Dec. 31, 1940. W. G. FITZPATRICK 2,226,558

HYDRODYNAMIC BRAKE RESISTANCE CONTROL AND COOLING SYSTEM

Filed Nov. 7, 1938 3 Sheets-Sheet 1

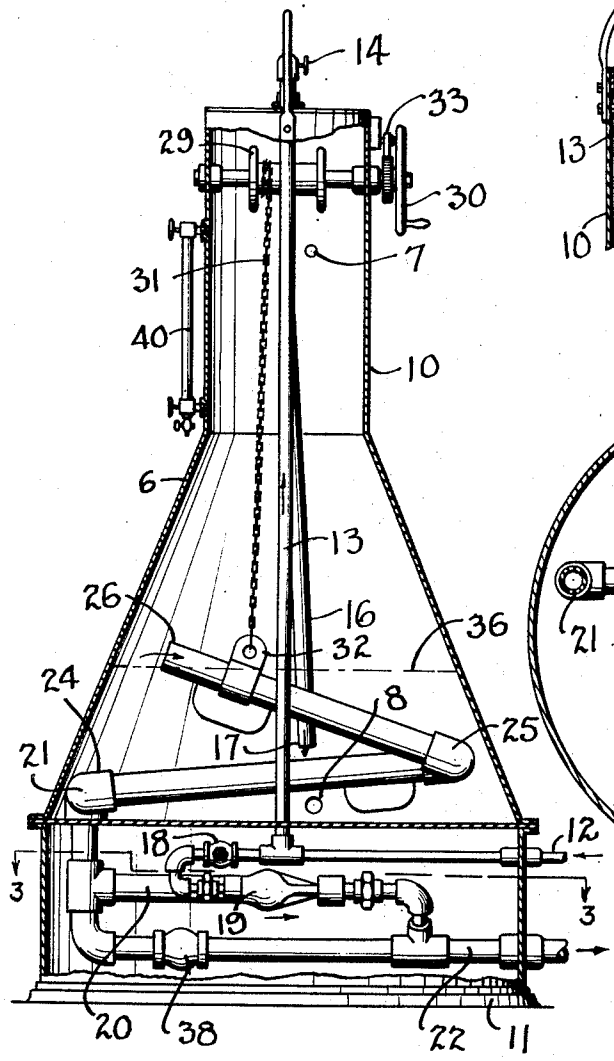


Fig. 1.

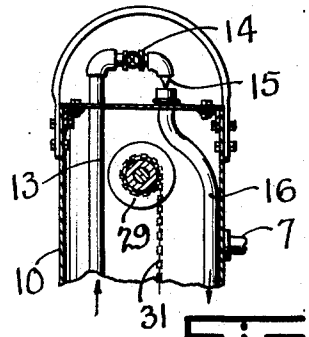


Fig. 2.

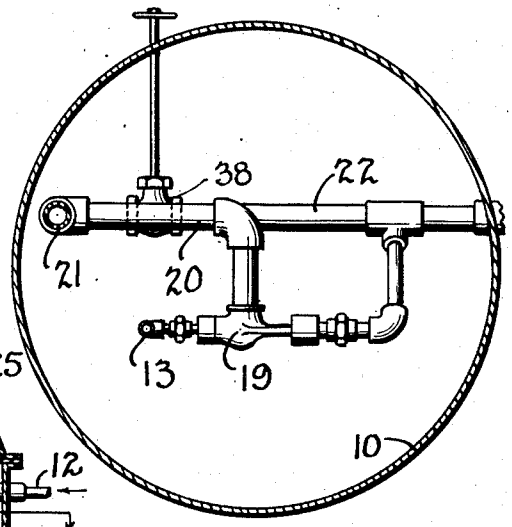


Fig. 3.

Inventor
WALTER G. FITZPATRICK
Jesse R. Stone
Lester B. Clark

By

Attorneys.

