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assignments

3,208,958 9/1965 Jennings..... 259/7X
3,220,801 11/1965 Rill..... 259/8X
3,385,671 5/1968 Axelsson 23/252
3,459,408 8/1969 Boushka..... 259/8

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[54] **CHEMICAL INGREDIENT EATING APPARATUS**
19 Claims, 18 Drawing Figs.

[52] U.S. Cl..... 259/8,
23/252

[51] Int. Cl..... B01f 7/16

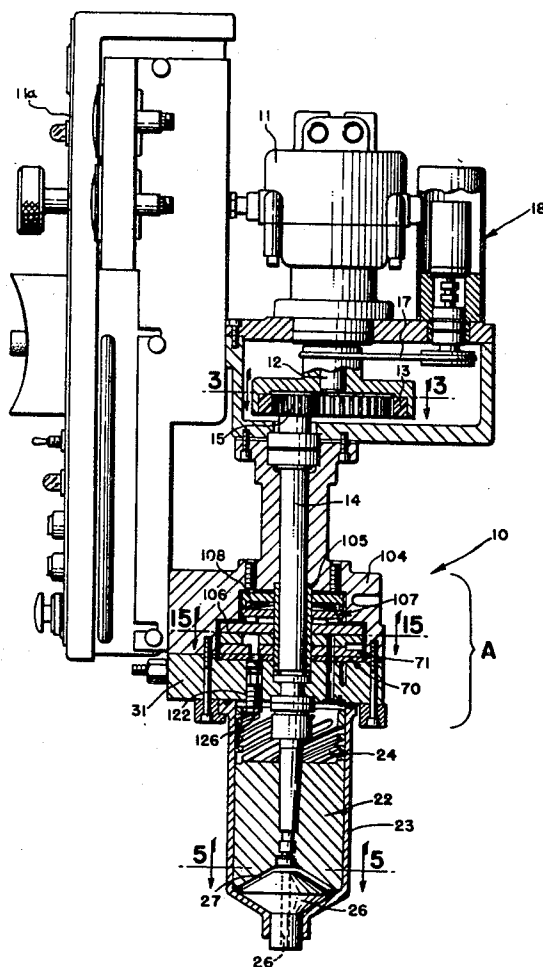
[50] Field of Search..... 259/7, 8, 5,
6, 9, 10, 23, 24, 43, 44; 23/252

[56] **References Cited**

UNITED STATES PATENTS

3,111,389 11/1963 Hansen..... 259/7X

ABSTRACT: A mixing-head assembly for a chemical ingredient treating system is provided characterized in that a shift from recirculation mode to feed-to-mixing-chamber mode of operation may be carried out by valve means which limits the possibility of leakage of chemical components, while metering-port construction, which permits variable flow control, also contributes to control of any possible leakage. Close control of mixing-chamber conditions is provided for by means which inhibits transfer of heat from the source of motive force to the mixing chamber, and means is provided for preventing undesired air pickup by the mixture in the mixing chamber.



