Dec. 19, 1939. W. O. CHACE 2,183,859

AGITATING AND MIXING MECHANISM

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Fig. 1.

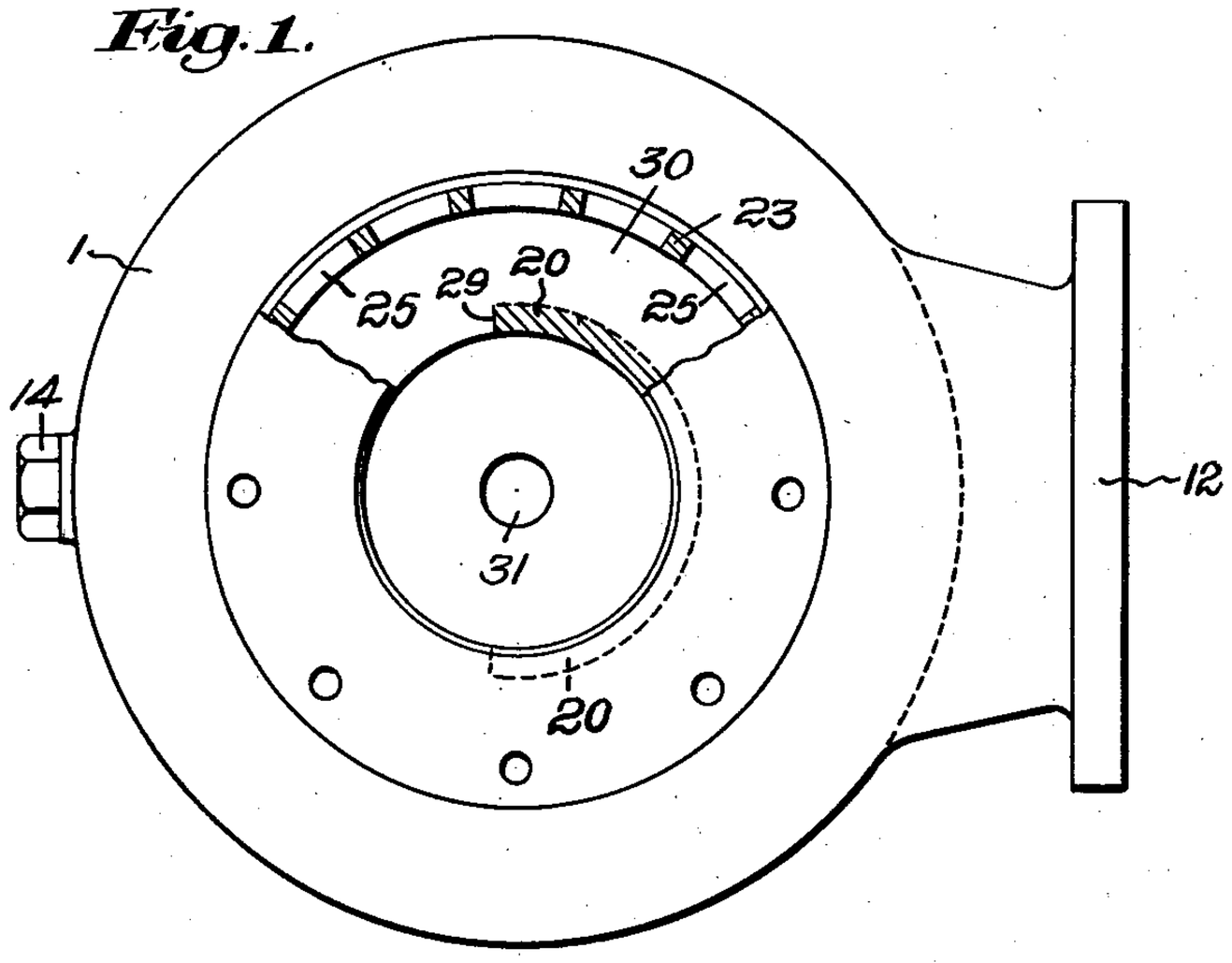

Fig. 2.

