Dec. 25, 1962 M. CRANDALL 3,070,109

CONTROL SYSTEM FOR PUMPING ENGINES

Filed Jan. 26, 1959

2 Sheets-Sheet 1

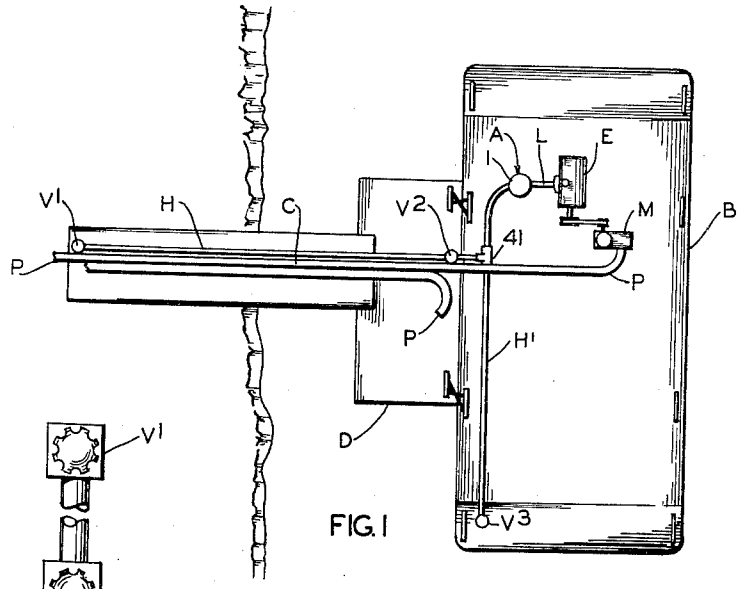



FIG. 1

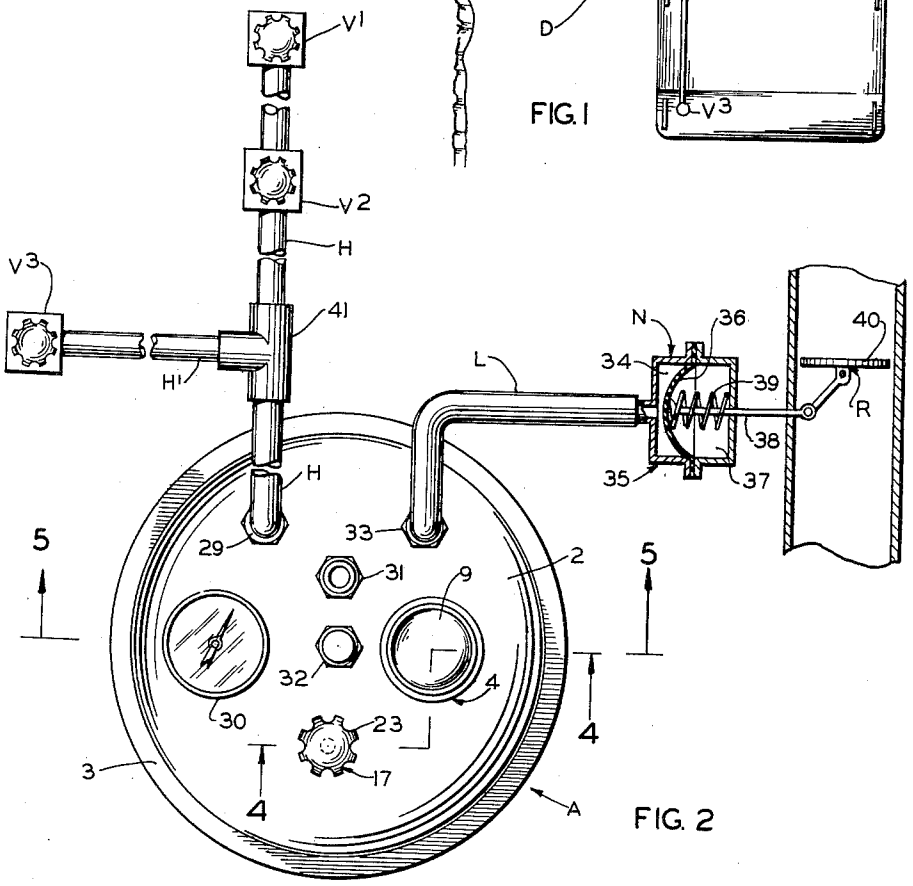



FIG. 2

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Dec. 25, 1962 M. CRANDALL 3,070,109