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HYDRODYNAMIC BRAKE RESISTANCE CONTROL AND COOLING SYSTEM

Filed Nov. 7, 1938 3 Sheets-Sheet 2

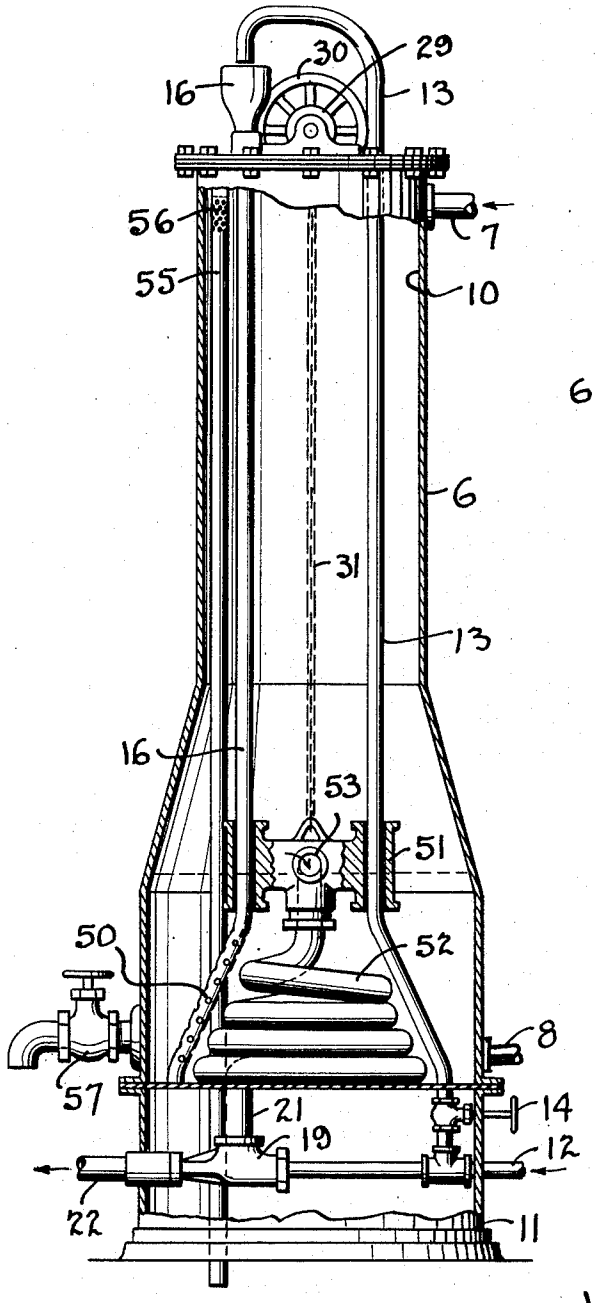


Fig. 4.

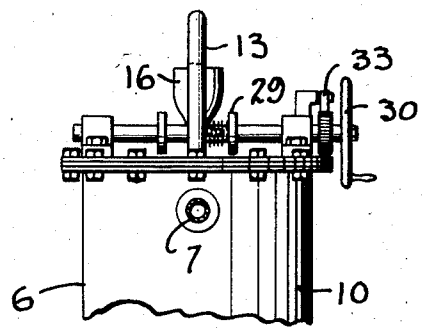


Fig. 5.

Inventor
WALTER G. FITZPATRICK
Jesse R. Stone
Lester B. Clark

By

Attorneys.

