W. W. NUGENT.

COMBINED FILTER AND WATER SEPARATOR.

APPLICATION FILED JUNE 23, 1916.

1,383,479. **Patented July 5, 1921.**

2 SHEETS—SHEET 1.

Fig. 1.

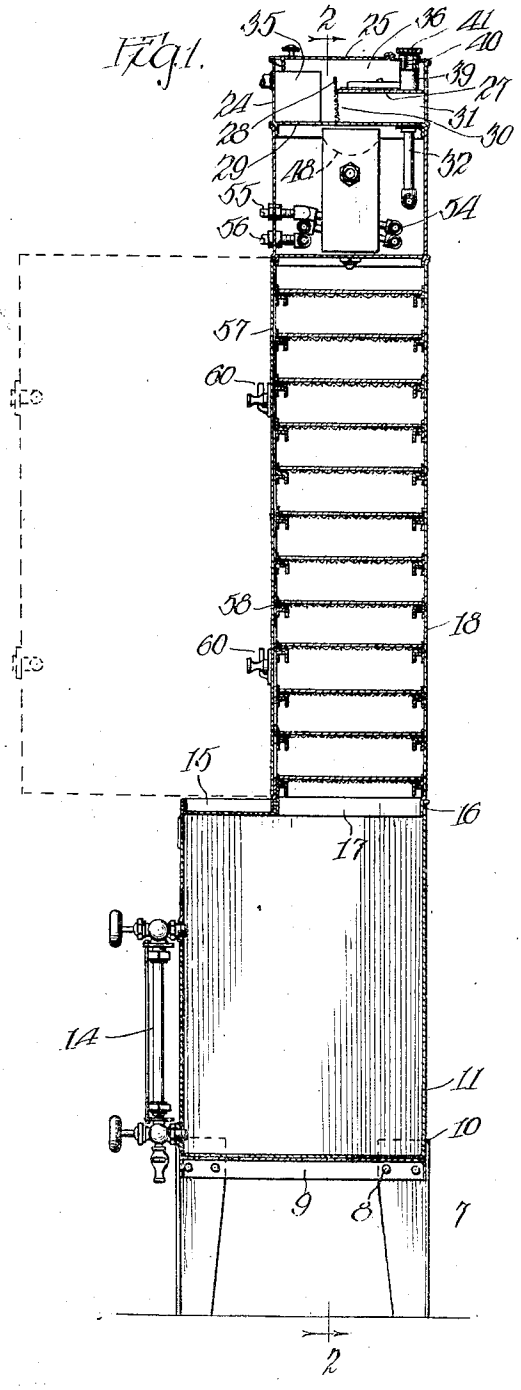
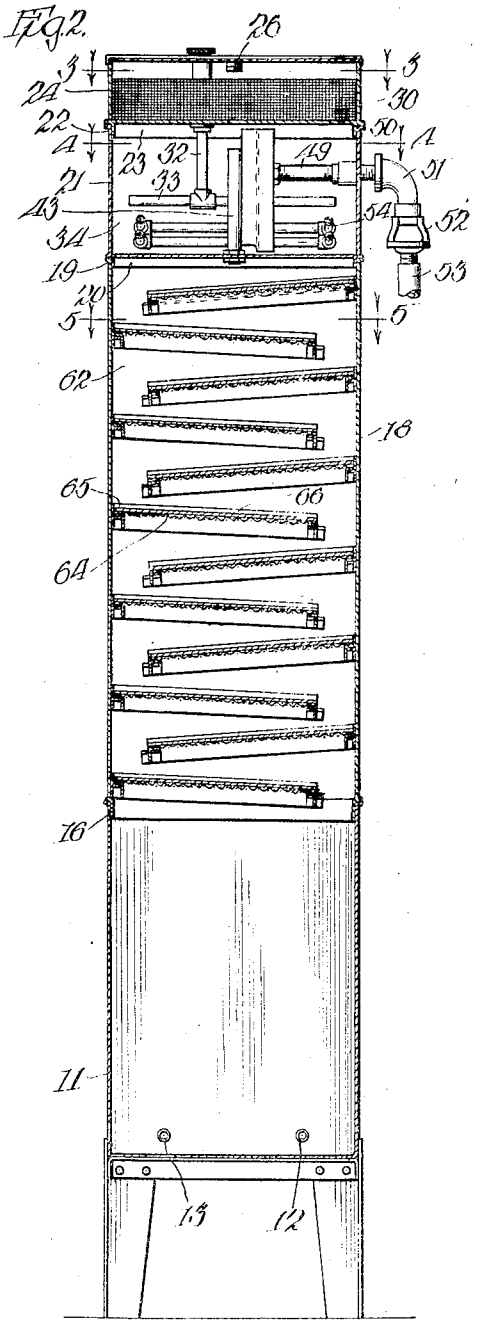