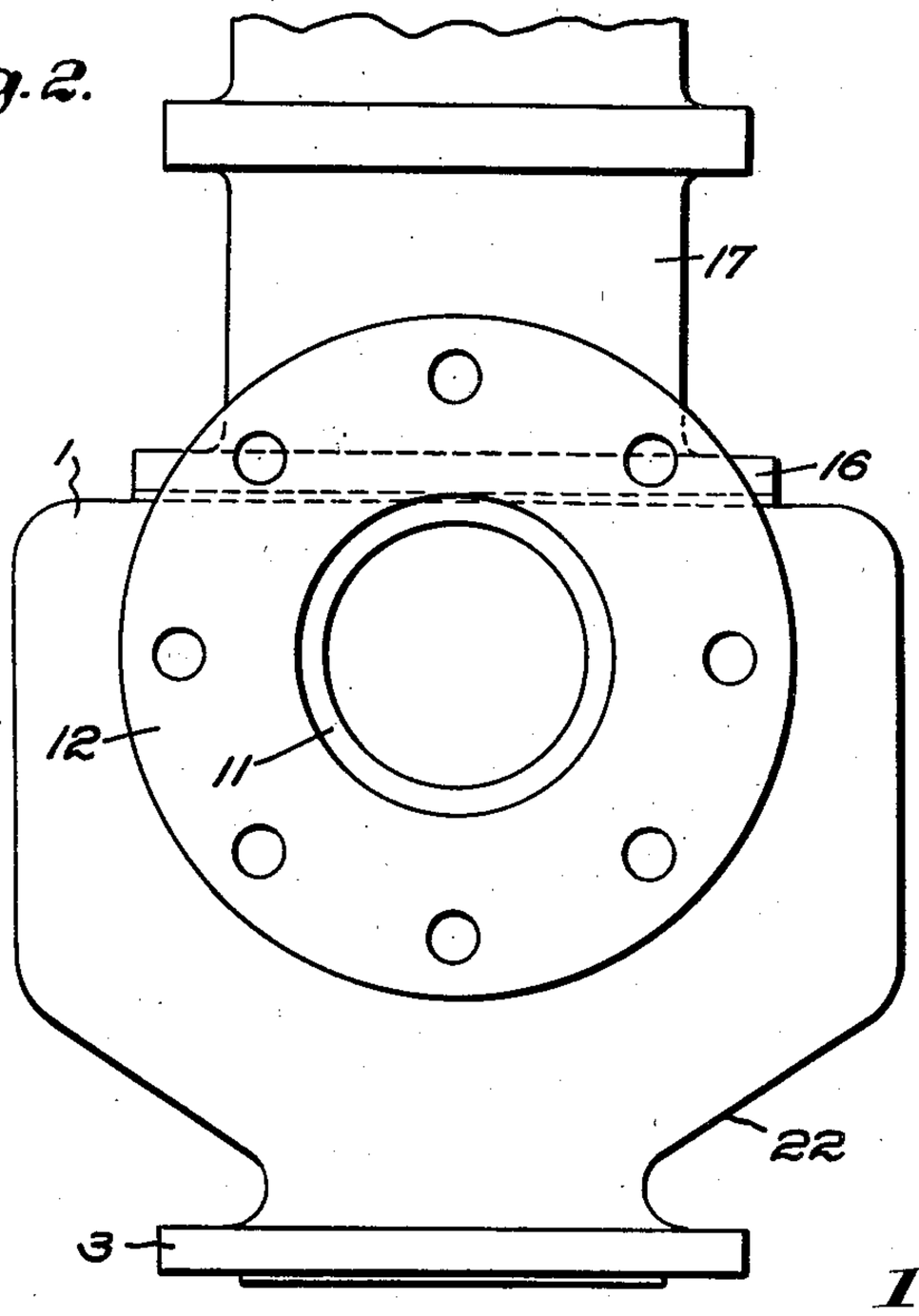

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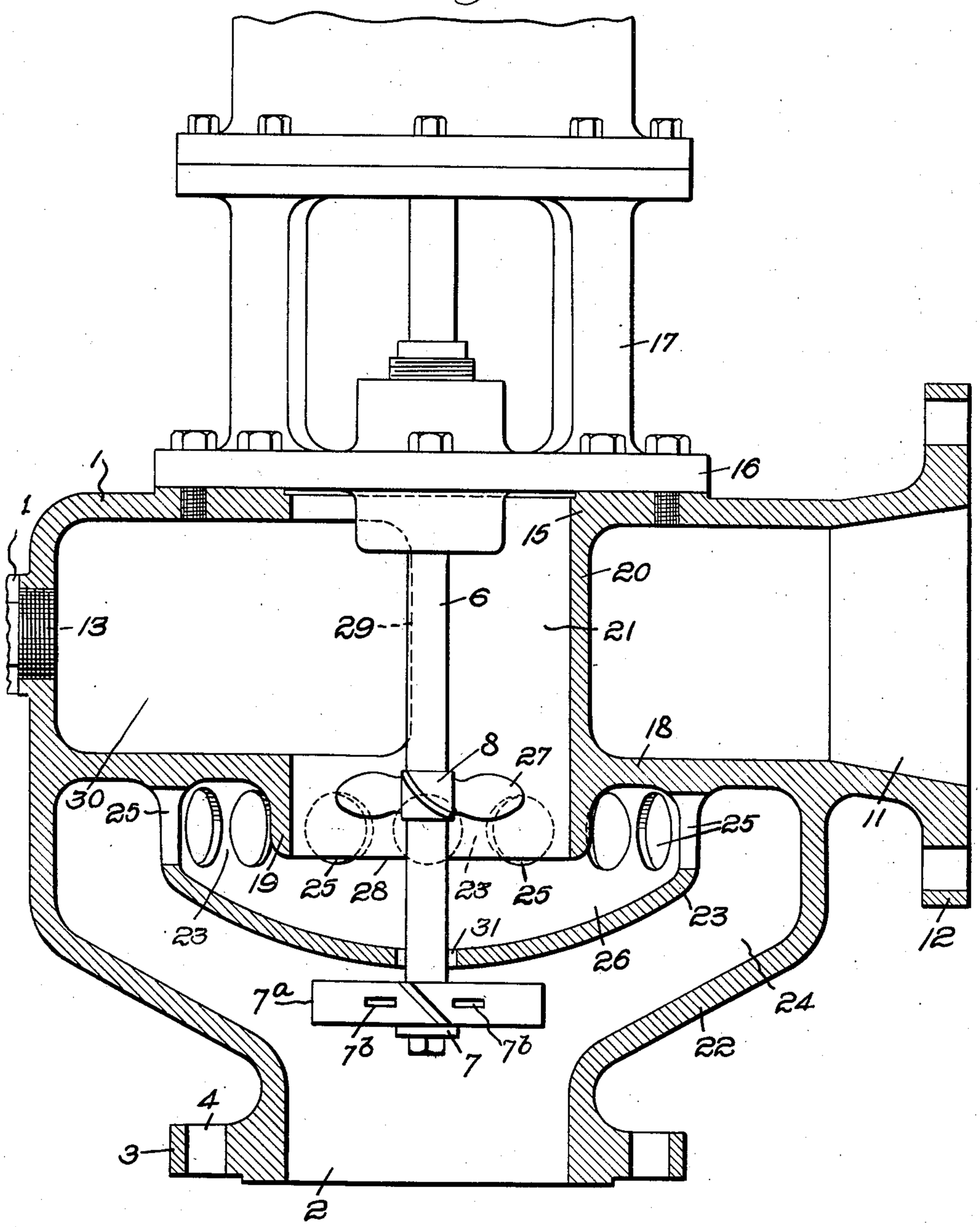
Fig. 3.



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AGITATING AND MIXING MECHANISM

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4 Claims. (Cl. 259—7)

This invention concerns agitating and mixing means or mechanisms for performing such functions generally with respect to two or more liquids, semi-liquids, or liquid and gas, and one or more solid or dry materials, and its aim is to perform such mixing and agitating operation, as a continuous operation, as distinguished from the batch method, and to a more complete or perfect degree than is now done by any means known to me.

