

June 3, 1941.

J. R. ALEXANDER

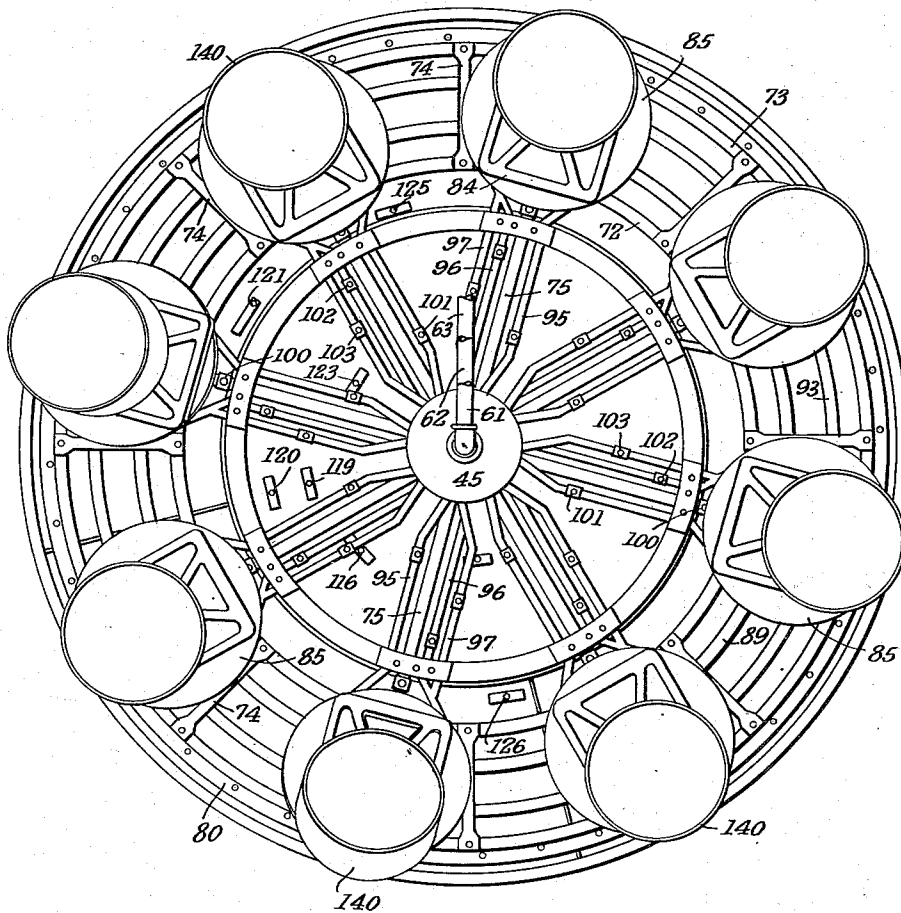
2,244,040

APPARATUS FOR CLEANING AND CONDITIONING DRUMS

Original Filed Sept. 11, 1934

5 Sheets-Sheet 1

Fig. 1.



INVENTOR
JOHN R. ALEXANDER

BY
Mitchell B. Burt
ATTORNEYS.

June 3, 1941.

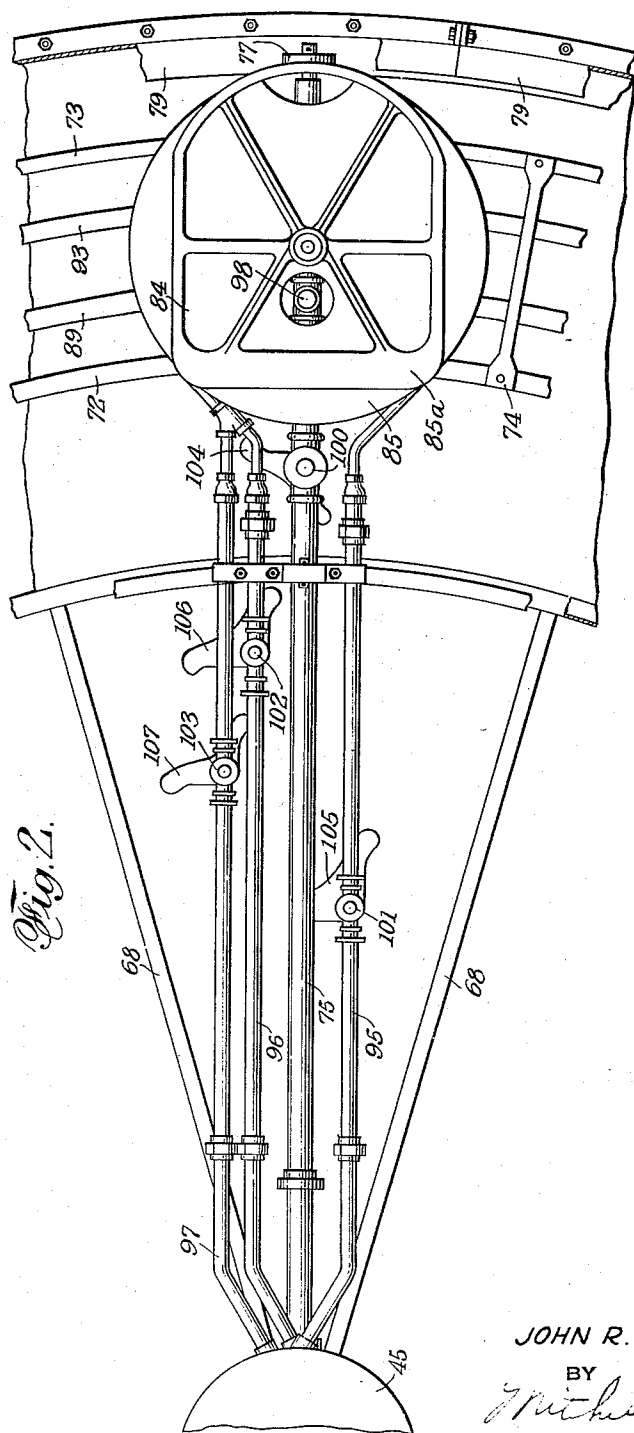
J. R. ALEXANDER

2,244,040

APPARATUS FOR CLEANING AND CONDITIONING DRUMS

Original Filed Sept. 11, 1934

5 Sheets-Sheet 2



INVENTOR
JOHN R. ALEXANDER

BY

ATTORNEYS

June 3, 1941.