Fig. 2.



Witness:

Leo J. Dufraine.

Inventor:

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Attys

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2 SHEETS—SHEET 2.

Fig. 3.

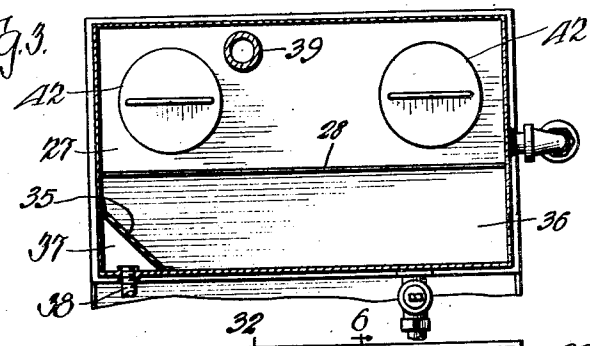


Fig. 4.

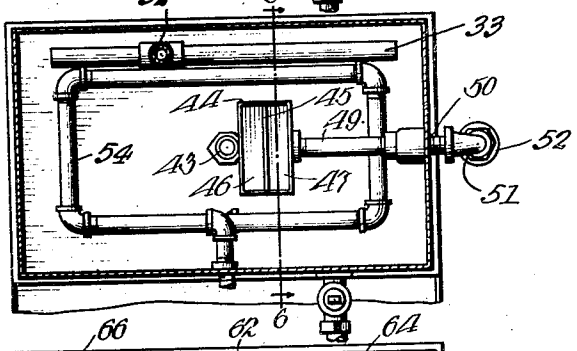


Fig. 5.

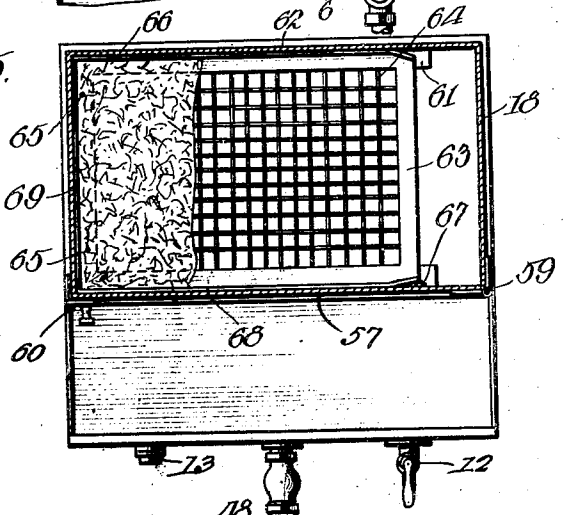
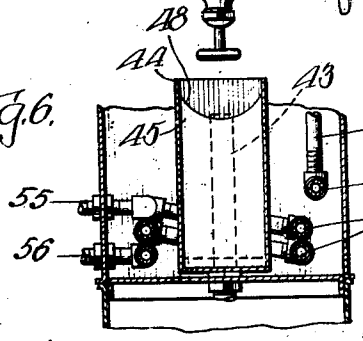


Fig. 6.



