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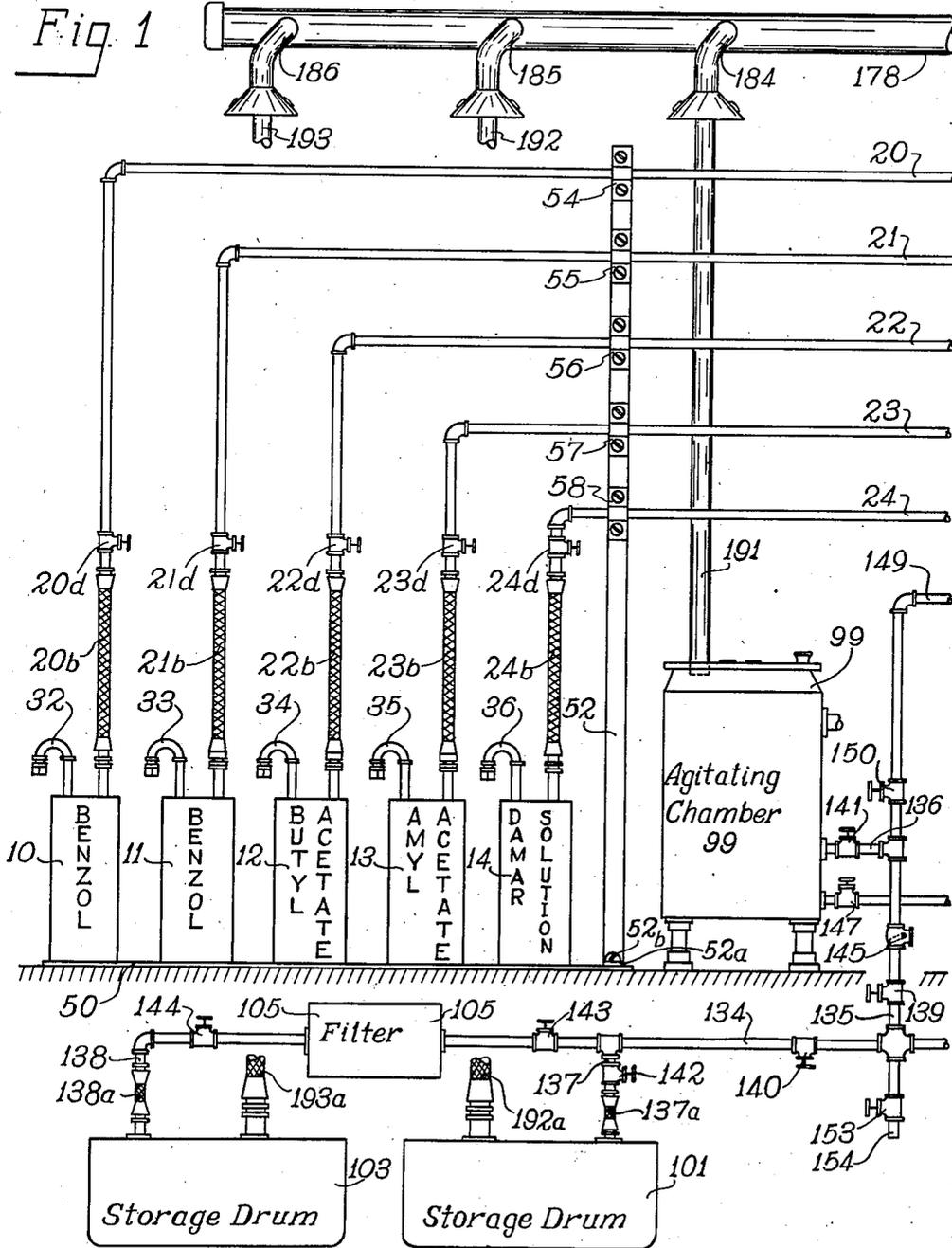
A. DE V. HARNETT

2,343,454

METHOD AND APPARATUS FOR MIXING LIQUIDS

Filed July 20, 1940

3 Sheets-Sheet 1



INVENTOR  
A. De Vere Harnett  
BY  
Davis, Lindsey, Smith & Skotts  
ATTORNEYS

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A. DE V. HARNETT

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3 Sheets-Sheet 2

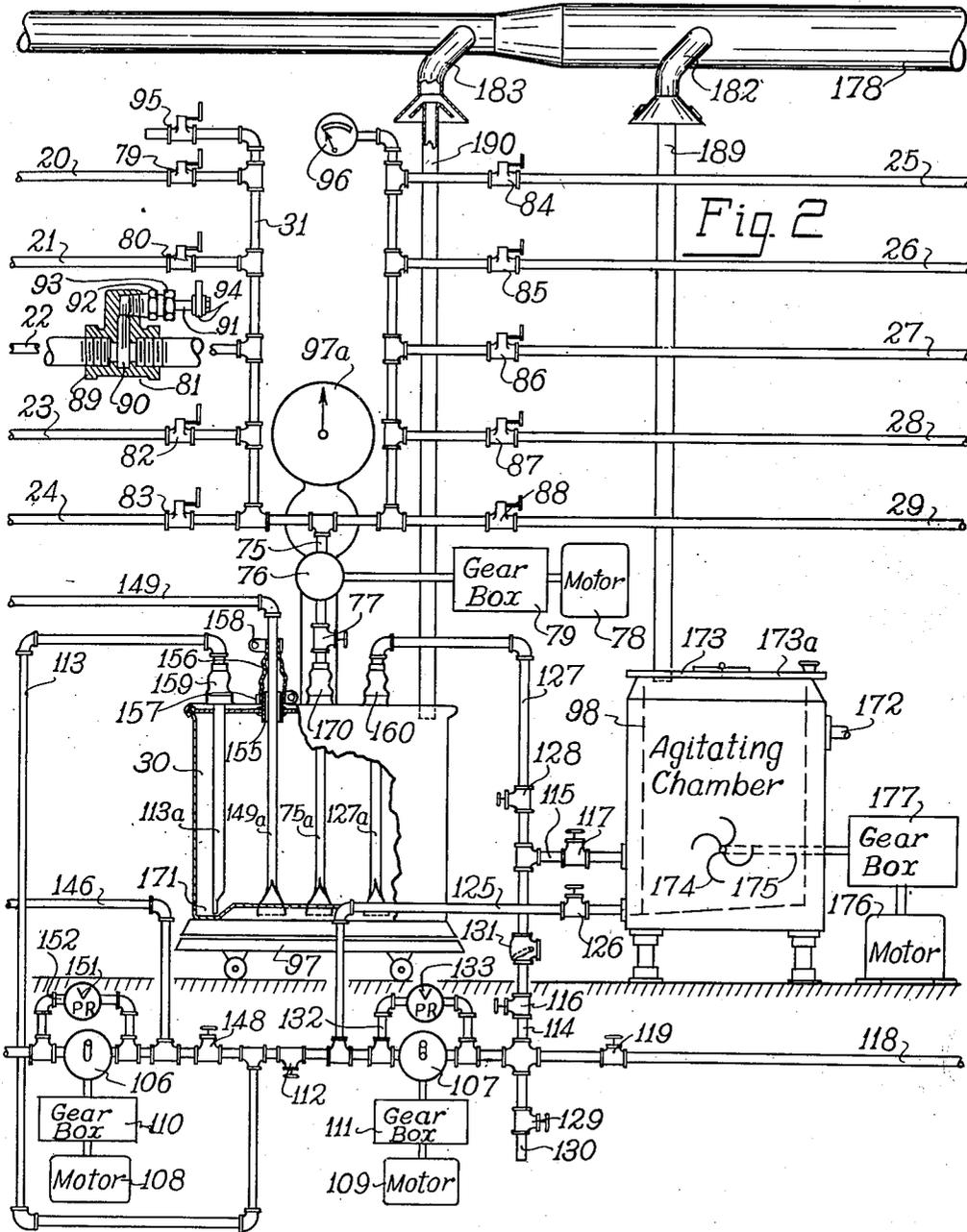


Fig 2

INVENTOR  
A. De Vere Harnett  
BY  
R. W. Lindsey, Smith & Shonta  
ATTORNEYS

March 7, 1944.

