Aug. 8, 1933. B. R. ANDERSON 1,921,279

OIL RECOVERY APPARATUS

Filed Dec. 23, 1929 2 Sheets-Sheet 1

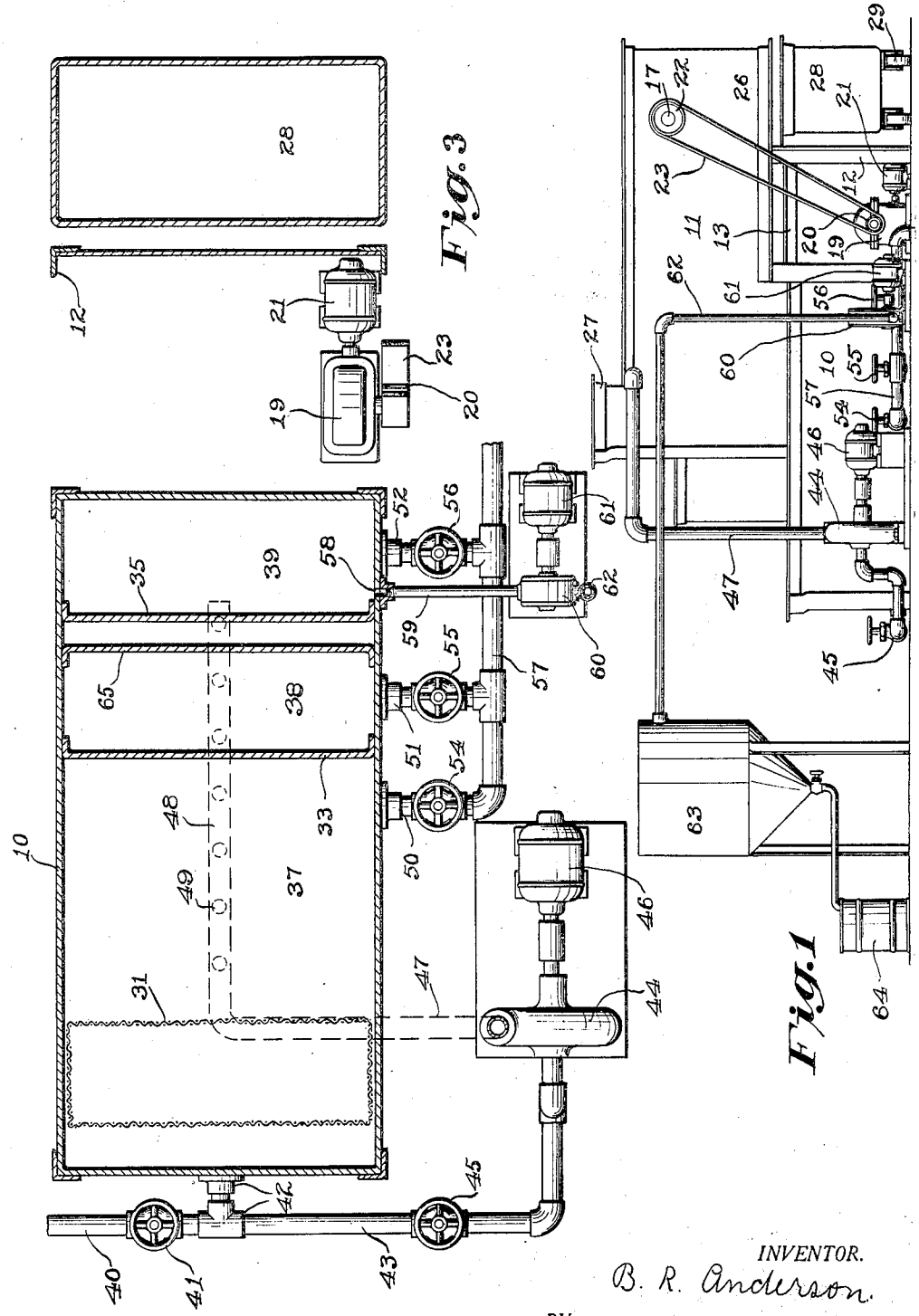


Fig. 3

Fig. 1

INVENTOR.
B. R. Anderson.
BY
E. L. Davis
ATTORNEY.

