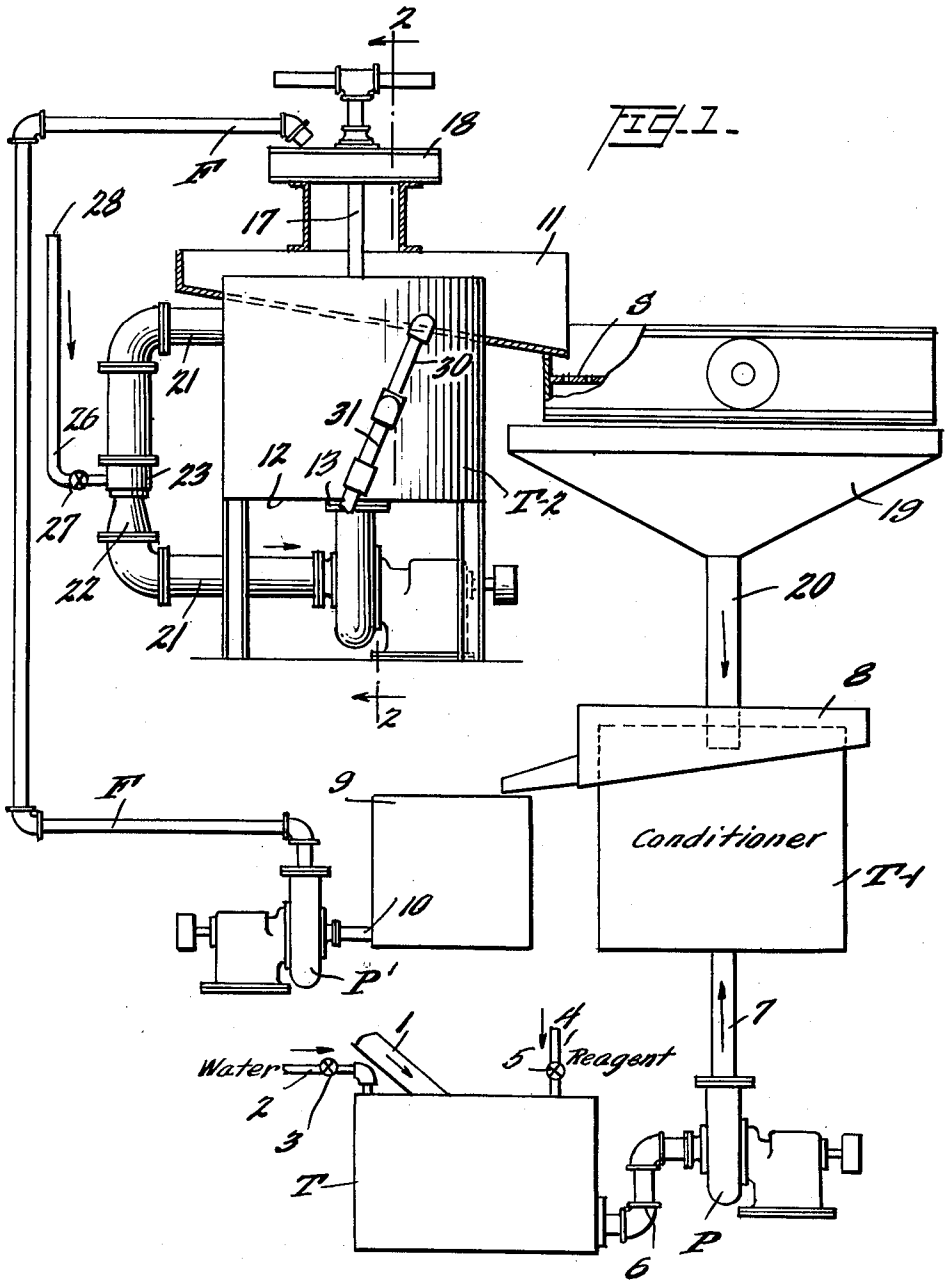
June 9, 1953 W. L. REMICK 2,641,362

APPARATUS FOR SEPARATING MIXED MATERIALS

Filed Jan. 4, 1950 2 Sheets-Sheet 1

FIG. 1.



INVENTOR

Walter L. Remick,

BY Ogle R. Singleton

ATTORNEY

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Filed Jan. 4, 1950 2 Sheets-Sheet 2

FIG. 2.

