Aug. 2, 1932. M. P. WETMORE 1,869,533

VACUUM BOTTLE SEALING MACHINE

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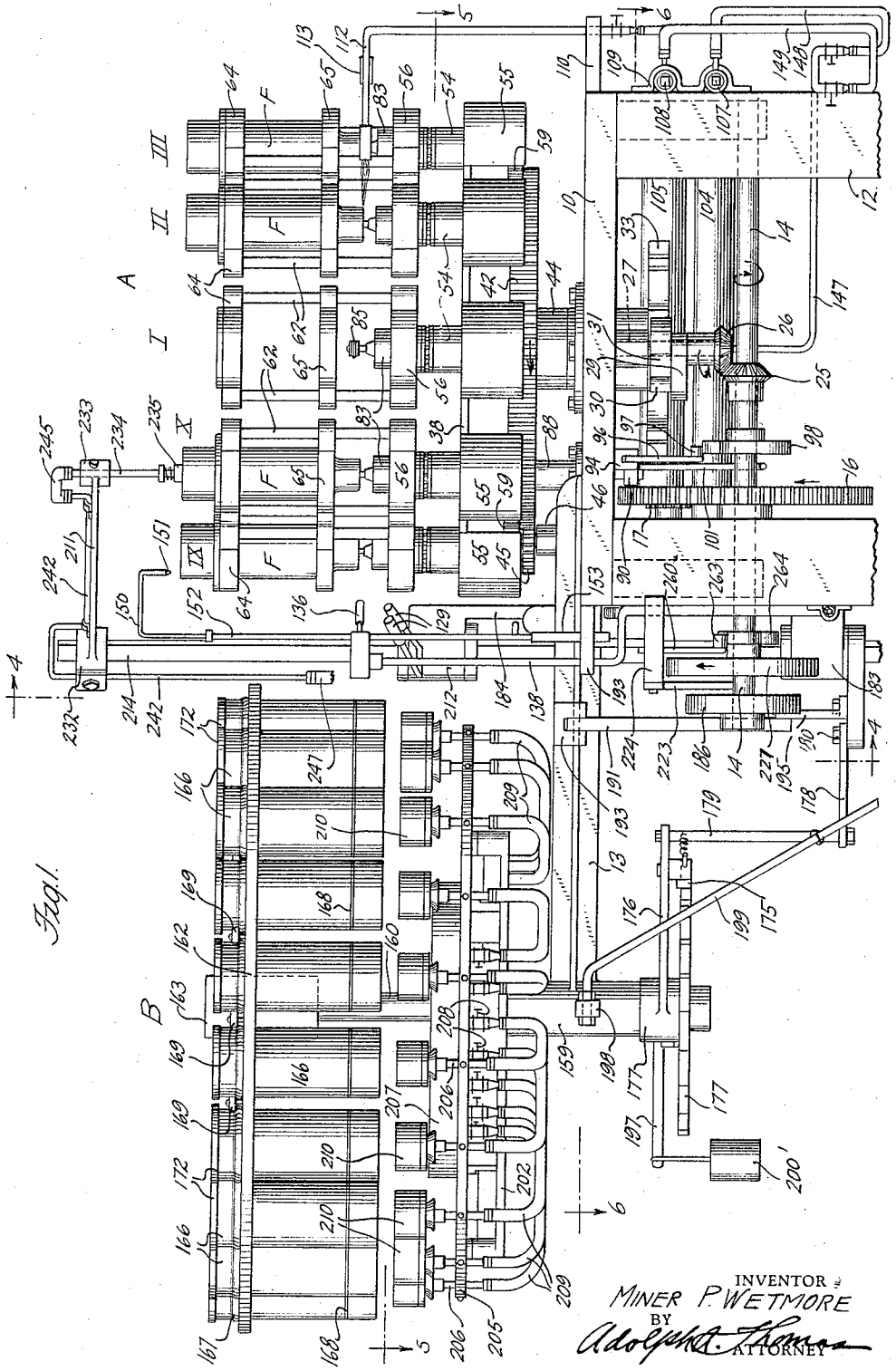

Fig. 1.

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VACUUM BOTTLE SEALING MACHINE

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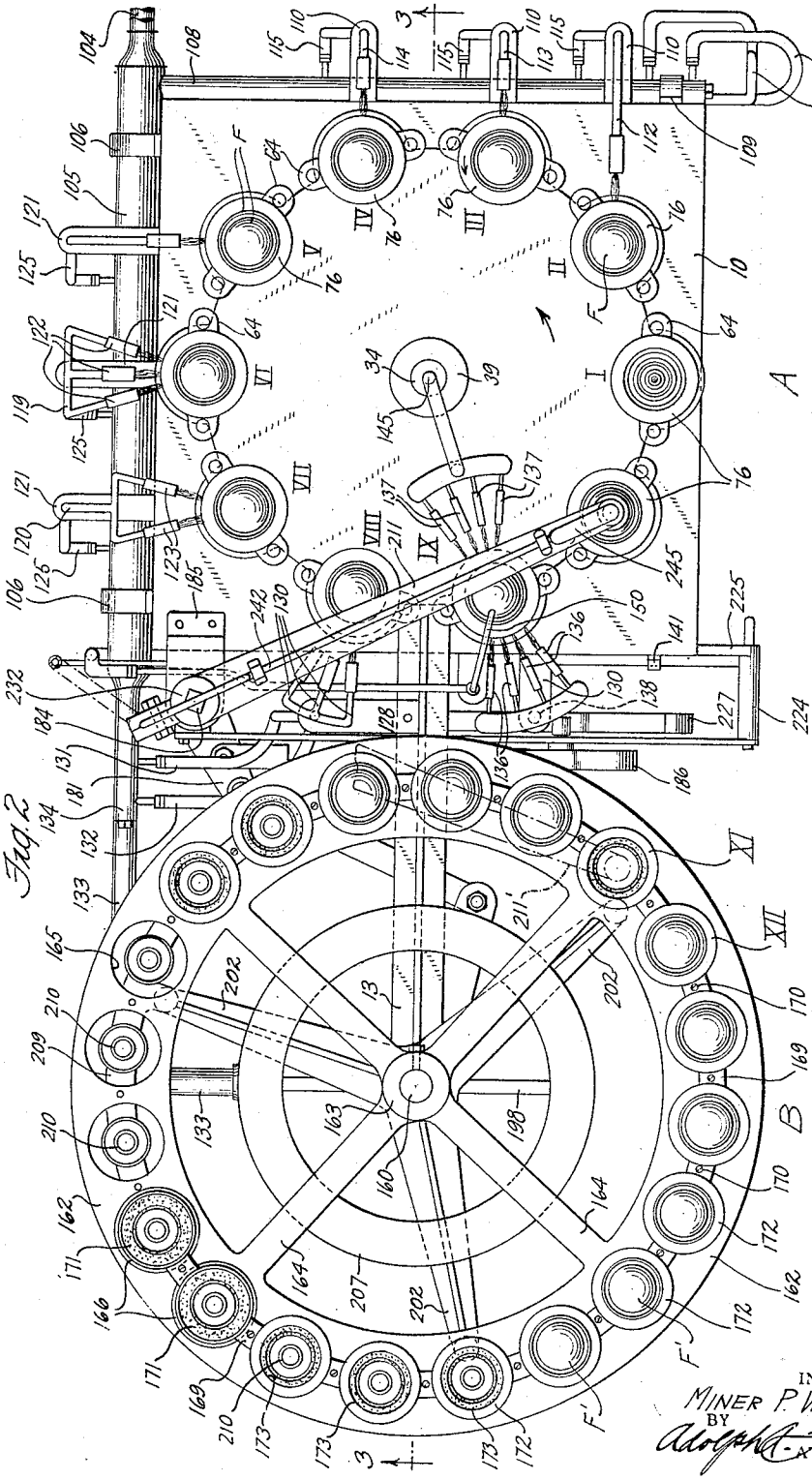