Aug. 8, 1933. B. R. ANDERSON 1,921,279

OIL RECOVERY APPARATUS

Filed Dec. 23, 1929 2 Sheets-Sheet 2

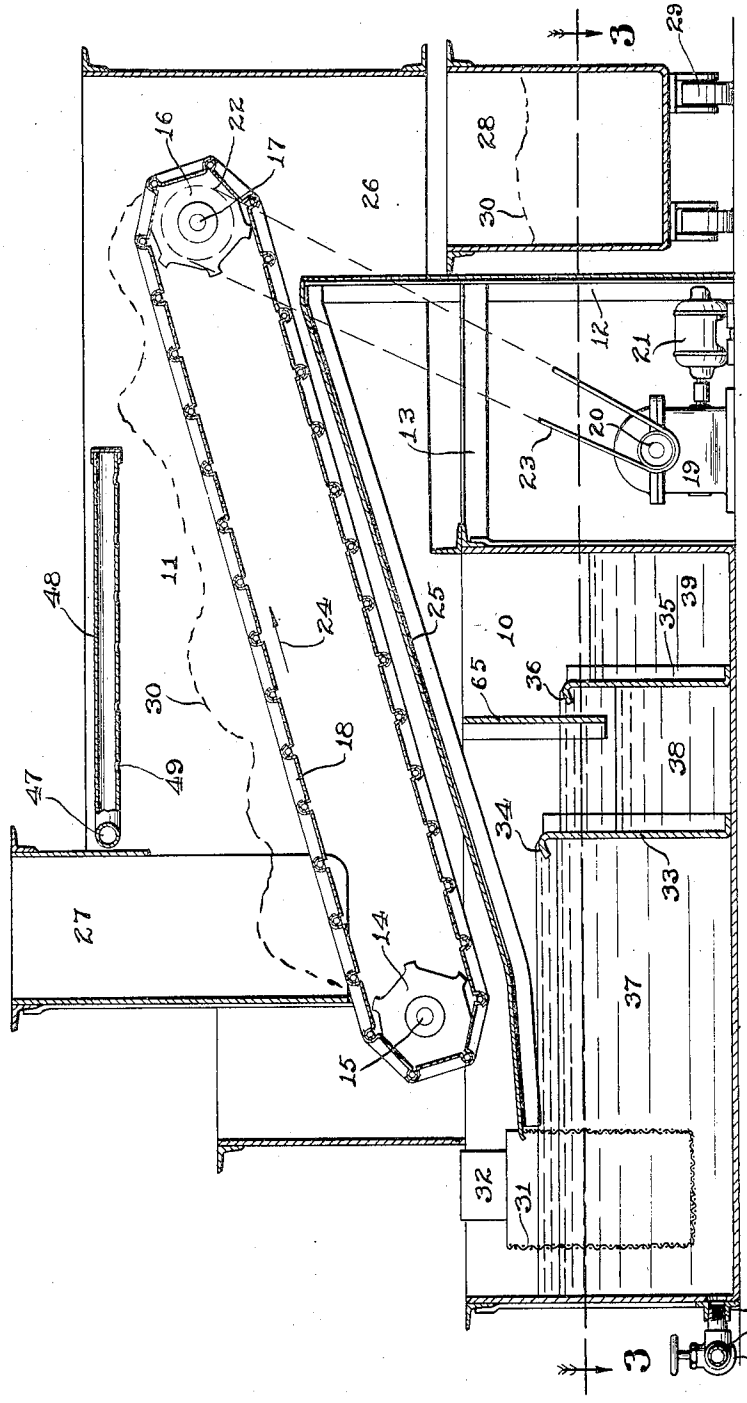


Fig. 2

INVENTOR.
B. R. Anderson.
BY
E. H. Davis
ATTORNEY.

Patented Aug. 8, 1933 1,921,279

UNITED STATES PATENT OFFICE

1,921,279

OIL RECOVERY APPARATUS

Bennett R. Anderson, Detroit, Mich., assignor to Ford Motor Company, Dearborn, Mich., a Corporation of Delaware

Application December 23, 1929
Serial No. 416,099

1 Claim. (Cl. 210—60)

The object of my invention is to provide an oil recovery apparatus of simple, durable and inexpensive construction.

A further object of my invention is to provide an oil recovery apparatus especially adapted for salvaging that portion of the cutting oil, incidental to machining operations, which ordinarily adheres to the chips and metal shavings. It is general machine shop practice when turning, boring, or cutting steel to apply a cutting oil to the work to be machined. The purpose of such oil is to lubricate and cool the cutting tool so that heavier cuts may be taken therewith. A large portion of the oil applied to the cutting tool is collected and recovered from the chip receptacle, but there is, nevertheless, a considerable quantity which adheres to the chips and which is ordinarily lost so that in manufacturing plants where quantity machine operations are carried on, the loss of cutting oil through this source is considerable.