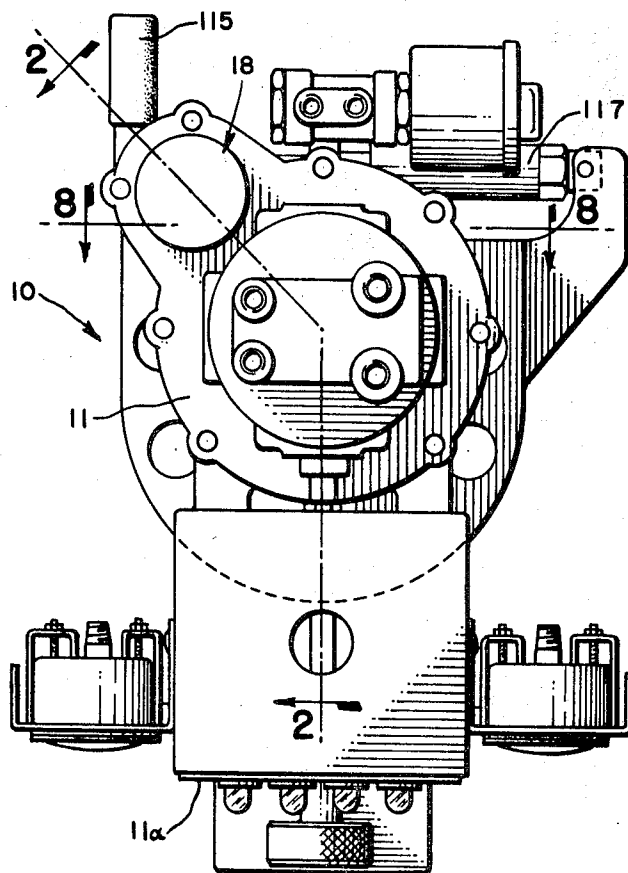


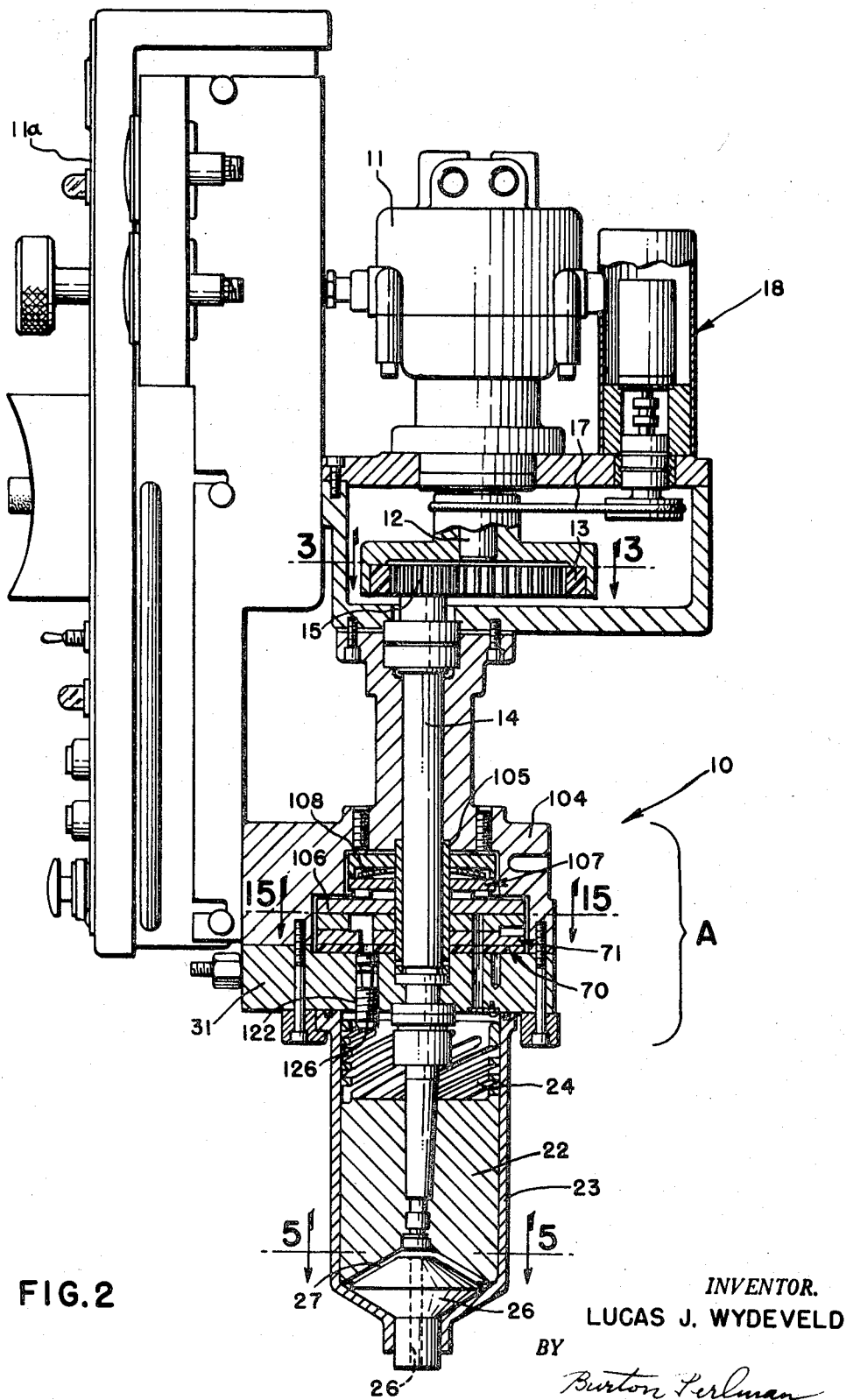
FIG. 1

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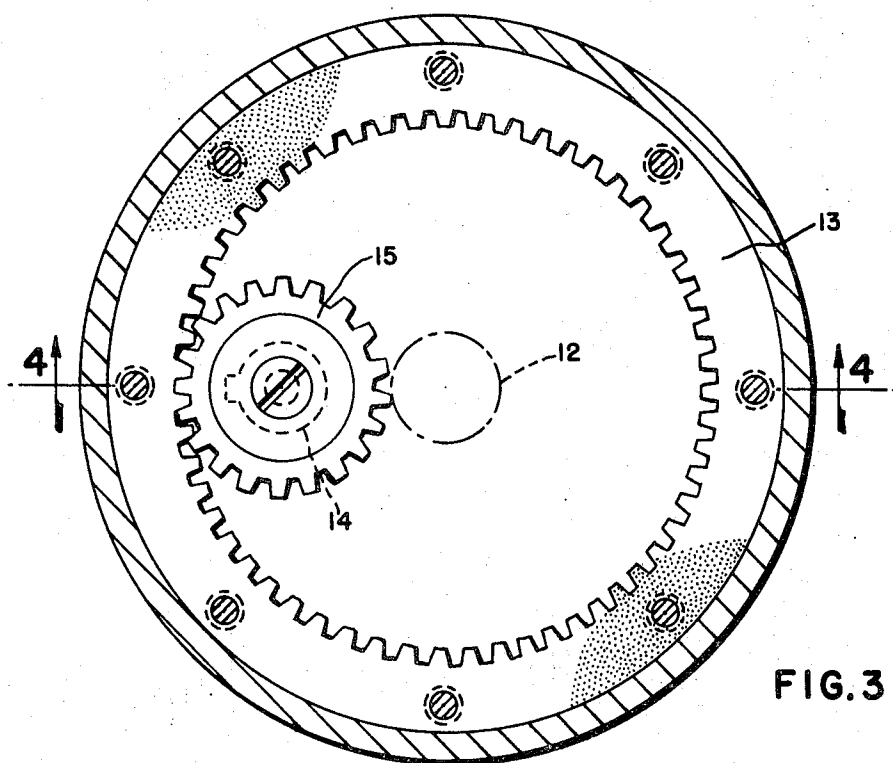


FIG. 3

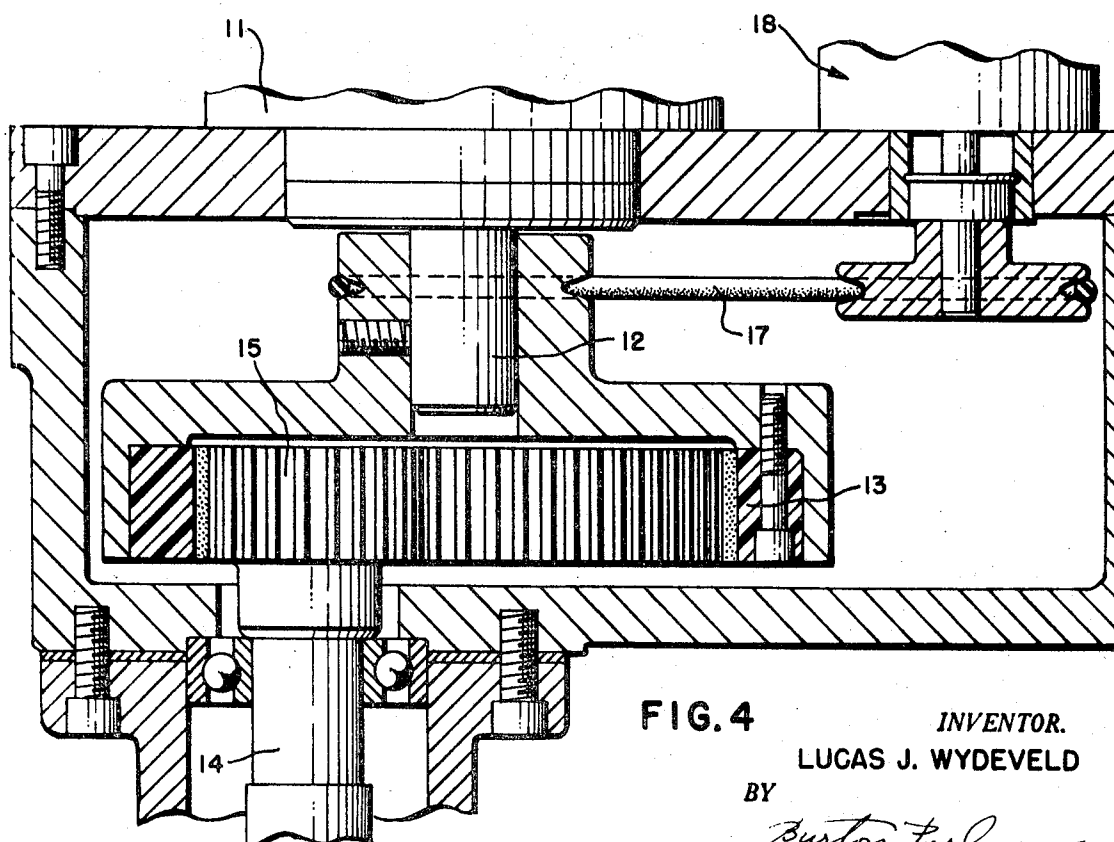


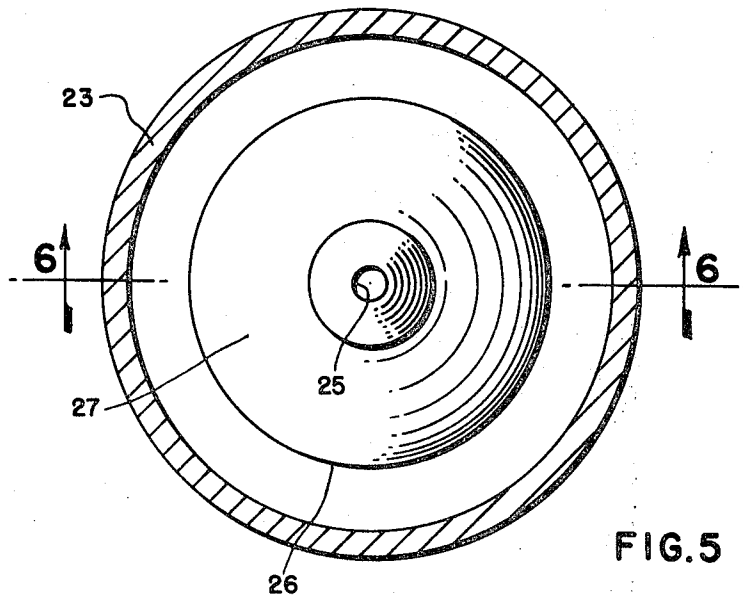
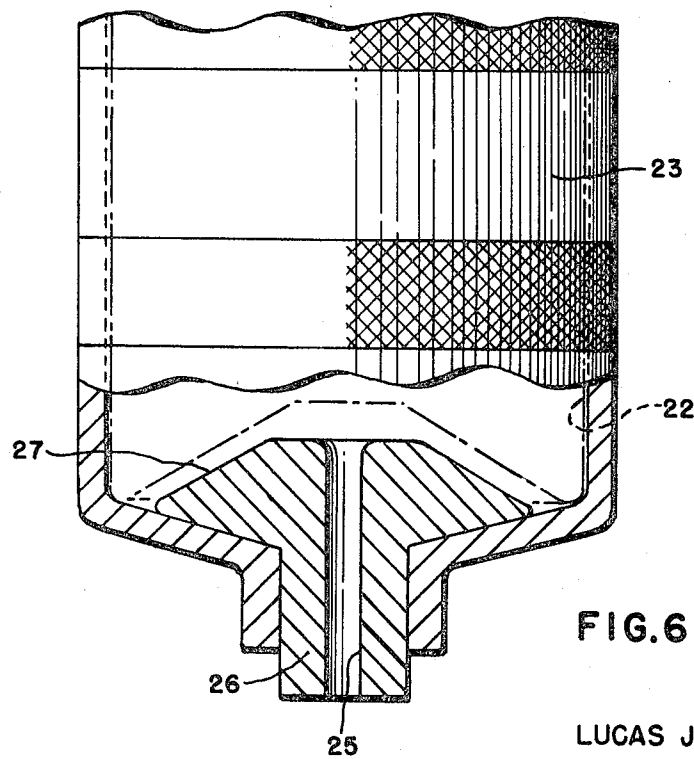
FIG. 4