A. DE V. HARNETT

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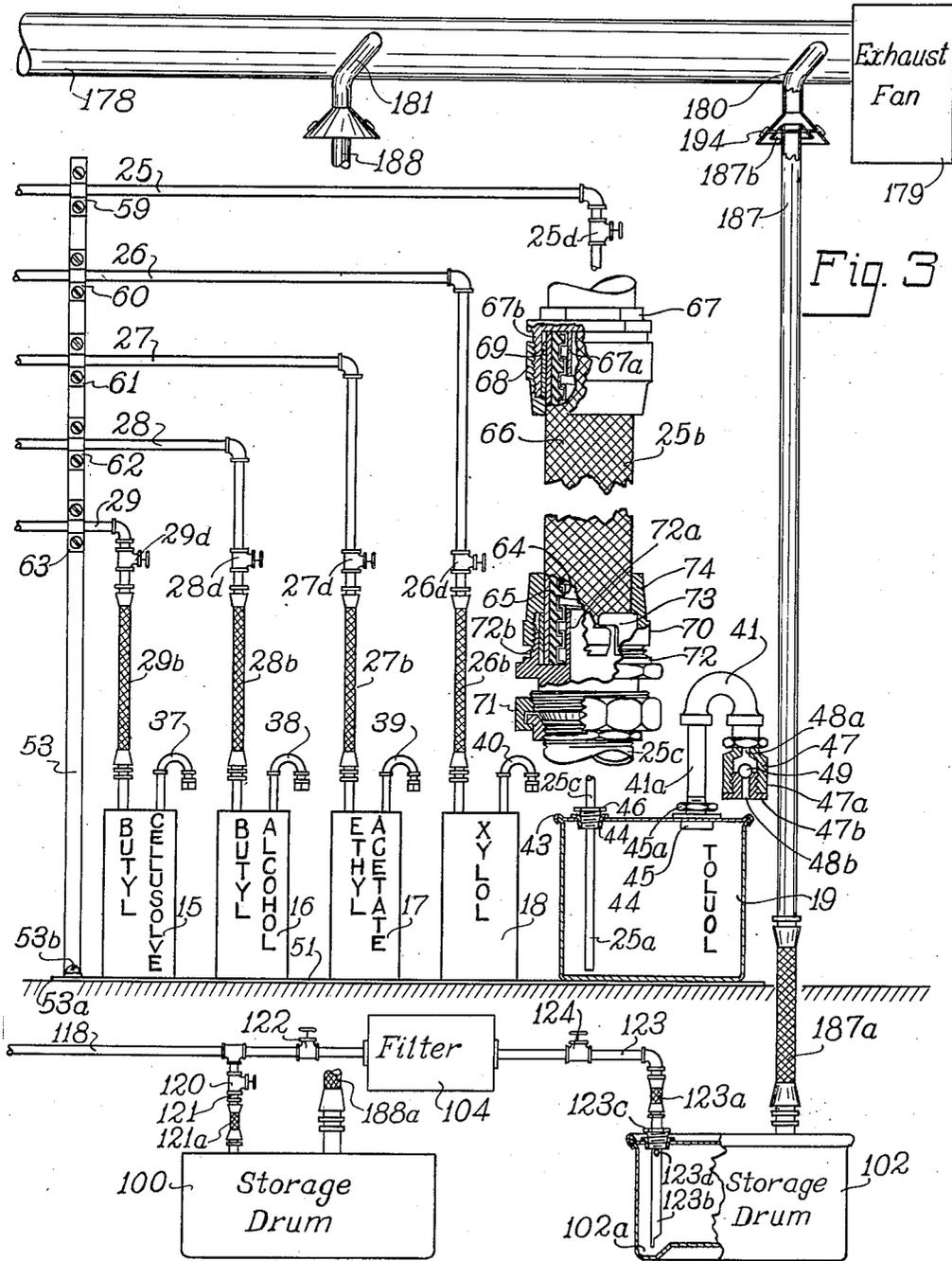


Fig. 3

INVENTOR  
A. De Vere Harnett  
BY  
Davis, Lindsey, Smith & Skoute  
ATTORNEYS

# UNITED STATES PATENT OFFICE

2,343,454

## METHOD AND APPARATUS FOR MIXING LIQUIDS

A. De Vere Harnett, Racine, Wis.

Application July 20, 1940, Serial No. 346,609

19 Claims. (Cl. 259-64)

The present invention relates to improved apparatus and an improved method for mixing lacquers, paints, enamels, varnishes, liquors and the like, certain of the constituents of which are extremely volatile and highly inflammable liquids.

It is an object of the present invention to provide improved apparatus of the character described which is of simple arrangement and is easily controllable to produce any desired quantity of a product of the class described, the different batches of which may differ in character.

It is another object of the invention to provide apparatus of the character described which is arranged in an improved manner such that the liquids to be used in a particular batch of a desired product may be transmitted to a common mixing chamber and the quantity of each liquid admitted to the mixing chamber accurately controlled and measured with a minimum of apparatus and a minimum number of control operations.

It is a further object of the invention to provide improved apparatus of the character described which is particularly adapted for use in a small mixing plant and is so arranged that the fire hazard attendant with the mixing of easily vaporized and highly inflammable liquids is reduced to a minimum.

It is another object of the invention to provide improved apparatus of the character described which is so arranged that all of the parts are maintained at ground potential to preclude electrical discharges therebetween, and all of the liquid chambers, containers and conduits are effectively sealed to prevent the escape of inflammable vaporization products to the surrounding atmosphere.

It is a still further and more specific object of the invention to provide improved apparatus of the character described wherein all of the chambers and containers to which the volatile liquids are transmitted are, during use of the apparatus, partially exhausted to remove therefrom any vaporization products resulting from the transmission and mixing of the liquids.

It is another object of the invention to provide an improved method of mixing a product of the character described wherein large or small batches of a product having the same or different characteristics may be mixed as desired with a minimum amount of apparatus and a minimum number of steps.

It is a further object of the invention to provide an improved method of the character described wherein the steps are so arranged that the quantity of each liquid utilized in mixing a batch of a desired product may be accurately controlled and measured.

It is still another object of the invention to provide an improved method of the character described wherein the vaporization of the volatile

liquids is reduced to a minimum and the escape of vaporization products from the apparatus utilized in practicing the method is positively prevented.

5 It is a still further and more specific object of the invention to provide an improved method of mixing lacquers, paints, enamels and the like, wherein the steps are so arranged that the constituents of the desired product and the constituents of a thinner therefor may be mixed at the same time and with the same apparatus.

10 The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawings in which Figures 1, 2 and 3, 15 when placed side by side in the order named, illustrate partially schematically and partially in detail apparatus connected and arranged in accordance with the present invention and capable of utilization in practicing the improved method 20 disclosed herein.

25 Referring to the drawings, the apparatus there illustrated comprises a plurality of containing chambers 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19 which, if the apparatus is to be utilized in mixing lacquers, for example, may comprise drums respectively containing the liquids identified by the names appearing thereon. These containing chambers are interconnected by a conduit system comprising feed pipes or conduits 20, 21, 22, 23, 24, 25, 26, 27, 28 and 29 with a mixing chamber 30. More specifically, each of the enumerated conduits is connected to communicate with a substantial U-shaped header 31 which is provided at suitable intervals along the legs thereof with T-joints for connection with the respective ends of the enumerated feed conduits. These conduits have included therein auxiliary control valves 20d, 21d, 22d, 23d, 24d, 25d, 26d, 27d, 28d and 29d, respectively, which are provided in order 40 to permit the disconnection of the feed conduits from empty containing drums and the connection thereof to filled drums while the apparatus is being used. Normally, the enumerated auxiliary control valves are left open. The containing chambers 10 to 19, inclusive, may each comprise 45 the usual liquid shipping drum and each is provided with two openings through the top wall thereof, one of the openings being utilized for effecting a connection with the associated feed conduit and the other opening being provided for the purpose of venting the interior of the drum to the surrounding atmosphere. To this end, inverted U-shaped conduits 32, 33, 34, 35, 36, 37, 38, 39, 40 and 41 are provided which 50 communicate respectively with the drums 10, 11,

12, 13, 14, 15, 16, 17, 18 and 19 in the order named. Each of the enumerated U-shaped conduits terminates in a check valve which is directed to permit the admission of air to the associated chamber and to prevent the escape of vaporization products or gases from the associated chamber. The manner of connecting the conduits 20 to 29, inclusive, and 32 to 41, inclusive, with their respective associated drums is the same in each instance and, accordingly, will be readily understood from a consideration of the arrangement of the drum 19 illustrated in Fig. 3. This drum is provided with a cover plate 43 having two openings therein into which are sealed or fabricated internally threaded connection plugs 44 and 45, respectively. One section 25a of the conduit 25 is provided with an intake end disposed adjacent the bottom of the drum 19 and is threaded into a connecting thimble 45 which, in turn, is threaded into the plug 44. A second section 25c of the conduit 25 is threaded into the upper end of the thimble 46. The inverted U-shaped conduit 41 includes a section 41a which is threaded into a thimble 45a which, in turn, is threaded into the plug 45. The other end of the conduit 41 is connected to a check valve 47 of the movable ball type. More specifically, this valve comprises a body member 47a and a cap 47b having communicating openings 48a and 48b extending therethrough, which openings communicate with the interior of the drum 19 through the conduit 41. The upper end surface of the cap 47b is tapered downwardly to provide a seat for receiving a check ball 49, this ball normally being sealed in place over the opening 48b by the force of gravity to prevent vaporization products or gases generated within the drum 19 from escaping to the surrounding atmosphere. It will be understood that when the pressure within the drum 19 is decreased below atmospheric pressure, the ball 49 is moved slightly to unblock the opening 48b and thus permit air to flow into the drum 19.