The cutting oil used is ordinarily a mixture of mineral oil and oleic acid. The oleic acid has the property of wetting the chips so that water containing caustic soda and denatured alcohol may form an emulsion therewith to wash the oil from the chips. In my improved apparatus the emulsion is allowed to settle and the oil drawn off the surface to obtain the recovery thereof.

A process for partially recovering this otherwise lost cutting oil has come into considerable use and consists in placing the chips in a centrifuge where they are rotated so that the oil may be thrown off by centrifugal action. Only a small part of the oil can be recovered by this process for the reason that only a thin film adheres to the surface of each chip, the irregular and large amount of surface accounting for the large amount of oil held therein. Even at the highest speed which it is safe to operate these centrifuges, this film of oil usually remains intact and only the small amount of free oil between the chips is recovered.

A further disadvantage to this process arises because there is considerable power required to operate such contrifuges and which necessarily makes their cost of operation considerable. Further, extreme care must be taken when placing the chips in these machines so that a balance may be maintained to provide against excessive vibration in the machine.

My improved apparatus which will presently be described in this specification, overcomes the above mentioned disadvantages and further obtains a complete recovery of all the oil from the chips.

Briefly, this process consists in conveying the chips as they come from the turning machine slowly beneath a stream of washing solution. The solution is then collected in a tank where it is allowed to settle, the oil rising to the surface so that it may be drawn off. The washing solution is used over and over again, there being very little lost in the washing operation. It may readily be seen that as the only power required in this apparatus is used to operate the slow moving conveyor and the circulating pump for the washing solution, the cost of operation is very little. Further, no balancing or the like is required so that unskilled operators may run the device at full efficiency. It may be mentioned that with ordinary chips from which the oil has been drained a single machine, as shown in the drawings, recovers from 50 to 100 gallons of oil per hour and requires only one or two attendants to operate it.

In the manufacture of certain apparatus it is usually desirable to machine the harder steels in the presence of the above mentioned cutting oil while with the softer steels, a soda water solution is often used. This solution usually consists of oleic acid, denatured alcohol, caustic soda, and paraffine oil, mixed with about twenty-five parts of water. Such a soda solution acts to wet the chips so that the oil may be washed away by the water. When these two cutting fluids are used in the same plant, the chips which are saturated with each solution may be simultaneously fed through my oil recovery machine and only water used for the washing solution. The water cleans the soda solution from the chips containing it, while this solution is pumped over the chips containing oil thereby forming an emulsion from which the oil will settle out. It is thus possible in most plants to continuously operate the machine without adding new washing solution. The addition of only a little water to compensate for evaporation is all that is required.

With these and other objects in view, my invention consists in the arrangement, construction, and combination of the various parts of my improved device, as described in my specification, claimed in my claim, and illustrated in the accompanying drawings, in which:

Figure 1 shows a side elevation of my improved apparatus.

Figure 2 shows a vertical, central, sectional view through the device shown in Figure 1, and

Figure 3 shows a sectional view taken on the line 3—3 of Figure 2.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate a rectangular shaped tank ordinarily placed on the floor of the building which houses the apparatus and which forms the washing solution reservoir and settling tank. A conveyor housing 11 is disposed directly above and slightly to the rear of the tank 10 and is provided with a pair of legs 12 which support the rear end of this housing. A pair of horizontal bracing members 13 extend from the rear of the tank 10 to the legs 12 to rigidly interconnect it with the conveyor housing 11.

A continuous conveyor is diagonally mounted in the conveyor housing 11 with its forward end extending into the tank 10 by means of a pair of idler sprockets 14 secured to a shaft 15, the latter being rotatably mounted in the lower part of the conveyor housing 11. A pair of driven sprockets 16 are secured to a shaft 17 which is also rotatably mounted but in the upper and rear portion of this conveyor housing.

A continuous conveyor 18 formed from a plurality of trays linked together extends around these two sprockets so that when the shaft 17 is rotated, the upper surface of the conveyor 18 will travel in the direction shown by the arrow 24. Each tray of the conveyor 18 is perforated with a plurality of small holes in the bottom thereof so that washing solution which may be deposited therein will drain through these trays.