Witness:
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Inventor:
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UNITED STATES PATENT OFFICE.

WILLIAM WASHBURN NUGENT, OF CHICAGO, ILLINOIS.

COMBINED FILTER AND WATER-SEPARATOR.

1,383,479. Specification of Letters Patent. Patented July 5, 1921.

Application filed June 23, 1916. Serial No. 105,350.

To all whom it may concern:

Be it known that I, WILLIAM W. NUGENT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Combined Filters and Water-Separators, of which the following is a specification.

This invention relates to apparatus for removing impurities from lubricating oil and also for separating water from lubricating oil, and the principal object of the present invention is to provide an improved device of this nature which is made up of detachable sections to facilitate transportation and the assembly thereof at the place of use, such improved device being simple in construction, easily accessible as to various parts, and effective, efficient and automatic in operation.

Other objects of the invention will appear hereinafter, the novel features and combinations of elements being set forth in the appended claims.

Referring to the accompanying drawings—

Figure 1 is a sectional side elevation of my improved combined water separator and filter;

Fig. 2 is a sectional elevation on the line 2—2 of Fig. 1;

Fig. 3 is a sectional plan view on the line 3—3 of Fig. 2;

Fig. 4 is a sectional plan view of Fig. 2 on the line 4—4;

Fig. 5 is a sectional plan view on the line 5—5 of Fig. 2; and

Fig. 6 is a sectional elevation of a portion of Fig. 4 on the line 6—6.

Referring to Figs. 1 and 2 it will be seen that the base of the combined water separator and filter comprises upright legs 7 of sheet metal which are riveted at 8 to a base plate 9.

The sheet metal legs 7 are provided with upper extensions 10 to form angular recesses into which fit the lower corners of the large reservoir 11. This reservoir is therefore firmly though detachably supported on the base member, being prevented from movement laterally therefrom by the upward extensions 10.

The large reservoir 11 is provided, as shown in Fig. 2, with a faucet 12 near the forward lower edge. Also at the forward lower edge a screw-threaded opening 13 is provided which may be closed by a plug or connected with a circulating lubricating system as hereinafter explained.

The front wall of the reservoir 11 may also be provided with a gage glass 14 connected up as shown in Fig. 1, or in any other well known manner.

In the upper portion of the reservoir 11 I prefer to provide a rectangular opening back from the upper forward edge so as to leave a recessed shelf 15 which forms an oil collecting pan. In the rectangular opening 16 in the upper side of the reservoir 11 is fitted a depending rectangular flange 17 of the filter casing 18. Into the upper open end 19 of the filter casing 18 is fitted a depending flange 20 of the water separator casing 21. In a similar manner into the upper rectangular opening 22 of the water separator casing 21, is fitted a depending flange 23 of the filling casing 24.

It will thus be observed that the combined water separator and filter is composed of five principal parts which are detachable from each other and can therefore very easily be transported. However, the construction is such that the said principal parts may easily be assembled and when stacked one on top of the other they are held together with sufficient firmness for all practical purposes. If desired, the said five principal parts or any two of them may be permanently connected together by soldering or otherwise. I prefer, however, to make the parts detachable to facilitate transportation, assembly and replacement of accidentally injured parts.

As shown in Fig. 1, the filling casing 24 is closed on its upper side and provided with a hinged cover plate 25 to facilitate cleaning. The lubricating oil which is to be cleaned and from which the water is to be separated may be introduced through an opening 26 in the upper side of the filling casing 24. This opening 26 may be screw-threaded on its interior to receive the screw-threaded end of the pipe extending from a circulating lubricating system. The lubricant introduced through the filling opening 26 flows over the upper surface of the plate 27 and then through the reticulated or perforated metal projection or dam 28 which extends between the lateral walls of the filling casing 24. The lubricant then passes to the bottom 29 and through the partition 30 of reticulated or perforated metal to screen the larger foreign substances in the lubricant. From

the inclosed compartment 31 the lubricating oil, together with the water and fine particles of impurities, passes down the vertical pipe 32 into the horizontal pipe 33 which is open at its ends, thus introducing the lubricant into the water separator chamber 34 near its lateral walls.