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2 Sheets-Sheet 2

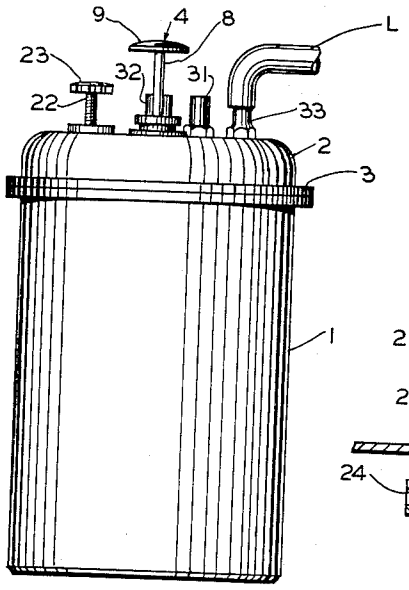



FIG. 3

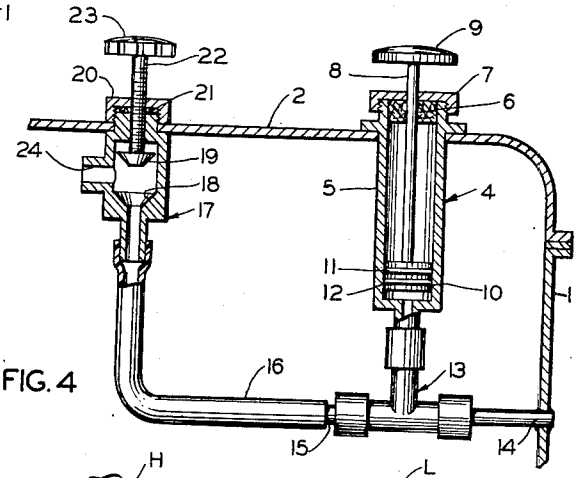



FIG. 4

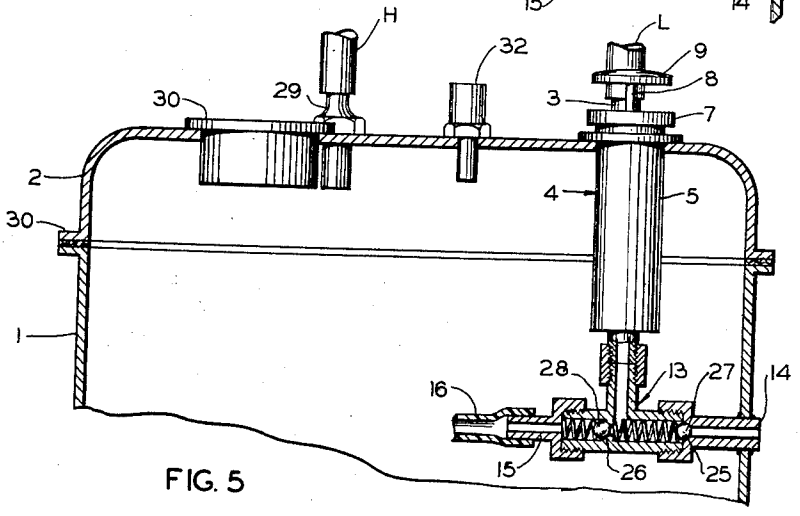



FIG. 5

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United States Patent Office 3,070,109 Patented Dec. 25, 1962



3,070,109

# CONTROL SYSTEM FOR PUMPING ENGINES

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Filed Jan. 26, 1959, Ser. No. 789,053
6 Claims. (Cl. 137—68)

This invention relates, in general, to certain new and useful improvements in pumping systems and, more particularly, to a remote control for automatically shutting down a pumping system in the event of various emergencies such as as line-breakage, fire explosions and the like.

In pumping oil and similar fluids from a barge or tanker into shore-side storage tanks or from storage tanks to ship-board, the pumps are usually driven either by a diesel engine or gasoline engine. Ordinarily such diesel or gasoline engines cannot be quickly reached in case of emergency, since it is not convenient or even feasible to have an employee stationed at the engine controls at all times. In fact, the crew-members or other employees have many duties to perform during pumping operations. Thus, if the barge should break away from its moorings or for some reason suddenly shift position the pumping lines may part, spewing oil into the water or over the deck. Under such circumstances it is entirely possible that the crew-members may be on shore and thus unable to shut down the pumping engine. Moreover, such engines cannot be safely shut down by conventional means since, in oil pumping operations, when leaks occur the atmosphere may be sufficiently charged with gases that the intake air drawn into the engine will be rich enough in fuel vapor to keep the engine running. It will, of course, be apparent that many other emergencies may occur in which it would be highly desirable to shut down the pumping engine quickly.