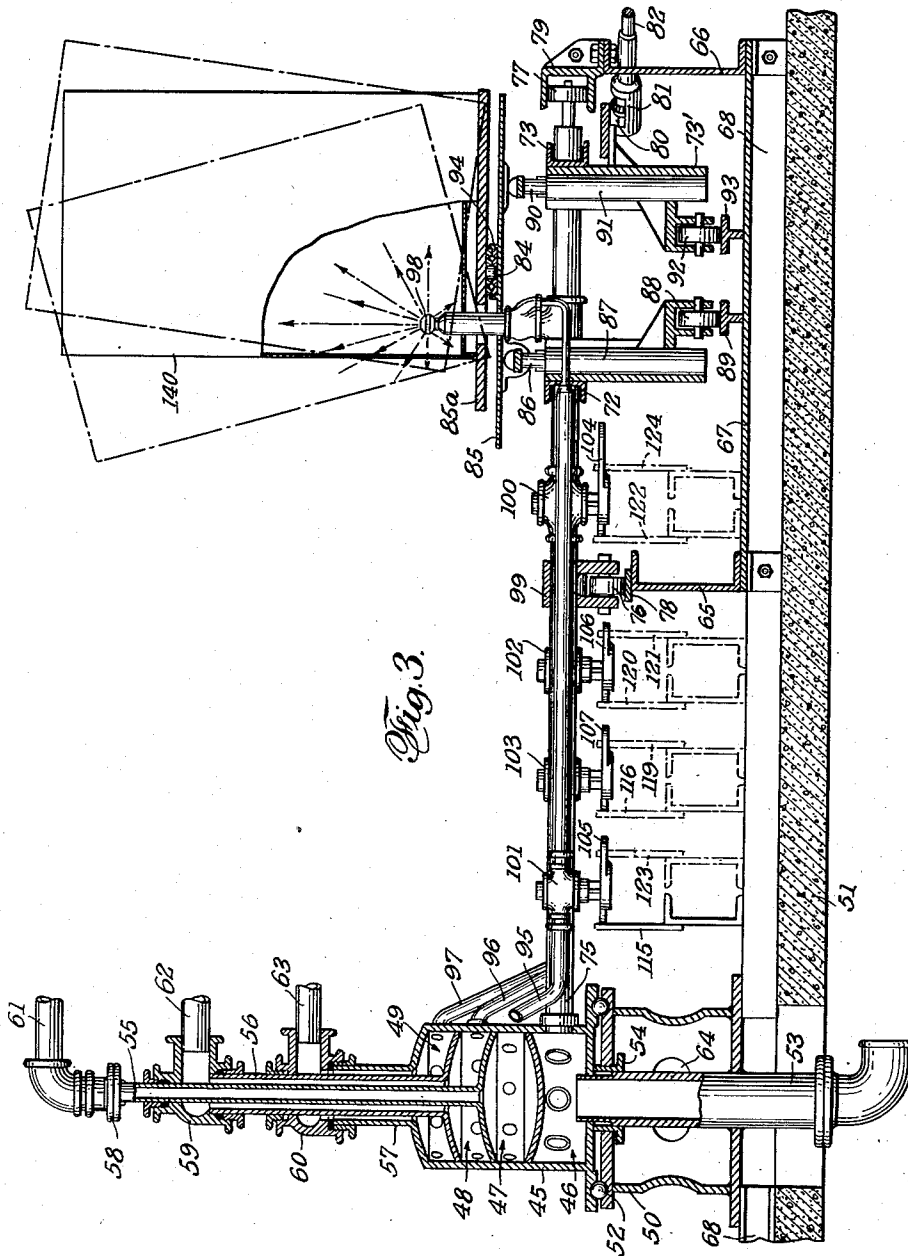
J. R. ALEXANDER

2,244,040

APPARATUS FOR CLEANING AND CONDITIONING DRUMS

Original Filed Sept. 11, 1934

5 Sheets-Sheet 3



INVENTOR
JOHN R. ALEXANDER

BY
Mitchell Barbert
ATTORNEYS.

June 3, 1941.

J. R. ALEXANDER

2,244,040

APPARATUS FOR CLEANING AND CONDITIONING DRUMS

Original Filed Sept. 11, 1934

5 Sheets-Sheet 4

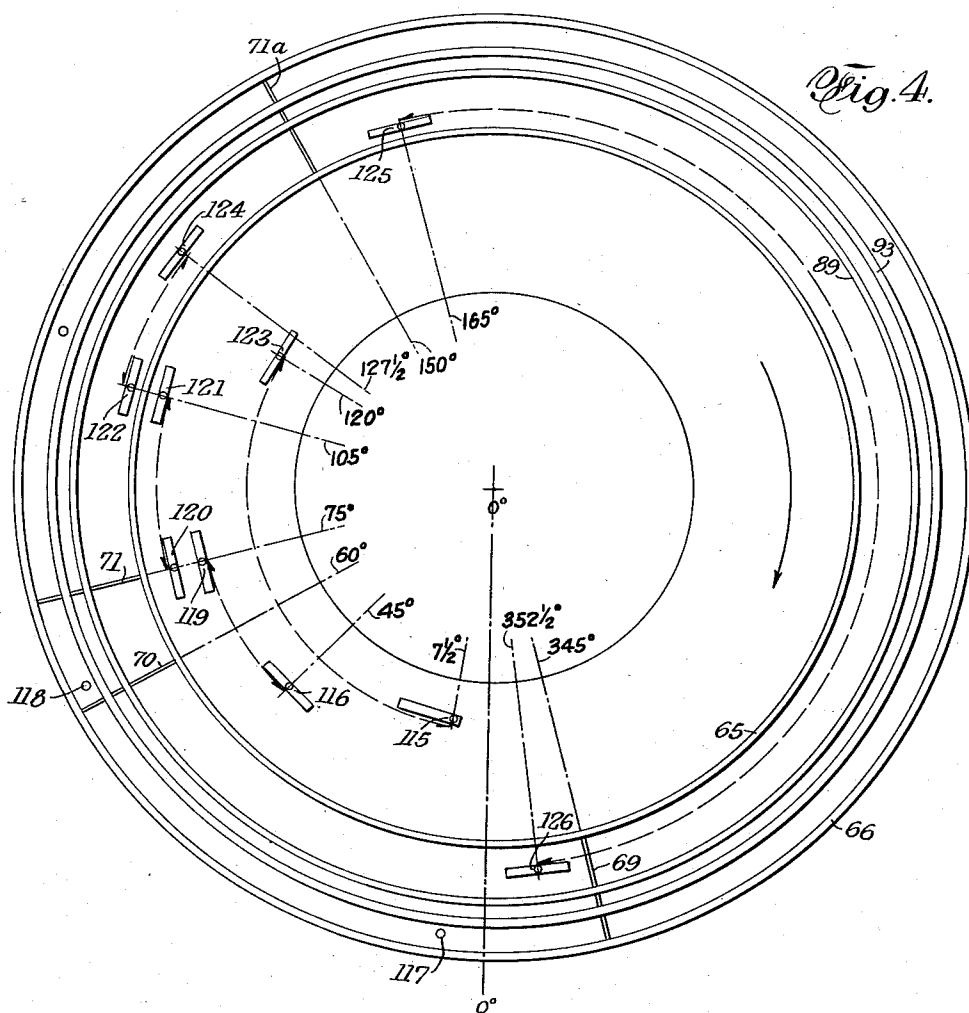
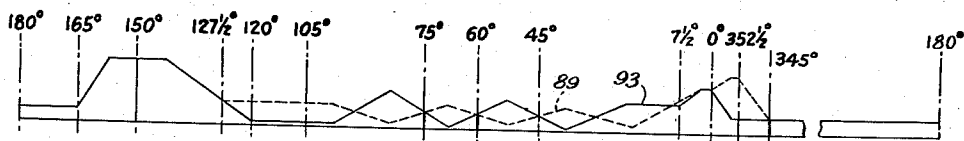


Fig. 5.



