Dec. 25, 1945. J. C. REED 2,391,642

PULLEY STRUCTURE FOR BELT-TYPE LIQUID ELEVATORS

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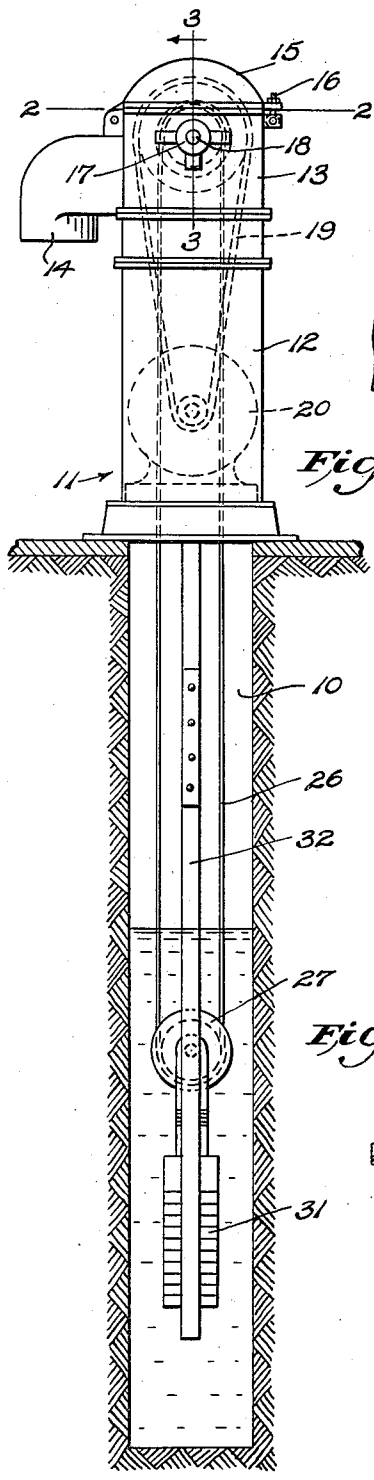


Fig. 1.

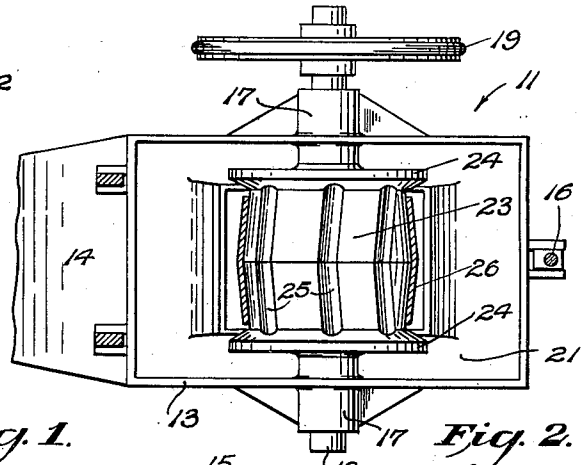


Fig. 2.

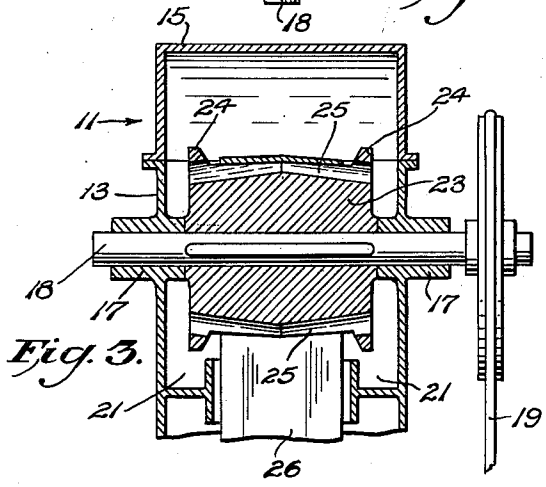


Fig. 3.

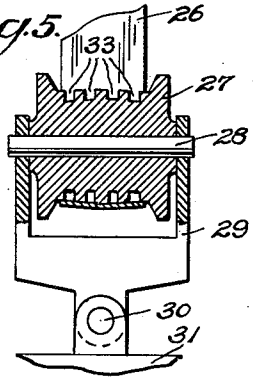


Fig. 5.

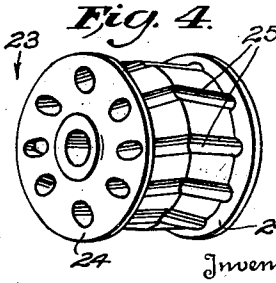


Fig. 4.