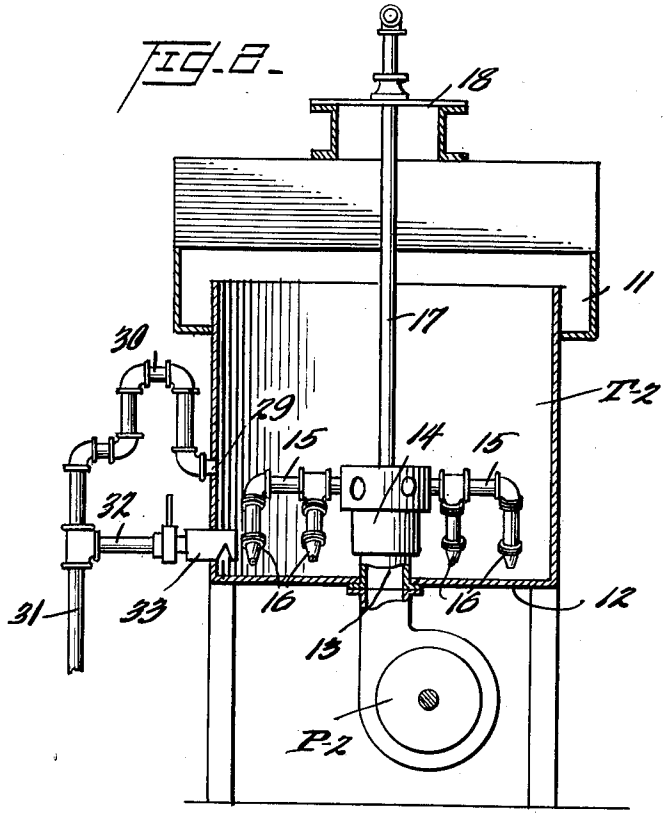
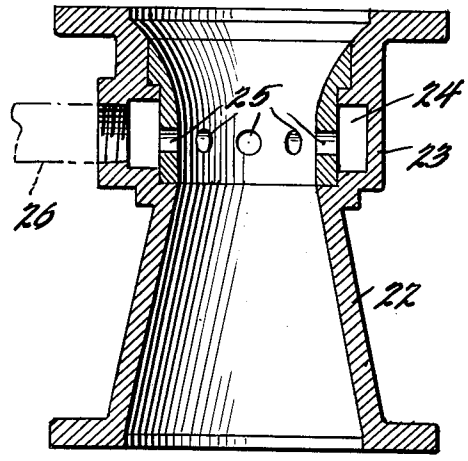


FIG. 3.



INVENTOR

Walter L. Remick,

BY Ogle R. Simpleton

ATTORNEY

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APPARATUS FOR SEPARATING MIXED MATERIALS

Walter L. Remick, Evanston, Ill., assignor to Hydrotator Company, Evanston, Ill., a corporation of Delaware

Application January 4, 1950, Serial No. 136,726

2 Claims. (Cl. 209—155)

1

My invention consists in a new and useful improvement in process of and apparatus for separating mixed materials and is intended more particularly for separating coal from its associated non-combustible material. The process hereinafter fully described is an improvement upon the froth flotation process disclosed in my co-pending application, Serial Number 60,335, now abandoned, and my improved apparatus hereinafter fully described provides novel means for practicing my improved froth flotation process.

I have found by experience that the capacity of the apparatus is materially increased by using a Venturi tube in the liquid circulating system and aspirating into the system the requisite air for the frothing zone. I have effected material improvement of the froth flotation by using a "conditioner" tank to receive the mixed materials to be separated and the frothing re-agent, and supplying to this tank by gravity the separated fine coal passing the screen, and mixing with the feed for re-treatment. The agitated mixture in the "conditioner" tank is fed to the froth flotation tank, independently of the liquid circulation system of the latter tank, thereby greatly simplifying the adjustment for effective control of the operation of the liquid circulation system.

While I have illustrated in the drawings and have hereinafter fully described a specific embodiment of my invention as to my improved apparatus, it is to be distinctly understood that I do not consider my invention as to my improved apparatus to be limited to said specific embodiment, but refer for its scope to the claims appended hereto.

In the drawings:

Fig. 1 is a side elevation, partly diagrammatic, of my improved apparatus.

Fig. 2 is a vertical section on the line 2—2 of Fig. 1, in the direction of the arrows.

Fig. 3 is an enlarged vertical section of the Venturi tube in the pump intake.

As shown in the drawings, my improved apparatus has a supply tank T into which discharges a chute 1 for feeding the mixed materials into the apparatus. A pipe 2 with a valve 3 is provided for supplying water under pressure into the tank T, and a pipe 4 with a valve 5 is provided for supplying a suitable frothing re-agent to the tank T. The tank T is provided in its bottom with a discharge pipe 6 connected to the intake of a suitable pump P provided at its outlet with a discharge pipe 7 connected with the bottom of a "conditioner" tank T–1 provided with suitable agitating mixing means common in such tanks.