INVENTOR
JOHN R. ALEXANDER

BY

Matthew B. Burt
ATTORNEYS.

June 3, 1941.

J. R. ALEXANDER

2,244,040

APPARATUS FOR CLEANING AND CONDITIONING DRUMS

Original Filed Sept. 11, 1934

5 Sheets-Sheet 5

Fig. 6.

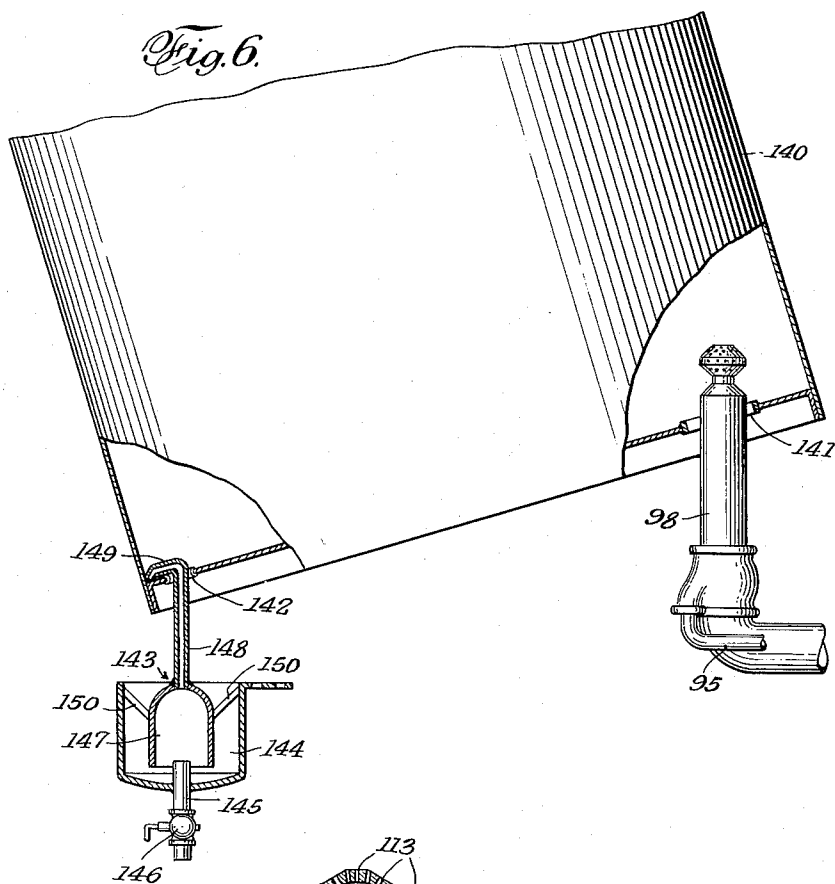
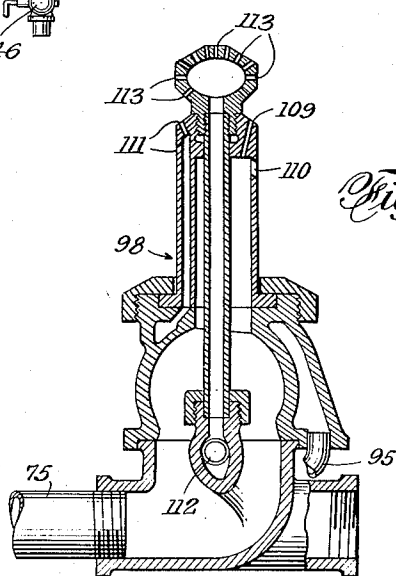


Fig. 7.



INVENTOR
JOHN R. ALEXANDER

BY
Witcher & Roberts
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,244,040

APPARATUS FOR CLEANING AND
CONDITIONING DRUMS

John R. Alexander, Elizabeth, N. J.

Continuation of application Serial No. 743,512,
September 11, 1934. This application October
29, 1937, Serial No. 171,662

7 Claims. (Cl. 141—6)

This invention relates broadly to improvements in apparatus for cleaning and for conditioning drums, barrels and similar containers, and this application is a continuation of my co-pending application, Serial No. 743,512, filed September 11, 1934. The invention is more particularly pertinent to improvements in means for clean- and conditioning drums suitable for the shipment and storage of petroleum oils and the products of such oils.

Processes and devices of various kinds and character have been advanced and have been utilized successfully for more or less automatically cleaning certain types of containers, such as bottles and cans. Such types of containers have conformed to a generally symmetrical shape in which the opening in one end was substantially concentric with the periphery of the outer circumference of the container. Furthermore, the concentrically disposed opening in the containers is usually of relatively generous proportions in the matter of the size thereof.

The symmetrical shape of such containers and the usually generously sized centralized openings therein simplify the cleaning thereof to a marked extent. A uniform distribution and impingement of the cleaning fluids is thereby permitted on both inside and outside surfaces of the containers and the relatively large openings permit the easy introduction into the container of the various cleaning fluids and also facilitates the removal of said cleaning fluids from the interior of the container.

On the other hand the conditions presented with respect to cleaning containers generally utilized in the petroleum industry are quite different from those presented in connection with cleaning other containers as hereinbefore described and are much more difficult of solution. Certain types of drums utilized for petroleum and its products have a bung hole in the tops thereof located as close to the periphery of the head as conditions permit. In other words the bung hole in an oil drum is located as far from the center of the head as possible. Such a location of the bung hole is necessary to enable the drum to be readily emptied. Furthermore, the bung hole in an oil drum is quite small in comparison to the volume of the drum and the area thereof to be cleaned. For example, the diameter of the bung hole in one conventional drum is of the order of $1\frac{1}{2}$ inches.

Because the bung hole in an oil drum is located near the periphery of the head of the drum as aforesaid the problem of inserting a nozzle there-

in and obtaining a substantially uniform impingement and distribution of the cleaning fluid over the interior surfaces of the drum is an important one. Proper cleaning will not result unless all of the surfaces and every part thereof are contacted with the cleaning fluid in a satisfactory manner. In addition to the uniform impingement and distribution as set forth several fluids may be required to clean and treat a drum. In this invention, under certain desired conditions of operation, it is preferred that the several fluids pass into the drum through one nozzle, which contains a multiplicity of conduits and orifices therein and which nozzle may remain in the bung hole without removal therefrom during a multiplicity of the cleaning and treating operations, as will be hereinafter described.