The drums 10 to 19, inclusive, are supported by and electrically connected to two metal plates 50 and 51 which, preferably, rest upon the ground or are otherwise connected to ground by running conductors therefrom to a nearby water pipe. These plates are supported and electrically connected to two metal posts 52 and 53, respectively, which form the supporting and electrical grounding structure for the feed pipes 20 to 29, inclusive. More particularly, the metal post 52 is provided with feet 52a which are anchored to the plate 50 by means of bolts or screws 52b. Similarly, the feet 53a of the post 53 are anchored to the plate 51 by means of screws or bolts 53b. For the purpose of securing the conduits 20 to 24, inclusive, to the upstanding metal post 52, five metal clamping brackets 54, 55, 56, 57 and 58 are provided which are bolted or otherwise secured to the post 52 and serve respectively to clamp the conduits 20 to 24, inclusive, to the post 52 in the order named. In a similar manner, the conduits 25, 26, 27, 28 and 29 are clamped to the metal post 53 by means of five additional clamping brackets 59, 60, 61, 62 and 63, respectively.

In order to facilitate the interconnection of the conduits 20 to 29, inclusive, with the liquid containing drums 10 to 19, inclusive, or with other drums containing the same or different liquids, these conduits are individually provided with flexible sections 20b, 21b, 22b, 23b, 24b, 25b, 26b, 27b, 28b and 29b, each of which

is identical in construction with the flexible conduit 25b shown in Fig. 3. More particularly, the flexible conduit 25b comprises a flexible metal liner 64, an intermediate layer of rubberous material 65 and an outer covering 66 of fabric or flexible composition material. This flexible conduit section is connected at its upper end to the end of the adjacent section of the conduit 25 by means of a coupling connection which comprises mating members 67 and 68 and a split annular ring 69. The upper portion of the coupling member 67 is internally threaded to receive the threaded end of the adjacent section of the conduit 25 and is provided with a downwardly extending ledge 67a formed integral therewith and over which the upper end of the flexible conduit 25b is telescoped. In order to clamp the end walls of the flexible conduit 25b against this ledge the coupling member 67 is provided with an externally threaded annular portion 67b which is split longitudinally around its circumference, and the mating threads of this annular member and the other coupling member 68 are tapered. Accordingly, the several sections of the annular member 67b compress the split ring 69 to seal the end side walls of the flexible conduit 25b against the ledge 67a as the two coupling members 67 and 68 are screwed together. The lower end of the flexible conduit 25b is secured to the adjacent conduit section 25c by means of a similar coupling element 70 which includes a union joint 71 of conventional construction and arrangement. More specifically, the coupling element 70 includes a body member 72, a split annular ring 73 and an annular compression member 74. The body member 72 is provided with an annular upstanding ledge 72a over which the lower end of the flexible conduit 25b is telescoped, and with a second externally threaded upstanding member 72b which is longitudinally split and cut away at points around its circumference to provide compression fingers. The member 72b is provided with tapered external threads which mate with the tapered internal threads of the compression member 74. As thus arranged, when the compression member 74 is screwed onto the annular member 72b, the split ring 73 is compressed to force the end side walls of the flexible conduit 25b against the ledge 72a and thus provide a gas-tight seal. From the foregoing explanation it will be apparent that the metal liner 64 which traverses the length of the flexible conduit 25b and at opposite ends thereof is compressed against the ledges 67a and 72a, provides an electrical connection between the coupling elements 67 and 70 whereby the coupling element 70 is maintained at the same electrical potential, namely, ground potential, as the other parts of the apparatus. As a result, electrical discharges in the form of ignition sparks between the coupling element 70 and a liquid containing drum which may be moved into place on the supporting plate 51 for connection with the feed pipe 25 are positively prevented.

The common header 31 at which conduits 20 to 29, inclusive, terminate is connected to communicate with the mixing chamber or tank 30 through a connection 75 which has serially included therein a vacuum pump 76 and a control valve 77. The vacuum pump 76 which is provided for the purpose of exhausting the header 31 to create a partial vacuum therein during operation of the apparatus, is preferably of the meshing gear type and is arranged to be driven by a motor 78 through a speed reducing gear

mechanism 79. In order selectively to expose the conduits 20 to 29, inclusive, to the vacuum created in the header 31 through operation of the pump 76, thereby to permit the liquids contained in the drums 10 to 19, inclusive, selectively to be withdrawn into the mixing chamber 30, the enumerated conduits are respectively provided with admission valves 79, 80, 81, 82, 83, 84, 85, 86, 87 and 88. These valves are preferably of the well-known gate type and are of identical construction. Briefly described, the valve 81 which is illustrated in detail, by way of example, comprises a body member 89 which is provided with oppositely disposed internally threaded portions into which the ends of the adjacent pipe sections are threaded. In the central portion of the body member 89 a semi-annular shaped slot is formed to provide oppositely disposed valve seats arranged to receive therebetween a valve gate 90. This valve gate is mounted at one of its ends upon an operating spindle 91 which is journaled in a plug member 92. This plug member is threaded into an internally threaded opening drilled through the body member 89 into the gate receiving slot and is provided with a small stuffing box. This stuffing box is packed with sealing material and is threaded internally to receive the threaded end of a sealing cap 93 which is telescoped over the spindle 91. The spindle 91 is provided at its free end with an operating handle 94 which is rigidly secured to the spindle 91 in any desired manner. This type of valve is particularly well suited for use in the apparatus since it is easily and quickly operable between its fully opened and fully closed positions and permits of positive adjustment to a partially opened position where it will remain even though substantial pressures are exerted on the valve gate 90.

For the purpose of venting the common header 31 to the surrounding atmosphere, thereby positively to withdraw from the header any residue liquids or gases which may be held therein following closure of one of the admission valves 79 to 88, inclusive, a vent valve 95, identical in construction with the valve 81, is provided which is connected to the upper end of the left leg of the header. The other leg of the header 31 is connected to a vacuum gauge 96 which is provided for the purpose of measuring the decrease in pressure which occurs within the header during operation of the pump 76, thus providing an indication as to when this pressure has been sufficiently lowered to enable the liquids to be withdrawn from the containing chambers 10 to 19, inclusive.

In order to measure the liquids selectively withdrawn into the mixing chamber 30 from the containing chambers 10 to 19, inclusive, weighing apparatus comprising a set of platform scales 97 is provided. More specifically, the mixing chamber 30 is supported upon the weighing platform of these scales and is arranged in the manner more fully described hereinafter for substantially free movement with the moving parts of the scales, whereby indications are given by the indicating element 97a of the scales 97 as to the quantity of each liquid discharged into the mixing chamber.

The liquids withdrawn into the mixing chamber 30 from the drums 10 to 19, inclusive, may selectively be discharged into either of two agitating chambers 98 and 99. Alternatively, the contents of the mixing chamber 30 may be discharged directly into either of two storage drums or con-

tainers 100 and 101, or through filters 104 and 105 into either of two additional storage drums or containers 102 and 103. To this end, two discharge pumps 106 and 107 are provided which are interconnected with the mixing chamber 30, the two agitating chambers 98 and 99, the storage drums 100 to 103, inclusive, and the filters 104 and 105 by means of a conduit system having suitable control valves provided therein. These pumps are arranged to be driven by motors 108 and 109, respectively, through suitable speed reducing gear mechanisms 110 and 111, respectively. The filters 104 and 105 are preferably of the gravity flow discharge type and may be of any desired commercial construction suitable for use in filtering viscous liquids. Each of these filters is provided with a tight fitting removable cover in order to facilitate removal of its filtering element for cleaning or replacement.