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PULLEY STRUCTURE FOR BELT-TYPE LIQUID ELEVATORS

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5 Claims. (Cl. 103—72)

This invention relates to liquid-elevating apparatus, having particular reference to that type of such apparatus in which an endless belt is disposed for operation in a well bore or shaft, and wherein the upper portion of the belt is passed around a motor-actuated driving pulley arranged in a casing above the well bore or shaft, and wherein the lower part of the belt passes around a weighted pulley submerged in the liquid to be elevated and disposed in the bottom of the bore or shaft, the arrangement being such that when the belt is actuated, liquid adheres to the surfaces thereof and is conducted upwardly and discharged from the apparatus when the belt passes around the upper or driving pulley.

In such apparatus, considerable difficulty has been encountered in designing the lower liquid-submerged pulley or roll in providing proper guidance for the endless belt and at the same time enabling a maximum amount of the surface area of the belt to be presented for contact with the liquid to be elevated. Usually, the lower pulley or roll has been formed to present a smooth unbroken cylindrical body for engagement with the inner surface of the associated belt. As the belt passes around such a smooth surface, liquid is largely removed from between the same, which correspondingly diminishes the liquid carrying capacity of the belt. Also, it has been customary to form the upper pulley or belt with smooth body surfaces which function to diminish the amount of liquid discharged from the apparatus.

Accordingly, it is an object of the present invention to provide belt wheels or pulleys for a belt-type liquid-lifting apparatus having belt-engaging surfaces formed with channels or grooves, whereby to reduce their belt-contacting surface area and improving the efficiency of such apparatus in its liquid-lifting and discharging capacities.

It is another object of the invention to provide in such apparatus a submergible belt wheel or pulley adapted to be disposed in the body of liquid to be elevated and wherein the belt-engaging periphery of said wheel or pulley is formed with a multiplicity of annular grooves so arranged as to provide for the retention of liquid on the inner surfaces of the belt as the same passes around said wheel or pulley, thereby increasing the liquid-retaining capacity of the belt.

It is a further object of the invention to provide the outer periphery of the upper wheel or pulley, around which the liquid-elevating belt passes to discharge liquid from the apparatus, with a series of transverse grooves or channels which extend from the middle of the wheel or pulley to its outer vertical end surfaces, whereby to provide for the drainage of liquid from the inner surfaces of the belt and the delivering of such drained liquid to the outlet of the apparatus, so that but a minimum of the liquid elevated by the belt, and adhering to its inner surfaces will, without useful purpose, drain back into the well opening or shaft.

In certain respects, this invention constitutes a continuation-in-part of that disclosed in my prior copending application, Serial No. 555,009, filed September 20, 1944.

For a further understanding of the invention, including additional objects and advantages thereof, reference is to be had to the following description and the accompanying drawing, wherein:

Fig. 1 is a vertical sectional view, partly in side elevation, of liquid-elevating apparatus formed in accordance with the present invention;

Fig. 2 is a horizontal sectional view on the plane indicated by the line 2—2 of Fig. 1 and illustrating in top plan the construction of the upper belt wheel or pulley;

Fig. 3 is a vertical sectional view taken through the upper belt wheel or pulley on the plane indicated by the line 3—3 of Fig. 1;

Fig. 4 is a detail perspective view of the upper belt wheel or pulley;

Fig. 5 is a vertical transverse sectional view taken through the lower liquid-submerged belt wheel or pulley and disclosing its grooved belt-engaging construction.

Referring by numerals to the accompanying drawing, which illustrates a practical embodiment of my invention, the numeral 10 designates the bore of a subterranean well or shaft, the latter containing in the bottom thereof a column or body of liquid to be elevated. At the ground level, around the bore or shaft, there is provided a casing structure, indicated at 11. The latter embodies a vertically disposed hollow pedestal 12 which supports at the upper end thereof a discharge head 13 having a liquid outlet spout 14. The open top of the head 13 is normally closed by a hinged lid or cover 15, which may be held in its position of closure by the threaded means indicated at 16. The side walls of the head section 13 of the casing are formed with bearings 17 for the rotatable reception of an operating shaft 18, the latter being driven by a motion-transmitting device 19 operatively associated with a motor or the like, shown at 20. Within the head section of the casing, there is formed on opposite sides thereof a trough 21 which leads to the spout 14.

Fixed for rotation on the shaft 18 and arranged within the head section 13 is the upper driving pulley 23, the latter having flanged sides 24. The outer peripheral surface of the pulley between the sides 24 is provided with longitudinally extending channels or grooves 25 which are inclined from the middle of the pulley toward the shaft 18 and at their outer ends terminate in circular openings arranged concentrically around the vertical sides of the pulley, the openings being formed in part in the flanges 24.