Economics demand that the drums be cleaned and reconditioned as quickly as possible. Furthermore, to clean the drums properly it is desirable that definitely prescribed and established minimum quantities of the respective fluids be used in certain respectively prescribed periods of time. This is accomplished in this invention in a novel manner and not only yields favorable results but also insures economies in the consumption of the fluids, such as air, steam, water and chemicals.

The largest nozzle that can be used is one that will enter the bung hole and still leave an area of sufficient extent between the nozzle and the inner wall of the bung hole to permit ready escape and drainage of the cleaning fluids and residues from the inside of the drum.

All of the aforementioned problems may be solved and the economic conditions surrounding the solution thereof may be readily met and satisfied in an effective manner by the use of this invention.

The utilization of oil drums in the petroleum industry is extensive and is surrounded by rigid specifications and requirements. Numerous products of petroleum are shipped in drums and in general the products so shipped comprise the higher priced products manufactured to specifications and calling for high freight rates. Unless the drums are absolutely clean on the inner surfaces contamination of the product results with probable accompanying rejection by the buyer. Such a condition not only results in loss and expense to the shipper but also acts as a decided deterrent to future and continued business. With respect to the outer surfaces of the drum competition has brought about the condition where it is now a necessity in the trade for

any seller to ship only drums that have the appearance of an entirely new article.

The cleaning and treating of containers, such as drums, used in the petroleum industry presents a different problem from that normally met with in many other industries. In these latter industries the containers usually are re-filled with the same product as previously contained therein. In the petroleum industry a drum may be filled with any one of many products, ranging from the lowest priced fuel oil to the highest priced lubricating oil. The intermediary products may consist of gas oil, kerosene, gasoline, cheaper lubricating oils, etc. In any event, irrespective of what the drum did contain, it may be filled with an entirely different product on its succeeding filling. There is practically no distinction, as all the drums look alike and are filled as they come.

Metal drums are used almost exclusively at present in the petroleum industry. Corrosion is an important factor, and all rust or other corrosive products must be removed, otherwise contamination of the contained product may ensue. No two drums are exactly alike in this regard. Some may be returned in a badly corroded condition; others may have different degrees of corrosion. Oftentimes deposition of sediment will result in one inner side of the drum, depending on the material stored therein, the length of time the drum remained in one position, and on other causes. Accordingly, a broad and varying set of conditions is to be encountered and must be completely overcome in cleaning and conditioning drums for subsequent filling with petroleum or a product thereof.

Heretofore the cleaning and reconditioning of drums in the petroleum industry has been done largely by manual labor. Chemicals have been applied to the outside and the inside of the drum. Corrosion on the inside has been removed by placing lengths of chains within the drum and rotating it for periods of time, as might be decided by the operator in his discretion. Corrosion on the outer surfaces of the drum has been removed by the use of wire brushes. The drum has been placed manually on a steam jet and subjected to steaming operations for periods of time, depending on circumstances and the judgment of the operator. Drying of the drum has been accomplished by manually placing it on an air jet and, after a period of time, manually removing it therefrom. Painting has been accomplished in several manners, such as spraying or dipping, and the drying of the paint has been accomplished by heating the drum in a kiln.

The net result of so cleaning and conditioning a drum has been that satisfactory results can be obtained only by long and painstaking work, accompanied by rigid inspection at every operation. The human equation is so much in evidence that uniformity is impossible and, upon shipping products in the drums so cleaned, a large percentage of rejections is entailed. The expense usually attains a total amount so high that the economies surrounding the utilization of previously used drums largely disappears. In fact some of the largest manufacturers of petroleum products have desisted from the use of previously used drums and now utilize new drums exclusively.

By the use of this invention the human equation is almost, if not entirely, eliminated in the cleaning and conditioning of large containers

such as are used for the shipment of petroleum or its products. The labor necessary is substantially only that required to supervise the apparatus and its mechanism and to place the drums onto the apparatus and to paint the drums during the process. Each and all of the fluids used are subject to complete and automatic control with respect to volumes, pressures and temperatures and the period of time that any fluid may be applied is automatically governed and may be varied at will. Each and every drum or container is treated exactly in the same manner and for the same period of time, thereby giving a great uniformity of product. The method of treatment, the control of the fluid flow, the control of temperatures and the degree to which any drum is subjected to treatment are so adjusted that the drums most difficult to clean are effectively and properly cleaned, thereby insuring that all the drums so treated will constitute a superior conditioned product. Experiments have demonstrated that by the use of this invention the percentage of rejections because of improperly cleaned drums approaches the vanishing point.

This invention may be applied in apparatus of marked compactness and durability and that require small power consumption in the operation thereof. The apparatus have large capacity in comparison to the space occupied. A capacity of one container per minute, for example, is practical and economical, but larger or smaller capacities may be utilized as desired.

Accordingly, one object of this invention is to provide a means for conditioning containers wherein the labor requirements are low and the human equation affecting results is substantially eliminated.

Another object of this invention is to provide a means whereby the containers are uniformly and properly conditioned.

A further object of the invention is to provide means for the conditioning of containers with an accompanying small consumption of power, steam, water, air and chemicals.

Still another object of the invention is to provide means that is continuous and that will permit a reduction in the time heretofore required for cleaning and conditioning drums.

Further objects of this invention will be apparent to those skilled in the art or will be set forth in this specification.

For a more detailed description of my invention reference is made to the accompanying drawings, which are in part diagrammatic in character and which are presented without regard to the proportion of the parts. The drawings and the description referring to said drawings illustrate one type of apparatus embodying my invention.

In the drawings—

Fig. 1 is a top plan view of apparatus for cleaning the insides of drums, the drums being shown in place;

Fig. 2 is a fragmentary enlarged top plan view of one drum carriage and associated parts;

Fig. 3 is a substantially central vertical sectional view of parts shown in Fig. 2;

Fig. 4 is a generally diagrammatic top plan view of the track and trigger members of the inside cleaning apparatus;

Fig. 5 is a diagrammatic development of the track members shown diagrammatically in Fig. 4, the full lines indicating the outside track and the dotted lines indicating the inside track. This

figure indicates bulkheads or partitions at 60°, 75°, 150° and 345°;

Fig. 6 is an illustrative view of a drum fragment showing the cleaning nozzle in place and a siphon device for withdrawing water; and

Fig. 7 is a substantially central vertical sectional view on an enlarged scale of the cleaning nozzle.

In accordance with my invention, the interior of the drum may be first treated with steam, whereby the drum is cleaned internally and also heated, thereby causing the outside surfaces to dry quickly and accordingly prevent rust or other corrosion forming on said outside surfaces. While steam is still flowing into the interior of the drum it is oftentimes preferred that caustic or other chemical solution be concurrently introduced into the interior of the drum for a portion of the period of time that steam is flowing thereinto, and that steaming be continued after the caustic or other chemical solution is shut off. It is always preferred that the velocity of the fluids entering the drum be high in order that substantial impingement of the fluids on the interior surfaces be attained. Likewise it is always preferred that the distribution over interior surfaces be as complete as possible, so as to assure effective impingement on all of the said interior surfaces. These preferred conditions are attained in a novel manner by the use of this invention, as will be more fully described hereinafter.