Fig. 2

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VACUUM BOTTLE SEALING MACHINE

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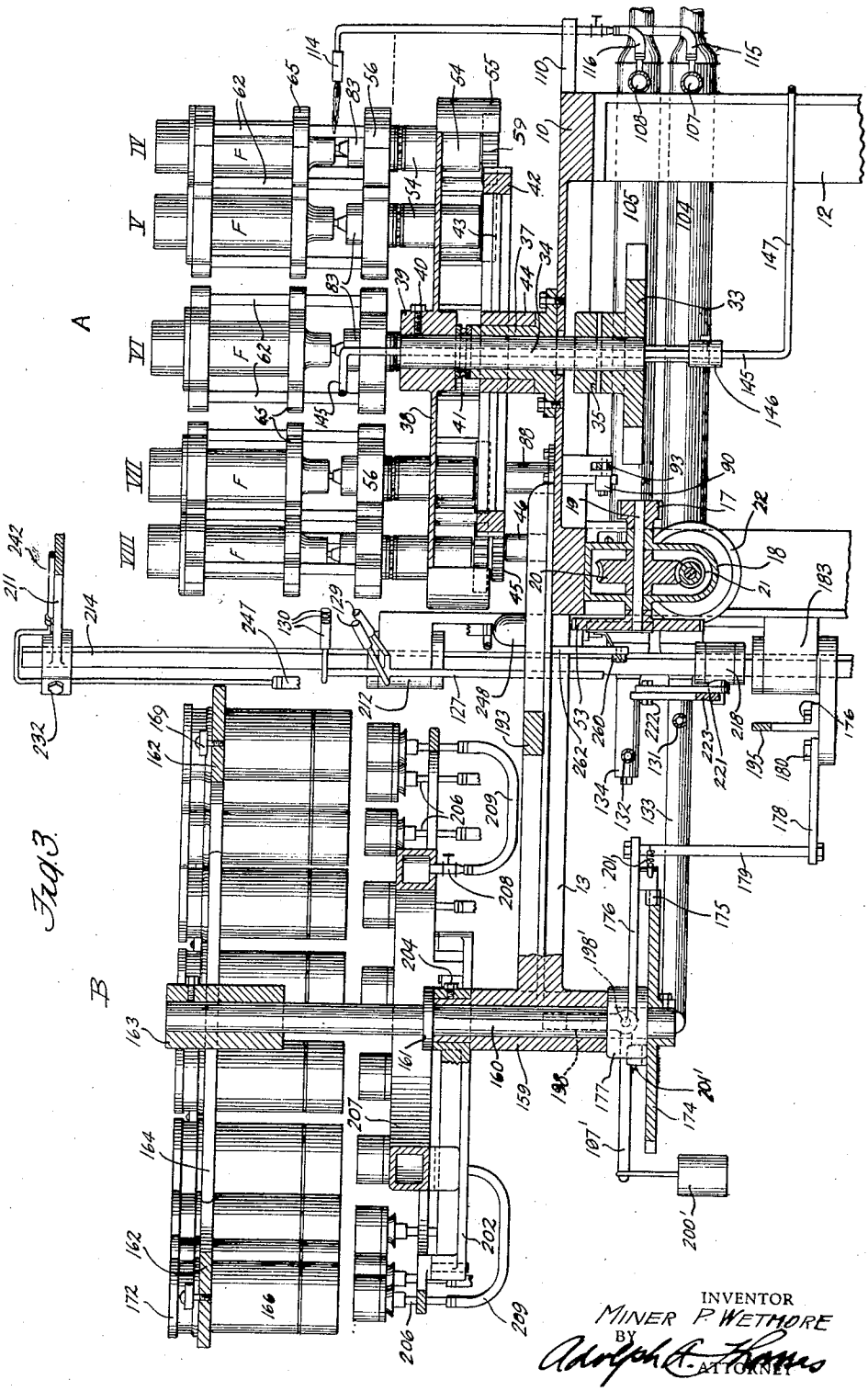

Fig 3.

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VACUUM BOTTLE SEALING MACHINE