Passing over the upper part of the pulley 23 is the upper portion of a flexible endless carrier 26 which may be in the form of a belt of rubberized material. This belt is adapted to be disposed vertically in the well bore or shaft 10 and the lower run of the belt, which is submerged in the water or other liquid contained in the bottom of the well bore is trained over a weighted bottom pulley 27. The shaft 28 of the pulley 27 is journaled in a yoke 29 from which is pivotally suspended as at 30 a series of weights 31, which are used in maintaining the belt 26 under a required amount of tension. The weights 31, as set forth in my aforesaid application may be guided for vertical movement in frame bars 32 depending rigidly from the casing structure 11.

The distinctive feature of the lower pulley 27 is to be found in the fact that this belt engaging periphery is formed with a plurality of longitudinally spaced annular grooves 33 instead of being plane, smooth and uninterrupted. These grooves provide ribs at each side thereof which have limited surface contact with the belt. Thus, as the latter passes around the pulley 27, liquid adhering to the inner surfaces of the belt is retained on the latter to a very large degree so that it is unnecessary to rely merely on the upward travel of the belt, after it passes around the lower pulley to collect the liquid to be elevated.

The construction of the pulley 27 thus insures the adherence of as much liquid on the inner and outer surfaces of the belt as it is possible for the latter to carry without burdening the belt with buckets. The belt, it will be understood, is adapted to operate at high speeds with the use of a comparatively light or low horse power motor, hence the provision of buckets on the belt would defeat the essential working principle of the apparatus. While but films of liquid are present on the upwardly moving roll of the belt, nevertheless the rate of linear advance of the latter is rapid so that a comparatively large amount of liquid is elevated in a given period of time. Thus with the use of a light low horse power motor, the apparatus is enabled to elevate volumes of liquid which, with the use of ordinary pumps and other elevating equipment would require the employment of motors of much greater horse power than those utilized with the present apparatus.

As the belt travels around the upper wheel or pulley 23, the water which adheres to the under or inner surface of the belt is caught in the grooves or channels 25 and gravitationally conveyed to the sides of the element 23, when the water or other liquid is deposited in the trough 21, together with that discharged from the outer surfaces of the belt, and delivered to the outlet spout 14. Through this construction, there is but a minimum loss of the liquid elevated by the belt as the latter passes around the driving pulley so that the outflow volume is maintained at a high peak and drain back of the liquid into the well bore is minimized.

While I have described what I consider to be a preferred embodiment of my invention, nevertheless, it will be understood that the same is subject to certain variation or modification without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. Belt-type liquid-elevating apparatus comprising a casing having a liquid outlet, a belt-receiving and driving pulley rotatably mounted in said casing contiguous to said outlet, said pulley having its annular belt-contacting surfaces formed with spaced longitudinally extending liquid-receiving grooves, the latter opening to the sides of the pulley, an endless liquid-elevating and discharging belt passing around said pulley and depending therefrom into a body of liquid to be elevated, and troughs formed with the side walls of said casing below said pulley for receiving liquid discharged from said grooves and conducting the same to said outlet.

2. A pulley for belt-type liquid-elevating apparatus comprising a substantially cylindrical shaft-mounted body having annular belt-guiding flanges formed at the ends thereof, the outer circumference of said body being formed with open grooves for the reception of liquid confined between the inner surfaces of the associated liquid-elevating belt and the pulley body, the outer ends of said grooves opening to the sides of the pulley body within the confines of said flanges, whereby to effect discharge of liquid from said grooves through openings formed at the sides of said body.

3. A pulley for belt-type liquid elevating apparatus, comprising a substantially cylindrical shaft-mounted body having annular belt-guiding flanges formed at the ends thereof, the outer circumferential portion of said body between said flanges being formed with a plurality of annularly spaced and longitudinally extending liquid-receiving grooves which terminate at the sides of the pulley.

4. A pulley for liquid-elevating apparatus comprising a substantially cylindrical body having annular belt-guiding flanges at the ends thereof, the belt-engaging surfaces of said body between said flanges being formed with a plurality of liquid-conducting grooves leading to the opposite sides of the pulley.

5. A pulley for belt-type liquid-elevating apparatus comprising a substantially cylindrical body having annular flanges formed at the ends thereof defining an annular belt-confining recess, the annular walls of said recess between said flanges being reversely inclined from approximately the center of the pulley body, and the said reversely inclined walls being formed with annularly spaced longitudinally extending water-conducting grooves which open to the opposite sides of the pulley body within the confines of said flanges, said grooves possessing an inclination corresponding to that of the bottom walls of said recess.

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