After the interior cleaning of the drum has been completed the steam is shut off and hot air may be passed into the interior of the drum for a shorter period of time. The air may then be turned off and the drum painted or enameled. The hot air is again introduced into the interior of the drum and the paint dried by the heat transferred thereto from the interior of the drum. This is an important feature because the paint dries from the surface of the drum outwards and give a more durable paint finish, yielding an exceptionally fine surface lustre. The paint having sufficiently dried the drum is removed from the apparatus and leaves a vacant drum position to receive another drum to be cleaned and refinished.

In the apparatus for cleaning the drums on the inside, shown in Figs. 1 to 7, there is a centrally disposed receptacle 45, divided into four pressure tight compartments 46, 47, 48 and 49. Receptacle 45 is rotatably mounted on a supporting member 50, which is rigidly mounted on foundation 51. The bearing of receptacle 45 may be of the ball bearing type 52. A stationary axial pipe 53 extends through the foundation 51 and leads into compartment 46. Leakage of fluid from compartment 46 around pipe 53 is prevented by stuffing box 54. An axial inner pipe 55 leads into compartment 47, a middle concentric pipe 56 leads into compartment 48, and an outer pipe 57 leads into compartment 49. Pipes 55, 56 and 57 are rigidly secured to receptacle 45 and rotate therewith and swing joints 58, 59 and 60 of any conventional form remain stationary and are connected with sources of fluid 61, 62 and 63, respectively. Access to stuffing box 54 is through manhole 64.

It is preferred, in carrying out this invention, to pass heated air through pipe 53 into compartment 46, steam through pipe 55 into compartment 47, hot water through pipe 56 into compartment 48, and hot chemical solution, such as caustic, through pipe 57 into compartment 49,

from which respective compartments such fluids are distributed to the container to be cleaned, as will be set forth hereinafter.

Surrounding receptacle 45 and concentric therewith are stationary annular walls 65 and 66, preferably welded to a liquid tight bottom 67 which rests on several radial supports 68 resting on foundation 51. Bulkhead members 69, 70, 71 and 71^a (Fig. 4) are radially disposed between members 65 and 66 and form three sumps in the annular area between wall members 65 and 66.

Two rails 89 and 93 surround receptacle 45 at a suitable distance therefrom and are concentric therewith. Said rails constitute a carriage track member that supports carriage 84 and that also cause the carriage to rock, as will be described hereinafter.

Surrounding receptacle 45 and concentric therewith are two annular channel members 72 and 73, rigidly connected together by members 74, which assembly constitutes a rotatable frame or carriage holder. Said rotatable frame is supported by radial pipes 75, which in turn are carried on rollers 76 and 77. Roller 76 rotates on a track member 78 supported on member 65 and roller 77 rotates in a groove in member 79, rigidly mounted on member 66. A ring gear 80 is secured to member 73' and is driven by pinion gear 81, mounted on shaft 82, on which is mounted a sprocket or gear 83. Rotation is given to the aforementioned rotatable frame by said gears being driven by power applied to sprocket or gear 83 and receptacle 45 rotates uniformly therewith, as will be hereinafter explained.

Movably supported at equal intervals within said rotatable frame or carriage holder are carriages or drum carriers 84, which support the containers to be cleaned. Eight carriages are shown in Fig. 1 but a greater or lesser number may be used in accordance with the desired capacity of the apparatus. Each carriage 84 consists of a top member 85, movably secured to a sliding member 86, which may slide upwards or downwards in guide member 87, rigidly secured to member 72. A roller 88 is provided at the bottom of slide 86 and travels on rack 89. Top member 85 is further supported on a sliding member 90, which may slide upwards or downwards in guide 91, rigidly secured to member 73. A roller 92 is provided at the bottom of slide member 90 and travels on track 93. Movably secured to member 85 by bearing 94 is a spider or table 85^a, which may be rotated independently of top 85.

Extending radially from receptacle 45 to the rotatable frame or carriage holder at each carriage location thereon are a series of pipes 75, 95, 96 and 97. Pipe 75 supports a nozzle 98. These pipes are all rigidly secured to receptacle 45 and pipe 75 is also rigidly secured to member 72 and the pipes are all clamped together by clamp 99. In this manner the rotation of member 72, which is a part of the aforementioned rotatable frame or carriage holder, causes receptacle 45 to rotate with and in fixed radial position to said carriage holder.

Located on pipes 75, 95, 96 and 97 are valves 100, 101, 102 and 103, respectively, and on said valves are rigidly fixed cams or valve handles 104, 105, 106 and 107, respectively. The valves are adapted to control the flow of fluids from receptacle 45 and the cams are adapted to automatically open and close said valves during the operations, as will be more fully described hereinafter.

Nozzle 98 (Fig. 7) is adapted to receive fluids

from each of the compartments in receptacle 45 and to distribute said fluids onto interior surfaces of the container to be cleaned. Fig. 3 shows one method of supporting nozzle 98 on pipe 75. Hot air flowing through pipe 75 passes upwards in the nozzle and escapes through orifices 109 and 110. Steam entering the nozzle through pipe 95 passes upwards and escapes through orifices 111. Pipes 96 and 97 are joined together beyond their respective control valves 102 and 103 and therefrom form one conduit which enters the nozzle 98 at port 112. Fluids entering said nozzle at port 112 flow upwards and escape through orifices 113. Pipes 96 convey hot water to the nozzle 98 and pipe 97 conveys chemical solution to said nozzle. In this apparatus water and chemical solution are never introduced into the container at the same time. It is therefore practical to convert pipes 96 and 97 into one conduit beyond the control valves 102 and 103, respectively.

The location and direction of orifices 113 are important, as will be hereinafter set forth.

The purposes of the parts and the application of the invention may be more fully understood by describing the process of cleaning and conditioning a container therein.

Experiments have demonstrated that for normally dirty drums the time required for cleaning and conditioning a drum by the use of this invention is about twenty-four minutes. The drums travel through approximately 360° of arc in the process and accordingly the speed of rotation is approximately one revolution in twenty-four minutes. The apparatus depicted in Fig. 1 has eight carriages or drum carriers. Its capacity would be rated at eight drums in twenty-four minutes. Similarly, an apparatus with twenty-four carriages or drum carriers would have a capacity of twenty-four drums in twenty-four minutes. It is apparent, therefore, that greater or lesser capacity is essentially a function of the number of carriages in the apparatus and not a general function of the speed of rotation of the apparatus which experimentation has defined as above set forth. The speed being constant, the automatic functioning of the cams 104, 105, 106 and 107 is fixed with respect to arc and time and the containers receive the prescribed treatments automatically and uniformly by the use of this invention.