In the filling casing 24 I provide a diagonal partition 35 across one of the front corners so that when the lubricant in the filling chamber 36 exceeds in depth the height of the partition 35 the lubricant will overflow into the compartment 37, as shown in Fig. 3, and then through the overflow pipe 38 to any convenient receptacle from which it may again be taken and introduced into the filling casing.

In order to facilitate the cleaning of the inclosed compartment 31 I provide a pipe 39 extending from an opening in the upper wall of the compartment 31 to an opening 40 in the upper surface of the filling casing. The opening 40 is preferably screw-threaded and provided with a screw-threaded plug 41. When the plug 41 is removed a bent wire may be introduced through the pipe 39 into the compartment 31 to scrape the sediment from the corners in the compartment 31. The upper plate 27 of the chamber 31 may also be provided with two comparatively large openings normally closed by the caps 42, 42. When the caps 42 are removed the openings are preferably sufficiently large to permit a person's hands to be easily placed in the compartment 31 to handle such material as may be convenient to clean out sediment which may collect in the chamber 31. When the caps 42, 42, and the large openings covered thereby are used, I prefer to place the opening 40 and the vertical pipe 39 in vertical alinement with the vertical pipe 32 so that when the plug 41 is removed and a straight wire inserted through the pipe 39 it may be used to clean out sediment collected in the pipe 32, and by using a wire of sufficient flexibility the wire may be extended through the branch pipes 33 so as to maintain free flow of the lubricant from the filling chamber into the water separating chamber.

Before introducing any lubricant into the filling chamber it is preferable to fill the water separating chamber 34 partially full of water, approximately two-thirds full, such water not being shown. Then when the lubricant is introduced into the chamber 34 the oil will rise to the top and the water separate therefrom, but not until the combined depth of the water and the oil is sufficient will any oil flow into the filtering apparatus. In the center of the water separating chamber 34, as shown in Fig. 4, is located a vertical pipe 43 which is open at its upper end and communicates with the filter casing 18 at its lower end. Therefore, when the depth of the combined water and oil exceeds the length of the vertical pipe 43 the flowing oil will flow down the pipe 43 into the upper end of the filter casing 18.

Alongside the vertical pipe 43 is located a sheet metal receiver 44 with an intermediate partition 45 specially constructed for a particular purpose. This partition divides the receiver 44 into two compartments 46 and 47. The compartment 46 is open at both its lower and its upper ends while the compartment 47 is closed at its lower end and open only at its upper end, thus forming a cup rectangular in cross section. No oil can enter either of the compartments 46 or 47 because the receiver 44, as shown in Figs. 1 and 2, extends a sufficient distance above the vertical pipe 43 to prevent any oil from flowing over the upper edges of the receiver 44. The water, however, enters the lower open end of the compartment 46 and extends upwardly therein tending to reach a depth to overflow the partition 45 into the cup 47. If the partition 45 had a horizontal straight edge at its upper end there would be considerable tendency for capillary attraction in the corners to elevate the water higher than desired and thus tend to empty the contents of the separating chamber 34 not only of the water therein but also of the oil ultimately. This tendency may be augmented particularly when the connections are such that a siphoning action might continue the flow started by the capillary attraction at the corners of the compartment 46 adjacent the partition 45. I therefore prefer to provide a curved or arcuate edge 48 for the upper end of the partition 45, as shown in Figs. 1 and 6. This will prevent any overflow of a liquid by reason of capillary attraction at the corners. The lowermost edge of the curve 48, as shown in Fig. 6, is arranged below the upper end of the pipe 43 only a small distance; preferably, in practice, about a quarter of an inch, so as to economize in the total quantity of lubricant and also to hasten the cleaning operation thereof. By having a film of oil on top of the water of no greater thickness than is necessary to prevent the water from flowing through the vertical pipe 43 it will be seen that the oil will be very quickly introduced into the filtering casing 18 after it has been introduced into the filling casing.