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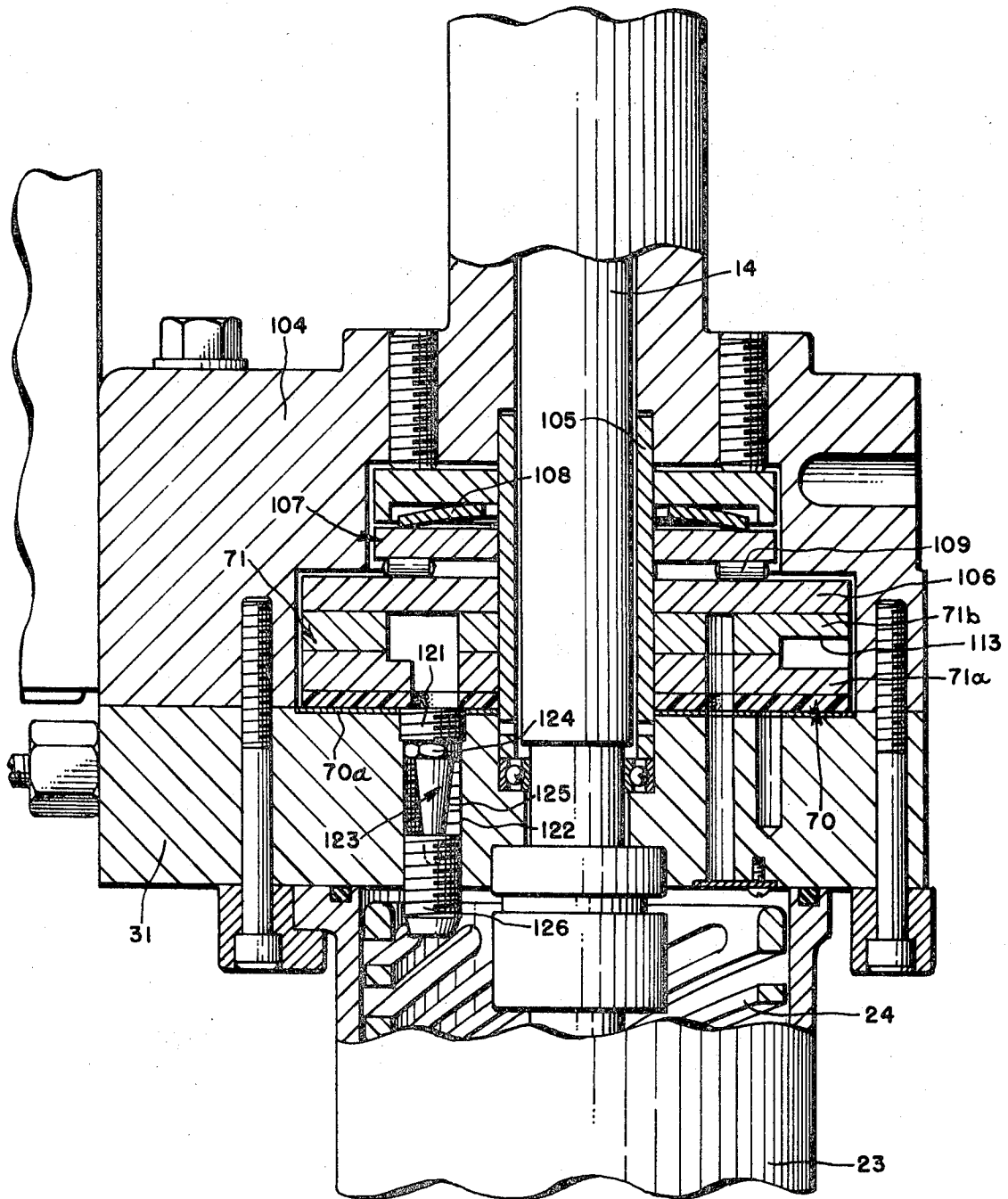


FIG. 7

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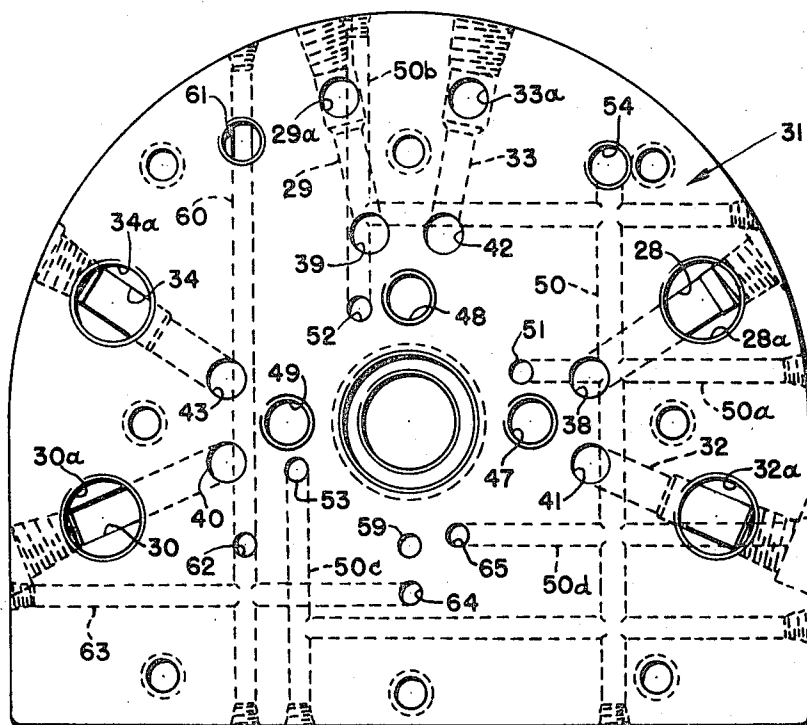


FIG. 9

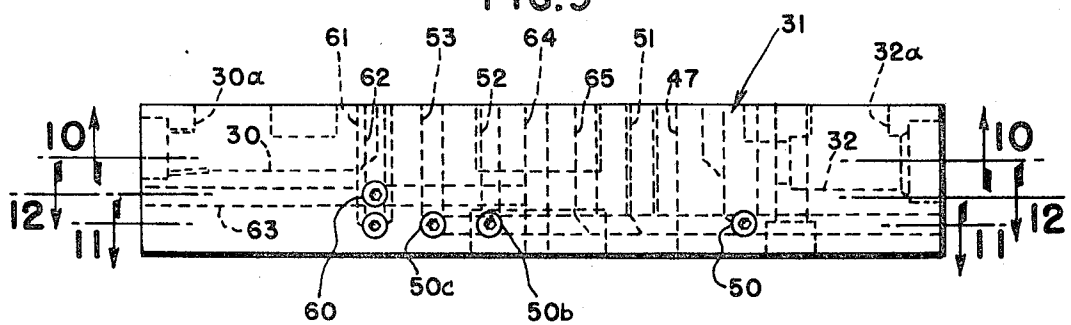


FIG. 8

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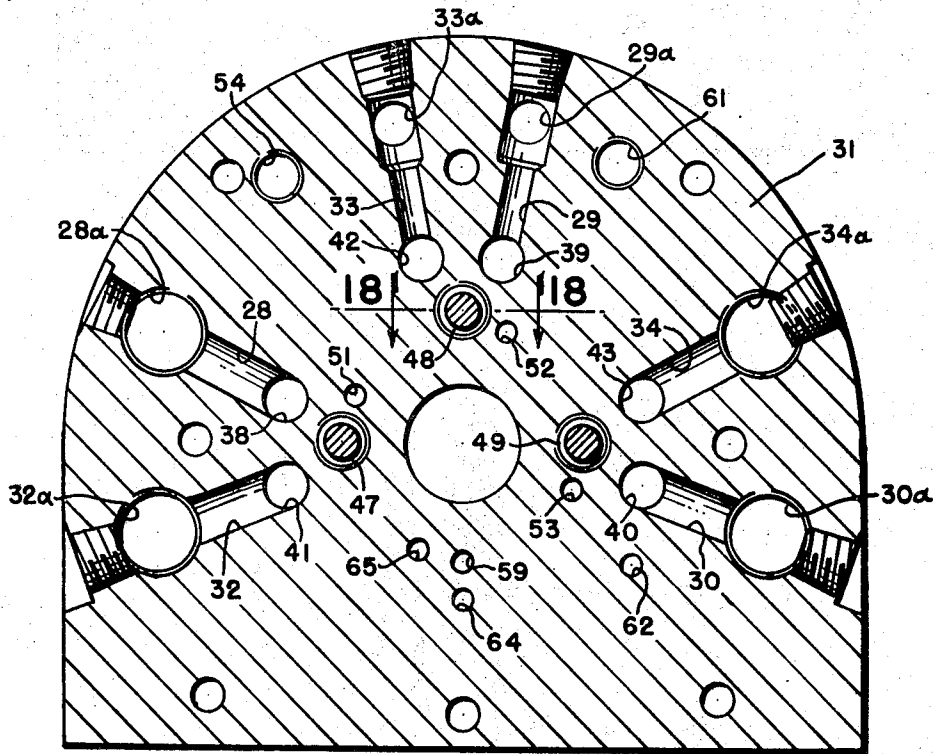