It is therefore the primary object of the present invention to provide a remote control and safety cut-off system for pumping engines which will automatically and immediately shut down the engine in event of such emergencies as explosions, fire, breakage of the pumping lines, and the like.

It is another object of the present invention to provide a remote control system of the type stated which is absolute in operation and cannot fail or become inoperative during use.

It is a further object of the present invention to provide a remote control system which is relatively inexpensive and is, nevertheless, highly flexible in application so as to be readily adapted to a wide variety of pumping installations.

It is an additional object of the present invention to provide a remote control system which will not only operate automatically in case of various emergencies, but will also afford a simple inexpensive means of manual control whereby the pumping engine can be shut down at will from any number of desirable or selected control-points.

It is likewise an object of the present invention to provide a remote control device for use in the system of the type stated.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (two sheets)—

FIG. 1 is a diagrammatic view of a pumping system embodying a remote control constructed in accordance with the present invention;

FIG. 2 is a top plan view of a remote conrtol device constructed in accordance with and embodying the present invention;



FIG. 3 is a side elevational view of the remote control device;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 2; and

FIG. 5 is a vertical sectional view taken along line 5—5 of FIG. 2.

Referring now in more detail and by reference characters to the drawings, which illustrate a preferred embodiment of the present invention, A designates a control device comprising a pressure-tank 1 formed of heavy-gauge sheet metal or any other structurally strong material capable of sustaining and holding pressures of the order of 50 to 100 p.s.i. Actually, the control system of the present invention does not ordinarily require pressures in excess of 15–25 p.s.i., but it is considered prudent to construct the tank 1 with an adequate safety factor.

Mounted in the top wall 2 of the pressure-tank 1 by means of a concentric mounting ring 3 is a hand operated air pump 4 including a cylinder 5 provided at its upper end with a packing collar 6 and an end cap 7, the latter being centrally apertured for slidably receiving a piston rod 8 which extends therethrough and into the cylinder 5. At its upper, or external, end the piston rod 8 is provided with a handle 9 and at its lower, or internal, end is provided with a piston 10 having a pair of axially spaced O-rings 11, 12. Threaded or otherwise suitably mounted in the bottom wall of the cylinder 5 is a double ball check valve 13 having an intake nipple 14 which extends through the side wall of the pressure-tank 1 and communicates with the outside atmosphere. Similarly, the check valve 13 is provided with a discharge nipple 15 which is connected by a conduit 16 to a stop valve 17 having a valve seat 18 for receiving a valve plug 19 which is operatively mounted on the end of threaded valve stem 20, the latter extending upwardly through a suitable packing gland 21 and being provided on its external end 22 with a handle 23. The stop valve 17 is also provided with an open discharge nipple 24 which communicates directly to the interior of the pressure-tank 1.

The check valve 13, as may be seen by reference to FIG. 5, is provided with two spring biased balls 25, 26, respectively, arranged to sit against ball-sets 27, 28, respectively. Thus, when the piston 10 is drawn upwardly, the ball 26 will seat and the ball 25 will open allowing air to be drawn into the cylinder 5 from the outside atmosphere. When the piston rod 8 is pushed downwardly again the ball 25 will seat and the ball 26 will open allowing air to be forced under pressure into the interior of the pressure-tank 1 through the stop valve 17 which, of course, is in the open position shown in FIG. 4, for purposes presently more fully appearing.

Operatively mounted in and extending through the top wall 2 of the pressure-tank 1 is a straight nipple 29 which is adapted to communicate at its inner end with the interior of the pressure-tank 1. On its exterior end the nipple 29 is adapted for receiving an air line or hose H, which is relatively light in weight and constructed preferably of thermoplastic material or material which will become weakened or burn when exposed to flames or the elevated temperatures associated with a fire and will break under some predetermined physical stress, such as the stress which might rupture the pumping lines. In fact, for most applications the hose H should be weaker than the pumping lines so as to afford anticipatory protection thereto.