For purposes of description consider the treatment of one drum only. The process is continuous, drums are being regularly removed from the apparatus and being regularly placed on the apparatus and the treatment of each and every drum is uniform.

The apparatus having been set into motion at the rate of, say, one revolution in twenty-four minutes by the application of suitable power on sprocket 83, a drum is placed on the apparatus when a carriage 84 arrives approximately at the line marked 0° in Figs. 4 and 5. At that position the elevation of the inner and outer rails may be the same. The placing of the drum on the apparatus may be done manually. As said drum moves in a circular path on said carriage 84 and reaches the line marked 7½° on Figs. 4 and 5, cam 105 is engaged by an upward projecting and stationary trigger 115, and the onward circular travel of the center of cam 105 causes said cam to turn through an angle of about 90°, thereby opening valve 101. Steam having been introduced into chamber 47, for example, at about fifty pounds gauge pressure, then flows through pipe 95, through nozzle 98 and

into the interior of said drum. Steam continues to flow into the said drum at a uniform rate, heating the drum, drying the outside thereof, and cleaning the interior thereof. Steaming in such a manner continues until said drum has traveled on said carriage 84 to the line marked 45°. The interior of the drum has then been steamed during the travel of said carriage through an arc of 37½°.

By reference to Fig. 5 it will be seen that during this travel inner track 89 has been lowered, then elevated and is again being lowered while concurrently outer track 93 was continually being lowered and is now being elevated. By alternately so raising and lowering said tracks, rollers 88 and 92 are correspondingly raised and lowered and the carriage 84 is thereby given a rocking motion, causing the drum thereon to change the angle of its axis to the axis of the nozzle 98. Nozzle 98 being rigidly secured to pipe 75 remains in a substantially vertical position and, were the drum to remain stationary also, the fluids escaping from the orifices in said nozzle would constantly impinge on certain definite areas of interior surfaces of said drum with the result that other areas of interior surfaces would not be cleaned. Rocking the carriage changes the interior areas on which the jets of fluids coming from the orifices of nozzle 98 impinge. By placing the orifices so that the angle between the jets issuing therefrom bears a proper relationship to the angle through which the carriage is rocked all of the interior surfaces may be subjected to impingement of fluids utilized and be thoroughly cleaned thereby.

When said drum has traveled in its circular path to the line marked 45°, cam 107 is engaged by an upwardly projecting and stationary trigger 116 of Figs. 3 and 4, and the onward circular travel of the center of cam 107 causes said cam to turn through an angle of about 90°, thereby opening valve 103. Caustic or other suitable chemical solution having been introduced into compartment 49, for example, at about fifty pounds gauge pressure and at a temperature of about 190° Fahr. flows through pipe 97 into nozzle 98, through port 112 and through orifices 113 and impinges at high velocity on interior surfaces of said drum. The steam is allowed to flow concurrently into the drum through nozzle 98 and beneficial effects are obtained by flowing the steam and caustic concurrently. The drum is kept hot by the steam and the caustic is further heated also by said steam with the result that marked cleaning effects are produced by the hotter caustic on the hot metal of the interior surfaces of the drum. Furthermore, the very high velocity of the steam adds to the velocity of the particles of caustic, giving a greater impingement of the caustic on interior surfaces of the drum.

The flowing of steam and caustic concurrently into the drum continues until said drum has traveled on said carriage 84 to the line marked 75°. The interior surfaces of the drum have then been concurrently treated with steam and caustic during the travel of said carriage through an arc of 30°.

By reference to Fig. 5 it will be seen that during the travel through the last mentioned 30° of arc inner track 89 has been lowered, then elevated, and is being lowered again while outer track 93 has been elevated, then lowered and is being elevated again, thereby rocking said carriage 84 and changing the interior surfaces of said drum with respect to the impingement of

fluids thereon during the period of concurrent steaming and treating with caustic.

During the travel to the line marked 60° in Figs. 4 and 5 the fluids escaping from the drum through the bung-hole thereof were trapped in a sump formed by bulkheads 69 and 70 and annular wall members 65 and 66, whence the fluids may be drained through drain 117 and reutilized if desired. Similarly, during the travel from the line marked 60° to the line marked 75°, the fluids escaping from the drum were trapped in a sump formed by bulkheads 70 and 71 and annular wall members 65 and 66, whence the fluids may be drained through drain 118 and reutilized if desired.

When the drum has traveled in its circular path to the line marked 75°, cam 107 is engaged by an upwardly projecting and stationary trigger 119 (Fig. 4). Trigger 119 is so situated as to engage cam 107, so as to reverse its turning and the onward circular travel of the center of cam 107 causes said cam to turn back through an angle of about 90° and close valve 103, thereby shutting off the chemical solution. Concurrently cam 106 is engaged by an upwardly projecting and stationary trigger 120 of Figs. 3 and 4, and the onward circular travel of the center of said cam 106 causes said cam to turn through an angle of about 90° and open valve 102. Heated water having been introduced into compartment 48, for example, at about fifty pounds gauge pressure and at a temperature of about 180° Fahr., now flows through pipe 96 into nozzle 98, through port 112 and orifices 113 and impinges on interior surfaces of the drum at high velocity. The steam is allowed to flow concurrently through nozzle 98, thereby inducing a higher velocity in the water particles and a greater impingement on inner surfaces of the drum.

The flowing of steam and hot water concurrently into said drum continues until the carriage 84 and the drum thereon have traveled in a circular path to the line marked 105°. The interior surfaces of the drum have then been concurrently treated with steam and hot water during the travel of said carriage through an arc of 30°.

By reference to Fig. 5 it will be seen that during the travel through the last mentioned 30° of arc, inner rail 89 has been lowered and then gradually elevated, while outer rail 93 has been elevated and then lowered, thereby rocking carriage 84 and changing the angle of inner surfaces of said drum to the axis of nozzle 98.

When the drum has traveled in its circular path to the line marked 105°, cam 106 is engaged by an upwardly projecting and stationary trigger 121 (Fig. 4), so situated as to reverse the turning of the cam and the onward circular travel of the center of cam 106 causes said cam to turn back through an angle of about 90° and close valve 102, thereby shutting off the hot water. Concurrently cam 104 is engaged by an upwardly projecting trigger 122, caused to turn through an angle of about 90° and open valve 100. Hot air having been introduced into compartment 46, for example, at a pressure of about fifteen inches of water in some instances and in other desired conditions at higher pressure of as much as thirty pounds per square inch or more, and at a temperature of about 400° Fahr., now flows through pipe 75, through nozzle 98 and through orifices 109 and 110. Steam may be allowed to flow concurrently through nozzle 98.

The flowing of steam and hot air concurrent-

ly into said drum continues until the carriage 84 and the drum mounted thereon have traveled in a circular path to the line marked 120°. The interior surfaces of the drum have then been concurrently treated with steam and hot air during the travel of said carriage through an arc of 15°.