The receiver 44 is preferably supported near the center of the water separating chamber by means of the pipe 49 which is rigidly secured at 50 to one of the walls of the water separating chamber. The pipe 49 communicates with the upper portion of the cup 47 and is connected to the elbow joint 51 which directs the water through the sight-feed 52 into the waste-pipe 53. It will thus be evident that when water passes into the lower end of the compartment 46 and over

the partition 45 it fills the cup 47 until it overflows through the pipe 49 into the waste-pipe 53. This operation goes on automatically as more and more lubricant is introduced into the filling casing.

To facilitate the separation of the water from the oil and to facilitate the flow of the oil, heating pipes 54 may be arranged in the water separating chamber as shown in Figs. 1, 2 and 4. The heating devices are preferably supported from the front wall of the water separating chamber 21 without interfering with the supply pipe 33 or with the water chambers 46, 47 or the intake oil pipe 43. The heating medium, such as steam, may be introduced at 55 and after circulating through the pipes 54 withdrawn at 56.

It should be particularly observed that the intake oil pipe 43 and the water chambers 46 and 47 are preferably located approximately in the center of the water separating chamber 21 so that when the entire combined water separator and filter is not on a level the operation of separating the water will not be seriously interfered with. Tilting movements within certain limits of the entire apparatus away from a horizontal position of the separating chamber will not alter the relation between the upper central edge of the partition 45 and the upper end of the pipe 43 to prevent proper separation of the water while still maintaining efficiency. For the sake of efficiency it is preferable to reduce the thickness of the film of oil on top of the water in the separating chamber and this is accomplished not only by having the curved edge 48 but also by centering the pipe 43 together with the receiver 44. Or, the farther the receiver 44 and the pipe 43 are separated and the less they are centralized in the water separating chamber 21 the greater the necessity for exact leveling of the entire apparatus if efficiency is to be maintained.

The filter casing 18 is provided with a series of filter sections over which the oil after the water has been separated therefrom may flow successively. The series of filter sections are also superposed or in vertical alinement so that oil which filters through each section drops on the section immediately below. The serially arranged filter sections are also successively inclined or arranged in a manner so that as the oil flows over the filter sections in succession it will be continuously gravitating to the large reservoir 11. The filter sections may also be said to be in staggered relation in that a series of spaced apart parallel sections connected to one wall of the filter casing 18 alternate with respect to intermediate sections which are also superposed, spaced apart and in parallel relation to each other but connected to the opposite wall of the filter casing.

In order that the entire serially arranged filtering mechanism may be easily accessible I prefer to provide doors 57 and 58, as shown in Fig. 1, hinged to the casing 18 at 59 as shown in Fig. 5. Latch devices 60, 60 may be provided to hold the doors normally in closed position. When in open position they occupy the position shown in dotted lines in Fig. 1, thereby exposing the entire filtering apparatus which is clearly shown in section in Fig. 2.

In Fig. 2 I have shown 12 filtering sections but their number, their spacing and their inclination may be varied to some extent, but I prefer to use about a dozen for a medium sized combined water separator and filter and have the incline of each section gradual so as to assure thorough cleaning and filtering of the oil.