The pump 107 is, in the arrangement illustrated, utilized solely to transmit liquids between the mixing chamber 30, the agitating chamber 98 and either of the two storage drums 100 and 102. To this end, the inlet side of the pump 107 is connected through a valve 112 to communicate with the mixing chamber 30 by way of an intake conduit 113 which conduit is also utilized to conduct liquids from the mixing chamber to the inlet side of the pump 105. The discharge end of the pump 107 is connected by means of conduits 114 and 115 having control valves 116 and 117 respectively included therein, to communicate with the agitating chamber 98. A check valve 131 is also included in the conduit 114 in order to prevent any possibility of backward flow from the agitating chamber 98 after operation of the pump 107 is arrested. The outlet side of the pump 107 is also connected by way of a conduit 118 having control valves 119 and 122 included therein to the intake side of the filter 104, a branch connection comprising a second control valve 120 and a conduit 121 being utilized to connect the conduit 118 with the storage drum 100. The outlet side of the filter 104 is connected to communicate with the storage drum 102 through a conduit 123 which includes another control valve 124. In order to permit the contents of the agitating chamber 98 to be returned to the mixing chamber 30 for the purpose of weighing the same, and to permit the contents of this agitating chamber to be discharged into one of the two storage drums 100 and 102, a conduit 125 is provided which communicates with the chamber 98 at the extreme bottom thereof and connects the interior of this chamber with the inlet side of the pump 107. A normally closed control valve 126 is provided in this conduit in order normally to prevent the contents of the agitating chamber 98 from flowing back to the inlet side of the pump 107. Further to enable the pump 107 to be utilized in discharging the contents of the agitating chamber 98 back into the mixing chamber 30, the discharge end of this pump is connected over a path including the conduit 114 and an additional conduit 127 having a control valve 128 connected therein to communicate with the interior of the mixing chamber. The pump 107 may also be utilized for the purpose of extracting samples from either the agitating chamber 98 or the mixing chamber 30. To this end, the discharge end of the pump 107 is also connected through a control valve 129 to a discharge pipe 130. In order to prevent excessive back pressures which may inadvertently be developed in the conduits 114 and 118 from overloading or stopping the

pump 107, a conduit 132 having a relief valve 133 connected therein is provided which connects the intake and discharge ends of the pump. This relief valve is so connected and arranged and is so adjusted that under normal operating conditions it remains closed, but if the pressure developed on the outlet side of the pump exceeds a predetermined value it operates to provide a circulating path and thus relieve the load imposed upon the pump.

The conduit system interconnecting the mixing tank 30, the agitating chamber 99, the two storage drums 101 and 103, the filter 105, and the pump 106 is identical in arrangement with that just described, which interconnects the mixing chamber 30, the pump 107, the agitating chamber 98, the filter 104 and the two storage containers 100 and 102. Briefly to describe this duplicate conduit system, the outlet side of the pump 106 is connected by means comprising conduits 134, 135, 136, 137 and 138 selectively to discharge liquids contained in the mixing chamber 30 into the agitating chamber 99, the storage container 101 or through the filter 105 into the storage container 103; suitable valves 139, 140, 141, 142, 143 and 144 being provided for determining the direction of liquid flow. As indicated above, the common intake conduit 113 is utilized for the purpose of conducting liquids to the inlet side of the pump 106, a control valve 112 being provided for blocking liquid flow from the conduit 113 to the inlet side of the pump 107. To prevent backward flow through the conduit 135 to the outlet side of the pump 106, a check valve 145 is provided in this conduit which is directed to permit flow into the agitating chamber 99 but to prevent backward flow from this chamber. For the purpose of conducting the contents of the mixing chamber 99 to the inlet side of the pump 106 there is provided a conduit 146 having a control valve 147 included therein. An additional conduit 149 having a control valve 150 included therein is provided which connects the outlet side of the pump 106 with the interior of the mixing chamber. In order to protect the pump 106 against excessive back pressures which may inadvertently be developed on the discharge side thereof a conduit 152, having a relief valve 151 therein is provided to connect the inlet and outlet sides of the pump 106 so that a circulating path through this pump may be established in the event the valve 151 is opened. The discharge end of the pump 106 is also connected through a control valve 153 to a discharge 154, thereby to provide a path for withdrawing samples from the agitating chamber 99 or the mixing chamber 30.

In order to permit substantially free movement of the mixing tank or chamber 30 with the moving parts of the scales 97, gas-tight flexible connectors of identical construction are utilized for sealing the openings through which the conduits 75, 113, 127 and 149 extend into the chamber 30. Thus, the section 149a of the conduit 149 extends through an enlarged opening provided in a plug 155 which, in turn, extends through an opening formed in the top wall or cover plate of the mixing chamber 30. This plug is fabricated or otherwise secured in sealed relationship to the sides of the opening formed in the cover of the mixing tank 30 through which it extends, and is provided with an upstanding annular ledge portion over which is telescoped the lower end of a flexible connector 156 formed of leather or non-porous composition material. The lower end of the flexible connector 156, after being telescoped over

the end of the upstanding annular portion of the plug 155 is clamped in place by means of a clamping strap 157 of conventional construction. The upper end of the flexible connector 156 is clamped to the outer surface of the pipe section 149a by means of a clamping strap 158. The other conduits 113, 127 and 75 include sections 113a, 127a and 75a, respectively, which are sealed to plugs inserted in the cover of the mixing tank 30 by means of flexible connectors 159, 160 and 170, respectively, of identical construction and arrangement with the flexible connector just described. Each of the conduit sections 113a, 149a, 75a and 127a communicating with the interior of the mixing tank 30 includes a flattened end portion which extends within an annular well 171 formed in the bottom wall of the tank adjacent the side walls thereof. This well is provided for the purpose of enabling a liquid pool to be quickly formed within the mixing tank 30 thereby to minimize vaporization of the more volatile liquids required in mixing a batch of a desired product.

The agitating chambers 98 and 99 are of similar construction, the chamber 98 being illustrated, by way of example, as comprising inner and outer walls which are spaced apart to define an annular heating chamber having a steam inlet conduit 172 communicating therewith. This conduit 172 may, if desired, be connected to any convenient source of steam. This arrangement permits ingredients introduced into the agitating chamber 98 to be readily heated, thereby to facilitate mixing. A removable cover plate 173 provided with a hinged portion 173a is utilized to close the top of the agitating chamber 98, the fixed portion of this cover plate being clamped tightly to the ends of the side walls of the chamber 98 in any suitable manner, and a latch mechanism, preferably of the toggle type, being provided for tightly clamping the hinged portion 173a of the cover plate to the top edge of the chamber. Further to facilitate the mixing of ingredients deposited in or transmitted to the agitating chamber 98, an agitator or beater 174 is provided which is mounted upon a shaft 175 journaled in bearings extending through the side walls of the chamber and is arranged to be driven by a motor 176 through a speed reducing gear mechanism 177. The inner bottom wall of the chamber is sloped downwardly toward the inlet end of the discharge conduit 125, thereby to insure complete drainage of the chamber when the discharge valve 126 is opened.

In order to facilitate the connection and disconnection of storage drums to the discharge conduits 121, 123, 137 and 138, these conduits are provided with flexible sections 121a, 123a, 137a and 138a each of which is identical in construction with the flexible conduit section 25b included in the conduit 25. Preferably, the storage drums used in this apparatus are identical in construction with the drum 102 which is illustrated in Fig. 3 of the drawings as including a raised bottom portion which defines an annular liquid well 102a adjacent the side walls of the drum. The discharge conduit 123 is provided with a section 123b having a flattened discharge end which extends into this liquid well. The pipe section 123a is connected to a coupling plug 123c which is threaded into a mating plug member fabricated to the top wall of the drum 102. In order to prevent excessive back pressures from being developed in the discharge conduit 123, the pipe section 123b is provided with a small opening 123d which extends through the

wall thereof at a point adjacent the inner surface of the drum cover.

