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HYDRAULIC HOIST

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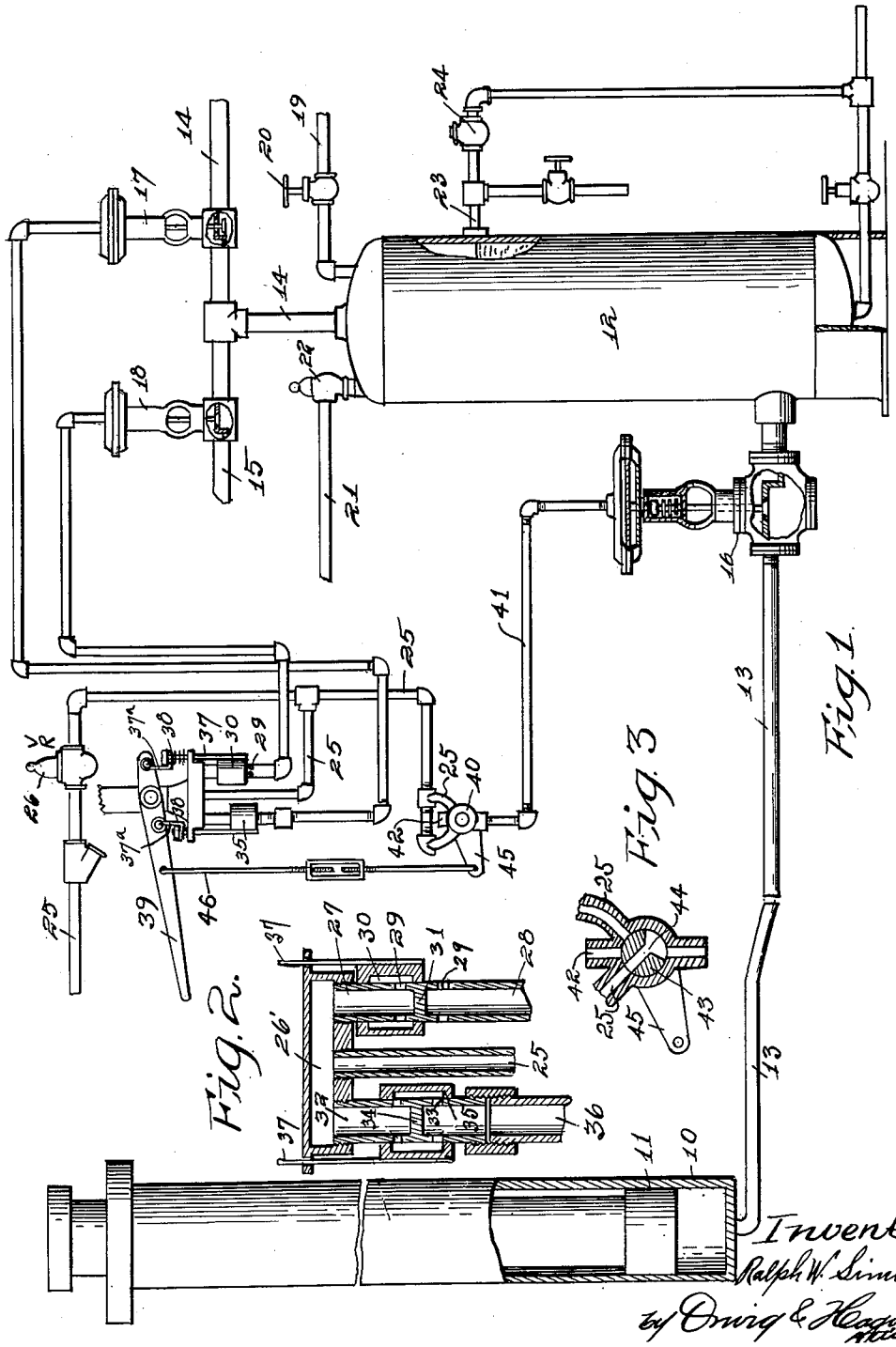


Fig. 1.

Fig. 3

Fig. 2.