FIG. 10

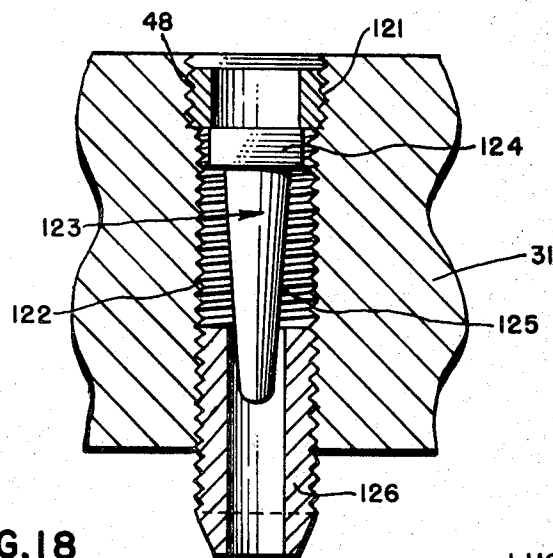


FIG. 18

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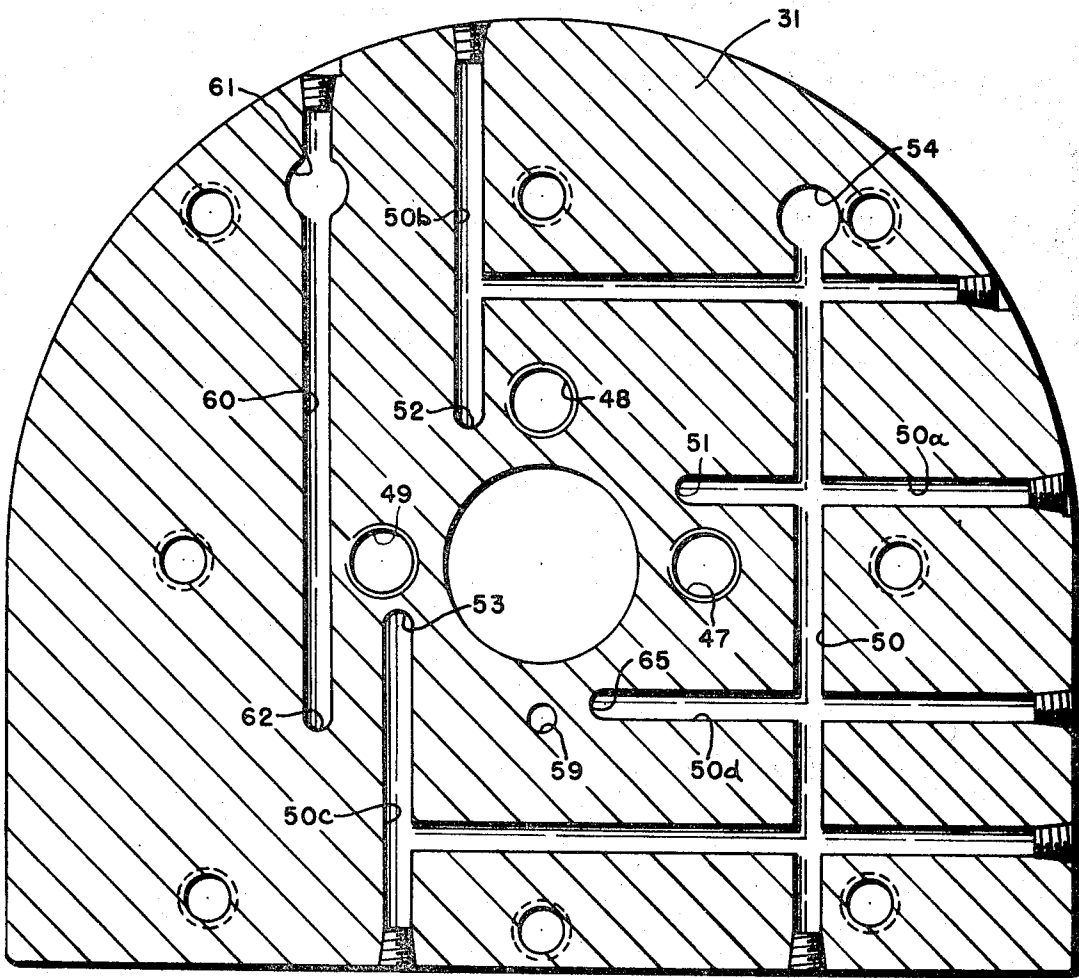


FIG. 11

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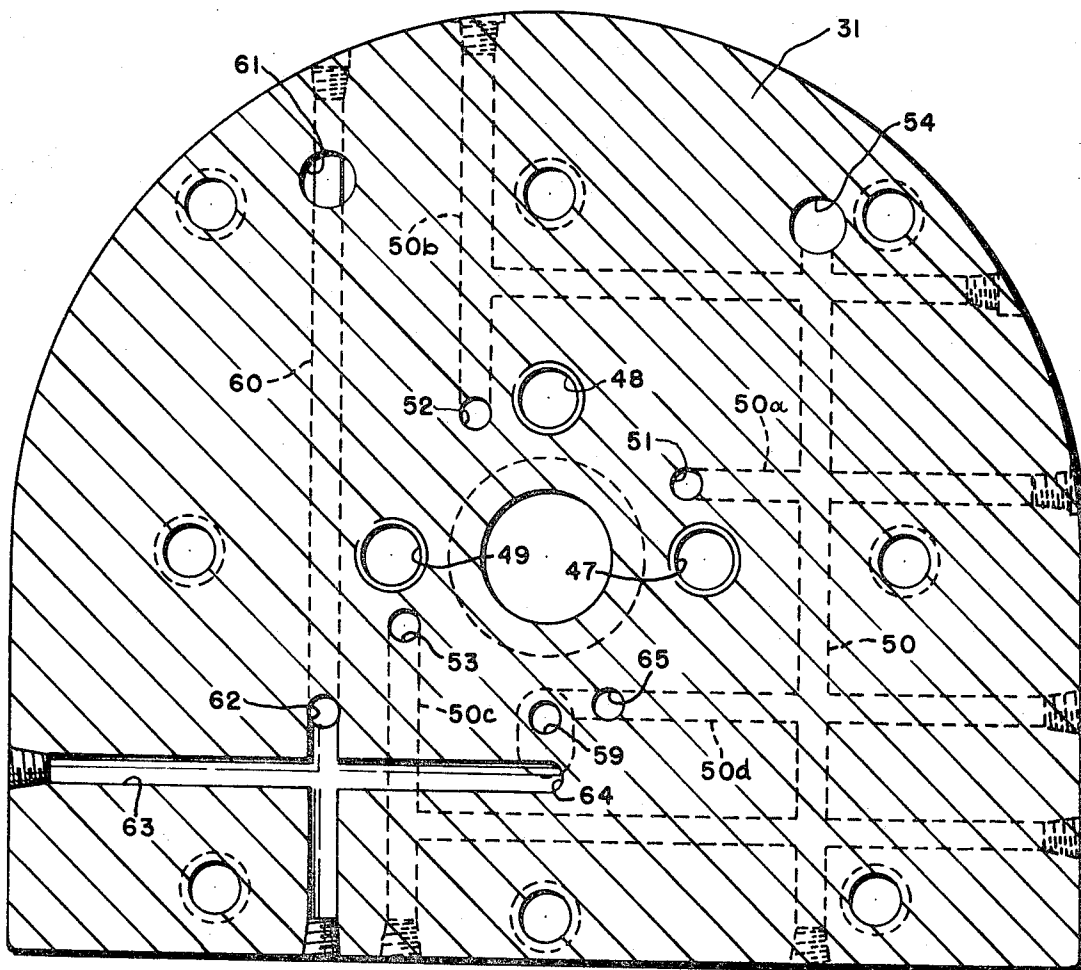