By reference to Figs. 4 and 5 it will be seen that during the travel through the last mentioned 15° of arc tracks 89 and 93, respectively, have remained at practically a level position, inner track 89 being slightly higher than outer track 93. During this portion of the travel the effect on interior surfaces was largely a drying operation and rocking the carriage was not essential.

At the line marked 120° the steam is shut off by an upwardly projecting and stationary trigger 123, engaging the moving cam 105, turning it in a direction to close valve 101. The hot air is allowed to continue to flow until the drum on carriage 84 has reached the line marked 127½°. Here an upwardly projecting and stationary trigger 124 engages cam 104 in such a manner as to turn it and close valve 100. Accordingly the hot air was allowed to flow into the drum while said drum mounted on carriage 84 traveled through an arc of 7½° of the circular path.

In one type of conventional drums utilized in the petroleum industry a small vent bung-hole about three-quarters of an inch in diameter is located in the top thereof, in addition to the larger or main bung-hole. Usually these bung-holes are situated at an angle of 180° from each other. Under certain conditions of operation it is desirable to utilize the vent bung-hole for draining or syphoning liquid that has collected within the drum, thereby facilitating drying of interior surfaces of said drums.

Referring to Fig. 6, a drum 9 has a large bung-hole 141, into which nozzle 98 is inserted. Vent bung-hole 142 is shown located in the drum approximately 180° of arc from bung-hole 141. A syphoning device 143 consists of an outer cup or container 144, the top of which is open and through the bottom of which leads a pipe 145, on which is a valve 146. Disposed within cup 144 is an inverted cup 147, open at the bottom and closed at the top. A pipe 148 leads through the top of cup 147 and forms a goose neck 149, which is inserted through vent bung-hole 142 and rests against the periphery of the drum, as shown. Cup 147 is fixed to cup 144 by strap members 150.

Syphoning device 143 may be inserted into the vent bung-hole 142 when the drum is first placed on carriage 84 and remain there until the syphoning action is performed, as will be hereinafter set forth.

As the drum travels on its circular path and is treated with steam and other fluids as hereinbefore described, the drainage of the liquids from the drum as it rocks with carriage 84, fills cup 144 and the liquids will attain substantially the same level within cup 147 as is attained in the annular space between cups 144 and 147. When the carriage 84 and the drum mounted thereon arrive at the line marked 120°, the steam is shut off as aforesaid. Promptly thereafter valve 146 is opened. At this point of the travel of the drum the inner rail 89 is slightly elevated above outer rail 93, thereby giving the drum an inclination so that any liquid in the interior thereof will flow towards the inner periphery of the drum adjacent to the vent bung-hole 142. As the liquid

flows through pipe 145 and the level within cups 144 and 147 lowers a partial vacuum is created in pipe 148, and any liquid at the end of goose-neck 149 within the drum will be caused to flow into cup 147 and be thereby drained or siphoned out of the drum.

Experiments have shown that as much as six ounces of liquid may be so drained from the inside of the drum under conditions of treatment as hereinbefore described. The hot air flowing concurrently into the drum through nozzle 98 assists in this final operation of drying the interior of the drum. Furthermore, the liquid having been removed at this point the hot air entering the drum heats the drum more quickly and renders it at a suitable temperature for receiving the paint on outside surfaces. The hot air is shut off when carriage 84 and the drum thereon arrive at line marked 127½°, and siphoning device 143 may then be removed from the drum prior to rotating the drum and painting exterior surfaces thereof.

By reference to Fig. 5 it will be seen that both inner track 89 and outer track 93 commence to rise rapidly at the line marked 127½°. Both rollers 88 and 92 are raised until the spider 85^a has been raised above the topmost part of nozzle 98, which is thereby removed from the bung-hole. It is then possible to spin or rotate spider 85^a on bearing 94, which is preferably of anti-friction type, and the drum resting on said spider rotates with said spider. The drum is at high temperature and the exterior surfaces are dry and constitute an ideal surface for receiving paint, such as enamel or any suitable paint product. The drum may then be rotated, paint applied to all exterior surfaces, excepting the head that rests on the spider 85^a, and the carriage may then be lowered, the nozzle 98 again inserted in the bung-hole of the drum and the hot air under pressure again be allowed to pass into the drum by trigger 125 engaging cam 104 and opening valve 100 in the same manner as hereinbefore described.

During the travel of carriage 84 and the drum mounted thereon from line marked 127½° in a circular path to line marked 165°, the carriage was elevated, nozzle 98 was removed from said drum, the drum was rotated, exterior surfaces of the drum were painted, the carriage was lowered and nozzle 98 was reinserted in said bung-hole, all during a travel through 37½° of arc of said circular path.

During the travel of said drum on said carriage in a circular path from line marked 75° to line marked 150°, fluids escaping from the drum through the bung-hole thereof were trapped in a sump formed by bulkheads 71 and 71^a and annular members 65 and 66. The fluids so trapped may be withdrawn through a drain and reutilized if desired.

Heated air under pressure as may be selected is permitted to pass into the drum during its travel on carriage 84 in a circular path from line marked 165° to line marked 352½°, when cam 104 is actuated by trigger 126 in such manner that valve 100 is closed in the same manner as hereinbefore described. During this travel the drum is heated internally and the paint on exterior surfaces is dried largely by heat transfer from interior surfaces of said drum. Accordingly, heated air was flown into the drum mounted on carriage 84 traveling in a circular path, while said carriage traveled through 187½° of arc of said circular path.

Tracks 89 and 93 were at substantially uniform

elevation during the travel from line marked 165° to line marked 345°. Then inner track 89 rises rapidly and at about 352½° attains an elevation above outer track 90 sufficient to cause the drum to tip or fall off the carriage. The travel from line marked 352½° to line marked 7½° allows a travel of carriage 84 through 15° of arc of its circular path which is utilized for removing the conditioned drum from said carriage and for placing another drum on said carriage.

Upon removing the drums from the apparatus the drums are placed on their ends with the bung-holes up, the bungs are inserted and the tops are then painted. The sensible heat retained by the drum expedites the drying of the paint placed on the top of the drum after its removal from the apparatus. The drums are then in first class condition for use in the petroleum industry.

It is seen from the above description that the carriages move continuously in a circular path at a uniform rate of speed and that drums placed thereon are subject to treatment during the travel through 345° of arc, the remaining 15° of arc being utilized for removing a conditioned drum from the carriage and placing another drum on the carriage so vacated by the removal of the conditioned drum.