In order to withdraw from the mixing chamber 30, the two agitating chambers 98 and 99, and the four drums 100 to 103, inclusive, any vaporization products or gases resulting from the mixing and transmission of the volatile liquids utilized in the manufacture of products of the character described, exhaust apparatus is provided which includes a main exhaust conduit 178 having its outlet end communicating with the intake side of an exhaust fan 179. The discharge end of the fan 179 is connected to discharge vaporization products drawn into the conduit 178 on the outside of the building in which the mixing apparatus is housed. The conduit 178 is positioned above the two agitating chambers 98 and 99 and the mixing chamber 30 and may, if desired, be supported from the ceiling of the housing structure by means of suitable suspension brackets. At suitably spaced points along its length, the main exhaust conduit 178 communicates with seven intake conduits 180, 181, 182, 183, 184, 185 and 186, each of which terminates in a downwardly extending inverted funnel shaped opening. More specifically, the enumerated intake conduits extend through openings provided in the side walls of the main exhaust conduit 178 to communicate with the interior of the main conduit at points above the bottom thereof. These intake conduits are also arranged to communicate with vapor exhaust pipes 187, 188, 189, 190, 191, 192 and 193, respectively, which extend to and communicate with the interiors of the storage drums 102, 100, the agitating chamber 98, the mixing chamber 30, the agitating chamber 99 and the storage drums 101 and 103, respectively. In order to insure adequate grounding of all parts of the exhaust apparatus, the main exhaust conduit 178 is electrically connected to a water pipe at one or more points along its length and good electrical connections are provided between all of the mechanically connected metal parts of this apparatus. The exhaust pipes 187, 188, 192 and 193 are provided with flexible sections 187a, 188a, 192a and 193a for facilitating the connection and disconnection of the associated drums to the main exhaust conduit 178. Preferably, each of these flexible exhaust pipe sections is identical in construction and arrangement with the flexible conduit section 25b included in the conduit 25. The exhaust pipes 187 to 193, inclusive, are respectively provided with reversely bent funnel shaped end portions which are disposed within the funnel shaped openings of the respective associated conduits 180 to 186, inclusive. Thus, the exhaust pipe 187 terminates in an inverted funnel shaped end portion 187b which extends within the flared terminus of the conduit 180 and is positioned with its outer walls spaced apart from the inner walls of the flared terminus of the conduit 180. This pipe is supported from the conduit 180 by means of a bolt or rod 194 which passes through aligned openings provided in the inverted funnel shaped ends of the conduit 180 and the pipe 187, suitable provisions being made for preventing lateral displacement of the pipe 187 along the supporting element 194. The exhaust pipes 188, 189, 191, 192 and 193 are similarly suspended from the flared ends of the intake conduits 181, 182, 184, 185 and 186, respectively. The exhaust pipe 190 which communicates with the interior of the mixing chamber 30 is rigidly mounted upon the cover plate of this chamber

for movement with the chamber and the moving parts of the scales 97. The inverted funnel shaped end of this exhaust pipe is disposed within the inverted funnel shaped opening forming one end of the conduit 183, the walls of these two funnel shaped openings being spaced apart so that no engagement occurs therebetween either when the chamber 30 is empty or when the chamber is filled with liquids withdrawn from the containing chambers 10 to 19, inclusive. In order partially to equalize the subatmospheric pressures developed within the various enumerated exhaust pipes through operation of the Venturi orifices thus formed between these pipes and their respective associated conduits 180 to 186, inclusive, the diameter of the main exhaust conduit 178 is decreased at one or more points along its length in the manner illustrated in the drawings.

In utilizing the apparatus briefly described above to manufacture lacquers, paints, enamels and the like the preferred practice is to provide one shipping drum for receiving the mixed lacquer, paint or enamel and a separate drum for the thinner which is used by the consumer to prepare the raw lacquer, paint or enamel for use. If this apparatus is to be used in mixing a lacquer, for example, the chambers 10 to 19, inclusive, may respectively be utilized as containers for the liquids identified by the names respectively inscribed on these chambers. With the exception of toluol and damar solution all of these liquids are well-known solvents commonly used in the manufacture of lacquers and lacquer thinners. Toluol is a well-known diluent and damar solution a well-known resinous body ingredient also commonly used in the manufacture of lacquers. Other body ingredients which may be used and which are obtainable either in solid, crystalline or paste form, are the ester gums, alkyd resins and phenolic resins. Thus, a typical formula which may be used in mixing a four hundred pound batch of lacquer is as follows:

	Pounds
45 Solvents:	
Butyl acetate.....	64
Amyl acetate.....	32
Ethyl acetate.....	16
Butyl alcohol.....	32
50 Butyl cellosolve.....	16
Diluent:	
Toluol .....	160
Lacquer base:	
Nitrocellulose .....	40
55 Alkyd resin, phenolic resin, damar solution or the like.....	32
Dibutyl phthalate.....	8

To accompany the lacquer produced in accordance with the above formula, approximately four hundred pounds of thinner therefor would ordinarily be required. A suitable formula for this thinner is as follows:

	Pounds
65 Butyl acetate.....	80
Amyl acetate.....	40
Ethyl acetate.....	20
Butyl alcohol.....	40
Butyl Cellosolve.....	20
Toluol .....	200

Briefly to consider the method of mixing this lacquer and the thinner therefor in accordance with the above formulas, the operator or attendant first initiates the operation of the motor-driven exhaust fan 179. With this fan op-

erating, air is drawn through the orifices formed between the upstanding skirted ends of the exhaust pipes 187 to 193, inclusive, and the respective associated inverted funnel shaped ends of the intake conduits 180 to 186, inclusive, and the main exhaust conduit 178, and is discharged externally of the building housing the apparatus through the exhaust fan. As a result, a partial vacuum is created in each of the exhaust pipes 187 to 193, inclusive, and in the chambers and containers with which these pipes respectively communicate. Normally the scales 97 are adjusted so that the indicator 97a normally indexes a reading of approximately two pounds when the mixing chamber 30 is empty. When, however, operation of the exhaust fan 179 is initiated the air is withdrawn from the mixing chamber 30 and a suction pulling force is exerted on the upper end of the pipe 190 which is sufficient to cause operation of the indicator 97a to a predetermined tare indication of zero pounds. After starting the exhaust fan 179 and observing the indication of the indicator 97a to see that the reading is correct, the operator next opens the valve 77 and initiates operation of the motor 78 to drive the vacuum pump 76. Through operation of this pump a partial vacuum is created in the U-shaped header 31.

When the pressure gauge 96 indicates that a predetermined subatmospheric pressure has been developed within the header 31, the operator starts the mixing operation by opening one of the valves 79 to 83, inclusive, which is included in a conduit extending to a containing chamber having one of the desired liquids therein. These valves corresponding to the desired liquids are operated one at a time to admit only one selected liquid to the mixing chamber 30 at a time and, preferably, the less volatile of the selected liquids are withdrawn into the mixing chamber 30 first. Thus, benzol and toluol, for example, are highly volatile liquids and tend to vaporize when subjected to the agitation which occurs incident to the transmission thereof to the mixing chamber. Accordingly, if one of these liquids were admitted to the mixing chamber first a large percentage thereof would be vaporized and withdrawn through the exhaust pipes 190 and 178 by the exhaust fan 179. On the other hand, amyl acetate is not so volatile as the other liquids named. Assuming that the last-mentioned liquid is the one selected for initial admission to the mixing chamber 30, the valve 82 is operated to its open position, thereby to expose the conduit 23 and the interior of the containing chamber 13 to the partial vacuum created in the header 31 through operation of the pump 76. When this valve is opened the amyl acetate contained in the chamber 13 is, by virtue of the atmospheric pressure exerted on the surface of the liquid through the check valve contained in the conduit 35, forced through the conduit 23, the base portion of the header 31, the connection 75 and the pump 76 into the mixing chamber 30. As this liquid is initially discharged into the mixing chamber 30 a pool is formed in the annular well 171 which quickly surrounds the discharge end of the conduit section 75a. The valve 82 is held open until approximately thirty-one pounds of the amyl acetate have been withdrawn into the mixing chamber 30 to produce a corresponding reading by the indicator 97a. As this reading is approached, the admission valve 82 is gradually closed to lessen the liquid flow and is fully closed

when the reading of thirty-one pounds is obtained. After fully closing this valve the attendant opens the vent valve 95, thereby to permit the residue liquid which is held in the header 31 and the section of the conduit 23 connecting this header with the valve 82 to be withdrawn through the conduit 75 and the pump 76 into the mixing chamber 30. In practice, it has been found that approximately one pound of liquid will be withdrawn into the mixing chamber after an admission valve is fully closed. In this way the desired amount of thirty-two pounds of amyl acetate is accurately withdrawn into the mixing chamber 30. Before opening a second of the admission valves the vent valve 95 is closed so that a partial vacuum is again created in the header 31 through operation of the pump 76.

If, following the withdrawal of the amyl acetate into the mixing chamber 30, the butyl acetate, butyl cellosolve, ethyl acetate, butyl alcohol and toluol are withdrawn into the chamber in the order named, the admission valves 81, 83, 85, 87 and 84 are opened and closed one at a time. By an accumulative weighing process the amount of each liquid as determined by the above formula may be accurately measured. Following the closure of each of these valves and before the next admission valve to be operated is opened, the vent valve 95 is operated for the purpose of withdrawing any residue liquid held in the header 31 and the one of the associated conduit sections which extends to the last operated admission valve.