FIG. 12

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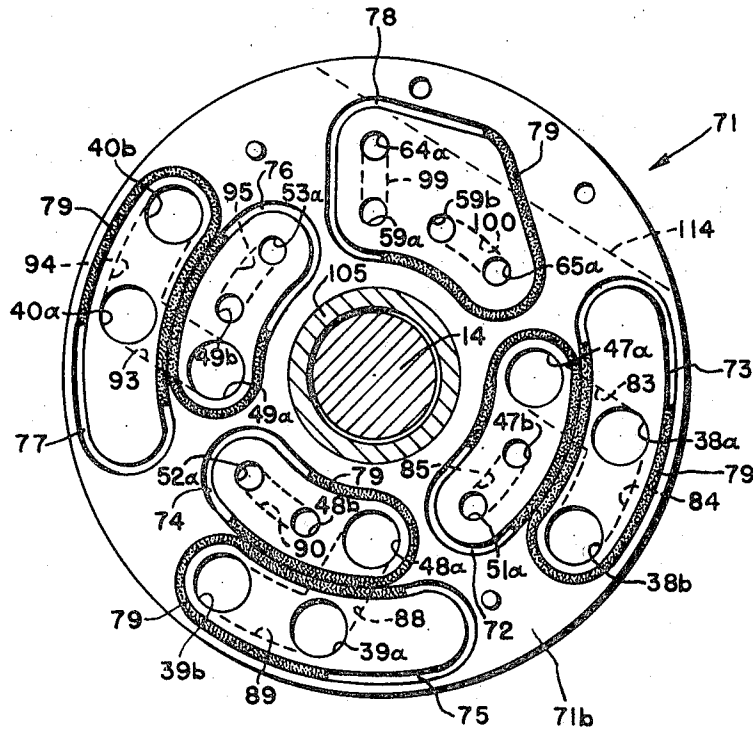


FIG. 13

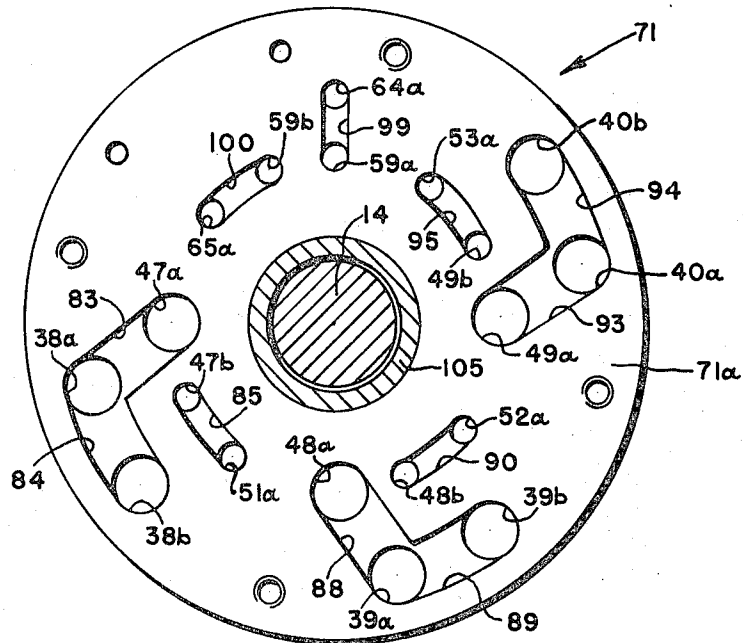


FIG. 14

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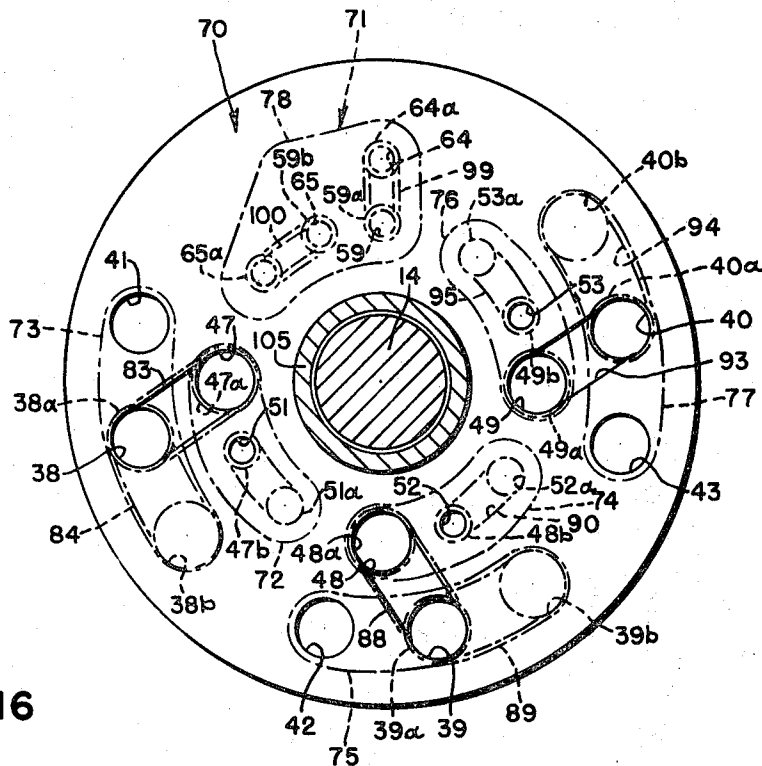


FIG. 16

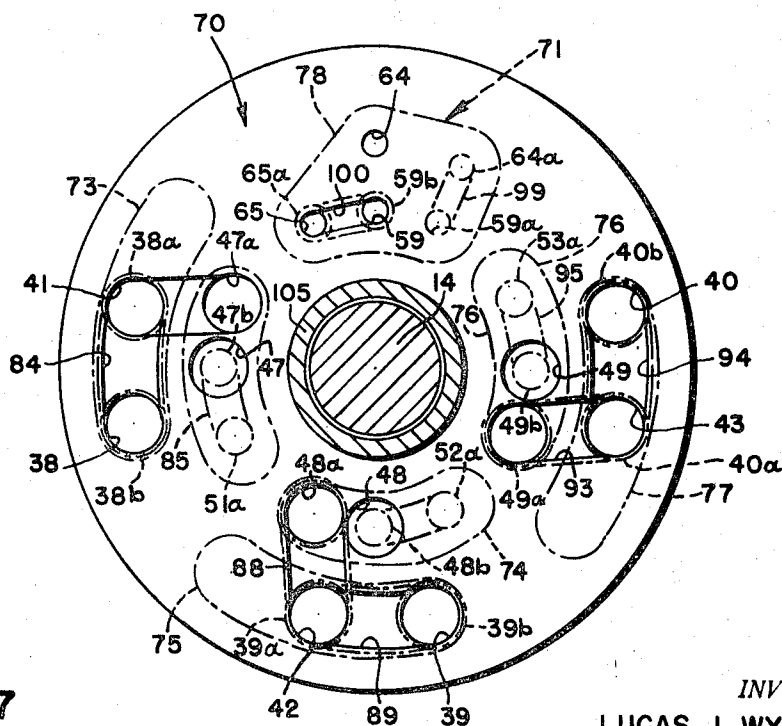


FIG. 17

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CHEMICAL INGREDIENT EATING APPARATUS

This invention relates to apparatus in which chemical ingredients may be treated as by mixing them together, preparatory to molding or otherwise forming the resultant mixture, and more particularly to that portion of such an apparatus (which apparatus as well will include reservoir means and means for circulating chemical ingredients) where the control of treatment and act of mixing of chemical ingredients occurs. The present inventive subject matter will be useful, for example, in the art having to do with the production of items from polyurethane polymers.

