber and the gas supply pipe does not permit sufficient gas to enter the intake chamber to be mixed with the air to operate the engine with the valve wide open. Then the valve between the air intake pipe and the gas supply pipe may be opened to mix gas with the air supplied to the engine before it reaches the intake chamber to thus increase the content of combustible gas in the mixture in said chamber in proportion to the air and bring it up to the point where the same has the desired richness to give the explosive action which is necessary for efficient operation of the engine. This would ordinarily be sufficient to operate a gas engine under all conditions ordinarily found to exist, but it has sometimes been found to be desirable to provide another supplemental gas supply means for adding a richer gas to that entering the intake chamber. It has also been found that while the intake chamber is ordinarily the usual mixing chamber provided with the usual valves therein, the valve between the gas intake pipe and the mixing chamber may be omitted with our arrangement of a supplemental gas supply leading into the air intake, the air intake pipe thus acting as a portion of the mixing chamber and the proportion of gas to the air therein can be regulated by the valves we provide leading from the gas supply so that the proper mixture is drawn into the engine with each suction stroke.

Other objects and advantages of the invention will appear as the description of the accompanying drawings proceeds. However, we do not wish to be understood as limiting ourselves to the exact details shown or described, but to include as part of our invention all such obvious changes and modifications of parts as would occur to a person skilled in this art and as would fall within the scope of the claim.

In the drawings:

Fig. 1 is a perspective view of an internal combustion engine showing our improved gas supply means associated therewith.

Fig. 2 is a fragmentary view partly in

elevation and partly in section of the gas and air conduits leading to said engine.

Fig. 3 is a view similar to Fig. 1, of a modified arrangement.

Referring in detail to the drawings:

In Figs. 1 and 3 is shown an internal combustion engine 10 having the cylinders 11 to which a mixture of gas and air is supplied from the intake chamber 12. The fuel for for the engine is supplied from a source here shown to be an oil well 13 provided with a casing head 14 from which the gas supply pipe 15 passes to a gas pipe line or main 16. An oil supply pipe 17 also leads from said well under ordinary circumstances. The main 16 may supply the gas to any number of engines or other devices associated therewith and in the case in which a plurality of engines is associated with said main, the connections are made substantially the same on each engine and accordingly only one engine is shown with the connections leading thereto. In the arrangement shown in Figs. 1 and 2 the gas supply pipe 18 leads from the gas main 16 and is provided with a fitting 19 which is preferably made in the form of a Y and has the obliquely extending portion 20 from which the relatively small gas supply pipe 21 leads to the intake chamber 12. A valve 22 is interposed in the pipe 21 to vary the effective opening thereof for the supply of gas to the intake chamber 12. Extending from the fitting 19 in substantially axial alignment with the gas supply pipe 18 is a pipe 23 which is substantially the same size as the pipe 18 and which has the valve 24 provided therein. An air intake pipe 25 is connected with the air intake opening 26 of the intake chamber 12 in any suitable manner as by means of the usual screw threaded connection, and the pipe 23 communicates with the interior of the air intake pipe 25, being connected therewith in any suitable manner, as by welding, to provide a substantially air tight connection between the pipe 23 and the pipe 25. The air intake connection preferably is further provided with an elbow 27 which leads to the open-ended air intake pipe 28, the intake connection thus being open to the air at the end 29 thereof and opening into the intake chamber 12 at the other end thereof, a suction operated valve 30 being provided in the intake chamber at the air intake connection if desired.