Inasmuch as each section is similar to the others I will describe only one of them in detail. As shown in Fig. 5 a supporting U-shaped frame 61 is connected to the rear wall 62 of the casing 18 and to one of the side walls of said casing. This U-shaped frame is securely fastened to the interior of the casing 18 so as to occupy an inclined position and be adapted to receive the metal tray comprising the rectangular frame 63 and the reticulated metal or screen 64 preferably of large mesh. At the upper end of the rectangular frame 63 are secured upwardly projecting sharp points 65, 65 over which may be forced one end of the rectangular piece of filtering cloth 66, preferably felt, although other porous material may be used. It should be particularly observed that the tray comprising the rectangular frame 63 and the reticulated metal bottom 64 is entirely open at its lower end so that no material will collect at the lower end of the tray but will either pass through the filtering cloth and through the tray or else pass over the cloth and from the open end of the tray. The tray is held in proper position by the abutment 67 but it should be understood that the entire tray, together with the filtering cloth thereon, may easily be removed when the door 57 or 58 or both are open.

Since the tray is provided with vertical flanges 68 at the back and front portion and with a vertical connecting flange 69 at the upper end the tray directs flowing oil over the filtering cloth out of the lower open end of the tray. Therefore, the cleaning of the oil does not depend in any way on sedimentation nor does it depend altogether on filtering through the filtering cloth because it has been found in practice that when the oil is permitted to gradually flow over the filtering material many of the impurities adhere to the filtering material and are taken out of the oil which are not taken out by filtering through the filtering

cloth. In order to have rapid cleaning of the oil the porosity of the filtering material should not be such as to make the process too slow. I have therefore found that by combining the through filtering action with the flowing action I clean the oil of the larger particles by the through filtering action and of the smaller or minute impurities of the flowing action while maintaining the entire cleaning operation at a rapid rate and therefore maintaining the efficiency of the entire apparatus which is particularly important where considerable oil is being used in a circulating lubricating system and the large tank 11 is the source of supply and the oil is constantly drawn from the opening 13 into the lubricating circulating system.

While the trays for supporting the filtering cloths 66 may be secured in fixed position in the filtering casing 18 I prefer to make them removable not only for the renewal of the filtering cloth but also to prevent interference with the continuation of the cleaning and filtering operation when one tray is thus removed. If one tray is removed at a time for renewal of its filtering cloth the cleaning and filtering operation need not be interfered with, particularly when the filtering sections are sufficient in number. The filtering cloths may be used repeatedly after cleaning them in each instance preferably by soaking them in kerosene and subsequently boiling them in a mixture of soap and water.

However, if desired, new filtering cloths may be used for all renewals, but in any event the cloths should be preferably so cut as to fill the entire width and length of each tray and fit close to the upper end of each tray so that substantially all of the oil entering the upper end of the filter casing 18 will pass through and over the filtering cloths in succession or serially.

My improved water separator and lubricant cleaning apparatus hereinbefore described is particularly adapted for use in connection with an automatic lubricating system for bearings of an engine in which lubricating system a pump draws the cleaned oil from the opening 13 and after being directed to the various bearings of the engines and being used it is directed back toward the source of supply by being permitted to flow into the opening 26 at the top of the cleaning apparatus. My improved water separating and cleaning apparatus for lubricating oil is particularly adapted for use in connection with the automatic circulating lubricating system disclosed in my United States Letters Patent No. 1,207,067, granted December 5, 1916, for an improvement in oiling and filtration apparatus, but I wish it to be understood that such combined water separating and cleaning apparatus may have a general application. Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of my invention as defined by the claims hereto appended, and I wish therefore not to be restricted to the precise construction herein disclosed.

In this application I have claimed the water separator, the general combination shown and described and also the filtering mechanism, in particular, being disclosed and claimed in my copending application Serial Number 393,576, filed July 2, 1920, for an improvement in combined filter and water separator.

What I claim and desire to secure by Letters Patent of the United States is—

1. In a separating device, the combination with a casing, of an overflow pipe, a receiver having two compartments one open at both ends and the other open at its upper end but closed at its lower end, a curved edge for the upper end of the partition separating the said compartments, and a pipe for directing liquid from the upper portion of the compartment closed at its upper end.