Chemical mixing apparatuses of the general type just described are on the market and are now in use for the production of polyurethane products. In such apparatuses chemical ingredients are recirculated through the system when they are not being fed to the mixing head where mixing occurs. The purpose of the recirculation is to keep the system in such condition that feed of chemicals may be commenced without need for a "warmup" period preliminary to operation. When it is desired to employ the mixing chamber, valve means must change the mode of operation from recirculation to feed or dispense, and between periods when the mixing chamber is so employed, the system must be changed back to the recirculation mode. Problems relating to undependability of performance, for example, in that an unsuitable mix may result and have to be discarded at either or both the beginning or the end of a run, sometimes arise with use of present apparatuses. An unsuitable mix may result where all chemical ingredients do not commence to flow at their optimum rate promptly upon being switched on stream for feeding to the mixing chamber, and equally promptly cease flowing upon a reverse switching. In addition, such known apparatus can often not be depended on to prevent leakage of chemical components and their mixture other than in the mixing head, and such unplanned mixing is capable of causing great damage to the total system. Prevention of unplanned mixture of ingredients in apparatus of this kind is difficult because such machines are customarily operated for a considerable length of time during which a number of cyclic changes from feeding to recirculating condition and visa versa will take place. Necessarily, severe wear on sealing means occurs under these conditions. Use of prior art apparatus often is also objectionable in that though close control of temperature is vital to the operation because slight fluctuations may have disproportionate consequences, heat may reach the mixing chamber from heat generated by operation of parts of the machine, upsetting control of temperature in the mixing chamber. In addition, where prior art apparatus is used there may be a tendency for an excessive amount of air to be picked up during the mixing cycle and unwanted air bubbles sometimes will appear in molded products, resulting in rejection of them. In prior apparatus used for the present purpose, only incremental control has been available to regulate the flow of chemicals into the mixing chamber and the precise overall control of feeding of materials which is obtainable only with a continuously variable regulator has been beyond the capability of such apparatus.

It is the primary object of the present invention to provide an apparatus for use in the mixing of chemical ingredients in which the close control of feed and temperature necessary for successful operation of such apparatus is obtainable. An apparatus providing for continuous variation of orifice for chemical feed is presented in a construction not inconsistent with leak prevention. Vagrant temperature influences are shielded from the sensitive mixing chamber and an inhibition against occlusion of air in the mix when this is unwanted is prevented. Of paramount importance in achieving the primary object is the novel valve by means of which the system may be shifted from feed of chemicals to the mixing chamber to recirculation mode of operation. By means of the novel valve here provided simultaneous input of all chemical ingredients may be commenced and the possibilities of leakage and unplanned intermixture of chemicals are avoided. In addition, a feature

of the present invention is that when chemical ingredients are switched from the dispense mode of operation to the recirculation mode, the act of switching provides means whereby solvent or air flush of the valve openings can occur, thereby preserving the mixing head in a state of readiness for trouble free operation.

How the stated objects and many others are to be implemented will become clear through a consideration of the accompanying drawings wherein:

FIG. 1 is a top view of mixing head assembly;

FIG. 2 is a section at 2-2 of FIG. 1 illustrating the interior structure of the mixing head assembly;

FIG. 3 is a section taken at 3-3 in FIG. 2;

FIG. 4 is a section taken at 4-4 in FIG. 3;

FIG. 5 is a section taken at 5-5 in FIG. 2;

FIG. 6 is a section taken at 6-6 in FIG. 5;

FIG. 7 is an enlarged view of the portion of mixing head assembly seen in FIG. 2 and identified by bracket indexed A;

FIG. 8 is a side view of subplate shown in this figure apart from the overall mixing head assembly taken at 8-8 in FIG. 1;

FIG. 9 is a top view of the subplate seen in FIG. 8;

FIG. 10 is a section taken at 10-10 in FIG. 8;

FIG. 11 is a section taken at 11-11 in FIG. 8;

FIG. 12 is a section taken at 12-12 in FIG. 8;

FIG. 13 is a view of a flat surface of a portion of the porting plate shown removed from the assembly of FIGS. 2 and 7;

FIG. 14 is a view of the other flat surface of the portion of the porting plate seen in FIG. 13;

FIG. 15 is a view of the porting plate shown in a section of the assembly of FIG. 2 taken at 15-15 of FIG. 2;

FIG. 16 is a top view of the gasket seen in FIG. 13 with the pattern of openings in the porting plate superimposed thereon and indicated in broken lines, when the porting plate overlays the gasket in dispense position;

FIG. 17 is a view of the gasket similar to that seen in FIG. 10, except that the pattern of openings of the porting plate is in recirculation position; and

FIG. 18 is a section through a metering port taken at 18-18 in FIG. 10.

The entire mechanism depicted in FIGS. 1 and 2 may be referred to as a mixing head or mixing head assembly 10. Motor housing 11 therein contains a motor of known construction which operates in response to controls on control panel 11a. The motor turns shaft 12 upon which is mounted a ring gear 13. The ring gear 13 is made of a suitable plastic of low heat conductivity so that heat from the motor is prevented from being transmitted to the mixing chamber, hereinafter to be described, thereby permitting close control of the conditions in such mixing chamber.

The main drive shaft 14 of the mixing head 10 terminates in a pinion gear 15 the teeth of which mesh with those of ring gear 13, so that upon rotation of ring gear 13, rotation of pinion gear 15 and main drive shaft 14 will occur.

Belt 17 passes around ring gear 13 providing drive means for tachometer 18, the tachometer 18 being present for purposes of control of the operation.

The purpose of main drive shaft 14 is to supply a rotary motive force for impeller 22. Impeller 22 is disposed within impeller housing or mixing chamber 23. As may best be seen in FIG. 2 impeller 22 has helical surface vanes 24 which serve to knead chemical constituents which are fed into the mixing chamber 23 through valve and port means hereinafter to be described.

Upon rotation of impeller 22 such chemical components are mixed and worked together and because of the downward inclination of the helical vanes, are finally emitted from the mixing head at opening 25. Removable nozzle 26 of novel construction is disposed at the egress from mixing chamber 23. Such nozzle has an upwardly inclining top surface 27, and by reason of this configuration, the mixed and kneaded material after reaching the bottom of impeller 22 must move upwardly and towards the center of the mixing chamber 23 in order to reach opening 25 through which it can be emitted. By

the employment of a modified mixing head structure, modified in that before the material mixed in the chamber may be dispensed, it must rise over surface 27, the efficiency of the mixer is increased and pickup of air in the chemicals mixed together during their travel in the mixer is reduced.

Having examined the mixing mechanism and the drive therefore, let us turn now to an examination of the valve and port means which regulates and admits chemicals to the mixing chamber. Three separate chemical ingress passages 28, 29, and 30 are provided through which three separate chemicals may be supplied to the mixing chamber, such passages being present in subplate 31. It will be understood that while such passages are shown in FIGS. 9—12 extending to the edge of subplate 31, such passages are plugged at such edge. Access to the passages is through threaded inlet openings 28a, 29a, and 30a respectively. Because it would greatly complicate the drawings and is not necessary to an understanding of the present invention, the means for conducting chemicals to the passages 28, 29, and 30 are not specifically shown, though it will be readily appreciated that such means consists of pump and tubing means extending between respective openings 28a, 29a, and 30a and a reservoir for the respective chemical fed, tubing being secured at each of threaded inlet openings 28a, 29a, and 30a by a threaded fitting which is not illustrated because it is of conventional construction.

Coupled with each of the ingress passages 28, 29, and 30 in subplate 31 is a second passage 32, 33, and 34 respectively, each of which comes into play when dispensing of chemical from the mixing head is not desired, but instead recirculation of chemical constituents through the system is desired, passages 32, 33, and 34 therefore being referred to as recirculation passages. Again, it will be understood that passages 32, 33, and 34 are plugged at the edge of subplate 31 and access to them is through threaded outlet openings 32a, 33a, and 34a respectively. In addition, conventional tubing means, not shown, secured by threaded fittings at such openings 32a, 33a, and 34a, is employed to convey chemicals from passages 32, 33, and 34 to reservoirs for the respective chemicals.

Subplate 31 in the mixing head assembly is horizontally disposed and has horizontally bored thereinto chemical ingress passages 28, 29, and 30 and also recirculation passages 32, 33, and 34, all such passages also being horizontally disposed. But subplate 31 is also pierced vertically, so that there is communication between the end of each of the just mentioned passages and the top of subplate 31. Thus chemical ingress passages 28, 29, and 30 terminate in vertical apertures 38, 39, and 40 respectively. (See FIGS. 8 and 9). In like manner apertures 41, 42, and 43 respectively provide communication between the top of subplate 31 and the ends of recirculation passages 32, 33, and 34 respectively.

Examination of FIG. 9 shows that the chemical ingress passages and recirculation passages may be grouped in pairs consisting of 28 and 32; 29 and 33; and 30 and 34. Associated with each of such pairs is an aperture which completely passes through subplate 31 from top to bottom and each of these apertures is a metering port, the respective metering ports being designated 47, 48, and 49. Hereinafter, the term "opening" will be employed to refer generically to apertures and ports.