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HYDRODYNAMIC BRAKE RESISTANCE CONTROL AND COOLING SYSTEM

Filed Nov. 7, 1938 3 Sheets-Sheet 3

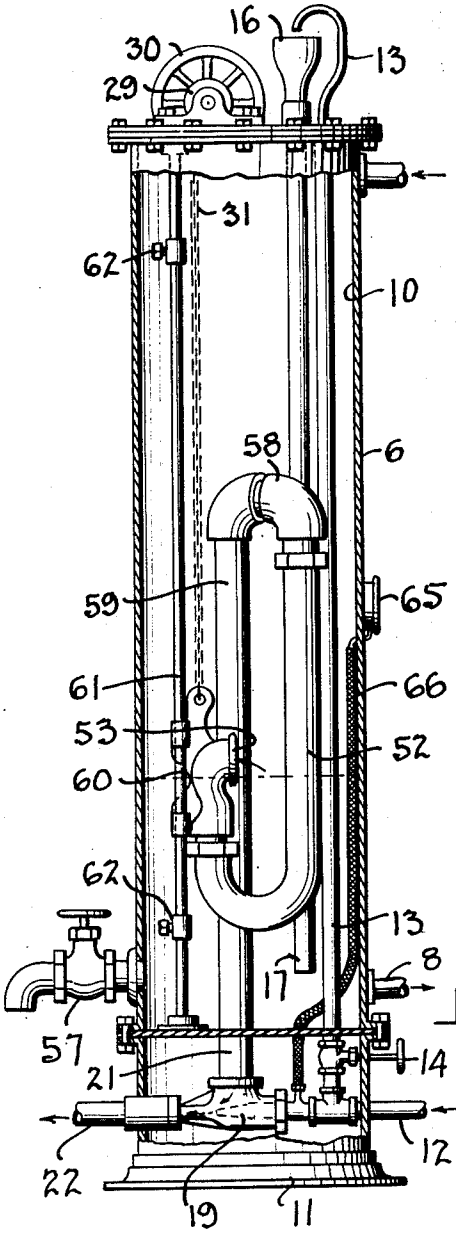


Fig. 6.

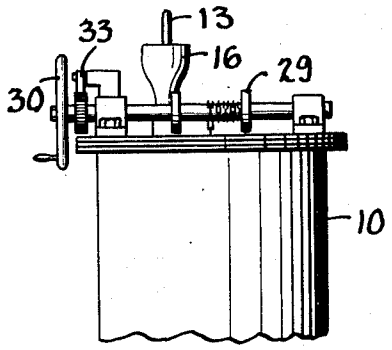


Fig. 7.

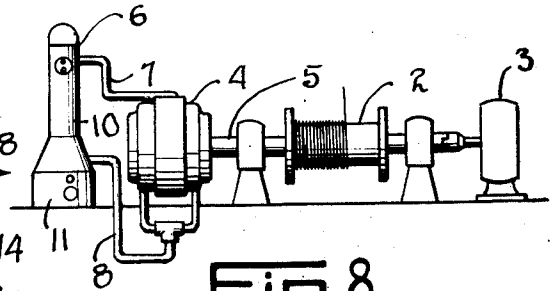


Fig. 8.

Inventor

WALTER G. FITZPATRICK.

By Jesse R. Stone
Lester B. Clark

Attorneys.

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UNITED STATES PATENT OFFICE

2,226,558

HYDRODYNAMIC BRAKE RESISTANCE CONTROL AND COOLING SYSTEM

Walter G. Fitzpatrick, Houston, Tex.

Application November 7, 1938, Serial No. 239,272

14 Claims. (Cl. 188—90)

The invention relates to a resistance control and cooling system for use with a hydrodynamic brake, particularly of the type used in hoisting equipment such as drilling rigs.

In the drilling of oil wells by the rotary method the drill bit and string of drill pipe are raised and lowered in the well bore continuously during the drilling operation and must be suspended while being rotated so that the brake mechanism is a very important element in the combination.

Hydrodynamic brakes have been utilized in the drilling of wells and one such brake is disclosed in the patent to De LaMater, No. 1,992,911, granted February 26, 1935.

In the actual operation of such brakes in the field, however, it has been found that it is desirable to vary the resistance which is applied to the brake by varying the back pressure on the cooling liquid. In the De LaMater patent a storage tank has been disclosed but this has been found to be insufficient because it does not permit of suitable control and suitable cooling. The present invention, therefore, contemplates a modification of the storage tank by incorporating therein both a variable resistance for the cooling liquid and a cooling arrangement therefor.