With the constantly increasing manufacture and use of synthetic products, the question of complete mixing and agitating of the materials used becomes constantly of greater importance. While my novel agitator is adapted for use in many arts, including the treatment for purifying and otherwise treating various oils and the like, it is very successfully used, for instance, in refining petroleum for making gasoline, and it conveniently may be described in that connection as one illustration of its value and mode of operation.

As is well known by those familiar with the art of refining heavy oils, as crude petroleum, whether for lubricating purposes of making gasoline, the product of the various steps in the art, before it can be distributed to the public, must be purified for color, the removal of tarry and asphaltic and other materials, and to neutralize or remove from it a very strong and disagreeable odor. This step in the process is sometimes called the sweetening of the so-called "sour gas". The globules of the liquid before treatment are known as mercaptans, and after treatment and purifying, as mercaptides. For this purpose generally, immiscible reagents, such as sulphuric acid, water, alkali and frequently sodium plumbite, a derivative of litharge treated with caustic soda, is introduced into the so-called "sour gas", which, however, while effective as a purifying agent to remove the offensive odor, leaves an element that must be removed. This use of the sodium plumbite introduces so much lead into the gas that the excess must be removed, as by precipitating it in the form of a powder, usually with the aid of flour of sulphur, sulphuric acid or liquid of sulphur.

At the present time, for the above purpose, by one known process, the product is passed through a series of orifice towers or tubes, so-called, each provided with a series of staggered baffle or orifice plates, the result being that the constantly changing of the direction of flow of the gasoline from one plate to the next will so agitate the liquid as to precipitate the excess sulphur from the liquid. The precipitate, however, does not remove all the sulphur or other immiscible material, owing, as I believe, to the incomplete and ineffective agitating and mixing of the materials used for the purpose.

In the drawings of one embodiment of my invention selected for disclosure and description herein:

Fig. 1 is a plan of my mixing and agitating mechanism, a portion being broken away to show certain parts as described;

Fig. 2, a side elevation from the right; and

Fig. 3, a vertical section looking toward the right, and on an enlarged scale.

The mixing and agitating mechanism, Fig. 3, comprises an housing member 1, herein generally curvilinear, of suitable size, for the work in hand. The outer wall of the housing is provided at any suitable point, in this instance on its lower face, with an intake opening 2, and any suitable means as a flange 3, with bolt apertures 4, for securing the housing to any standard supply or feed pipe connection, not shown, with the source of supply. Obviously, the form of the connection may be as desired. The reagent, or reagents, to be used are fed into the supply pipe in suitable quantities, as desired, ahead of the connection 3, and between it and the supply reservoir. In my improved process, I rely, as important, in securing intimate contact of the globules by changing the shape of the material-stream body itself frequently, during agitation, and thus to change the location of the different globules in the stream, as productive of best results, instead of depending largely upon effecting contact of the globules with each other generally in the same location or environment, as by forcing the oil through small orifices, or over baffle plates, and thus to promote intimate contacting of the reagent globules with those of the oil.

The agitating element, as the turbine 7, has its blades 7*a*, at the proper pitch, each provided with an elongated opening 7*b*, to permit some of the material being agitated to pass through the blade and fill up any vacuum created behind the blade during its rotation, and thus offset any retarding effect of such vacuum on the movement of the material by the blades.

At any suitable point, herein at the right-hand side of the housing, Fig. 3, is a discharge orifice or port 11, provided with any desired means, as a suitable flange 12, for connecting it to a discharge or delivery pipe, not shown.

Opposite this discharge pipe, in this instance, is an aperture 13 to receive a threaded support

for the core in the mold, not shown, for the housing, when the element is cast, and which support is of course removed at the foundry when the casting is finished, and the aperture 13 is then closed by any convenient means, as a threaded plug 14.

The opening 15 at the top of the housing is closed by the base plate 16 of the base 17 for the agitator motor, or drive, broken away.