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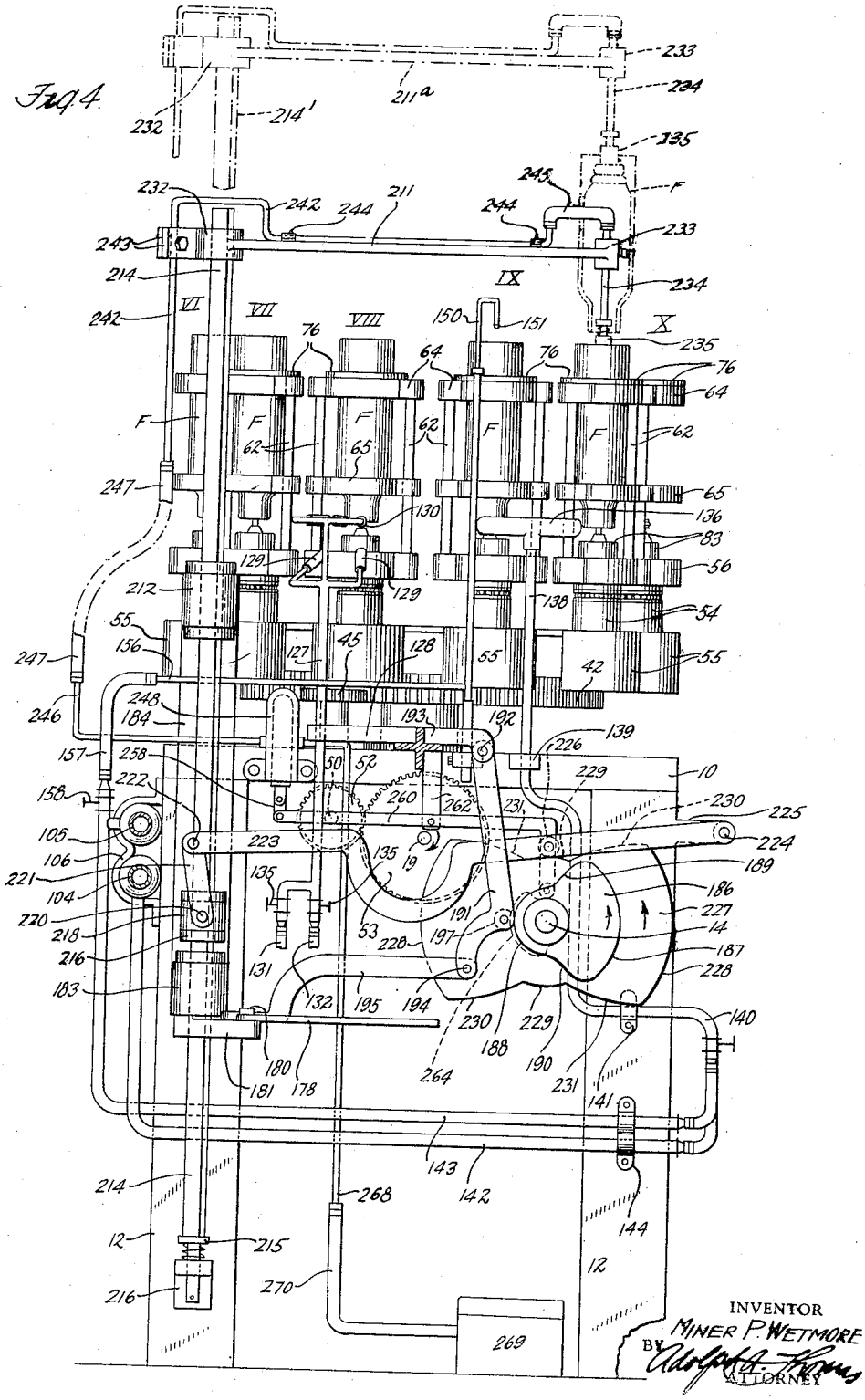
Fig 4.



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VACUUM BOTTLE SEALING MACHINE

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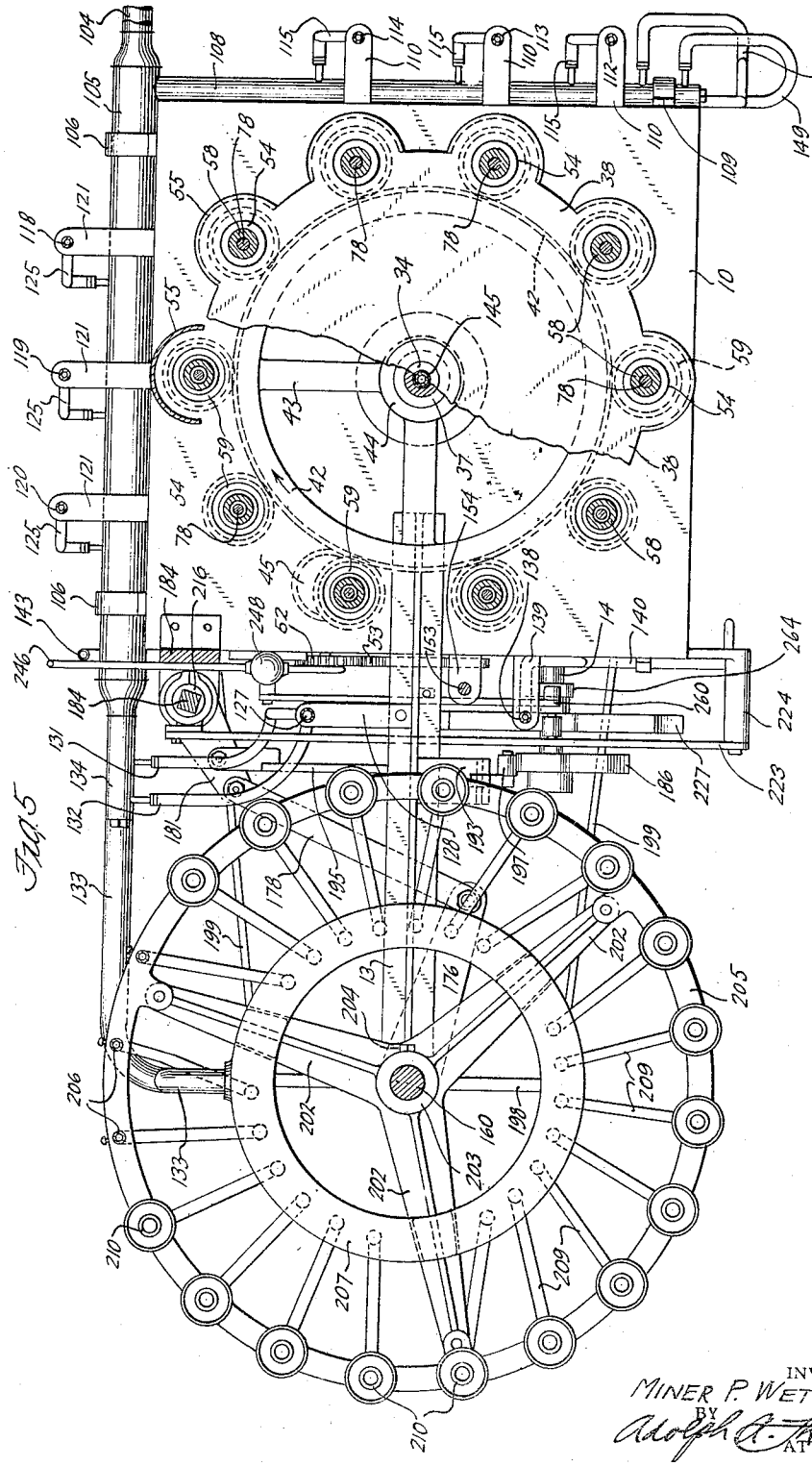

Fig. 5

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VACUUM BOTTLE SEALING MACHINE