It is one of the objects of the invention to apply a variable back pressure to an hydrodynamic brake.

Another object of the invention is to provide a combination storage, cooling and control tank for hydrodynamic brakes.

Still another object of the invention is to provide an adjustable outlet for storage tanks so that any desired head of liquid may be maintained therein so that such head of liquid will be available as a back pressure on an hydrodynamic brake.

Still another object of the invention is to provide a jet arrangement for withdrawing liquid in a cooling system for hydrodynamic brakes.

Still another object of the invention is to provide a control reservoir wherein the head of liquid can be adjusted and the temperature of the water controlled so as to obtain the most efficient operation of the brake.

Still another object of the invention is to provide an arrangement for introducing and withdrawing the cooling water from a resistance control reservoir for hydrodynamic brakes.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings wherein:

Fig. 1 is a vertical sectional view showing one form of the apparatus wherein the outlet from the reservoir to control the head of liquid therein is adjustable.

Fig. 2 is a vertical section taken at right angles to the section of Fig. 1 and showing the uppermost portion of the reservoir.

Fig. 3 is a section taken on the line 3—3 of Fig. 1.

Fig. 4 is a vertical sectional view of a modified form of the device wherein a flexible connection is provided for the outlet of the liquid by which the resistance head is controlled.

Fig. 5 is an elevation taken at right angles to the view of Fig. 4 and showing the uppermost portion of the device.

Fig. 6 is a vertical sectional view of a second form of the invention wherein a slightly different arrangement of the exhaust outlet has been provided.

Fig. 7 is an elevation taken at right angles to the section of Fig. 6 and showing the uppermost portion of the device.

Fig. 8 is a diagrammatic view showing the general arrangement and combination of the resistance control and cooling system as applied to an hydrodynamic brake.

The invention will be best understood by having reference to Fig. 8 wherein a hoisting equipment is indicated generally at 2 and the power unit 3 therefor is shown as connected to operate the hoist. A hydrodynamic brake 4 is connected to the shaft 5 of the hoisting mechanism and the present resistance control and cooling system is shown at 6 as receiving the discharge connection 7 from the brake and the inlet pipe 8 to the brake.

In operation the head of liquid in the reservoir 6 is available through the pipe 8 inside of the housing of the brake 4 to serve as a resistance in controlling the brake. The water or liquid which becomes heated and discharges from the brake 4 will pass through the connection 7 and discharge into the reservoir 6. In order to control the resistance head and at the same time to provide cooling water the special reservoir 6 has been provided and one form is shown in Fig. 1.

In this form the connection 8 is shown in the middle of Fig. 1 near the bottom thereof and it is through this pipe that the cool water discharges into the brake housing. The connection 7 by which the heated water returns to the reservoir is shown near the top of Fig. 1.

The reservoir 6 is in the form of a tank 10 which is mounted on a base 11. A pipe 12 is connected to a suitable source of fresh cold water under pressure and the flow of this water is up-

wardly through the pipe 13 to the top of the reservoir where the flow is controlled by a valve 14, as best seen in Fig. 2. The water flowing through this pipe is visible, as at 15, where it enters the down pipe 16. It is desirable that this connection be open so that the operator can observe the amount of water which is entering the resistance reservoir.

The down pipe 16 is best seen in Fig. 1 and terminates at the elevation 17 closely adjacent the outlet port 8 and near the bottom of the reservoir. A continuation of the pipe 12 carries a valve 18 by which any desired proportion of the liquid can be discharged into a Venturi tube 19, which is provided in a bypass line 20 in order to create a suction in the control pipe 21. This control pipe discharges at 22 so that any desired amount of liquid can be discharged from the reservoir 6 in order to maintain the desired elevation of the head of liquid above the outlet pipe 8. This discharge may be into the atmosphere, to a feed water line for boilers, to a cooling tower to be returned to the system or to any other connection desired.