In using the apparatus described above, ordinarily, when the gas mixture coming through the main 16 comes from wells that lead from an oil sand which is supplied with a compressed fluid including air, the mixture passing through the main 16 includes variable quantities of air and combustible gas. Where the content of combustible gas proportionate to that of the air is relatively large, the gas is supplied through the pipe 21, only, to the intake chamber 12, the valve 22 being regulated to obtain the desired proportion of said mixture to the air passing in through the intake pipe 25. The percentage of combustible gas in the mixture of gas and air in the pipe line 16 varies considerably, however, and at times reaches such a low proportion of the total mixture of gas and air flowing in the pipe 16 that it is impossible to obtain an explosive mixture in the intake chamber 12 that is rich enough to efficiently operate the engine. In other words, the mixture is so diluted with air that the force of the explosion is reduced to such a point that very little power is obtained or even to the point where the mixture will not ignite properly by the usual means employed for this purpose. When such a condition exists the valve 24 is unseated sufficiently to add enough of the mixture of gas and air to the air that is in the intake pipe 25 to increase the content of combustible gas in the intake chamber 12 sufficiently to get the desired richness for efficient operation of the engine. It has been found that the richness of the mixture cannot only be built up in this way, but due to the fact that when the valve 24 is open, gas is constantly flowing into the air intake comprising the pipes 25 and 28, which mixes with the air therein, as the air surges back and forth during and between suction strokes, a much more efficient mixing of the gas and air takes place than is ordinarily the case in the intake chamber 12 and as a result a mixture of gas and air having a smaller content of gas than would ordinarily operate efficiently in the engine will operate the engine in the desired manner, as the explosiveness of the mixture is, of course, dependent upon how thoroughly the air and gas are mixed. It has even been found that the usual valve 30 controlling flow into the intake chamber 12 may be dispensed with and the entire intake chamber 12 and air intake conduit comprising the pipes 25 and 28 utilized as a mixing chamber for the internal combustion engine, the gaseous mixture thus flowing in constantly both through the pipes 21 and 23, or only through the pipe 21, as the case may be, and mixing with the air contained in the entire passage open to the outer air at 29, but none of the gas passing out of the end 29 thereof due to the length of the pipe 28 and due to the frequent recurrence of the suction strokes of the engine, it being, of course, understood that the valve 22 or the valve 24 or both of the valves will have to be regulated to control the amount of gas entering between suction strokes to obtain the desired mixture of gas and air for the desired combustion action.

The engine 10 in Fig. 3 is connected in a very similar manner to that shown in Figs. 1 and 2, with the gas main 16 and with the

air intake connection, and the same numerals are used for the parts corresponding to those described in connection with Figs. 1 and 2 wherever the same parts are utilized.

Instead of connecting the pipe 21 directly with the intake chamber 12, a fitting 32 which is similar to the fitting 19 is provided to provide a three way connection between the pipe 21, the pipe 33 leading into the intake chamber 12 through a valve 34, and a pipe 35 which leads to a suitable source of gas supply through the valve 36. It is, of course, understood that the fitting 32 has all the openings thereof substantially the same size and that the pipes 21, 33 and 35 are all of substantially the same size. The gas pipe 35 may be connected with any suitable source of gas supply from which a substantially uniform rich gas mixture is obtained, that is, from a source of natural gas supply, that is not obtained from wells leading from oil sand to which compressed air has been applied, or any form of artifical gas, such as producer gas. It will be obvious that the mixture passing through the pipe 33 can be enriched in this manner to any desired degree by regulating the relative amount of opening of the valves 22 and 36, and that the quantity of said mixture relative to the amount of air or air and gas mixture entering through the air intake 25 may be varied by adjustment of the valve 34, the operation of the device being otherwise substantially the same as described in connection with Figs. 1 and 2.

What we claim and desire to secure by Letters Patents is:

In combination with an internal combustion engine including a fuel intake chamber having an automatic valve, an air line having an intake open to atmosphere and communicating with said chamber, a gas line communicating with the air line between said intake and said chamber whereby gas is supplied to the air line to enrich the air with the gas between intake strokes of the engine, a branch leading from the gas line to said chamber, and valves in the gas line and branch for selectively controlling supply of gas to the air line or chamber.

In testimony whereof we affix our signatures.

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LESLIE C. MINGUS.