Also mounted in the top wall 2 of the pressure-tank 1 is a conventional pressure gauge 30, the interior portion of which is exposed to the pressure within the pressure-tank 1. The top wall 2 is also provided with a conventional pressure-relief valve 31 and a fusible-plug safety port 32, the latter merely being an added safety feature in case a fire breaks out right at, or proximate to, the pres-

sure-tank 1. Similarly mounted in the top wall 2 of the pressure-tank 1 is a nipple 33 which communicates on its inner end with the interior of the pressure-tank 1. On its exterior end the nipple 33 is adapted for receiving an air line L which is connected to one chamber 34 of a diaphragm actuator N. The latter includes a housing 35 and a diaphragm 36 which divides the housing 35 into chambers 34, 37. Slidably mounted in and extending through the housing 35 is an actuator rod 38 which projects across the chamber 37 and is mechanically attached to the diaphragm 36. The rod 38 and diaphragm 36 are biased toward the chamber 34 by a spring 39 so that the rod 38, which is operatively connected at its remote end to the intake valve-flapper 40 of valve R, will normally hold this valve closed. The valve R is hereby shown in conventional manner. Gasoline engines, of course, all have some sort of air-intake valve which operates to throttle and cut-off the air-supply to the engine and where the control system of the present invention is used with a gasoline the air-intake valve is, in effect, the valve R as herein designated. On the other hand, diesel engines, except for one type, all are designed with air-intakes which do not have any valve at all, and in such case, it is contemplated, for purposes of the present invention, to install a simple form of butterfly valve to serve as the valve R. Since the structure of such valves is not, in and of itself, a part of the present invention, such valves are not described in detail herein. Thus, as long as the air-pressure in the line L remains at a predetermined pressure the valve-flapper 40 will remain open.

For use, the remote control device A can be set up adjacent to the diesel engine E or similar prime mover located, for example, on an oil barge B, as shown diagrammatically in FIG. 1. Usually, when a delivery of oil is being pumped from an oil barge, an intermediate or so-called "dock barge" D is employed, the latter being part of the permanent short-side installation. Running from the dock barge D to the shore tanks (not shown) are permanent conduits or pipes P. Thus, in unloading the oil barge B, a flexible pump line or conduit is connected from the barge pump M to one of the oil pipes P in the usual manner. Thereupon, the frangible hose H is strung adjacent to or along the conduit C and preferably attached at its remote end to the oil pipe P or some other stationary shore-mounted element. If desired, conventional hand operated closure valves $V^1$, $V^2$, can be interposed at conventional locations along the length of the hose H. Similarly, a conventional pipe-T 41 can be inserted at a suitable location along the hose H and a branch hose $H^1$ connected thereto. This latter hose $H^1$ may, if desired, be strung out along the deck of the barge B and provided at its remote end with a conventional hand operated valve $V^3$.

Thereupon, air under pressure is pumped into the pressure tank 1 by means of the hand pump 4 and, of course, the hose lines H, $H^1$, L, will also be filled with air under pressure since they are connected directly to the pressure tank 1 through the nipples 29 and 33. As soon as the pressure within the pressure tank 1 has reached the desired level, as indicated on the gauge 30, the stop valve 17 is shut off so that the air pressure will not leak through the check valve system 13. Thus, the entire system, including the pressure tank 1 and the hose lines H, $H^1$, L, are charged with air pressure to the desired limit, such as, for example, 20 p.s.i., assuming that the actuator is designed to overcome the bias of the spring 39 and hold the valve-flapper 40 open at this pressure, and the latter will remain open at long as air pressure is maintained in the system.

Once the various connections have been made, the hoses or air-lines H, $H^1$, L, are strung out in suitable directions as shown in FIG. 1 and the system charged with air pressure, the valve-flapper 40 will open as above described and the engine E can be started in the conventional manner. Thereafter, if the air-lines or hoses H, or $H^1$ are burned, ruptured, or the valves $V^1$, $V^2$, $V^3$, are manually open, the air pressure in the pressure tank 1 will immediately drop, causing the diaphragm to shift toward the chamber 34 and causing the valve-flapper 40 to close and to shut down the engine E.

If the engine E is started before air pressure is built up in the pressure tank 1, the valve-flapper 40 will be closed. Hence, it is impossible to operate the engine E if there is no air pressure in the pressure tank 1 or if the air pressure in the pressure tank 1 is too low.