In Fig. 1 the control pipe 21 is shown as hinged or pivoted at 24 and 25 so that the elevation of the end 26 thereof may be raised to any desired position. In order to effect the desired adjustment of this control pipe a windlass 29 has been provided in the top of the housing 10 and this windlass may be operated by a handwheel 30. A chain 31 extends from the windlass to the clamp 32 near the end 26 of the control pipe. A ratchet arrangement 33 enables the operator to set the windlass at any desired position to control the elevation of the entrance end 26 of this control pipe. As seen in Fig. 1, the elevation of the liquid level in the container will be at the line 36, which is the elevation of the end 26 of the control pipe.

With the arrangement just described the hot water entering the pipe 7 will be in the upper portion of the reservoir while the cold water will be discharged through the down pipe 16 near the bottom of the reservoir. The water being discharged from the reservoir through the control pipe 21 will be taken from the upper elevation and will be the warmer water, so that there will be a tendency to control the temperature by varying the amount of water introduced through the flow line 12 as compared with the amount of heated water which is discharged from the control pipe 21. On the other hand, the head of liquid from the variable elevation at 36 controls the back pressure which is applied through the pipe 8 to the brake 4 so as to vary the braking effect thus obtained.

If desired, a valve 38 may be provided in the outlet pipe 22 in order to control the rate of flow so that if it is desired to quickly increase the head of liquid in the reservoir this valve may be closed to prevent any escape or to control the volume of liquid which escapes from the reservoir.

In operation the driller can adjust the end 26 of control pipe to the desired elevation by manipulation of the hand wheel 30 so that he can apply the desired resistance to the brake. The amount of cooling water can be observed by noting the flow from the pipe 13 into the down pipe 16. If desired a sight gauge 40 can be provided on the side of the reservoir.

Fig. 4 shows a modified form of the device which is substantially the same in operation as that described in connection with Fig. 1. The inlet water pipe and the down pipe are the same as previously described except that the down pipe may be provided with a plurality of perforations 50, as best seen in Fig. 4. The down pipe 16 and the inlet or supply pipe 13 serve as guides for an adjustable head 51 which carries the upper end of the control hose 52. This control hose takes the place of the control pipe 21 and, as seen in Fig. 4, is coiled in position adjacent the base of the reservoir or housing 10. The entrance to this pipe is at 53 in the head 51 and by manipulating the chain 31 this head can be raised to any desired elevation the same as the end 26 of the control pipe. An overflow pipe 55 has been provided with a plurality of perforations 56, so that no excessive pressure can be created in the reservoir. The remaining portions including the discharge and Venturi arrangement are the same as described in connection with Fig. 1. A drain valve 57 is shown on the side of the reservoir.

Fig. 6 shows still another form of the invention which is a modification of Fig. 4 in that the flexible hose 52 has been somewhat shortened by having its discharge end 58 connected to an upright pipe 59 while the adjustable head 51 has been replaced with a bracket 60 which is adjustable along a guide rod 61, upon which the stops 62 are adjustably arranged. The chain 31 and windlass 29 operate the same as in connection with Figs. 1 and 4.

Fig. 6 shows a pressure gauge 65 connected by a conduit 66 to the supply pipe 12 adjacent the venturi 19, so that the operator may observe that the pressure at which the venturi is being operated has an indication of the amount of liquid which is being withdrawn from the reservoir.

Figs. 4 and 6 operate in exactly the same manner as described in connection with Fig. 1.

Broadly the invention contemplates a combination resistance control and cooling system to be used in combination with hydrodynamic brakes.

What is claimed is:

1. The combination with a hydrodynamic brake, a system for cooling and regulating the pressure on such brake, said system including connections to and from the brake, a reservoir to which said connections are attached so that cooling liquid flows to the brake from adjacent the base and heated liquid enters the top of said reservoir from the brake, means adjustable in said reservoir to determine the elevation at which the liquid will be withdrawn from said reservoir, and additional means to force liquid from said reservoir through said first means.

2. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reservoir to control the back pressure on the cooling liquid to vary the resistance to said brake including a discharge pipe adjustable as to elevation, and means exterior of said reservoir to adjust the elevation of such discharge pipe.

3. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reservoir to control the back pressure on the cooling liquid to vary the resistance to said brake, said means including a discharge control outlet from said reservoir, and means exterior of said reservoir to adjust the elevation of such discharge outlet.

4. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reser-

voir to control the back pressure on the cooling liquid to vary the resistance to said brake, said means including a discharge control outlet from said reservoir, having an entrance which is adjustable as to elevation, and means exterior of said reservoir to adjust the elevation of said entrance.

5. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reservoir to control the back pressure on the cooling liquid to vary the resistance to said brake, said means including a discharge control outlet from said reservoir, and a suction device connected to said means.

6. In a resistance and cooling liquid control device for hydrodynamic brakes, a reservoir for liquid which flows to and from the brake, an inlet for cool liquid, and a discharge for warm liquid, said discharge including a jointed pipe to be adjusted as to elevation to vary the resistance applied to the brake.

7. In a resistance and cooling liquid control device for hydrodynamic brakes, a reservoir for liquid which flows to and from the brake, an inlet for cool liquid, and a discharge for warm liquid, said discharge including a flexible hose to be adjusted as to elevation to vary the resistance applied to the brake.

8. In a resistance and cooling liquid control device for hydrodynamic brakes, a reservoir for liquid which flows to and from the brake, an inlet for cool liquid, a discharge for warm liquid, said discharge including a flexible hose to be adjusted as to elevation to vary the resistance applied to the brake, and means to adjust the entrance to said hose.

9. In a resistance and cooling liquid control device for hydrodynamic brakes, a reservoir for liquid which flows to and from the brake, an inlet for cool liquid, and a discharge for warm liquid, said discharge including an upstanding pipe, a flexible hose section thereon, and means to adjust the end of said hose to vary the head of liquid-applying resistance to said brake.

10. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reservoir to control the back pressure on the cooling liquid to vary the resistance to said brake, including a discharge pipe adjustable as to elevation, and means exterior of said reservoir to adjust the elevation of such discharge pipe, including a hoist which can be set to support said discharge pipe at different elevations.

11. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reservoir to control the back pressure on the cooling liquid to vary the resistance to said brake, including a discharge pipe adjustable as to elevation, and means exterior of said reservoir to adjust the elevation of such discharge pipe, including a hoist having a cross head and guide rods in the reservoir which cross head can be set to support said discharge pipe at different elevations.

12. In a resistance and cooling liquid control device for hydrodynamic brakes, a reservoir for liquid which flows to and from the brake, an inlet for cool liquid, and a discharge for warm liquid, said discharge including an upstanding pipe, a flexible hose section thereon, and means to adjust the end of said hose to vary the head of liquid applying resistance to said brake, including a hoist having a bracket connected to said hose.

13. In combination with a hydrodynamic brake, a reservoir connected to receive and discharge cooling liquid to said brake, means in said reservoir to control the back pressure on the cooling liquid to vary the resistance to said brake, including a discharge pipe adjustable as to elevation, and means to add cooling liquid to the reservoir including a sight feed to observe such addition.

14. In combination with a hydrodynamic brake, a reservoir for cooling liquid for the brake, a pipe fixed to said reservoir and brake to conduct liquid from the reservoir to the brake, another pipe fixed to the reservoir and the brake to conduct liquid from the brake to the reservoir, means independent of said pipes and carried by said reservoir to vary the back pressure of the cooling liquid in the reservoir to vary the resistance to said brake comprising means operable from the exterior of the reservoir to discharge the liquid from the reservoir at different levels.

WALTER G. FITZPATRICK.