From the foregoing explanation it will be apparent that each of the liquids discharged into the mixing chamber after the amyl acetate is introduced therein is discharged beneath the surface of the liquid pool formed in the well 171. As these liquids are transmitted from their respective containing chambers to the mixing chamber 30 they tend to vaporize, but the resulting vapors, upon entering the liquid pool are by condensation reconverted into liquids. Accordingly, the exhaust apparatus is prevented from withdrawing a substantial portion of the volatile liquids while in a vaporous state. A substantial reduction in the quantity of liquids wasted during the mixing thereof is thus effected. Further, by discharging the liquids into the mixing chamber beneath the surface of the liquid pool formed in the well 171 the intermixture thereof is enhanced.

After the thinner for the lacquer has been measured and mixed in the mixing chamber 30 in the manner just explained, it may be transmitted to the agitating chamber 98, for example, for mixing with the base or body substance of the lacquer. To this end, the motor 109 is started to initiate operation of the pump 107; the valves 126, 128, 119, 129 and 143 are closed; and the valves 112, 116 and 117 are opened. After the enumerated control valves have been operated in the manner indicated and the motor 109 has been started, the pump 107 operates to transmit the mixed liquids contained in the mixing chamber 30 to the agitating chamber 98 over a liquid flow path which comprises the common discharge conduit 113, the valve 112, the pump 107, the conduit 114, the valve 116, the conduit 115 and the valve 117. Initially, only a small portion of the batch of the mixed liquids contained in the mixing chamber 30 is admitted to the agitating chamber 98, the valves 112 and 117 being closed temporarily to arrest the liquid transmission

after the desired quantity of liquid is discharged into this agitating chamber. After these valves are closed the cover door 173a is opened and the base or body substance of the lacquer, which may be in solid, crystalline or paste form, is deposited in the agitating chamber 98. This body substance may, as was pointed out above, consist of forty pounds of nitro-cellulose, thirty-two pounds of an alkyd or phenolic resin, and eight pounds of dibutyl phthalate. After the base or body substance of the lacquer is thus introduced into the agitating chamber 98, the door 173a is closed and latched and the motor 176 is started to initiate operation of the agitator 174, thereby to intermix the lacquer base with the liquid mixture which has been previously conducted to the agitating chamber.

As agitation of the mixture contained in the chamber 98 progresses the valves 117 and 112 may again be opened for the purpose of discharging the remaining contents of the mixing chamber 30 into the agitating chamber 98. If desired, these valves may be opened and closed intermittently in order to admit only a small portion of the liquid mixture to the agitating chamber as the mixing of the liquids with the lacquer base progresses.

After all of the liquid mixture contained in the mixing chamber 30 is withdrawn into the agitating chamber 98, the mixing chamber may be utilized for the purpose of mixing the four hundred pound batch of thinner which is to be used with the lacquer which is in the process of being manufactured. To this end, the admission valves 82, 81, 88, 86, 87 and 84 are again operated one at a time and in the order named for the purpose of withdrawing the above-described liquids of the thinner into the mixing chamber. As each liquid is withdrawn into the chamber 30 it is measured through operation of the scales 97. Also, following the withdrawal of the desired quantity of each liquid and the closure of the admission valve corresponding thereto, the vent valve 95 is opened for the purpose of withdrawing into the mixing chamber the residue of the liquid contained in the header 31 and the associated last used conduit section.

After the liquids of the thinner are intermixed in the mixing chamber 30, they may be pumped directly into the storage drum 100. To this end, the control valves 148, 126, 116, 129 and 122 are held closed and the control valves 112, 119 and 120 are opened. Thus, the contents of the mixing chamber 30 are discharged into the storage drum 100 over a liquid circuit which includes the conduit 113, the valve 112, the pump 107, the valve 119, the conduit 118, the valve 120 and the conduit 121. After the drum 100 is filled the valve 120 may be closed and the flexible section 121a of the conduit 121 disconnected from the connecting plug provided in the top of the drum 100. A sealing plug is now inserted in the connecting plug. In addition, the flexible section 188a of the exhaust pipe 188 is disconnected from the other connecting plug provided in the drum 100 and a sealing plug inserted in this connecting plug. These operations may all be carried out while the lacquer is being mixed in the agitating chamber 98. After the ingredients of the lacquer are thoroughly intermixed in this chamber they may, through operation of the pump 107, be discharged through the filter 104 into the storage drum 102 or conducted back to the mixing chamber to be reweighed. Assuming that the lacquer is to be discharged directly into the

storage drum 102, the valves 117, 116, 112, 129 and 120 are maintained closed and the valves 126, 119, 122 and 124 are opened. Thus, a liquid flow path is established which extends from the bottom of the agitating chamber 98 by way of the valve 126, the conduit 125, the pump 107, the valve 119, the conduit 118, the valve 122 into the filter 104. From the filter 104 the filtered products are by gravity flow conducted to the storage drum 102 through the valve 124 and the conduit 123. By virtue of the annular well 102a provided in the storage drum 102 a liquid pool is quickly formed in the bottom of this drum so that the major portion of the filtered lacquer is introduced into the drum beneath the surface of the pool. As a result, the vaporization products resulting from the mixing, transmission and filtration of the lacquer are for the most part condensed in the liquid pool so that only a small portion thereof are withdrawn through the exhaust pipe 187 into the exhaust conduit 179. In practice it was found that in filling the storage drums in the manner just explained substantial back pressures were developed in the discharge conduit sections connected to the drums. Such back pressures were probably occasioned by excessive vaporization of the volatile constituents of the lacquer thinner during the transmission of the liquid over the flow path in use, which occurred with such rapidity that the rate of discharge did not compensate for the expansion of the gases. Regardless of the cause, it was found that the pressures developed were in some cases of sufficient magnitude to either stop the pump 107 from operating or to cause operation of the relief valve 133. In certain instances, the back pressures developed were of sufficient magnitude that the top of the filter 104 was blown off, thus discharging the vapors contained in the filter into the surrounding atmosphere. In order to obviate this difficulty the small opening 123d was provided in the discharge conduit section 123b for the purpose of relieving the pressures developed when discharging liquids through the filter 104. After this expedient was resorted to no further difficulty was experienced, the filling of storage drums connected to the conduit 123 proceeding in the desired manner. For the same purpose it was found advisable to provide small venting openings in the discharge sections of the conduits 121, 137 and 138, these openings being arranged identically with the opening 123d provided in the wall of the discharge conduit section 123b.

If it is desired to conduct the lacquer mixed in the agitating chamber 98 back to the mixing chamber 30 for the purpose of reweighing the same prior to transmission thereof to the storage drum 102, the valves 112, 129, 119 and 117 are maintained closed and the valves 126, 116 and 128 are opened. As a result, a flow path is established which extends from the bottom of the agitating chamber 98 through the valve 126, the conduit 125, the pump 107, the conduit 114, the valves 116, 131 and 128 and the conduit 127 to the annular well 171 formed in the bottom of the mixing chamber 30. After the lacquer has been thus transmitted from the agitating chamber 98 back to the mixing chamber 30 the operator may, of course, observe the weight thereof and then discharge the lacquer into the storage drum 102. To this end, the valves 148, 120, 126, 116 and 129 are either closed or left closed and the valves 112, 119, 122 and 124 are opened, thus establishing a flow path which extends from the bottom of the

mixing chamber 30 by way of the conduit 113, the valve 112, the pump 107, the valve 119, the conduit 118, the valve 122, the filter 104, the valve 124 and the conduit 123 to the storage drum 102.

It will be understood that during the mixing of the lacquer and the thinner therefor in the manner just described, the exhaust fan 179 is continuously operated for the purpose of withdrawing the vaporization products which are produced incident to the mixing and transmission of the volatile liquids and which collect above the surfaces of the liquid pools respectively formed in the mixing chamber 30, the agitating chamber 98 and the two storage drums 100 and 102. These vaporization products are, as explained above, discharged by the fan 179 externally of the building housing the mixing apparatus. In this regard it will be noted that the exhaust apparatus is arranged to preclude any possibility of residue gases contained in the main exhaust conduit 178 from leaking back through the intake conduits 180 to 186, inclusive, into the interior of the housing structure after operation of the exhaust fan 179 is arrested. It is for this purpose that the intake conduits 180 to 186, inclusive, are connected to communicate with the main exhaust conduit 178 along the side wall of this main conduit and at points displaced above the bottom thereof. More specifically, the vaporization products which occur incident to the mixing and transmission of liquids of the character described are heavier than air and so that when released in air they move down instead of up. Accordingly, the residue gases contained in the main exhaust conduit 178 after operation of the fan 179 is arrested are moved to the bottom of this conduit and cannot leak back through the intake conduits 180 to 193, inclusive, into the atmosphere surrounding the apparatus.