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HYDRAULIC HOIST

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1 Claim. (Cl. 60—51)

Hoists of this class are ordinarily operated by compressed air supplied from an electric motor-driven compressor, and controlled by an electric switch device.

In plants engaged in the manufacture of high explosives, such as T. N. T., such electrically operated and controlled hoists cannot be used with safety because of the probability of the generation of electric sparks.

In a certain plant of this character operated by the United States Government there is a demand for hydraulic hoists, and applicant has been advised that at said plant there is always available an ample supply of high pressure steam generated at a safe distance from the plant, and that there is also a limited supply of compressed air available at all times.

It was for the purpose of providing a hoist especially adapted for these unusual conditions that the present invention was made.

The object of my invention is to provide a hydraulic hoist of simple, durable and inexpensive construction and in which the power necessary to operate the hoist is obtained from high pressure steam, in contact with the liquid which raises the hoist, and more specifically in this connection, and because under such conditions steam will condense and greatly increase the volume of the liquid, it is my object to provide for the automatic maintenance of the proper quantity of liquid in the hoist tank.

In hydraulic hoists which are air operated and use oil as the fluid, it is only necessary to apply the air pressure to raise the hoist, then shut off the compressed air, whereupon the hoist is firmly supported in any elevated position. With the use of steam as a pressure medium, and after the steam supply is shut off, it will rapidly condense and, therefore, reduce the pressure upon the liquid, with the result that the hoist will move downwardly. One of my objects is to provide a steam operated hoist having means for automatically supporting the hoist in an elevated position, regardless of the condensation of the steam.

A further object is to provide a simple, durable and inexpensive valve apparatus to be actuated by compressed air for controlling the admission to and exhaust of steam from the fluid tank, and also for controlling the flow of liquid from the tank to the cylinder for raising the hoist piston, stopping all flow between the tank and cylinder for holding the hoist piston stationary and permitting a return flow for lowering the hoist piston.

In the accompanying drawing:

Figure 1 shows a side elevation of a complete hoist apparatus embodying my invention, parts being broken away to show structural details;

Figure 2 is an enlarged detail sectional view of the valve mechanism for controlling steam inlet and exhaust valves; and

Figure 3 shows an enlarged detail view of the valve device for controlling the water communication between the cylinder and tank.

The hoist cylinder is indicated by the reference numeral 10, 11 is the hoist piston, 12 the fluid storage tank connected to the cylinder by the pipe 13.

The steam supply pipe 14 enters the top of the tank 12 and has a branch 15 for exhausting steam from the tank.

In the pipe 13 is a diaphragm-operated valve 16, of ordinary construction and characterized by being opened by a downward movement of the diaphragm and spring closed, its valve being so positioned that pressure of fluid from the cylinder will tend to hold it closed. In the steam pipe 14 is a diaphragm-operated valve 17, and in the steam exhaust pipe 15 is a similar valve 18.

Leading to the top of the tank 12 is a water supply pipe 19, having a hand-operated valve 20. Leading from the top of the tank 12 is a discharge pipe 21 having a steam relief valve 22.

A water overflow pipe 23 leads from the tank 12 at its desirable maximum water level, and it is provided with an automatic relief valve such as a float valve 24 to permit excess water to discharge from the tank.

To provide for applying and relieving air pressure to and from the several valves in proper sequence to operate the hoist, I have provided the following:

An air supply pipe 25 receives compressed air from a suitable source of supply. It is provided with a pressure regulating valve 26, of ordinary construction.

I have provided a valve device for opening and closing the valves 17 and 18 in proper sequence, comprising a valve chamber 26' into which the air supply 25 enters. Communicating with this valve chamber is a tubular valve member 27 extended downwardly and connected to a pipe 28 leading to the exhaust valve 18, this tube having two rows of openings 29 spaced one row above the other. Slidingly mounted on the tube 27 is a hollow valve member 30 having tight fitting connection with the tube 27 and larger in diameter than the tube 27, so that when in the position shown in Fig. 2, air will enter at the top of the

tube 27 and pass out into the valve member 30, but cannot pass into the pipe 28 because of the partition 31 between the openings 29. When in this position the valve 18 is closed.