The interior of the said housing is provided with a series of novel chambers, or chambers and passages, for agitating and mixing, as suggested above, both or either liquid, gas and dry materials, for securing the greatest possible contacting of the globules of the different materials in different stream locations, and the means shown, and which has proven to be the most thorough and effective of any I know of, has, as its object, the substantially alternate dividing or splitting up of the main stream of mixed materials introduced into the feed line, into separate, smaller and differently-shaped bodies and streams, and the subsequent consolidation of them as the mass is agitated on its way through the agitator housing. These chambers or containers may, obviously, be constructed integral with the housing or not, as preferred.

To this end, radially of the interior of the housing, there extends a horizontal chamber-forming partition 18, which is broken at its central portion, and provides, by means of a downwardly-extended curved flange 19 and an upwardly like extended wall 20, a curvilinear chamber 21 for the motor shaft 6, the motor omitted for convenience, carrying the turbine member 7, already referred to, and propeller 8, all mounted in suitable bearings in the base 17, and which has another important purpose, to be described.

Between the flange 19 and the lower outside wall 22 of the housing, there depends from the partition 18 a downwardly and radially-extended, convex wall 23, of such shape that it forms, in the space below it, a saucer-shaped, turbulence and material-column receiving and mixing chamber 24, which is, in effect, an extension radially in all directions of the mouth or admission port 2, the depth of this chamber being relatively shallow. The entering material stream flow in the chamber 24 comes in contact at once with the very rapidly revolving blades of the turbine, which centrifugally tends to violently disarrange the normal tendency of the different elements in the stream to maintain relatively their same position in the stream as it flows, by creating a maximum of swirling turbulence.

The degree of incline of these blades of the turbine tends further to increase this turbulence or position-changing intermingling of the various elements, by causing a very greatly accelerated contact with the convex underside of the wall 23 above the chamber, with the result that when the flow reaches the upper section of the lower compartment 24, we have a very rapid, active, swirling turbulent condition, with the convex wall 23 tending to divide the incoming material stream through the port 2, and form the material mass into a hollow cylindrical body at its upper end near the partition 18, to further effect the position-changing action of the particles, or globules.

In the wall 23, near its upper edge, there are provided a plurality, herein 16, material-stream-dividing openings or ports 25, at right angles to the upper edge of the saucer-shaped material-body, to a central, material-swirling and stream-uniting chamber 26 between the wall 23 and the partition 18. The swirling action created by the turbine 7 and circular form of the chamber is materially reduced or counteracted by this division of the swirling hollow cylinder of elements into sixteen sub-divisions; and through the abrupt counteracting of the swirling tendency, and the division of the stream into smaller subdivisions, a further intermingling, position-changing and frictional contacting of the globules of the various elements are brought about by bringing the smaller streams together and consolidating them again into a common stream mass. There is every reason to believe, from the results achieved, that the intermingling and frictional particles of the mixed materials is much more thoroughly effected by the steps above described than by any means now in use.

From the chamber 26 the material mass is forced, and its shape again changed, on its upward way by the propeller 8, provided with properly shaped and spaced blades 27, calculated to impart a strong lifting action, and to drive the material upwardly from the chamber 26 to the cylindrical chamber 21, through the port or open end 28 of the chamber, still further changing the positions of the globules in the mass stream, and thus again compressing the several swirling streams from ports 25 into one stream in the cylindrical chamber 21. Finally, it is again divided into two streams, by driving it through the port 29 in the upright wall 20 into the circular passage 30 both to the right and left from the port, Fig. 2, part of the material going each way to the exhaust port 11, where the precipitate, or sludge is deposited in any suitable container, and the gasoline also to a suitable container, not shown. Any sludge that may collect in the chamber 26 may also escape by means of the enlarged shaft opening 31 in the wall 23.

This propeller 8 performs two functions, one is the further mixing of the stream flow and bringing about another marked frictional contacting of all elements; and at the same time, it counteracts the tendency of the lower compartment to check the normal flow of the liquid through the piping, and actually does accelerate the flow to this point, so that the device is not an obstruction to the normal flow through the piping.

In any event, the result is the most perfectly and completely blended mixture of ingredients that can be conceived, and, as stated, is believed largely to be the result of violently agitating the incoming stream, through successively splitting up into smaller streams the large incoming stream of material, then changing its direction of flow sharply at the ports 25, while dividing it into several smaller streams and subsequently, after it has again become one mass and intermingled, passing it again upward as one stream through the chamber 21, and compressing it by the member 8, and then splitting it laterally again through the passage 30 to the exit, where the precipitate is deposited.

By this means, the several globules of gasoline and other ingredients at different places in the material-stream are not simply caused to contact their neighbors, but the material mass itself is completely broken up, and its shape or outline changed, and the globules brought into contact with new neighbors.

The use of this mixing means is by no means confined to the sweetening of gas in the oil industry. It is designed and has a practical ap-

plication for any process that requires the complete and thorough mixing of two or more elements or ingredients, regardless of their nature, provided the consistency is such that they may be handled or transported through a piping system, as the introduction of chlorine and the like into water for purifying it, and it is believed will be found of very great value in accomplishing the very desirable change in manufacture from the batch process to the continuous process of manufacturing a great number of products.

My invention is not limited to the precise construction shown herein, but may be modified in many details, without departing from the spirit of the claims, and within the scope thereof.

I claim:

1. An agitator and mixer for liquids and dry materials comprising a generally cylindrical casing contracted at one end to provide an inlet port; a radially-extended partition in the casing dividing the same into two major portions; a central opening in said partition with a collar about its edge; the partition having a bowl-shaped wall spaced from said collar and provided with radially-positioned, particle-contacting-identity-changing ports, and forming a material-stream-consolidating, bowl-shaped chamber; the convex side of said bowl-shaped wall also forming, with the housing wall, a saucer-shaped chamber, said chamber being connected with the bowl-shaped chamber by said ports; the partition having on its face opposite the collar an axial wall, forming, with said collar, an axial passage, said wall forming, between the passage and casing, a curvilinear two-direction passage for the materials, and a discharge port therefrom in the casing.

2. An agitator and mixer for liquids and dry materials, comprising a generally cylindrical casing having at one end an inlet port; a radially extended partition in the casing dividing the same into two major portions; an opening in said partition with an axially-extended collar about its edge; the partition having thereon a bowl-shaped wall spaced from said collar, forming a like-shaped chamber, provided with radially positioned ports; the convex side of said wall also forming, with the casing wall, a saucer-shaped material-stream - radially - expanding chamber radially enclosing and connected with the bowl-shaped chamber by said ports; the partition having, on its opposite face, an axial wall, forming, with said opening, an axial passage, and forming also, between the passage wall and casing, a curvilinear passage; a discharge port therefrom in the casing and an agitating element in said saucer-shaped chamber and an impeller for the materials between the saucer-shaped chamber and the curvilinear passage.

3. An agitator and mixer for liquids and dry materials comprising a casing provided at one end with an inlet port; a radially extended partition in the casing dividing the same into a plurality of chambers and passages; an opening in said partition with a collar about one edge; the partition having a bowl-shaped wall depending therefrom and provided with radially-positioned material-stream-dividing ports, and forming a bowl-shaped chamber; the convex side of said bowl-shaped wall also forming with the housing wall a saucer-shaped material-stream-dividing chamber, connected with the bowl-shaped chamber by said radially positioned ports; the partition having on its face opposite the collar a curvilinear wall, forming with said collar an axial passage, and forming, between the passage and casing, a curvilinear passage with a port opening into the axial passage and a discharge port at each end of said curvilinear passage in the casing, and an agitating element between the inlet and discharge ports.

4. An agitator and mixer for liquids and dry materials comprising a generally cylindrical casing contracted at one end to provide an inlet port; a diametrically extended partition in the casing providing therein two major portions; a central opening in said partition with an axial collar thereabout; the partition having a bowl-shaped wall between said collar and casing with radially positioned ports, forming a bowl-shaped material-stream consolidating chamber; the convex side of said bowl-shaped wall also forming with the casing wall a saucer-shaped material-stream expanding chamber, and connected with the bowl-shaped chamber by said ports; the partition having on its face opposite the collar an axial wall, forming with said collar an axial passage, and forming between the passage and casing a circumferential passage, a discharge port therefrom in the casing, and a material impeller in the axial passage.

WARREN O. CHACE.