In addition to the chemical ingress and recirculation passages in subplate 31, there is another system of passages bored into subplate 31 at a different level thereof as will be understood from FIGS. 8, 11, and 12. This second system of passages 50 is intended to carry solvent or air for introduction to the system for flushing purposes as will hereinafter become clear. It will be understood that solvent or air will be alternatively admitted to system 50 in response to setting of a conventional valve for this purpose which is not illustrated. Branch 50a thereof terminates in an aperture 51 opening into the top of subplate 31, such aperture 51 being disposed closely adjacent metering port 47. A similar aperture 52 at the end of branch 50b of passage 50 lies adjacent metering port 48, while aperture 53 at the end of branch 50c is adjacent metering port

49. There is an inlet port 54 communicating between top of subplate 31 and passage 50, through which solvent or air may be introduced to such passage. While the specific means which conducts solvent or air to inlet port 54 is not illustrated, it will be understood that such means constitutes conventional tubing and conventional fitting necessary to hold such tubing in place at said port as well as valve means of known construction which may be employed to permit solvent or air alternatively to enter said port.

In addition to metering ports 47, 48, and 49 which pass entirely through subplate 31 vertically, there is a fourth port 59 meeting this description. Nucleation air may be introduced to mixing chamber 23 through port 59 at the same time that chemicals are introduced thereto through the metering ports 47, 48, and 49. Passage 60 having intake aperture 61, which is in communication with the top of subplate 31, has terminal aperture 62 which puts nucleation passage 60 into communication with another passage 60 at a different level in subplate 31, passage 63 terminating at aperture 64 which opens into the top of subplate 31. Aperture 64 lies close to port 59. In addition, branch 50d of passage system 50 terminates in an aperture 65 which also lies adjacent port 59 and aperture 64.

A Teflon gasket 70 is bonded by a suitable adhesive 70a to the top of subplate 31. Such gasket is pierced with holes corresponding to the various apertures and ports in subplate 31 just described. Separate index numbers are not employed to designate such openings in gasket 70, but instead they are designated by the same numbers as are the apertures and ports in subplate 31. The top surface of Teflon gasket 70 faces porting plate 71.

Porting plate 71, preferably made of stainless steel, provides valve means whereby the flow of chemicals and solvent and air through the varying passages heretofore described may be directed. Porting plate 71 is capable of assuming two different positions. In the first such position recirculation of chemicals through the system results and air and/or solvent flush may be directed through the metering ports 47, 48, and 49 and port 59. When porting plate 71 is in its other position, chemicals will be fed through metering ports 47, 48, and 49 into the mixing chamber 23, and nucleation air may be directed into the mixing chamber through port 59. In the ensuing discussion, first the relationship between openings in Teflon gasket 70 and porting plate 71 will be shown, then we will describe the construction of porting plate 71, finally we will show how the porting plate 71 effects direction of chemicals in either of the two modes mentioned.

For convenience of discussion the various openings in subplate 31 and hence Teflon gasket 70 will be divided into groups, and related to those in the porting plate 71. Thus openings 38, 41, 47, and 51 in Teflon gasket 70 may be designated Group 1; openings 39, 42, 48, and 52, Group 2; openings 40, 43, 49, and 53, Group 3; and openings 59, 64, 65, Group 4. Porting plate 71 has openings related to those in Teflon gasket 70 and these may be divided into groups, correspondence between groups of openings in porting plate 71 and groups in gasket 70 being indicated by a primed number. Thus, in the porting plate 71, Group 1' openings are 38a, 38b, 47a, 47b, 51a; Group 2' openings are 39a, 39b, 48a, 48b, 52a; Group 3' openings are 40a, 40b, 49a, 49b, 53a; and Group 4' openings are 59a, 59b, 64a, 65a. There is a pair of kidney-shaped grooves enveloping openings in each of the porting plate groups. In Group 1' these are grooves 72 and 73; in Group 2', grooves 74 and 75; in Group 3', grooves 76 and 77; and in Group 4' there is a single groove 78.

A "quad-ring" (an endless band of resilient material, approximately square in cross section) is disposed within each of the grooves 72 through 78 such quad-rings being collectively indexed 79. Each quad-ring 79 functions to seal off the openings within its confines from other openings in gasket 70 and porting plate 71 so that there will be no leakage where it is not tolerable. The materials from which the opposed surfaces of gasket 70 and porting plate 71 are made play an important part in the effective sealing against leakage by the "quad-

rings." The coefficient of friction of "quad-rings" relative to the material of the porting plate must be greater than it is relative to the material of the gasket for the reason that unless this is so the material comprising a "quad-ring" will not continue to have its thickness uniformly distributed in the groove containing that "quad-ring," but instead will tend to be pushed to one side of the groove. It has been found that where the porting plate 71 is of stainless steel and the gasket 70 is of Teflon the materials are appropriately related to fulfill this requirement as to coefficient of friction.

Porting plate 71 is made up of two portions, portion 71a through which openings are bored and in the bottom of which passages are routed, (see FIG. 13 and 14), and 71b, an unperforated portion which serves the function of enclosing the passages so that they are subsurface within the porting plate. In the unitized porting plate 71 which results upon securely fastening portions 71a and 71b together, in Group 1' openings 47a and 38a are connected by subsurface passage 83 while passage 84 interconnects openings 38a and 38b. Passage 85 interconnects apertures 47b and 51a. In Group 2' passage 88 provides a subsurface connection between openings 39a and 48a, while passage 89 does the same for apertures 39a and 39b, and passage 90 for openings 48b and 52a. Subsurface passage 93 in Group 3' interconnects openings 40a and 49b, and passage 94 joins openings 40a and 40b, while passage 95 joins openings 49b and 53a. Subsurface passage 99 joins openings 59a and 64a in Group 4', and similarly passage 100 interconnects openings 59b and 65a.

Referring to FIGS. 2 and 15, the latter being a section taken in FIG. 2 showing the location of the porting plate in the mixing head 10, it will be seen that porting plate 71 is in direct surface contact with gasket 70, and is substantially surrounded and disposed within upper housing portion 104. (Porting plate 71 is shown without detail of surface construction in FIG. 15 because the purpose of FIG. 15 is to illustrate the relationship of porting plate 71 in its two positions to the balance of the mixing head). Main shaft 14 passes through the center of porting plate 71 and is surrounded by bearing sleeve 105. Thrust bearing plate 106 rests upon the top of porting plate 71 and thrust bearing 107 exerts a downward force thereon because of the pressure upon said thrust bearing of spring 108 upon race thrust bearing 109 which in turn is in direct contact with thrust bearing 107.

Referring particularly to FIG. 15, it will be seen that porting plate 71 is fashioned with a slot 113 therein and there is a bottom surface 114 in said slot. Handle 115 is secured to the bottom surface 114 of the slot and thereby to the porting plate. Handle 115 is not the normal means for changing the position of porting plate 71 but rather is such manual shift done only in emergencies. The normal means for shifting the position of the porting plate is arm 116 which is actuated by hydraulic cylinder 117. Hydraulic cylinder 117 is controlled by conventional solenoid means not shown, such solenoids being actuated by means located on the control panel 11a. As indicated by the legend at the top of FIG. 15, when the porting plate 71 is in the position shown in solid lines in FIG. 15 the porting plate is in dispensing position, that is, chemicals will be introduced into the mixing chamber 23. The alternative position of the porting plate 71 is reached when arm 116 is moved in the direction of the arrow marked "recirculation." When porting plate 71 reaches rest position upon such movement, flow of chemicals into the mixing chamber will cease, chemicals will be recirculated through the system, and solvent will be available for flushing the ports into the mixing head, or, in the alternative, air flush may be employed.

The relationship of openings in the Teflon gasket and the porting plate when the porting plate is in dispensing position is shown in FIG. 16. Similarly the relationship between such surfaces when porting plate is in recirculation position is shown in FIG. 17. Neither FIGS. 16 nor 17 are actual sections in the mixing head. They are instead schematic representations showing how various openings are interconnected in each of the alternative settings of porting plate 71. Passages and

openings depicted in solid lines in FIGS. 16 and 17 are those occurring in Teflon gasket 70 and therefore subplate 31; the openings and passages in the porting plate 71 are shown in dotted lines. Thus, when the porting plate is in dispensing position relative to Teflon gasket as shown in FIG. 16 each of the metering ports 47, 48, and 49 are in communication with chemical intake apertures 38, 39, and 40 respectively by means of subsurface passages in porting plate 71 designated 83, 88, and 93 respectively. Nucleation air intake aperture 64 is in communication with port 59 by means of subsurface passage 99. It will be observed that apertures 38b, 39b, and 40b in porting plate 71 are out of use as are recirculation apertures 41, 42, and 43 respectively. Similarly aperture 65 in Teflon gasket 70 and apertures 59b and 65a in the porting plate are out of use during this setting of the porting plate.