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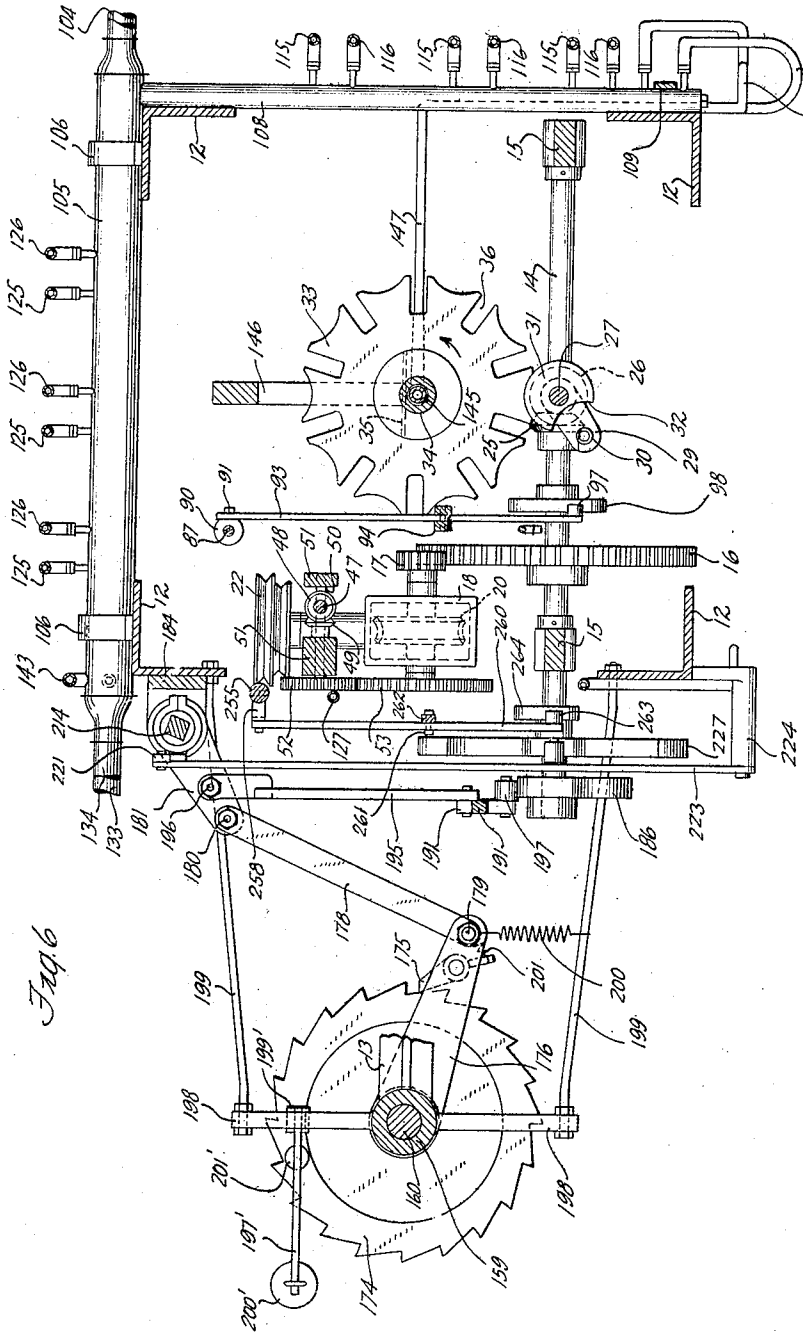

Fig. 6

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VACUUM BOTTLE SEALING MACHINE

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Fig. 7

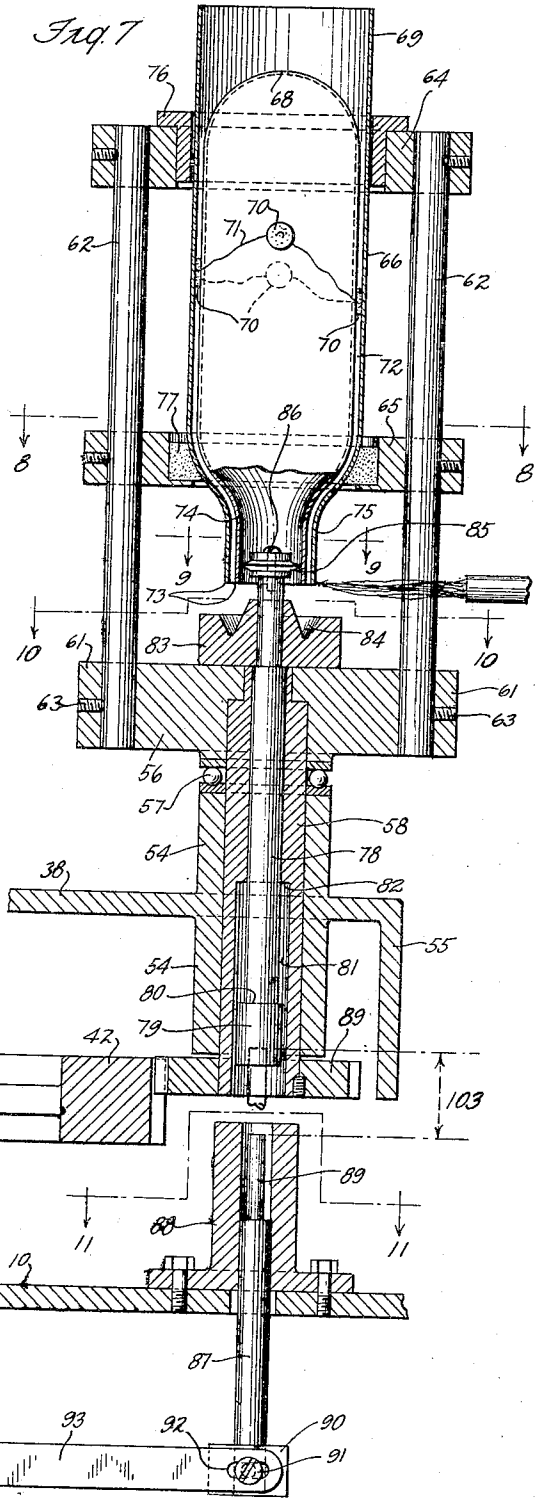


Fig. 8

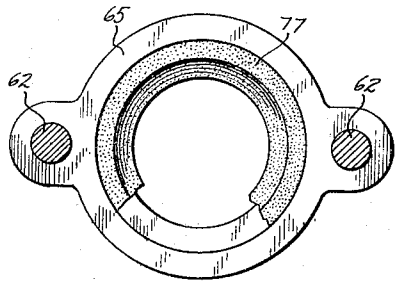


Fig. 9

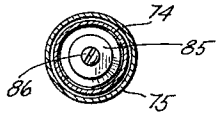


Fig. 10

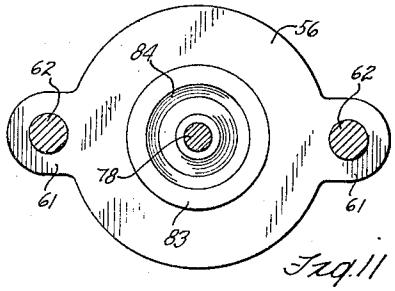
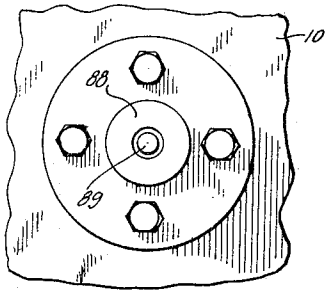


Fig. 11



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VACUUM BOTTLE SEALING MACHINE

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Fig. 12

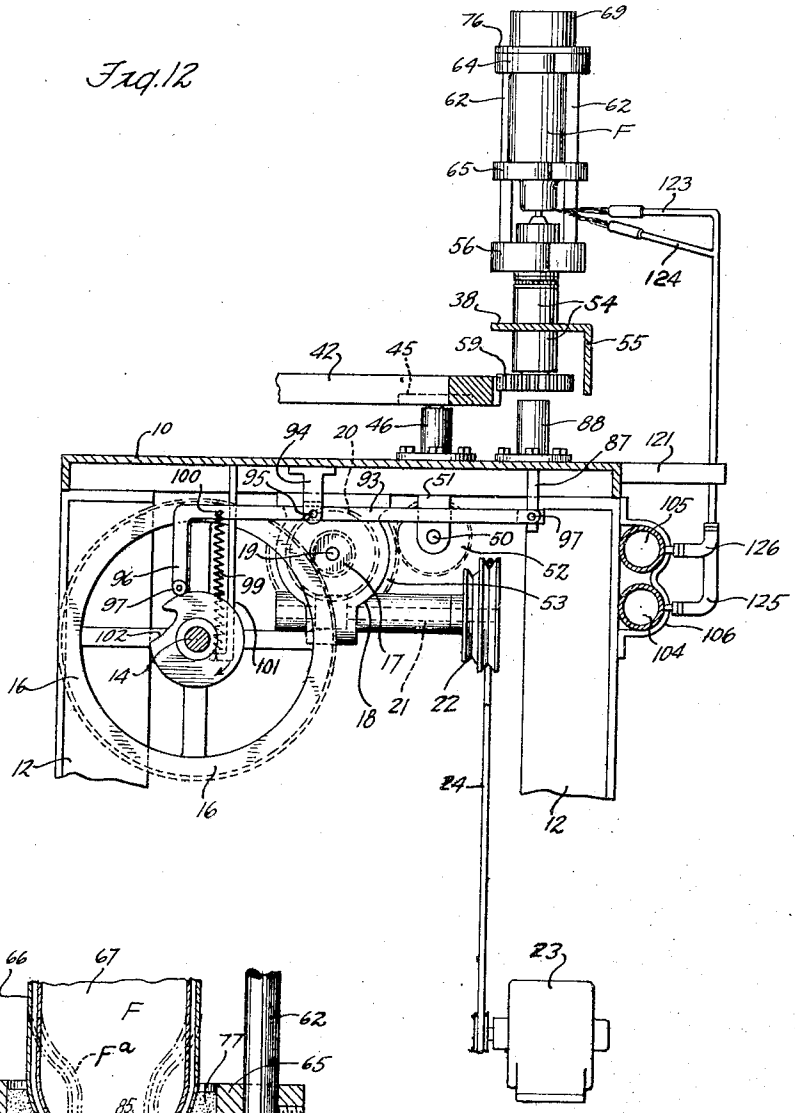
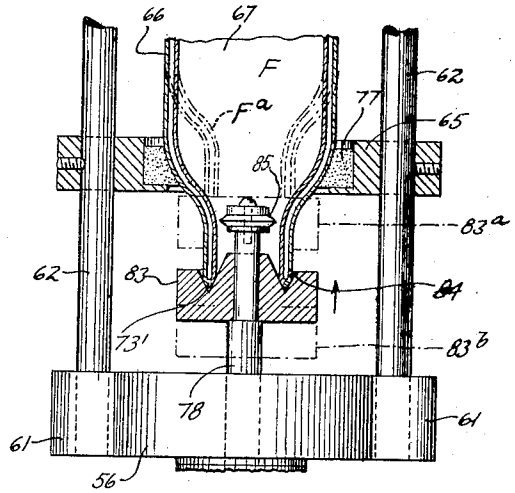


Fig. 13



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Aug. 2, 1932. M. P. WETMORE 1,869,533

VACUUM BOTTLE SEALING MACHINE

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Fig. 14

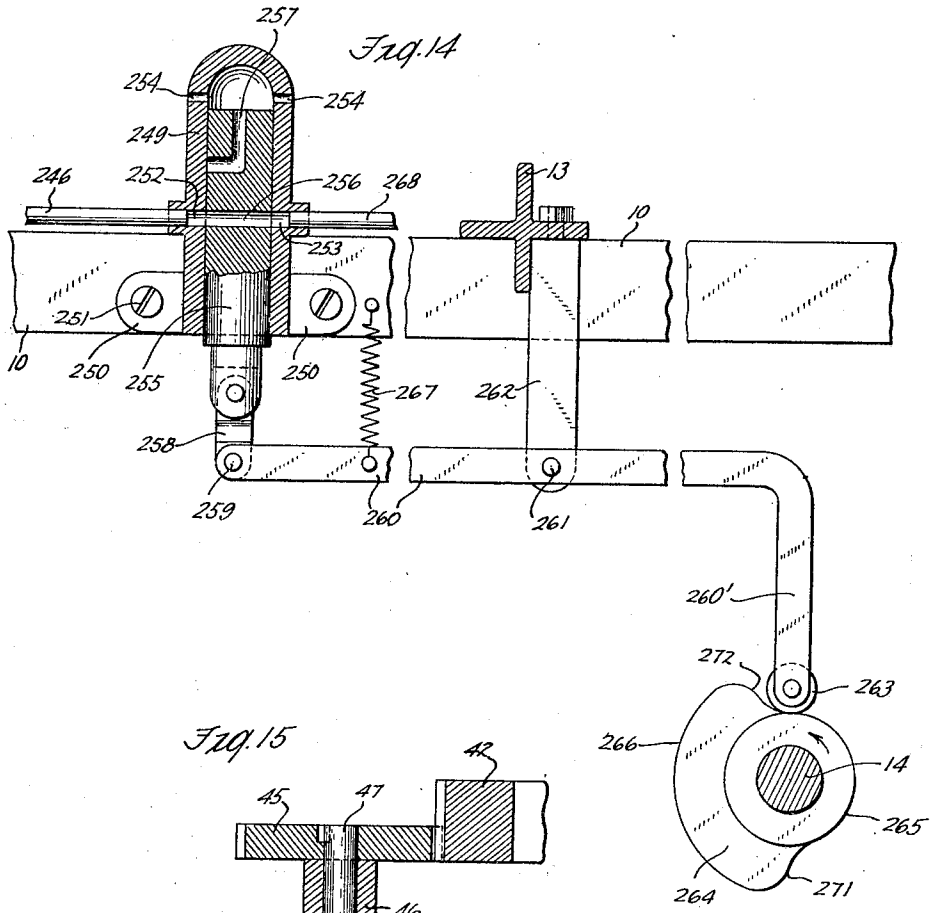
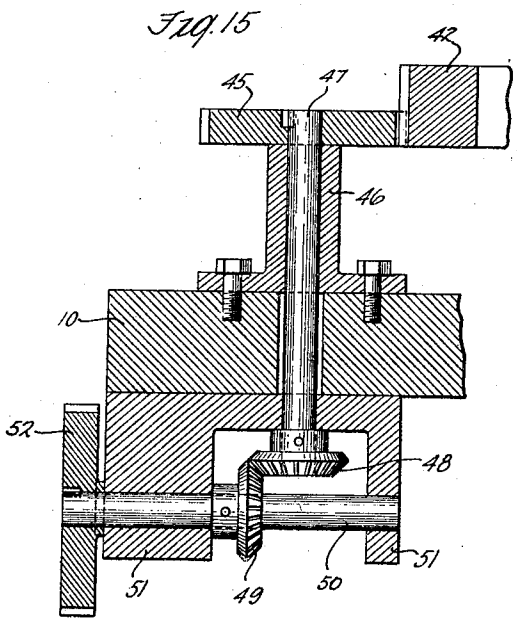