A conventional speed reducer 19 having a driven pulley 20 secured thereto is mounted just rearwardly of the tank 10 and an electric motor 21 is directly connected therewith to rotate the pulley 20 at a reduced speed. A second pulley, shown by dotted lines 22 in Figure 2, is secured to the outer end of the shaft 17 and a belt or chain 23 connects this pulley with the pulley 20. Thus, when the motor 21 is operated the conveyor chain 18 will travel slowly in the direction shown by the arrow 24.

A diagonally shaped trough 25 extends parallel and beneath the conveyor 18 into the tank 10, the purpose of which is to convey the washing solution which may drain through the trays 18 to the forward end of the tank 10. It will also be noted that a vertical flue 26 is formed in the rear part of the conveyor housing 11 directly below the rear end of the conveyor 18 so that material which may have been deposited on the conveyor may be conveyed over the rear end thereof and dropped through the flue 26. The chips are thus conveyed to the rear end of the machine while the washing solution is guided to the forward end of the settling tank.

An intake flue 27 extends upwardly from the forward end of the conveyor housing 11 and forms the intake through which the chips from which oil is to be recovered are placed in the machine. It may be seen that when the conveyor 18 is in operation, chips may be dropped into the flue 27 from where they will be conveyed along the upper section of the conveyor to the rear end of the housing 11 and will then be discharged through the flue 26. A portable bin 28 is placed directly beneath the flue 26 and is provided with a plurality of castors 29 so that after the oil has been recovered from the chips they may be conveniently disposed of. The dotted lines 30 diagrammatically illustrate the normal position of the chips on the conveyor chain and in the bin 28.

It will be noted from Figure 2 that a space is left between the end of the tank 10 and the forward end of the trough 25 which space it used to receive a wire mesh basket 31. a pair of straps 32 secured to the basket hook over the sides of the tank 10 thereby supporting the basket in the tank. The washing solution used in the device normally flows down the trough 25 and is deposited in this wire mesh basket from which it drains through to the tank 10.

A dam 33 is placed across the center portion of the tank 10 and extends from the bottom of the tank to a position about two-thirds of the way to the top. The upper edges of this dam 33 is rolled over forwardly at 34 for a purpose which will later be described. A second dam 35 is provided across the tank between the dam 33 and the rear wall thereof and extends from the bottom of the tank to a position slightly below the top of the dam 34. The dam 35 is likewise provided with a forwardly rolled over upper edge 36 similar to the edge 34. A baffle plate 65 extends across the upper portion of the tank between the dams 33 and 35, the lower edge of this baffle extending a short distance below the edge 36 of the dam 35. The tank 10 is thus separated in three compartments which for convenience are given the reference number 37, 38, and 39, respectively, starting from the forward end of the tank.

A water line 40 is connected to the forward lower part of the tank 10 through a suitable valve 41 and pipe fitting 42. To start the device, the valve 41 is opened until the water level in the tank reaches a predetermined height and is then only periodically operated to maintain this water level.

A pipe 43 is connected with the fitting 42 and extends through a valve 45 to the intake of a centrifugal pump 44. The pump 44 is of the conventional type and is directly driven by an electric motor 46 so that when the valve 45 is open, the pump 44 may draw fluid from the forward part of the tank 10. A discharge pipe 47 extends from the pump 44 to the upper portion of the conveyor housing 11 from which a horizontally extending distributing pipe 48 joined thereto extends directly over the center portion of the conveyor 18. A plurality of jets 49 are provided in the lower section of the pipe 48 so that the fluid pumped through this pipe will be sprayed over the full width of the conveyor 18.

It may thus be seen that after the tank 10 is filled with solution, this fluid will be continuously pumped through the jets 49, over the conveyor 18 and will then flow down the trough 25 carrying whatever oil which may have been washed from the chips on the conveyor into the tank 10.

The compartments 37, 38, and 39 are provided with drain fittings in the lower portions thereof which have been given the reference numerals 50, 51, and 52, respectively. These fittings are connected through valves 54, 55, and 56, respectively, with an outlet pipe 57 which extends to a suitable drain. The operator is thus able to lower the level in any compartment by operating its particular valve.

An oil outlet opening 58 is provided in the compartment 39 a short distance above the drain fitting 52, and a pipe 59 extends from this opening to a gear type pump 60 which is driven by an electric motor 61. A discharge pipe 62 extends from the pump 60 to a suitable oil reservoir

63 disposed adjacent to the machine. This reservoir is so elevated that the oil may flow therefrom into suitable drums 64 to be stored for future use.