If the operator desires, he may after mixing the thinner for the lacquer and discharging the same into the storage drum 100 in the manner just explained, utilize the mixing chamber 30 and the agitating chamber 99 for the purpose of mixing a second batch of lacquer and a batch of thinner therefor to be discharged into the other two storage drums 103 and 101, respectively, all while the first batch of lacquer is being mixed in the agitating chamber 98. In such case, the valves 128 and 112 are preferably held closed while the liquid constituents of the second batch of lacquer are being withdrawn from the proper containing chambers 10 to 19, inclusive, into the mixing chamber 30. After the liquid constituents of the second batch of lacquers are thus mixed they may be discharged into the agitating chamber 99 over a liquid flow path which comprises the conduit 113, the valve 148, the pump 106, the conduit 135, the valves 139 and 145, the conduit 136 and the valve 141. While the second batch of liquid mixture is being intermixed with the base or body substance of the lacquer in the agitating chamber 99, the second batch of thinner may be mixed in the chamber 30 by withdrawing the desired liquids from the storage containers 10 to 19, inclusive. After the second batch of thinner is thus mixed it may be withdrawn from the mixing chamber 30 and discharged into the storage drum 101 through operation of the pump 106 over a liquid flow path including the discharge conduit 113, the valve 148, the pump 106, the valve 140, the conduit 134, the valve 142 and the conduit 137. After the second batch of thinner is thus discharged into the storage drum 101, either of

the two batches of lacquer in the process of being mixed in the two chambers 98 and 99 may be withdrawn first and either discharged into the mixing chamber 30 for reweighing or conducted directly to the drum which has been provided for its storage. Assuming that the lacquer mixed in the agitating chamber 99 is to be filtered and then discharged into the storage drum 103, suitable valve operations, apparent from the preceding explanation, are made to establish a liquid flow path which extends from the bottom of the chamber 99 by way of the valve 147, the conduit 146, the pump 106, the valve 140, the conduit 134, the valve 143, the filter 105, the valve 144 and the conduit 138 to the drum 103. If the lacquer mixed in the agitating chamber 99 is to be reweighed prior to storage in the drum 103, the control valves are operated to establish a flow path which extends by way of the valve 147, the conduit 146, the pump 106, the conduit 135, the valves 139 and 145, the valve 150 and the conduit 149 to the interior of the mixing chamber 30. From the mixing chamber the reweighed lacquer may be discharged through the filter 105 into the storage drum 103 over a flow path which includes the common discharge conduit 113, the valve 148, the pump 106, the valve 140, the conduit 134, the valve 143, the filter 105, the valve 144 and the conduit 138.

The damar solution which is contained in the chamber 14 constitutes a lacquer body substance which consists of a resin in solution with liquids which include a small percentage of liquid wax. If this solution is to be used as the body substance of a particular batch of lacquer, the desired amount of the solution is withdrawn into the mixing chamber 30 for measurement and is then discharged into a selected one of the agitating chambers 98 and 99 before the desired solvents and diluents of the lacquer are withdrawn from those of the containing chambers 10 to 19, inclusive, in which they are contained into the mixing chamber 30 for mixing. After mixture in this chamber these intermixed liquids are, of course, transmitted to the selected one of the agitating chambers for mixture with the damar solution, after which the mixed lacquer may be handled in the manner described above.

The arrangement of the apparatus is such that if the operator desires or finds it necessary, the pump 106 may be utilized for the purpose of discharging the contents of the agitating chamber 98 into the storage drum 103. To this end, the control valves are operated to establish a liquid flow path which extends from the bottom of the chamber 98 by way of the valve 126, the conduit 125, the valves 112 and 148, the pump 106, the valve 140, the conduit 134, the valve 143, the filter 105, the valve 144 and the conduit 138 into the drum 103. Similarly, a liquid flow path may be established wherein the pump 107 is utilized to transmit the contents of the agitating chamber 98 to the storage drum 99. In this case the control valves are operated to establish a liquid flow path which extends from the bottom of the agitating chamber 99 by way of the valve 147, the conduit 146, the valves 143 and 112, the pump 107, the valve 119, the conduit 118, the valve 122, the filter 104, the valve 124 and the conduit 123 into the drum 102. By providing a control valve in the common discharge conduit 113 each of the two pumps 106 and 107 may also be utilized to transmit liquids from either of the two agitating chambers 98 and 99 to the mixing chamber 30,

From the foregoing explanation it will be apparent that the apparatus is arranged to obtain the maximum flexibility of operation in the mixing of different batches of lacquer, paints, enamels and the like, and of thinners therefor. In this connection it will be apparent that, if desired, the portion of the mixing apparatus which comprises the agitating chamber 99, the pump 106 and its associated driving equipment and the conduit system interconnecting these mixing units with the mixing chamber 30 and the main exhaust conduit 178, may be omitted. In such case, the unused opening of the T-joint which connects the common discharge conduit 113 with the valve 148 may be plugged or an elbow joint connecting the conduit 113 directly with the valve 112 substituted for the T-joint.

From the preceding explanation of the operation of the system it will be apparent that by suitable valve operations either of the two pumps 106 and 107 may be utilized for the purpose of withdrawing a sample from the mixing chamber 30 or either of the two agitating chambers into an open container. Thus, if the pump 106 is used for withdrawing a sample from the mixing chamber 30, for example, the valves 112, 139, 147 and 140 are closed and the valves 148 and 153 are opened so that a flow path is established whereby liquids in the mixing chamber 30 may be discharged through the outlet 154 into the container. Alternatively, if the pump 107 is utilized for this purpose the valves 148, 116, 136 and 119 are closed and the valves 112 and 129 are opened so that the liquids may be discharged through the outlet 130 into the container.

Although the apparatus and method described above are of particular utility in the mixing of lacquers, paints and the like, in that all operations may be accurately and rapidly carried out by one operator and the fire hazard attendant with these operations is completely eliminated, it will be understood that they are also of utility in the production of liquors and other products which involve the intermixture of volatile and inflammable liquids.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In apparatus for mixing a plurality of different liquids at least a portion of which are volatile and which comprises separate containing chambers for said liquids, a mixing tank, conduits for conducting the liquids in said containing chambers to said mixing tank, means for selectively exhausting said conduits one at a time, thereby to withdraw one at a time selected liquids from said containing chambers into said mixing tank, and weighing apparatus comprising a movable part supporting said mixing tank and operative to measure the quantity of each liquid transmitted to said mixing tank; the combination which includes an exhaust fan for withdrawing from said mixing tank any vaporization products resulting from the transmission and mixing of said volatile liquids, and conduit means connecting the interior of said mixing tank with said exhaust fan and provided with a pair of relatively movable orifice members arranged to permit substantially free movement of said mix-

ing tank with said movable part of said weighing apparatus.

2. In apparatus for mixing a plurality of different liquids at least a portion of which are volatile and which comprises separate containing chambers for said liquids, a mixing tank, conduits for conducting the liquids in said containing chambers to said mixing tank, means for selectively exhausting said conduits one at a time, thereby to withdraw one at a time selected liquids from said containing chambers into said mixing tank, and weighing apparatus provided with a movable part supporting said mixing tank and operative to measure the quantity of each liquid transmitted to said mixing tank; the combination which includes an exhaust fan for withdrawing from said mixing tank any vaporization products resulting from the transmission and mixing of said volatile liquids, an exhaust conduit extending to said fan and disposed above said mixing tank, an intake conduit communicating with one of the side wall portions of said exhaust conduit and terminating in a downwardly extending flared opening, and another conduit communicating with the interior of said mixing tank and including a portion terminating in an exhaust opening nested within but displaced from the inner side walls of said flared opening to permit substantially free movement of said mixing tank with said movable part of said weighing apparatus.