On the opposite side of the chamber 26 is a similar tubular member 32 having similar rows of openings 33, a partition 34, and surrounding it is a sliding valve member 35. A pipe 36 leads from its lower end to the valve 17. When in the position shown in Fig. 2 air may enter pipe 36 and be conducted thereby to the valve 17, to thereby open same and admit steam.

A rod 37 is fixed to each valve member 30 and 35, and is slidingly supported and projects above the valve chamber 26. Each has a spring 38 for holding it elevated.

Above the valve chamber 26 is a lever 39 fulcrumed between the rods 37 so as to be engageable with the upper ends of the rods 37 as viewed in Fig. 1. By this means, when the lever 39 is in neutral position both of the valves 17 and 18 are closed, when moved upwardly one of said valves is open and the other closed, and when moved downwardly the opposite arrangement of open and closed position is effected.

For controlling the valve 16 in proper sequence with the valves 17 and 18 I have provided a valve 40 connected to the air supply pipe 25 at its upper end, and to the air pipe 41 at its lower end, and leading to the valve 16. The valve is provided with a port 42. A rotary valve member 43 has a port 44 extended through it, and an arm 45 on the rotary member provides means for operating it. The arm 45 is connected by the rod 46 with the lever 39, whereby the lever and arm are moved in unison. This valve permits the supply of air to the air pipe leading to the valve 16 when the arm 45 is either raised or lowered.

I have demonstrated in practice that with the use of steam as the power, and compressed air for valve control, the hoist is fully and completely controlled, and with safety against sparking.

When steam is being admitted to the tank the valve 16 is open and the hoist is raised by the water under steam pressure. When the hoist is stopped in an elevated position it is desirable that the steam supply be cut off to economize steam. When this is done the steam within the tank cools and condenses, thus reducing its pressure. In order to prevent this condition from permitting the hoist to lower, I have provided the valve 16 in the water pipe between the cylinder and tank, and which is automatically closed when the valve 17 is closed. When such condensation of the steam occurs, the pressure of the weight on the hoist greatly exceeds the pressure of the water within the tank. For this reason the valve 16 is designed to be forced against its seat by the pressure of the hoist and the hoist is firmly held elevated. When the hoist is being moved upwardly the valve 17 and the valve 16 must both be open and the valve 18 closed, and when moving downwardly the valve 16 must be open, the valve 18 open and the valve 17 closed. This operation of the valves in their proper sequence is effectively accomplished with my two valve devices operatively connected for joint action.

The specific individual valve structures are of ordinary construction, and other specific valve structures having similar functions may be substituted. In the accompanying claim I desire it to be understood that it is not to be construed as limited to specific valve structures.

I claim as my invention:

An air-controlled hydraulic hoist, comprising a hoist cylinder, a piston therein, a liquid storage tank, a pipe connecting the storage tank and said cylinder, an air-controlled valve for controlling the flow of liquid through said pipe, a pipe for conducting fluid to the upper end of said storage tank, a second air controlled valve in said fluid conducting pipe, an exhaust pipe for conducting fluid from the upper end of said storage tank, a third air-controlled valve in said exhaust pipe, a pipe for supplying air under pressure, pipes for conducting air from said air supply pipe to each of said second and thi d air controlled valves, a pilot valve in each of the pipes for conducting air to said second and third air-controlled valves, and capable of being moved to inlet, exhaust and neutral positions, a hand-actuated lever pivoted to swing from a predetermined neutral position to opposite angular positions, means operatively connecting said lever with the pilot valves for moving both of said valves to exhaust positions when the lever is at its neutral position, for moving one of said valves to exhaust position and the other to inlet position when the lever is at one of its angular positions, and for placing said valves in reversed inlet and exhaust positions when the lever is at its opposite angular position, a pipe connecting said air supply pipe to the first air-controlled valve, a valve in the last said pipe having two inlet ports connected with said air supply pipe and an exhaust port, and means operatively connecting the last valve to said lever whereby said exhaust port will be opened with the lever in its neutral position and one or the other of said inlet ports will be opened when the lever is in either of its angular positions of movement.

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