The normal operation of the device consists in starting the conveyor 18 and the centrifugal pump 44, the compartment 37 having previously been filled with a solution of water and washing powder to a point just below the upper edge of the dam 34. The chips from which the oil is to be extracted are dropped through the flue 27, preferably from the floor above, onto the conveyor 18. The washing solution is thereby pumped up to the distributing pipe 48 and is discharged forcibly through the jets 49 onto the chips as they are conveyed beneath. If a portion of these chips contain soda water, no oleic acid or caustic soda need be added to the water in the compartment 37 as this mixes with the water to form a washing solution.

It may be seen that this action washes the oil from the chips and both the oil and the washing solution flow down the trough 25 into the basket 31. Some of the finer chips may be carried along with the washing solution through the trays of the conveyor and it is the purpose of the basket 31 to retain these small chips and to prevent them from being deposited in the tank 10. The major portion of the chips, however, are carried along to the end of the conveyor and deposited in the bin 28.

After the device has been in operation a short time the level in the compartment 37 is raised due to the addition of oil from the chips and, the oil being lighter than the washing solution rises to the top and flows over the upper edge 34 of the dam 33 in a semi-pure state. The centrifugal pump 44 being supplied from the lower portion of the tank 10 pumps only the washing solution so that comparatively clean solution is always sprayed onto the chips.

It will be noted that due to the agitation in the compartment 37, the oil which overflows into the compartment 38 is not entirely free from water. However, the rolled over portion 34 prevents agitation occurring in the compartment 38 so that the semi-pure oil which is deposited in this compartment may more thoroughly separate, the solution going to the bottom of the compartment while the oil remains in the upper portion. All scum, wood particles, or the like which may be floating on the upper surfaces of the oil are prevented from overflowing the upper edge 36 from the compartment 38 by means of the baffle plate 65.

These particles may be periodically raked off from this surface so that only quite pure oil is allowed to flow over the edge 36 of the dam 35 into the compartment 39.

Although the oil which is finally deposited in the compartment 39 is usually free from chips and all foreign particles, occasionally some washing solution will enter this compartment but such solution will be deposited in the bottom of the tank from where it can periodically be drawn off. As the level of the washing solution in each of the compartments 37, 38, and 39, rises above a predetermined point, the respective valve 34, 35 or 36 may be open to allow this solution to drain out thereby lowering the level in the tank. The oil outlet 58 from the compartment 39 is considerably above the drain fitting 52 so that only pure oil is pumped out through the pump 60 into the oil reservoir 63.

The chips are ordinarily quite hot when they enter the machine so that they heat up the washing solution thereby more thoroughly accomplishing the washing action.

It may be found advantageous after machining certain articles in the presence of cutting oil to run the articles themselves through my recovery apparatus thereby not only cleansing the parts but also recovering the cutting oil therefrom.

Many advantages arise through the use of my improved device, among which may be mentioned that, in this continuous process no manual handling of the chips is required. Further, all of the oil is extracted from these chips, not even a slight film remaining thereon after they are discharged from the machine. Full recovery of the oil is thereby obtained in which this process is superior to the centrifugal process now used for this purpose. Still a further advantage results over the centrifugal process in that the oil recovered is free from all chips and foreign solutions, whereas, in the centrifugal process the soda water which may be used with a portion of the chips is also extracted and mixed with the oil from the centrifuges. With my improved device the soda water associated with some of the chips is made to accomplish a desirable result, while in the centrifugal process the effects of soda water are harmful.

Some changes may be made in the arrangement, construction, and combination of the various parts of my improved device without departing from the spirit of my invention, and it is my intention to cover by my claim such changes as may reasonably be included within the scope thereof.

I claim as my invention:

A device for separating the oil from an oil and water mixture comprising, a rectangular shaped separator tank adapted to have said mixture conducted into one end thereof, a dam of lesser height than said tank extending there across, a second dam of lesser height than the first mentioned dam extending across said tank, said dams being so positioned that they form a plurality of partitions across the tank of gradually receding height when viewed from the end of the tank adapted to receive said mixtures, the upper edge of each of said partitions being rolled over towards the mixture receiving end of said tank so as to provide flat portions which are slightly inclined downwardly towards said receiving end and which flat portions form the top edge of each of said dams, and a baffle plate extending across said tank disposed in position between said dams, the lowermost edge thereof being spaced between the bottom of said tank and the top edge of said second mentioned dam and the upper edge of said baffle plate being positioned above the top edge of the first mentioned dam, said inclined portions being adapted to collect particles floating on the surface of said liquid so that they may be readily raked off.

BENNETT R. ANDERSON.