3. In apparatus for mixing a plurality of different liquids at least a portion of which are volatile and which comprises a mixing tank, closed liquid transmission apparatus including means selectively operable to discharge selected ones of said liquids into said mixing tank one at a time, and weighing apparatus provided with a movable part supporting said tank and operative to measure the quantity of each liquid transmitted to said tank; the combination which includes an exhaust fan for withdrawing from said tank any vaporization products resulting from the transmission and mixing of said liquids, an exhaust conduit extending to said fan and disposed above said mixing tank, an intake conduit communicating with one of the side wall portions of said exhaust conduit and terminating in a downwardly extending flared opening, and another conduit communicating with the interior of said mixing tank and including a portion terminating in an exhaust opening nested within but displaced from the inner side walls of said flared opening to permit substantially free movement of said mixing tank with said movable part of said weighing apparatus.

4. Apparatus for mixing a plurality of different liquids at least a portion of which are volatile comprising separate containing chambers for said liquids, a mixing chamber, a common header connected to said mixing chamber, conduits individually connecting said containing chambers with said common header, means for creating a vacuum in said header, valves included in said conduits and selectively operable to expose the associated conduits to the vacuum in said header, thereby to withdraw selected liquids from said containing chambers into said mixing chamber, and means for venting said header to atmosphere, thereby to permit liquids held in said header after closure of said valves to be drawn into said mixing chamber.

5. Apparatus for mixing a plurality of different liquids at least a portion of which are volatile with a paste, solid or powder material comprising

separate containing chambers for said liquids, a first mixing chamber, conduits for conducting the liquids in said containing chambers to said mixing chamber, means for selectively exhausting said conduits, thereby to withdraw selected liquids from said containing chambers into said mixing chamber, a second mixing chamber including provisions for depositing said paste, solid or powder material therein, a pair of storage containers, a filter, conduits interconnecting said mixing chambers, said storage containers and said filter, and means comprising a pump included in one of said conduits for selectively discharging the contents of said first mixing chamber into said second mixing chamber or into one of said storage containers over a path including said filter or into the other of said storage containers over a path from which said filter is excluded.

6. Apparatus for mixing a plurality of different liquids at least a portion of which are volatile with a paste, solid or powder material comprising separate containing chambers for said liquids, a first mixing chamber, conduits for conducting the liquids in said containing chambers to said mixing chamber, means for selectively exhausting said conduits, thereby to withdraw selected liquids from said containing chambers into said mixing chamber, a second mixing chamber including provisions for depositing said paste, solid or powder material therein, a pair of storage containers, a filter, conduits interconnecting said mixing chambers, said storage containers and said filter, means comprising a pump included in one of said conduits for selectively discharging the contents of said first mixing chamber into said second mixing chamber or into one of said containers over a path from which said filter is excluded, and means including said pump for selectively discharging the contents of said second mixing chamber into said first mixing chamber or into the other of said containers over a path including said filter.

7. Apparatus for mixing a plurality of liquids at least a portion of which are volatile comprising separate containing chambers for said liquids, a mixing tank having a depression in the bottom thereof, an inlet conduit extending into said mixing tank and having a discharge end disposed in said depression, conduits extending to said containing chambers and connected to said inlet conduit, and means for selectively exhausting said last-named conduits, thereby to transmit selected liquids from said containing chambers through said inlet conduit into said mixing tank.

8. Apparatus for mixing a plurality of liquids at least a portion of which are volatile comprising separate containing chambers for said liquids, a mixing tank, conduits connecting said containing chambers with said mixing chamber, means including said conduits for selectively transmitting liquids from said containing chambers to said mixing chamber, a storage container including a bottom wall having a depression therein, an inlet pipe extending into said container and terminating in a discharge end disposed in said depression, a filter, and means for transmitting liquids from said mixing chamber through said filter and said inlet pipe into said container.

9. Apparatus for mixing a plurality of liquids at least a portion of which are volatile comprising separate containing chambers for said liquids, a mixing tank, conduits connecting said containing chambers with said mixing chamber, means in-

cluding said conduits for selectively transmitting liquids from said containing chambers to said mixing chamber, a storage container including a bottom wall having a depression therein, an inlet pipe extending into said container and terminating in a discharge end disposed in said depression, said inlet pipe having an opening extending through the wall thereof at a point within and adjacent the top of said container to relieve back pressures developed in said pipe, a filter, and means for transmitting liquids from said mixing chamber through said filter and said inlet pipe into said container.

10. In combination with a storage container for receiving a liquid mixture including volatile constituents and provided with a bottom wall having a depression therein, an inlet pipe for discharging said mixture into said container and provided with an opening extending through the wall thereof at a point adjacent the top of said container to relieve back pressures developed in said pipe, apparatus for mixing the constituents of said mixture, and means for transmitting said mixture from said apparatus through said inlet pipe to said container.

11. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises withdrawing selected ones of said liquids one at a time from their sources into a mixing zone, accumulatively weighing the liquids thus withdrawn into said mixing zone, and exhausting said mixing zone to maintain a subatmospheric pressure therein continuously during the withdrawal of said liquids into said zone.

12. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises exhausting a mixing zone to create a sub-atmospheric pressure therein, withdrawing a selected one of said liquids of lesser volatility from its source into said mixing zone to form a vapor condensing pool in the bottom of said mixing zone, withdrawing other selected liquids from their sources, discharging said other selected liquids into said mixing zone beneath the surface of said pool, and measuring the quantity of each liquid thus withdrawn into said mixing zone.

13. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises exhausting a common chamber or header and a common mixing zone to create a sub-atmospheric pressure therein, sucking selected ones of said liquids from their sources through said common chamber into said mixing zone during succeeding and non-overlapping intervals, venting said common chamber to the atmosphere between at least a portion of said intervals, and measuring each liquid thus withdrawn into said mixing zone.

14. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises withdrawing selected ones of said liquids from their sources one at a time into a mixing zone, accumulatively weighing the selected liquids as they are withdrawn into said mixing zone, and exhausting said mixing zone to produce a predetermined tare indication of the weighing apparatus before the selected liquids are withdrawn into said mixing zone.

15. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises withdrawing a selected one of said liquids of

lesser volatility from its source into said mixing zone to form a vapor condensing pool in the bottom of said mixing zone, withdrawing other selected liquids from their sources one at a time, discharging said other selected liquids into said mixing zone beneath the surface of said pool, accumulatively weighing the selected liquids as they are withdrawn into said mixing zone, and exhausting said mixing zone to produce a predetermined tare indication of the weighing apparatus before the selected liquids are withdrawn into said mixing zone.

16. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises exhausting a common chamber or header to create a sub-atmospheric pressure therein, sucking a selected one of said liquids of lesser volatility from its source through said common chamber into a mixing zone to form a vapor condensing pool in the bottom of said mixing zone, sucking other selected liquids from their sources into said common chamber during succeeding and non-overlapping intervals, discharging said other selected liquids from said common header into said mixing zone beneath the surface of said pool, and venting said common chamber to atmosphere between at least a portion of said intervals.

17. The process of preparing a predetermined blended liquid from different liquids at least a portion of which are volatile, which comprises exhausting a common chamber or header to create a sub-atmospheric pressure therein, sucking a selected one of said liquids of lesser volatility from its source through said common chamber into a mixing zone to form a vapor condensing pool in the bottom of said mixing zone, sucking other selected liquids from their sources into said common chamber during succeeding and non-overlapping intervals, discharging said other selected liquids from said common chamber into said mix-

ing zone beneath the surface of said pool, venting said common chamber to atmosphere between at least a portion of said intervals, accumulatively weighing the selected liquids as they are discharged into said mixing zone, and exhausting said mixing zone to produce a predetermined tare indication of the weighing apparatus before the selected liquids are discharged into said mixing zone.

18. In apparatus for mixing a plurality of different liquids at least a portion of which are volatile and which comprises a mixing tank, closed liquid transmission apparatus including means selectively operable to discharge selected ones of said liquids into said mixing tank one at a time, weighing apparatus provided with a movable part supporting said tank and operative to measure the quantity of each liquid transmitted to said tank; the combination which includes an exhaust fan for withdrawing from said mixing tank any vaporization products resulting from the transmission and mixing of said volatile liquids, and a connection between the interior of said mixing tank and said exhaust fan, said connection including a pair of relatively movable conduits separated to define an air intake orifice.

19. Apparatus for mixing a plurality of liquids at least a portion of which are volatile comprising separate containing chambers for said liquids, a mixing tank having a depression in the bottom thereof, an inlet conduit extending into said mixing tank and having a discharge end disposed in said depression, conduits extending to said containing chambers and connected to said inlet conduit, and means comprising valves included in said last-named conduits for transmitting selected liquids from said containing chambers through said last-named conduits and said inlet conduit into said mixing tank.

A. DE VERE HARNETT.