When the porting plate is then moved to recirculation position as shown in FIG. 17, apertures 47a, 48a, and 49a in the porting plate are out of use while all of the apertures in the Teflon gasket in Groups 1, 2, and 3 are in use. In Group 4 in Teflon gasket aperture 64 is out of use while apertures 59a and 64a in the porting plate are also out of use.

It will be observed, and it is very important herein to notice, that in neither dispensing nor recirculating position of the porting plate nor in movement to or from any of these positions, do any of the apertures either in the Teflon gasket or the porting plate ever move outside the bounds defined by the grooves 72-73 within which are disposed quad-rings. This means that should there be leakage from any of such apertures such leakage will be confined to the area encompassed within one of such grooves and will never be carried beyond such boundary because an aperture passes over a quad-ring.

We have heretofore made reference to metering ports 47, 48, and 49 in connection with the feeding of chemicals into mixing chamber 23. FIG. 18 illustrates the detail of one such metering port representative of all. Such ports consist of threaded openings through subplate 31. The opening is divided into an upper portion 121 of larger diameter and portion 122 of smaller diameter. Within the metering port is a needle valve 123 consisting of a needle valve head 124 and tapering portion 125.

It will be observed that needle valve head 124 is of rectangular, not circular, shape and therefore an opening is left on either side of such head after it is threaded into engagement with portion of larger diameter 121 of the metering port, so that chemical may enter the metering port on either side of such head and pass therethrough into the mixing chamber. The rate of flow of chemical through the metering port is controlled by cooperation between needle valve 123 and a Teflon sleeve 126 which is threaded upwardly into the metering port. Depending upon the position of the Teflon sleeve relative to tapering portion 125 of the needle valve, a greater or lesser opening will be available for chemical to pass through and therefore a greater or lesser rate of feed of chemical will obtain. Where a stainless steel subplate is used as is the case preferred here, together with a Teflon sleeve as described, close control without leakage of chemical through the metering port is obtainable. Moreover, an infinitely variable control means is provided.

While specific illustration has here been made of the present inventive subject matter, it will be readily understood that such specific structure could be modified and changed, and despite this, still fall within the ambit of my invention.

I claim:

1. Chemical ingredient treating apparatus including:
 - a. means for recirculating a chemical ingredient;
 - b. chemical treating chamber;
 - c. closure plate means closing one side of said treating chamber, said closure plate means having a flat surface and openings in said flat surface terminating chemical-conducting means in said closure plate means;
 - d. rotatable porting plate means having a flat surface disposed in opposition to said closure plate means flat surface, said porting plate means flat surface having pairs

of openings terminating subsurface passages therein for selectively registering with said openings in said closure plate means to direct said chemical ingredient alternatively into said treating chamber or to said recirculating means;

e. endless groove means in one of said flat surfaces surrounding at least one of said openings therein; and

f. endless resilient band means in said endless groove means; whereby undesired leakage of chemical ingredient between openings in said closure plate means may be prevented.

2. Chemical ingredient treating apparatus as claimed in claim 1 wherein the material comprising one of said flat surfaces has a different coefficient of friction than the material comprising the other of said flat surfaces.

3. Chemical ingredient treating apparatus as claimed in claim 1 wherein the material comprising the flat surface in which said endless groove means occurs has a higher coefficient of friction than the material comprising the other flat surface.

4. Chemical ingredient treating apparatus as claimed in claim 1 wherein said openings in said closure plate means flat surface include a first opening terminating a chemical ingress passage, a second opening terminating a recirculation passage and a third opening terminating port means into said treating chamber, and one of said pairs of openings in said porting plate means flat surface terminates the ends of a subsurface passage for interconnecting said first and second openings when said porting plate is in position to direct said chemical ingredient into said recirculating means, and another of said pairs of openings terminates the ends of another subsurface passage for interconnecting said first and third openings when said porting plate means is in position to direct said chemical ingredient into said treating chamber.

5. Chemical ingredient treating apparatus as claimed in claim 4 wherein said first, second, and third openings constitute a group of openings in said closure plate means flat surface, and said one of said pairs of openings and said other of said pairs of openings constitute a group of pairs of openings in said porting plate means flat surface, there being a plurality of said groups in each of said flat surfaces.

6. Chemical ingredient treating apparatus as claimed in claim 4 wherein said openings in said closure plate means flat surface includes a fourth opening terminating a flushing agent ingress passage, and wherein still another of said pairs of openings in said porting plate means flat surface terminates the ends of a subsurface passage for interconnecting said third and fourth openings when said porting plate is in position to direct said chemical ingredient into said recirculating means.

7. Chemical ingredient treating apparatus as claimed in claim 6 wherein said endless groove means is in said porting plate flat surface and includes one endless groove encompassing said one of said pairs of openings therein, and another endless groove encompassing at least another of said pairs of openings.

8. Chemical ingredient treating apparatus as claimed in claim 7 wherein said endless groove encompassing said one of said pairs of openings therein encompasses also said second opening in said closure plate means flat surface when said porting plate is in either of said positions.

9. Chemical ingredient treating apparatus as claimed in claim 1 including rotatable mixing means in said treating chamber motor means for furnishing rotary power to said mixing means, and plastic gear means interposed between said motor means and said treating chamber.

10. Chemical ingredient treating apparatus as claimed in claim 9 wherein said plastic gear means is mounted for direct rotation by said motor means and including a drive shaft upon which sprocket means and said mixing means are mounted,

said plastic gear means being disposed between said motor means and said treating chamber and in engagement with said sprocket means.

11. Chemical ingredient treating apparatus as claimed in claim 1 including internally threaded port means through said closure plate means opening into said treating chamber, a needle valve within said port means, said needle valve having a substantially rectangular head portion and a tapered body portion, and externally threaded sleeve means within said internally threaded port means whereby an access opening to said treating chamber is provided which is continuously variable in size.

12. Chemical ingredient treating apparatus as claimed in claim 11 wherein said closure plate means is of metal and said externally threaded sleeve means is of plastic having a coefficient of friction lesser than that of said metal.

13. Chemical ingredient treating apparatus as claimed in claim 1 including rotatable mixing means in said treating chamber, an egress opening from said treating chamber, and an upwardly inclining surface adjacent said egress opening whereby mixed material must pass upwardly to reach said egress opening before being emitted from said treating chamber.

14. Chemical ingredient treating apparatus as claimed in claim 13 including removable nozzle means, said upwardly inclining surface being a part of said removable nozzle means.

15. Chemical ingredient treating apparatus including:

a. means for recirculating a chemical ingredient;

b. a chemical mixing chamber;

c. mixing means in said mixing chamber;

d. drive means for said mixing means;

e. motor means to furnish rotary power for said drive means; and

f. plastic gear means driven by said motor means, said plastic gear means being in engagement with said drive means for said mixing means and disposed between said mixing chamber and said motor means.

16. Chemical ingredient treating apparatus as claimed in claim 15 wherein said drive means includes a drive shaft and a sprocket mounted thereon, said plastic gear means being in engagement with said sprocket.

17. Chemical ingredient treating apparatus including:

a. a chemical mixing chamber having a wall;

b. mixing means in said mixing chamber; and

c. an internally threaded port in said mixing chamber wall opening into said mixing chamber;

a needle valve within said port means having:

a head portion of lesser areal dimension than that of said port means, whereby a chemical ingredient may pass said head portion to enter said port;

a tapered body portion within said port; and

externally threaded sleeve means within said internally threaded port, whereby an access opening to said treating chamber is provided which is continuously variable in size.

18. Chemical ingredient treating apparatus as claimed in claim 17 wherein said chemical mixing chamber is metal and said sleeve means is of plastic having a coefficient of friction lesser than that of said metal.

19. Chemical ingredient treating apparatus including:

a. a chemical mixing chamber;

b. mixing means in said mixing chamber;

c. drive means for said mixing means;

d. egress means from said mixing chamber; and

e. removable nozzle means having an upwardly inclined surface extending into said mixing chamber adjacent said egress means, whereby mixed material must pass upwardly to reach said egress opening before being emitted from said mixing chamber.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,559,955 Dated February 2, 1971

Inventor(s) Lucas J. Wydeveld

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet [54], and Column 1, title of invention "CHEMICAL INGREDIENT EATING APPARATUS", each occurrence, should read -- CHEMICAL INGREDIENT TREATING APPARATUS --

Signed and sealed this 29th day of June 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents