

March 19, 1940.

A. E. HINE

2,194,071

APPARATUS FOR WASHING AND FLUSHING FILTERING OR SIMILAR MATERIALS

Filed Aug. 21, 1936

2 Sheets-Sheet 1

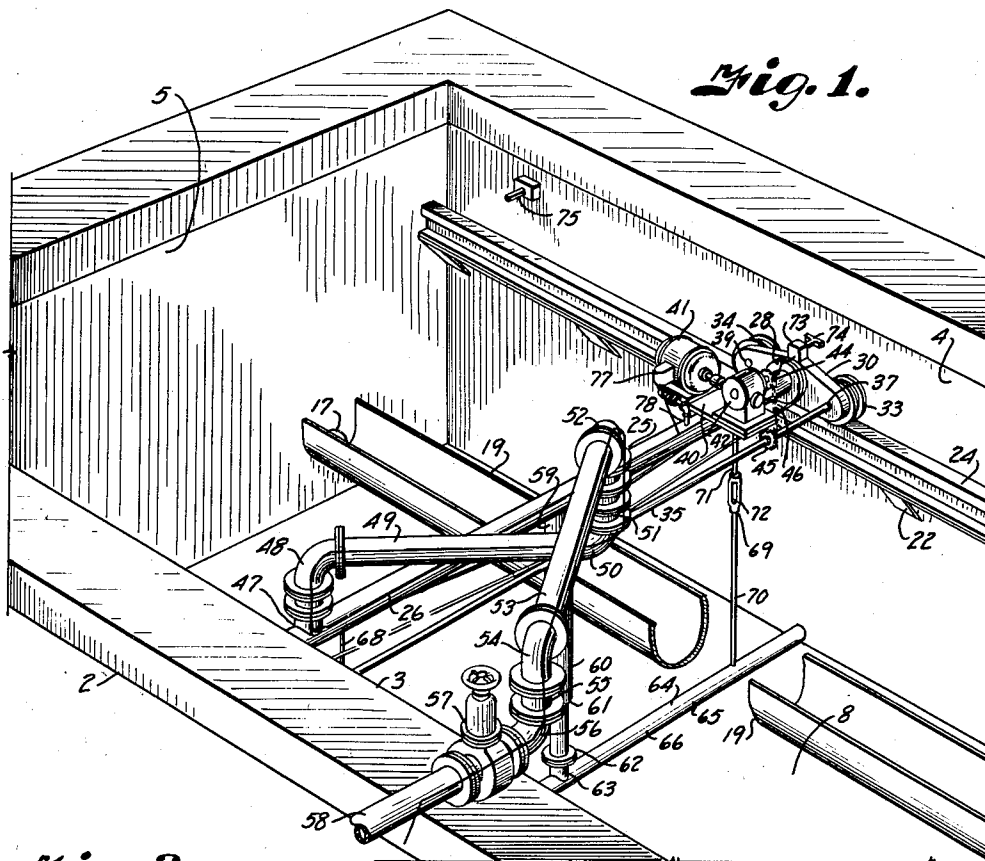
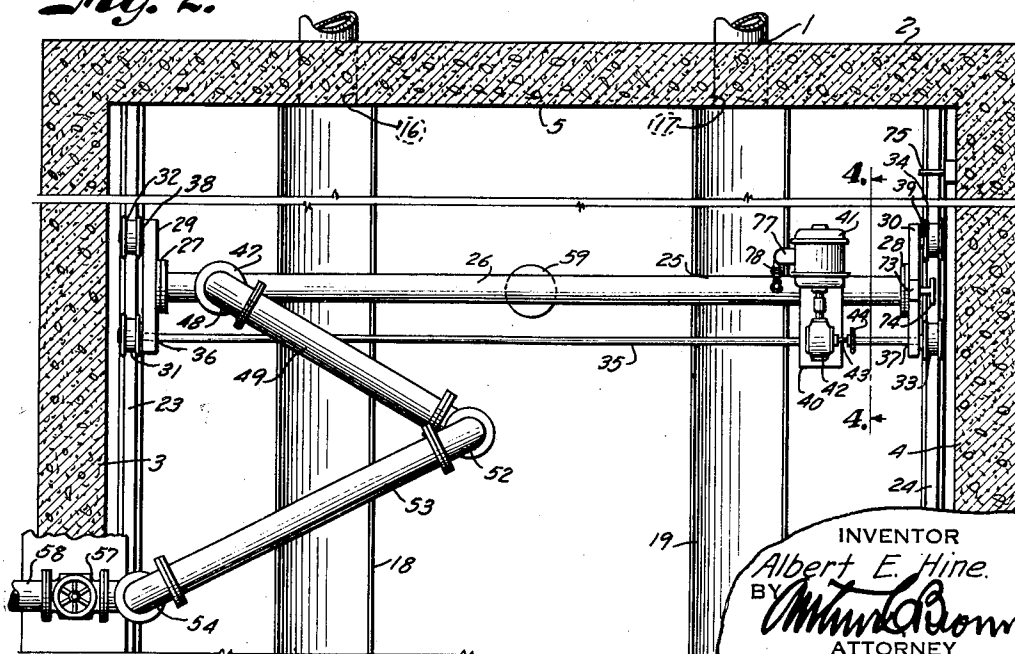


Fig. 2.



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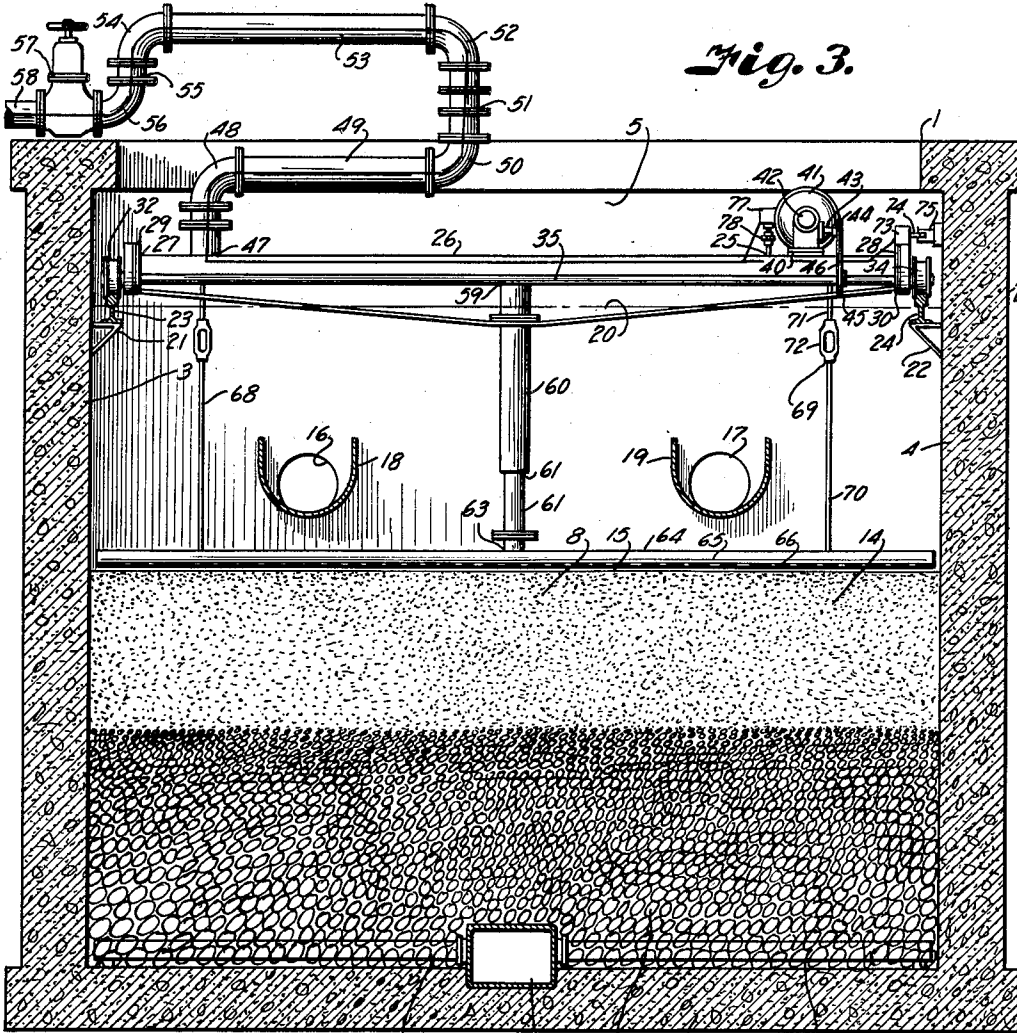