It should be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the Control System for Pumping Engines may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

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

1. In combination with a barge having a pumping station including a pump and an engine operatively connected to the pump, the engine having an air intake valve with a closure element operatively mounted therein, and elongated fluid delivery lines connected to the pump and extending between the barge and remote receptacle for delivering oil from the barge to a remote receptacle; a safety device comprising a tank, means for introducing fluid under pressure to said tank, actuator means responsive to pressure in the tank and being operatively connected to the closure element of the air intake valve, means for normally biasing the closure element to closed position, pressure-conduit means connecting the actuator means to the tank for causing the actuator means to hold the closure element open when the pressure in the tank exceeds a predetermined limit, and hose means formed of frangible non-metallic flexible material capable of rupturing when subjected to the elevated temperatures normally associated with a fire, said hose means extending along and substantially paralleling said fluid delivery lines so as to be subject to rupturing if a break occurs in said fluid delivery lines due to relative shifting movement between the barge and the remote receptacle, said hose means also being subject to rupturing when a fire occurs in a vicinity proximate to said fluid delivery lines, means connecting said hose means to the tank in communication with the pressurized fluid therein whereby, when the hose means is ruptured, the pressure within the tank will be released, said actuator means being thereupon operable to release the closure means and permit the latter to move to closed position.

2. In combination with a barge having a pumping station including a pump and an engine operatively connected to the pump, the engine having an air intake valve with a closure element operatively mounted therein, and elongated fluid delivery lines connected to the pump and extending between the barge and remote receptacle for delivering oil from the barge to a remote receptacle; a safety device comprising a tank, means for introducing fluid under pressure to said tank, actuator means responsive to pressure in the tank and being operatively connected to the closure element of the air intake valve, means for normally biasing the closure element to closed position, pressure-conduit means connecting the actuator means to the tank for causing the actuator means to hold the closure element open when the pressure in the tank exceeds a predetermined limit, and hose means formed of frangible non-metallic flexible material capable of rupturing when subjected to the elevated temperatures normally associated with a fire, said hose means extending along and substantially paralleling said fluid delivery lines so as to be subject to rupturing if a break occurs in said fluid delivery lines due to relative shifting movement between the barge and the remote receptacle, said hose means also being subject to rupturing when a fire occurs in a vicinity proximate to said fluid delivery lines, means connecting said hose means to the tank in communica-

tion with the pressurized fluid therein whereby, when the hose means is ruptured, the pressure within the tank will be released, said actuator means being thereupon operable to release the closure means and permit the latter to move to closed position, said tank also being provided with auxiliary pressure relief means in the form of a heat-sensitive fusible plug.

3. For use with a pumping station for pumping oil and similar liquids between two terminal points consisting of a remote receptacle on shore and a barge or other similar marine vessel which is moored adjacent to the shore, said pumping station including a pump and an engine operatively connected to the pump, the engine having an air intake, and elongated fluid delivery lines connected to the pump and extending between said two terminal points for conducting oil and similar fluids between the two said terminal points; a safety device comprising an air intake valve connected to the air intake of the engine, said air intake valve including a closure element, a fluid reservoir, means for introducing fluid under pressure into said reservoir, a pressure-sensitive actuator operatively connected to the closure element of the air intake valve in such manner that the intake valve is open when the reservoir is pressurized to a predetermined pressure and the intake valve is closed when the pressure within the reservoir falls below said predetermined pressure, pressure-conduit means operatively connecting said actuator means to the reservoir, and hose means formed of frangible non-metallic flexible material capable of rupturing when subjected to the elevated temperatures normally associated with a fire, said hose means extending along and substantially paralleling said fluid delivery lines so as to be subject to rupturing if a break occurs in said fluid delivery lines due to relative shifting movement ebtween the barge and the remote receptacle as a result of substantial unauthorized change in the moored position of the barge or other similar marine vessel, said hose means also being subject to rupturing when a fire occurs in a vicinity proximate to said fluid delivery lines,



means connecting said hose means to the reservoir in communication with the pressurized fluid therein whereby, when the hose means is ruptured, the pressure within the reservoir will be released, said actuator means being thereupon operable to release the closure means and permit the latter to move to closed position.

4. A safety device according to claim 3, further characterized by manually operable means for closing the remote end of the hose means and connection means mounted on the reservoir for establishing communication between the hose means and the pressurized fluid within the reservoir.

5. The safety device of claim 3 wherein a first relief valve is operatively mounted in the hose near said reservoir, and having adjusting means adapted for selectable depressurization of the reservoir.

6. The safety device of claim 4 wherein a first relief valve is operatively mounted in the hose near said reservoir, and having adjusting means adapted for selectable depressurization of the reservoir, and the means for closing one end of the hose includes a second relief valve which is operatively mounted at the closed end of the hose whereby to permit selectable depressurization of the reservoir from a remote point.

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