Fig. 15



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VACUUM BOTTLE SEALING MACHINE

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Fig. 16

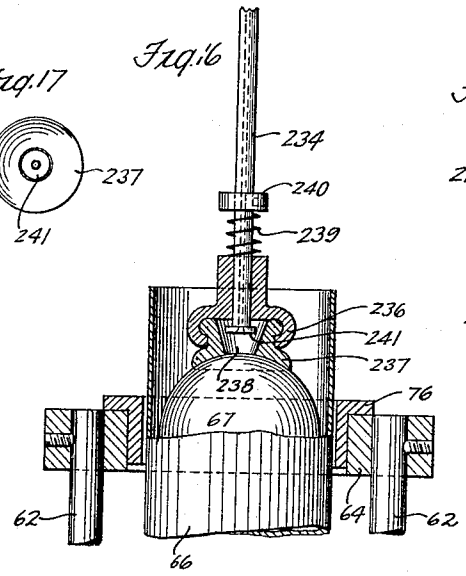


Fig. 17

Fig. 18

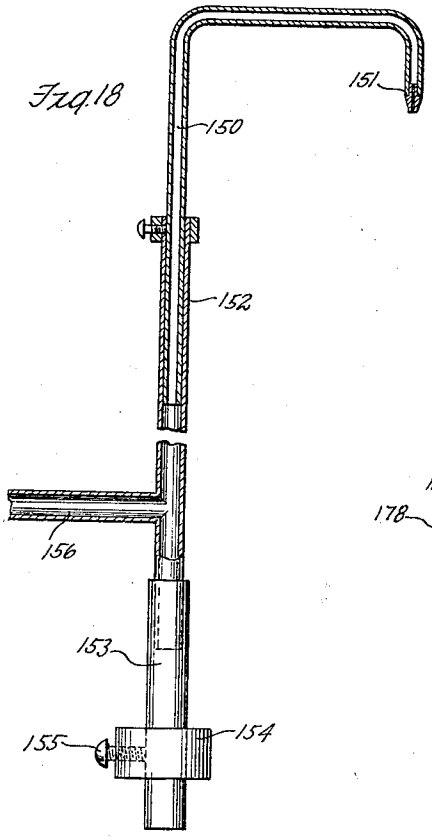


Fig. 19

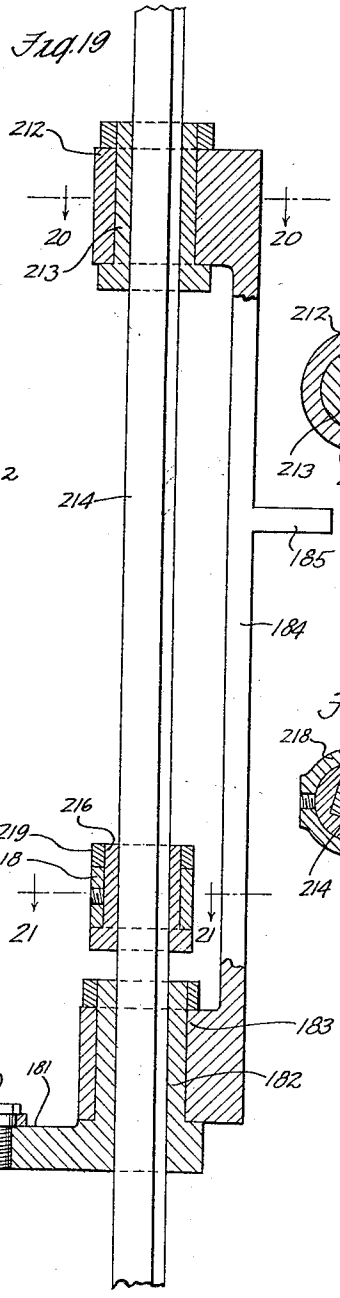


Fig. 20

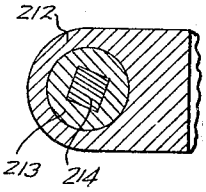
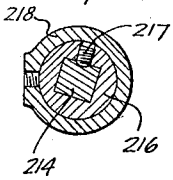


Fig. 21



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VACUUM BOTTLE SEALING MACHINE

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Fig.22

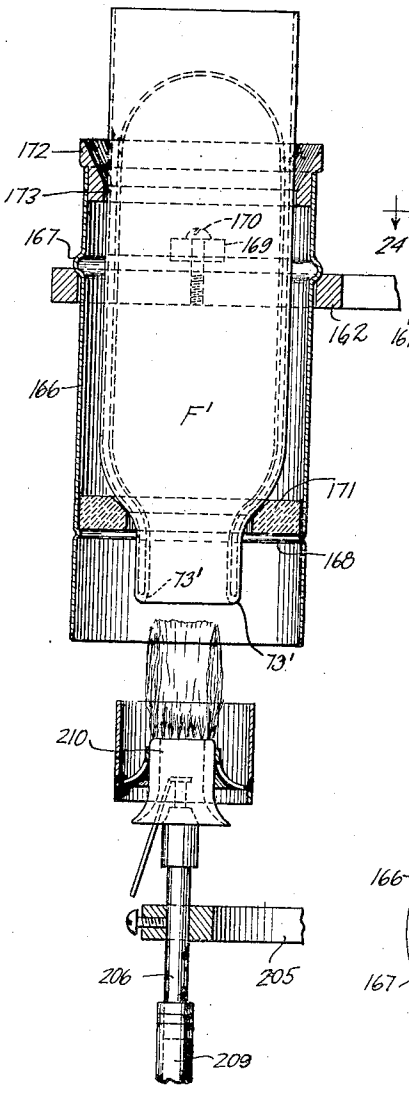


Fig.23

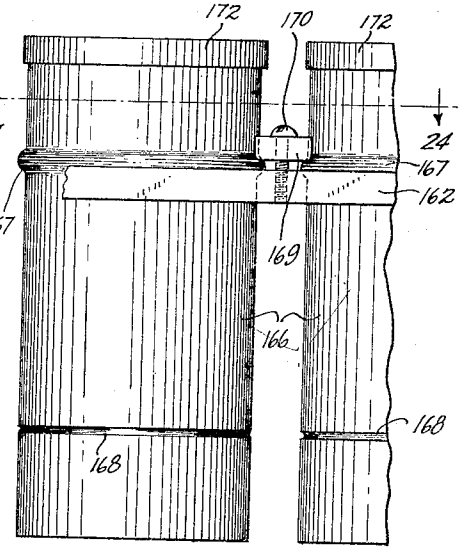


Fig.24

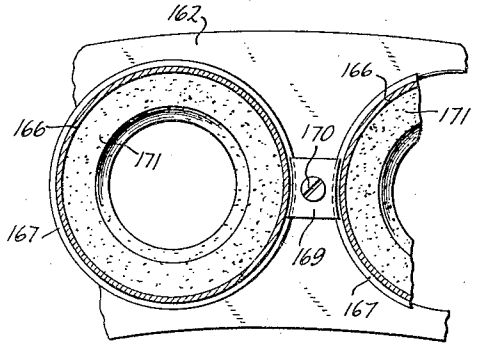
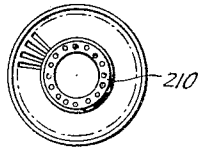


Fig.25



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Patented Aug. 2, 1932 1,869,533

UNITED STATES PATENT OFFICE

MINER P. WETMORE, OF NORWICH, CONNECTICUT, ASSIGNOR TO THE AMERICAN THERMOS BOTTLE COMPANY, OF NORWICH, CONNECTICUT, A CORPORATION OF OHIO

VACUUM BOTTLE SEALING MACHINE

Application filed June 9, 1928. Serial No. 284,073.

This invention relates to the manufacture of double-walled vacuum bottles of glass, and its object is to provide new and improved methods and apparatus for sealing the two cylinders at the neck. It is generally known that in bottles of this type there are two glass cylinders (or pistons, as the shopmen call them) in concentric arrangement and fused together at the top. This operation is called topping. The annular space between the cylinders is evacuated to surround the inner container with a heat-insulating medium.

In the method heretofore employed to seal the cylinders at the neck, they were placed in a machine in upright position and sealed at the top by means of a carbon tool which an experienced operator had to manipulate by hand against the heated rims of the bottle to force them together until they became fused. This old hand method not only required considerable skill in the handling of the tool, but the seal thus produced was not always satisfactory. In fact, no two seals could be made alike; and they were usually of uneven thickness, so that the glass was subjected to strains. In short, that old hand-sealing method was unsatisfactory and uneconomical.

To overcome these objections and disadvantages of prior sealing operations, I have devised new methods and apparatus for topping the glass cylinders of vacuum bottles in a simpler, cheaper and more expeditious way. Briefly stated, the machine of my invention in its general construction comprises two intermittently rotating tables, a topping table on which the glass cylinders are sealed at the neck in inverted position, and an annealing table on which the sealed joint is annealed. The sealed cylinders are automatically transferred from the topping table to the annealing table, from which they are removed by an attendant.

The sealing mechanism proper comprises a block having an annular sealing groove for receiving the softened tops of the inverted cylinders. The shape of this groove is such that the cylinder necks are automatically forced together and united in a fused seal, which is then smoothed off and annealed. This novel method of sealing and the mechanism for effecting the same constitute one of the most important features of my invention, as will become evident later on.

The practical advantages of my invention have been demonstrated by means of a commercial machine which has been successfully operated. I can, therefore, best explain the principle and operation of my invention by describing that machine, which is illustrated in the accompanying drawings. Let it be understood, however, that in selecting this particular embodiment of my invention for detailed description, I do not thereby intend to impose any restrictions or limitations on my invention. In these drawings—

Fig. 1 is a front elevation of the machine referred to;

Fig. 2 is a top view of the machine;

Fig. 3 shows a section on line 3—3 of Fig. 2;

Fig. 4 is a section on line 4—4 of Fig. 1;

Fig. 5 is a plan in section on line 5—5 of Fig. 1;

Fig. 6 represents a section on line 6—6 of Fig. 1;

Fig. 7 is a sectional detail view of the sealing or topping mechanism proper;

Figs. 8, 9, 10 and 11 are sections respectively on lines 8—8, 9—9, 10—10 and 11—11 of Fig. 7, to show more clearly certain parts of the topping mechanism;

Fig. 12 is a fragmentary sectional view showing the topping mechanism and certain operating connections;

Fig. 13 is a sectional detail view of the topping mechanism with a bottle in one of its positions during the sealing operation;

Fig. 14 is a fragmentary detail view of the valve connections for controlling the vacuum in the operation of transferring the bottles from the topping table to the annealing table;

Fig. 15 is a cross-section showing details of connections for continuously rotating the bottles on the topping table;

Fig. 16 shows a detail construction at the suction end of the transfer arm which car-

ries the sealed bottles from the topping table to the annealing table;

Fig. 17 is a bottom view of the suction pad or cup at the end of the transfer arm;

Fig. 18 shows a detail of the air-cooling connections for the bottles on the topping table;

Fig. 19 shows details of the mounting for the transfer shaft;

Figs. 20 and 21 are sections respectively on lines 20—20 and 21—21 of Fig. 19;

Figs. 22 and 23 show certain details of the annealing mechanism;

Fig. 24 is a section on line 24—24 of Fig. 23; and

Fig. 25 is a top view of the burner shown in Fig. 22.

The machine as a whole comprises two main parts—namely, topping apparatus A and annealing apparatus B. Both of these mechanisms are mounted on a base plate 10 supported on legs 12. The topping apparatus is mounted directly on the base plate 10, while the annealing apparatus B is mounted on an arm or bracket 13 secured to the base plate 10. Before taking up a detailed description of the topping and annealing mechanisms, I shall describe the main driving connections mounted below the base plate 10.