Fig. 3.

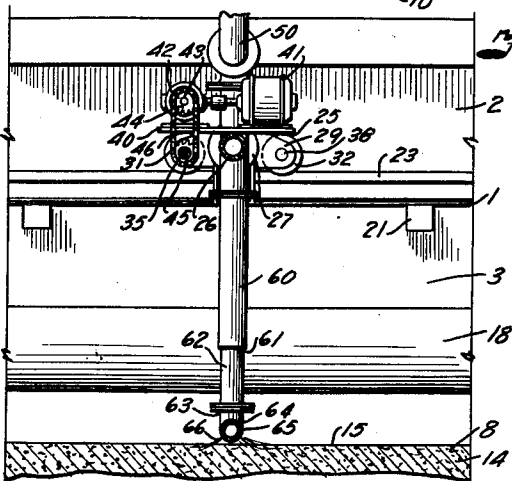


Fig. 4.

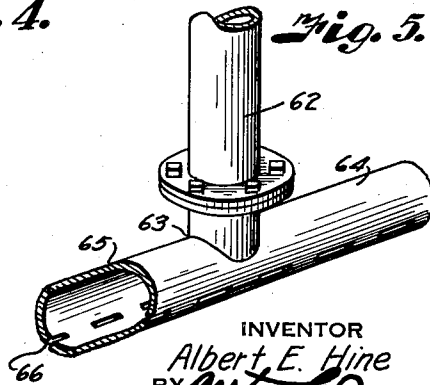


Fig. 5.

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2,194,071

APPARATUS FOR WASHING AND FLUSHING
FILTERING OR SIMILAR MATERIALSAlfred E. Hine, Sedalia, Mo., assignor to Eric W.
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Application August 21, 1936, Serial No. 97,158

4 Claims. (Cl. 210—128)

This invention relates to an apparatus for washing and flushing filtering or similar materials, for example the sand beds of filters as used in water purification systems. After filters have been in operation they gradually become clogged with foreign deposits that are closely compacted with the fine sand at the top of the filter bed. It is, therefore, necessary to periodically wash these deposits from the sand in order to restore the filter bed to its normal efficiency. This formerly has been accomplished by forcing water under pressure through a system located beneath the filter bed so that high pressure jets of washing liquid are directed upwardly through the sand, but this method of washing has not proved satisfactory for the reason that the jets cause the foreign deposits to form balls of mud that accumulate on or near the surface of the sand. It has been found impractical to utilize sufficient volume and pressure to create the violent agitation necessary to break up the mud balls because of resultant breaking up of the strata composing the filter bed. This difficulty has been solved to some extent by an overhead washing system used in conjunction with the lower system and which consists of a series of fixed pipes having jets discharging downwardly onto the upper surface of the bed and which are operated simultaneously or alternately with the jets from below. While this arrangement has produced better results, the upper jets are not capable of reaching all the particles of sand and it is therefore not uniformly effective. Furthermore, an extremely high pressure supply of water is necessary to operate the large number of sprays required to cover the entire bed.

It is, therefore, the principal object of the present invention to provide an overhead washing system to act in conjunction or intermittently with the jets from below for effectively washing the entire bed of the sand without the large volume and high pressure supply necessary in present washing systems.

Other important objects of the invention are to effect thorough agitation of the upper portion of the sand bed without disarrangement of the strata and to more effectively break up the accumulated foreign material such as mud balls and the like that may be formed in the filter.

It is also an important object of the present invention to provide means for adjusting the height of the spray above the sand to yield the most efficient results under varying conditions, such as size of the sand grains, depth of pene-

tration of the foreign material, growth or loss of sand bed, and other factors.

It is a further object to provide an overhead washing apparatus that occupies comparatively small space and may be moved to any position in the filter.

In accomplishing these and other objects of the invention, as hereinafter pointed out, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of a portion of a filter equipped with an overhead washing system embodying the features of the present invention.

Fig. 2 is a horizontal section through one end of a filter tank showing the washing apparatus in plan.

Fig. 3 is a vertical section through the filter tank.

Fig. 4 is a cross-section through a portion of the tank and washing apparatus on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary perspective view of the spray head.

Referring more in detail to the drawings:

1 designates a filter such as employed in water purification systems, and in the present instance is shown as including a tank 2 of rectangular shape. The tank includes side walls 3—4, end walls 5 and a bottom 7 adapted to support a filter bed 8. Extending longitudinally of the bottom of the tank is a manifold 9 having spaced laterals 10 and 11 extending toward the side walls 2 and 3 and provided with suitable openings through which the effluent is drained from the filter and through which a wash liquid is discharged through the filter bed as later described.

The filter bed includes a plurality of layers of filtering material 13 and 14, the lower layer 13 being composed of relatively large, coarse gravel-like material gravitating to a smaller size toward the upper surface thereof to provide drainage for the effluent in the direction of the laterals 10 and 11. The upper layer 14 is composed of relatively fine filtering sand and has its surface 15 terminating substantially midway of the height of the walls 3 and 4.

The influent or the liquid to be filtered is admitted through spaced ducts 16 and 17 formed in the end wall 5 at a point above the normal surface of the filter bed. Communicating with the ducts 16 and 17 and extending longitudinally of the tank in parallel relation with the side walls

are distributing troughs 18 and 19 as in conventional filter practice.

The filter thus far described is of conventional type and separately forms no part of the present invention.

In filters of the type illustrated the liquid to be filtered is admitted through the ducts 16 and 17 under sufficient pressure to carry the head of liquid in the filter at a point indicated by the dot and dash line 20 to provide a sufficient head for moving the liquid through the filter bed at the required rate of flow so that foreign materials carried therewith are filtered out upon passing through the filter bed prior to discharge through the laterals 10 and 11 and duct 9. After the filter has been in operation the filter bed becomes clogged with foreign material that has been removed incidental to the filtering process and it becomes necessary to wash the filter bed of the contained foreign matter in order that the efficiency of the filter may be maintained. As above pointed out, this is accomplished by forcing wash liquid under pressure through the duct 9 for flow in a plurality of jets in an upward direction through the filter bed from the openings in the laterals 10 and 11.

The wash liquid is admitted at as high a pressure as possible to wash the contained foreign material toward the upper surface of the filter bed without causing disarrangement of the respective layers. The jets of water passing up through the filter bed wash the foreign materials from the bottom toward the top of the filter with the intention of washing it over the sides of the troughs and through the openings 12 and 17, however, much of the material collects at or adjacent the surface of the filter bed to form the mud balls as above described, but owing to the necessarily low velocity of the wash liquid, it is impossible to cause their discharge into the troughs, therefore when the filter is again placed in operation these mud balls are washed by the liquid being filtered back into the lower layer of the filtering material to seriously interfere with the effective operation of the filter.

As above mentioned, it is the later practice to provide the filter tank with an overhead distributing system whereby fixed jets of wash liquid may be directed downwardly from the upper surface of the filter bed to cause breaking up of the closely compacted foreign matter, as well as the mud balls that are formed incidental to the action of the wash liquid admitted from the bottom of the bed. However, I have found that a system of fixed jets is not capable of reaching all of the surface of the filter bed so that it is impossible to thoroughly, adequately clean the fine filtering sand of the foreign deposits. I, therefore, have devised a mobile overhead washing system wherein the entire surface of the filter bed is subjected to the action of wash liquid to thoroughly break up and loosen the compact foreign matter and which may be operated simultaneously or intermittently with the lower washing system, as now to be described.

Supported by suitable brackets 21 and 22 from the side walls 3 and 4 of the tank, at a point substantially at the normal liquid level therein, are rails 23 and 24 extending the entire length of the tank to support a carriage 25. The carriage 25 is shown in the present illustrations as including a pipe 26 having flanged ends 27 and 28 to which are connected end plates 29 and 30 for closing the ends of the pipe and to provide supports for flanged wheels 31—32 and 33—34

that are operable upon the rails 23 and 24. The wheels 31 and 33 of the pairs are fixed to the ends of a shaft 35 rotatably mounted in suitable bearings 36 and 37 of the members 29 and 30, while the other wheels 32 and 34 of the pairs are mounted at the opposite side of the end members on studs 38 and 39.

Carried by the pipe 26 is a platform 40 mounting a prime mover, such as an electrical motor 41, that is operably connected with a suitable reduction gearing 42 also carried on the platform and in such position that the power take-off shaft 43 thereof is supported in parallel relation with the shaft 35. Fixed on the shaft 43 is a driving sprocket 44 aligning with a driven sprocket 45 fixed on the shaft 35, and operating over the respective sprockets is a chain belt 46 so that upon energization of the motor 41 the shaft 35 is rotated to drive the wheels 31 and 33 of the carriage and effect movement thereof along the rails.

Connected with the pipe 26 at the end thereof opposite to the motor 41 is a T connection 47 to swivelly connect an elbow fitting 48 carrying one end of a swing pipe 49. The opposite end of the swing pipe carries an elbow 50 having a swivel connection 51 with an elbow 52 on an end of a swing pipe 53 which has its opposite end fixed to an elbow 54 swivelly connected, as at 55, with an elbow 56, the elbow 56 being fixed to the discharge side of a shut-off valve 57. The elbow 56 is connected through the shut-off valve 57 with a supply pipe 58 wherethrough wash liquid is supplied by way of the swing pipes to the pipe 26. Extending downwardly from the pipe 26 at a point preferably midway thereof is a T connection 59 carrying a depending pipe section 60 having its lower end 61 terminating at a point above the normal surface of the filter bed.

Telescoped within the pipe 60 is a pipe 62 connected with a T 63 of a spray head 64. The spray head 64 consists of a pipe 65 extending across the upper surface of the filter bed and having substantially downwardly directed discharge openings 66, and which has its ends suspendingly supported from the ends of the pipe 26 by hangers 68 and 69. The hangers 68 and 69 are each shown as comprising rods 70 and 71 adjustably connected by turnbuckles 72 where-with the distributor head may be adjusted to and from the surface of the filter.

In order to effect continuous reciprocation of the carriage along the length of the filter, the motor 41 is preferably of the reversing type and is controlled by means of a reverse switch 73 located on the end plate 37 of the carriage and which has a T-shaped arm 74 adapted to be respectively engaged by stops 75 projecting inwardly from the side wall 4 of the tank in the path of the switch arm so that when the carriage reaches the respective ends of the filter the switch is actuated to effect reversal of the motor and movement of the carriage in the opposite direction. The motor is preferably energized by means of a switch 77 connected with the pipe 26 as shown at 78, and operated by the pressure therein. The current may be supplied to the motor in any suitable manner, for example through one of the rails or through a flexible conductor extending along the swing pipes to the pipe 26 and thence along the pipe 26 to the motor, as shown in Fig. 1.

In using a filter constructed and assembled as described, the influence connection thereof is closed and the water level allowed to drop in

the filter to a point slightly above the surface of the filter bed or in some instances to a point level with or below the filter bed, the level depending upon the nature and degree of the material clogging the filter. The influent connections are then connected with a sewer or other suitable disposal source and the valve 57 is opened to allow flow of wash liquid through the swing pipes to the pipe 26 and through the pipe 26 through the telescoping pipes 60 and 62 to the spray head.

As soon as the pressure of the wash liquid reaches the connection 78, the switch 77 is operated to energize the motor. The motor will then operate the gear reduction mechanism to drive the shaft 35 through the sprocket and chain connection and effect movement of the carriage along the rails toward the opposite end of the tank. Simultaneously with movement of the carriage sprays of wash liquid are discharged on the surface of the filter bed with sufficient pressure to break up and loosen the clogging material. When the carriage reaches the opposite end of the filter, the arm of the reversing switch engages the stop at that end of the filter to effect reversal of the motor whereupon the carriage is moved in the opposite direction until it is returned to the other end of the filter, whereupon the switch arm engages the other stop to again reverse the motor, thereby effecting movement of the carriage in the opposite direction.

During movement of the carriage, the swing pipe 53 moves on an arc about the axis of the swivel 55 while the swing pipe 49 swings about the axis of a swivel connection 48 to allow free movement of the carriage. It is thus obvious that the sprays discharged through the discharge opening in the distributor head are caused to cover the entire surface of the filter bed and that the sand is loosened with sufficient force to thoroughly agitate and wash the upper layer of the filtering material.

As the water level rises in the filter and begins to flow out through the troughs 18 and 19, the loosened foreign material is carried therewith and discharged from the tank. As the upper surface of the filter bed has been loosened, the effluent connection may be opened to cause jets of wash liquid to be discharged upwardly through the filter bed for washing the foreign material toward the top thereof and effect its discharge through the troughs 18 and 19. Since some of the filtering material may be removed incidental to the cleaning operation, the distributor head may be adjusted to the new level by adjusting the turnbuckles 72. When the wash liquid runs clear, the cleaning operation is complete whereupon the supply of wash liquid may be shut off and the filter returned to its normal operation. After use, the carriage may be moved to one end

or the other of the filter tank in which position it does not interfere with operation of the filter and is out of the way in case it is necessary to replace or replenish the filtering material. If desired the upper and lower spray systems may be intermittently and/or alternately operated depending upon the nature and condition of the filter bed.

From the foregoing, it is obvious that I have provided an overhead washing system that effectively washes and cleans the entire surface of the filter and will break up any tendency of the foreign material to form the mud balls incidental to injection of the wash liquid from below.

What I claim and desire to secure by Letters Patent is:

1. In combination with a filter including a tank containing a filter bed, rails supported at the sides of the tank, a carriage movable on the rails including a conduit, wheels carried at the ends of the conduit and operable on the rails, a spray nozzle suspended from the conduit, means connecting the spray nozzle with the conduit, and means for moving the carriage along the rails.

2. The method of washing a bed of granular filtering material including agitating the granules at the top of the bed by directing jets of wash liquid against the surface of the bed, and rolling the granules in rubbing contact with each other first in one direction and then in the opposite direction by progressively moving the jets across the bed in alternate directions.

3. The method of washing a bed of granular filtering material including agitating the granules at the top of the bed by directing jets of wash liquid against the surface of the bed, controlling level of liquid carried above the bed at a point to reduce interference with action of said jets, maintaining substantially the full force of the jets on said bed, rolling the granules in rubbing contact with each other first in one direction and then in the opposite direction by moving the jets across the bed in alternate directions, and inducing flow of wash liquid upwardly through the bed to carry off foreign material loosened from the granules of the filtering material incidental to said rubbing contact.

4. In combination with a filter bed, a spray nozzle, means supporting the spray nozzle for movement over the filter bed, a motor for actuating the supporting means, an electrical circuit for the motor, means connected with the spray nozzle for supplying a wash liquid, a switch in said circuit, and means responsive to pressure of said liquid in said supply means and having connection with the switch for closing the switch to start the motor when the wash liquid is admitted to said spray nozzle.

ALFRED E. HINE.