2

The tank T–1 has an overflow launder 8 discharging into a sump 9 provided in its bottom with a discharge pipe 10 connected to the intake of a suitable pump P–1 provided at its outlet with a feed pipe F for introducing the mixed materials from the "conditioner" tank T–1 into the upper end of a froth flotation tank T–2. The tank T–2 has an overflow launder 11 and a flat bottom 12 provided at its center with an inlet pipe 13 on which is rotatably mounted a head 14 provided with a plurality of radial pipes 15 provided with downwardly inclined, tangentially disposed nozzles 16 adjacent the bottom 12. A shaft 17 projects from the head 14 and is journaled in a frame 18 mounted on the top of the tank T–2. The pipe 13 is connected to the discharge end of a suitable pump P–2. The launder 11 discharges onto a vibrating screen S below which is disposed a sump 19 the bottom of which is connected by a pipe 20 with the upper end of the "conditioner" tank T–1. The tank T–2 has a discharge pipe 21 connected to the intake of the pump P–2 and provided, intermediate the tank T–2 and the pump P–2, with a portion 22 in the form of a Venturi tube having a collar 23 with an annular chamber 24 therein and a plurality of radial ports 25 leading into the pipe 21. An air supply pipe 26 tapped into the collar 23 communicates with the chamber 24, has a control valve 27, and has its open upper end 28 extended above the top of the launder 11. The tank T–2 has an upper discharge pipe 29 connected by a swingable U-pipe 30 to a pipe 31, and a lower discharge pipe 32 connected to the pipe 31 and provided with a valve 33.

Having described by improved apparatus, I will now describe its operation and use in the practice of my improved process. When the supply tank T has been properly charged with coal and refuse by chute 1, with the frothing re-agent through the pipe 4, and with the proper amount of water through the pipe 2, the contents of the supply tank T is supplied by the pump P to the "conditioner" tank T–1 in which the charge is properly mixed, and flowing to the sump 9 is supplied therefrom by the pump P–1 into the top of the froth flotation tank T–2 which has been filled with the proper amount of water by any suitable means (not shown). The operation of the pump P–2 then causes an upwardly flowing current of water through the pipe 13, head 14, pipes 15 and nozzles 16. This circulating water returns to the pump P–2 through the pipe 21, leaving the tank T–2 below a frothing zone in the upper part of the tank T–2. The level of the water in the tank T–2 can be determined by the withdrawal of water

and fine refuse through the pipe 29. Tilting of the swingable pipe 30 varies the water level in the tank T–2. The flow of liquid through the Venturi tube 22 in the pipe 21 aspirates air from the pipe 26. It is to be noted that the flow of air aspirated varies directly with the velocity of the flow of liquid through the pipe 21, and that the air supply can be controlled by valve 27 in the pipe 26. This air, thus aspirated, with the froth re-agent in the feed produces the froth in the frothing zone above the water level. This froth carrying the floated coal particles overflows through the launder 11 onto the screen S which by its vibrating action breaks the froth bubbles. The coal particles from the froth being thus freed from their froth bubbles pass over the screen S in the form of a cake similar to a filter cake, as a product of my improved process. Any finer particles which have overflowed, and the froth re-agent pass through the screen S with the water from the froth, into the sump 19, and pass thence by gravity into the "conditioner" tank T–1 to mingle with the feed, for re-treatment.

It is to be particularly noted that the screen undersize flows by gravity from the screen S, through the sump 19, into the "conditioner" tank T–1, and is returned, with the feed, to the froth flotation tank T–2, and that this mixing of the screen underflow with the feed is effected independently of the liquid circulating system of the froth flotation tank T–2.

The underflow from the tank T–2, comprising all of the refuse, including fine particles, and the coarse particles of coal, is discharged from the tank T–2 by the controlled valve 33 to pipes 32 and 31. It will be noted that the fine refuse from the pipe 28 also passes through the pipe 31.

It is to be understood that the materials discharged from the tank T–2 through the pipe 31 may be subjected to hydraulic classification, as disclosed in my said co-pending application, Serial Number 60,335.

Having described my invention, what I claim is:

1. In an apparatus for separating mixed materials by froth flotation, the combination of a pump; means for introducing said materials, water and a frothing re-agent into said pump; a receptacle, the discharge end of said pump being connected with said receptacle; a tank disposed above said receptacle; an overflow launder on said tank; a vibrating screen below said launder; a sump below said screen; connecting means between the bottom of said sump and said receptacle, adapted to supply the sump-discharge to said receptacle by gravity; a second pump having its inlet connected to said receptacle and its outlet discharging into the upper part of said tank, adapted to raise the receptacle-discharge over the top of the tank; a third pump having its outlet discharging into the lower part of said tank through the tank bottom; and a circulating pipe having one end entering said tank immediately below the top of the tank and its other end connected to the intake of said third pump.

2. An apparatus, as defined by claim 1, in which a Venturi tube is disposed in said circulating pipe, and an air supply pipe has one end communicating with said tube and its other end open to atmosphere above the top of the tank's launder.

WALTER L. REMICK.

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