Experiments have demonstrated that the relative periods of time allotted to each of the respective operations as hereinbefore described are important. Normally the operations may be carried out as described and excellent results be thereby obtained. There are certain limitations, however. For example, by the use of this invention it is possible to paint outside surfaces of a drum in a short period of time and, because of the favorable condition of the outside surfaces of the drum as presented and the internal heating thereof, the paint is dried rapidly from the surface of the drum outward. It is desirable to use air at as high a temperature as practical. If said air exceeds 400° Fahr. temperature the tendency is to burn the paint. Under such a limitation with respect to temperature it is desirable to utilize the travel of a drum in its circular path through an arc greater than 180° of arc of said circular path for the operation of placing paint on exterior surfaces of the drum or container and drying the paint. In order to attain such a desirable condition of operation it is necessary to utilize the travel of said drum through an arc of less than 180° of arc of its circular path for the operations of steaming, chemically treating, rinsing and drying said container prior to painting external surfaces of said container.

Similarly, in order to obtain a balance of the respective operations as hereinbefore described, it is necessary to utilize at least 100° of arc of the circular path of travel of the containers for operations performed prior to painting exterior surfaces of said containers and that the operation of painting be finished prior to 205° of arc in order that sufficient drying of the paint be obtained.

To attain all of the above desired conditions and to balance respective operations the containers are rotated and painted on exterior surfaces during the travel of a container through an arc of less than 90° of its circular path.

The cleaning of containers which do not require painting may be readily accomplished by the use of this invention. One method of so do-

ing is to permit the containers to receive treatments precisely as hereinbefore described, with the exception of the painting operation, which is omitted. However, it is readily apparent that if the painting is omitted the operation of drying the paint is also eliminated, and that the capacity of the apparatus, in that event, can be much increased.

Trigger members for throwing the valves may be located at any degree of arc of travel of the carriage 84 as may be selected, the points so selected being dependent upon the speed of travel of said carriages. For example, as hereinbefore set forth, the shown position of said trigger members is predicated upon a rotational speed of the carriages of one revolution in about twenty-four minutes. If the rotational speed of the carriages were one revolution in twelve minutes, the locations of said trigger members respectively would be such as to permit substantially the same time for each respective cleaning and drying operation, as hereinbefore set forth. It is possible, in this manner, when the operation of painting is omitted, to subject the containers to steaming, chemically treating, rinsing and drying during the travel of the containers through an arc of about 345° and thereby increase the capacity of the apparatus accordingly.

When the painting operation is omitted it is not necessary to elevate the carriage and remove the nozzle 98 from the bunghole of the container. Accordingly, inner track 89 and outer track 90 could then have profile contours respectively to cause only rocking of the carriages during the respective operations, as hereinbefore described.

When the paint is being dried by flowing heated air into the containers, as hereinbefore set forth, a final drying is concurrently effected on interior surfaces of the container. When painting is omitted such a final drying operation is not available. Accordingly in instances where painting is omitted it is often desirable to speed up the operation of drying interior surfaces of the containers. This may be effected by either increasing the temperature of the fluid entering the interior of the container or by increasing the pressure of the fluid entering the container or by an increase in both temperature and pressure. In some instances in the application of this invention heated air at a pressure of as much as fifty pounds per square inch or more may be introduced into the interior of the container for drying purposes.

While I have disclosed my invention in its preferred form it is to be understood that various changes, omissions and additions may be made within the scope of the invention as defined in the appended claims.

I claim:

1. In a drum cleaning apparatus, a carriage rotatable about a central upright axis, a plurality of drum platens carried by said carriage, an upright axis for each of said drum platens about which the latter are rotatable on said carriage, a plurality of nozzles carried by said carriage one for each drum platen and extending upwardly and located eccentrically of said upright axes, means for carrying drum conditioning fluid to said nozzles, and means for raising and lowering said nozzles and drum platens relatively to each other while the latter are moving in an orbit about said central carriage axis, each said nozzle, when in relatively raised position, being adjacent the bung of a drum on the platen to introduce fluid thereinto, and when in relatively lowered

position being free of said platen and drum to permit rotation thereof.

2. In a drum cleaning apparatus, a carriage rotatable about a central upright axis, a plurality of drum platens movably rotatably carried by said carriage on upright axes, a nozzle for each of said drum platens and movable with said carriage, said nozzles being mounted eccentrically of the axis of said platens, said nozzles being positioned to cooperate with the bung of a drum carried by each platen, means for passing cleaning fluid through said nozzles into drums carried by said platens during orbital motion thereof about said carriage axis, and means for rocking said drum platens to rock the drums carried thereby a plurality of times during orbital movement thereof, whereby the inclination of the stream of fluid from said nozzle will be changed relatively to each drum a plurality of times.

3. In a drum conditioning apparatus, a carriage rotatable about a vertical axis, a plurality of drum platens carried thereby, an upright axis for each of said drum platens and about which said drum platens are rotatable, a cleaning fluid nozzle for each of said drum platens and mounted eccentrically of said upright axes, means for raising and lowering said drum platens relatively to said nozzles during orbital movement of said drum platens about said central carriage axis, means for introducing cleaning fluid through said nozzles, and means for introducing heating fluid through said nozzles, each said nozzle, when in relatively raised position, being adjacent the bung of a drum on the platen to introduce fluid thereinto, and when in relatively lowered position being free of said platen and drum to permit rotation thereof.

4. In a drum cleaning apparatus, a carriage rotatable about an upright axis, a plurality of drum platens carried by said carriage and individually rotatable about upright axes during a part of their orbital movement about said central carriage axis, a cleaning fluid nozzle for each of said drum platens and mounted eccentrically of the axis thereof, means for carrying fluid to said nozzles for introducing the same into drums carried by said drum platens, and means for raising and lowering said nozzles and drum platens relatively to each other, each said nozzle, when in relatively raised position, being adjacent the bung of a drum on the platen to introduce fluid thereinto, and when in relatively lowered position being free of said platen and drum to permit rotation thereof.

5. In a drum conditioning apparatus, a carriage rotatable about an upright axis, a plurality of drum platens carried by said carriage on upright axes, a nozzle for each of said drum platens and mounted eccentrically of the axis thereof for cooperation with drums carried by said drum platens, a plurality of compartments for drum conditioning fluid, each connected to said nozzles, said compartments being mounted concentrically of said carriage, valve means for controlling the introduction of drum conditioning fluids to said nozzles, and means for rotating said carriage and parts carried thereby about the central axis.

6. In a drum cleaning apparatus, a rotatable carriage, a plurality of drum platens carried thereby for carrying drums, each of said drum platens being rotatable on said carriage about an upright axis, whereby drums on said platens may rotate therewith, cam track means for elevating said drum platens, and a cleaning nozzle for each platen and mounted eccentrically rela-

tive to the platen axis, for the purpose described.

7. In a drum conditioning apparatus, a carriage rotatable about an upright axis, a plurality of drum platen supports carried by said carriage, a drum platen rotatably supported by each of said supports about an upright axis, whereby said drum platens may rotate about said upright axes,

5 cam follower means supporting said drum platen supports, cam track means cooperating with said follower means for moving said drum platen supports and platens, and a nozzle means for each platen and mounted eccentrically relatively thereto, for the purpose described.

JOHN R. ALEXANDER.