2. In a device for separating water from lubricating oil, the combination with a casing, of a pipe connected to substantially the central portion of the bottom of said casing and extending to a position near the upper portion of the chamber formed by said casing, a receiver adjacent the pipe, and a partition dividing the receiver into two compartments, one of the compartments being open for receiving water at its bottom portion and for directing such water from its top portion to the top portion of the other compartment.

3. In a device for separating water from lubricating oil, the combination with a casing, of means for taking oil from said casing when floating on water therein at a predetermined height from the bottom of said casing, and means comprising a partition having a curved upper edge for directing the water from said casing.

4. A device for separating water from lubricating oil comprising a receptacle, a vertical pipe connected to the bottom of said receptacle and extending to the upper portion thereof, a receiver in the receptacle, and a partition in the receiver dividing the latter into two compartments, there being an opening in the bottom portion of one of the compartments and a portion of the top edge of the partition being lower than the top of said pipe.

5. In a water separating device, the combination with a receptacle, of means for withdrawing floating oil from said receptacle when such oil reaches a predetermined height therein, a receiver in the receptacle comprising walls forming two compart-

ments, one of the compartments being closed at its bottom and open at its top and the other compartment being open at both bottom and top, there being a communication between the compartments lower than the height of the oil-withdrawing means and a discharge pipe leading from the upper portion of the compartment having its bottom closed.

6. In a water separating device, the combination with a receptacle, of an oil outlet, a water outlet having its receiving end fixed at a predetermined height, a plate extending above the water outlet and to a position near the lower portion of said receptacle, an additional plate spaced from said first named plate and having its upper edge below said oil outlet, and means coöperating with said plates for directing the water to said water outlet while confining the flow of the floating oil to said oil outlet.

7. In a water separating device, the combination with a receptacle, of an oil outlet, a water outlet, and means comprising a plurality of spaced apart vertical plates for directing the water from the lower portion of said receptacle to said water outlet, one of said vertical plates extending above and below the said oil outlet and another of said vertical plates having its upper edge below the oil outlet.

8. In a separator, the combination with a receptacle, of an emptying tube having its inlet opening near the top of said receptacle, a water outlet below the elevation of said inlet opening, and means comprising spaced apart plates for directing the water from the lower portion of said receptacle to said water outlet, one of said plates extending from a position above said inlet opening to a position near the bottom of said receptacle, and another of said plates having an upper overflow edge a short distance below said inlet opening.

9. A water separating device comprising a receptacle, a stand-pipe in the central portion of said receptacle to form an oil outlet from the upper portion of said receptacle, a receiver, and a water outlet pipe holding said receiver in close proximity to said stand-pipe, said receiver comprising two compartments one being open at both ends and the other a cup connected to said pipe.

10. In a separating device, the combination with a receptacle, of an oil outlet from the upper portion of said receptacle, said outlet comprising a stand-pipe in the central portion of said receptacle, a receiver having a partition with its upper edge below said oil outlet, said receiver having two compartments one open at both ends above said oil outlet and near the bottom of said receptacle and the other being a cup, a water outlet pipe secured to the wall of said receptacle below said oil outlet and secured to said cup below the upper edge of said partition.

11. In a water separating device, the combination with a receptacle, of a stand-pipe in the central portion of said receptacle to form an oil outlet from the upper portion of said receptacle, a receiver comprising a partition with its upper edge below said oil outlet in the central portion thereof, said receiver having two compartments one being open above said oil outlet and at the lower portion of said receptacle and the other compartment forming a cup, a pipe secured to said receiver below the said upper edge of said partition, said pipe being secured to said receptacle to support said receiver in close proximity to said stand-pipe and to form a water outlet.

12. A water separating device comprising a receptacle, an oil outlet leading from the upper portion of said receptacle, a water outlet, and means comprising a vertical plate having a curved upper edge for directing the water to said water outlet separately from the flow of the oil through said oil outlet.

13. In a water separating device, the combination with a receptacle, of an oil outlet, a water outlet, a receiver comprising a partition with a curved upper edge the central portion of which is below said oil outlet, said receiver having two compartments one being a cup and the other open-ended above said oil outlet and near the lower portion of said receptacle, and a pipe secured to said receptacle and said receiver to support the latter and to serve as a communication between said receiver below the upper edge of said partition and said water outlet.

14. In a water separating device, the combination with a receptacle, of a stand-pipe in the central portion thereof to form an oil outlet from the upper portion of said receptacle, a receiver having an intermediate partition with its upper edge curved to bring its central portion below the said oil outlet, said receiver having a vertical passageway on one side of said partition opening into the lower portion of said receptacle, said receiver having a cup on the other side of said partition, and a water outlet pipe secured to said receptacle and connected to said receiver to support the same in close proximity to said stand-pipe.

15. In a water separating and filtering apparatus, the combination with a filling receptacle having a horizontal closed partition, a filling opening, a screening dam, a screening wall below said dam, and an outlet for directing the lubricant from the compartment formed by said horizontal partition, said screening wall and the adjacent walls of said receptacle.

16. In a water separator, the combination with a filling casing having a plurality of

compartments, means for screening the lubricant as it passes from one compartment to another, a water separating receptacle, a pipe extending from said filling casing into said water separating receptacle, and a cleaning pipe extending through one of said compartments and located in vertical alinement with the pipe extending into said water separating receptacle.

17. In a water separating device, the combination with a water separating receptacle, of a filling receptacle comprising an intermediate horizontal partition extending partially from one wall to the opposite wall, an inlet opening for directing lubricant on to the upper surface of said partition, means for screening the lubricant as it passes to the compartment below said partition, a pipe for directing the lubricant from the last named compartment into the water separating receptacle, and a pipe extending through said partition in alinement with the passageway of the pipe extending into said water separating receptacle.

18. In a water separating device, the combination with a filling casing, of an intermediate cross plate having a comparatively large cleaning opening therein, means for closing said opening, an inlet for directing the lubricant to the upper side of said cross plate, a screening dam extending upwardly from the inner edge of said transverse plate, a screening partition below said dam, a water separating receptacle, and means for directing the lubricant from the compartment below said transverse plate into said water separating receptacle.

19. In a water separating device, the combination with a filling receptacle, of an overflow device, an intermediate transverse plate in said receptacle, a filling opening for directing lubricant on to the upper surface of said transverse plate, a vertical screen extending upwardly from one edge of said transverse plate, an additional vertical screen forming with said transverse plate and walls of said receptacle an inclosed compartment, a water separating receptacle below said filling receptacle, and means for directing the lubricant from said inclosed compartment into said water separating receptacle below the upper portion thereof.

20. In a water separating and filtering apparatus, the combination with a filling receptacle, a transverse plate having a cleaning opening therein, means for closing said opening, overflow mechanism in said receptacle, a screening dam extending upwardly from one edge of said transverse plate, a screening partition forming with said transverse plate and the walls of said receptacle an inclosed compartment, a vertical pipe having lateral branches, said vertical pipe being connected to said inclosed compartment, a filling opening for directing the lubricant on to the upper surface of said transverse plate, and a cleaning opening comprising a pipe extending from the exterior of said filling receptacle into said inclosed compartment in alinement with the pipe leading from said inclosed compartment.

21. In a water separating device, the combination with a filling receptacle, of means in said receptacle for screening the lubricant, a water separating receptacle below said filling receptacle, means comprising a vertical pipe and branch pipes for directing the screened lubricant from said filling receptacle into said water separating receptacle below the upper portion thereof, a stand-pipe in the central portion of said water separating receptacle, a water outlet, means connected to said water outlet comprising a receiver in the central portion of said receptacle for directing the separated water to said water outlet, and heating coils in said water separating receptacle surrounding said stand-pipe and said frame.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 21st day of June A. D. 1916.

WILLIAM WASHBURN NUGENT.

Witnesses:
CHAS. M. NISSEN,
CHARLES H. SEEM.