Main driving connections

Referring to Figs. 1, 6 and 12, there is a cam-shaft 14 supported in bearings 15, which may conveniently be a pair of brackets suspended from the underside of base plate 10. The shaft 14 carries a large gear 16 in mesh with a pinion 17, which is part of a reducing box 18 supported beneath the base plate. A cross-section of this box is shown in Fig. 3, where it is seen that the pinion 17 is fixed on a cross-shaft 19 carrying a worm wheel 20 which engages a worm shaft 21. The outer end of worm shaft 21 carries a pulley 22 which is connected to a motor 23 through a belt or chain 24, as shown in Fig. 12. Any other practical driving connections may be employed for operating the cam-shaft 14 at proper speed. In the machine as actually operated for commercial work, the speed of shaft 14 is five revolutions per minute. This, of course, is in properly timed relation to the movements of other parts of the machine, as will be described later on.

The main driving shaft 14 carries a bevel pinion 25 meshing with a similar pinion 26 on a vertical shaft 27 rotatably mounted in bearings 28. The shaft 27 carries an arm 29 provided with a pin 30 near its outer end. A disk 31 having a cut-out section 32 is fixed on shaft 27. The parts 29 and 31 may be cast as a single piece. The disk 31 acts as a stop for a Geneva wheel 33 fixed on a vertical hollow shaft 34 in any practical way, as by means of a pin 35. As the arm 29 rotates, the pin 30 enters a slot 36 in Geneva wheel 33 and thereby moves the latter a distance represented by the width of one tooth. The disk 31 locks the Geneva wheel 33 against movement during its intervals of rest, as will be clear from Fig. 6. The cut-out section 32 of disk 31 permits a step-by-step movement of the Geneva wheel by the pin 30. As the wheel 33 has ten teeth, it receives one-tenth of a turn in a counter-clockwise direction (as viewed in Fig. 6) for every revolution of cam-shaft 14. Since the latter receives five revolutions per minute, it takes two minutes for the vertical shaft 34 to make one complete turn in periodic movements of one-tenth of a revolution each. The hollow shaft 34 is supported in a bearing 37 mounted on base plate 10.

Topping mechanism

On the upper end of shaft 34 is mounted a turntable 38, which may for convenience be called the topping table. As shown in Fig. 3, the table 38 has a hub 39 mounted on shaft 34 and fixed in adjusted position by a screw 40 or otherwise. A ball-bearing 41 permits smooth and easy rotary movement of the topping table. A large gear 42 is rotatably supported on the bearing 37 of shaft 34. The gear 42 is preferably of the ring type, having arms 43 (see Fig. 5) radiating from a central hub 44, by means of which the gear is mounted on bearing 37. It should be noted that the gear 42 does not rotate with shaft 34, but has a continuous rotary movement wholly independent of the shaft. The driving connections for gear 42 are these:

As best shown in Fig. 15, a small gear or pinion 45 is mounted on a vertical shaft 46 on table 10, so as to be constantly in mesh with the large gear 42 on shaft 34. The pinion 45 is supported on the upper end of a vertical shaft 47 which extends through the table 10, and at its lower end carries a small bevel gear 48 arranged to mesh with a bevel gear 49 fixed on a horizontal shaft 50. A suitable bracket 51 connected to the underside of table 10 supports the shaft 50. A small gear 52 on the outer end of shaft 50 meshes with a larger gear 53 on the cross-shaft 19 of the speed-reducing box 18. As previously explained, the shaft 19 is driven continuously by the pulley 22 connected to the electric motor 23, so that the large gear 42 below the turntable 38 is continuously rotated at proper speed in a clockwise direction (as viewed in Fig. 5). In Fig. 1, the direction of rotation of gear 42 is indicated by the arrow *a*.

The topping table 38 is provided with a series of bearings 54 extending above and below the table and arranged equi-distantly in a circular path, as may be seen in Fig. 5. These bearings are preferably cast integral with the table. A depending flange 55 may be provided adjacent each bearing 54 to protect the operator's hand from accidental contact with the gearing beneath the table. The

mechanism supported in each bearing 54 is best shown in the detail view of Fig. 7, to which I shall now refer. It will be understood that what is shown in Fig. 7 applies to each of the ten bearings carried by the topping table. On bearing 54 is rotatably mounted a disk 56 which is preferably supported on a ball-bearing 57 for smooth easy rotation. A rotatable sleeve 58 extends through bearing 54 and at its lower end carries a small gear 59 arranged to mesh constantly with the large gear 42. The disk 56 is fixed on the upper end of sleeve 58, as by a pin 60 or otherwise. It will thus be seen that the large central gear 42 simultaneously rotates all gears 59 and disks 56. In this particular machine, the gear connections are such that the disks 56 make sixty revolutions per minute.

Each disk 56 is formed with a pair of ears or lugs 61, which carry a pair of vertical rods 62 rigidly held by screws 63 or otherwise. The upper ends of rods 62 support a collar 64, and a second collar 65 is fixed on the rods at a predetermined distance below the top collar. The collars 64 and 65 constitute a vertical support for a glass filler F, which consists of two concentric cylinders 66 and 67. After these glass cylinders have been finally assembled and evacuated, they constitute a unit for insertion in an outer casing to form a complete vacuum bottle. These glass units are called fillers in the trade. The two cylinders 66 and 67 are blown separately in molds. The inner cylinder is formed with a rounded bottom 68, but the outer cylinder is left with an open extension 69 through which the inner cylinder 67 is inserted. Asbestos pads 70 connected by a wire 71 hold the two cylinders spaced to provide an annular chamber 72, which is subsequently evacuated to provide a heat-insulating medium for the inner cylinder or container 67.

The purpose of this invention is to seal the nested cylinders 66 and 67 at the edges 73 of the necks 74 and 75. This sealing operation is called "topping" because the sealed joint constitutes the top of the finished filler. The upper ring or collar 64 has a removable metal sleeve 76, whose inner diameter accommodates the outer cylinder 69 of the filler. The lower ring 65 carries a removable asbestos ring 77 shaped to receive the shoulder of the outer cylinder 69. To support fillers of different sizes, it is only necessary to insert a sleeve 76 and ring 77 of corresponding inner diameter.

Still referring to Fig. 7, in the rotary sleeve 58 is mounted a rod 78 arranged to move up and down. The lower end of rod 78 has an enlargement 79 which forms a shoulder 80. The sleeve 58 has an enlarged bore 71, which forms a shoulder 82. The shoulders 80 and 82 limit the upward movement of rod 78 in sleeve 58. The upper end of rod 78 carries a heavy metal disk or block 83 provided with an annular bevelled groove 84. For distinction I shall refer to the grooved member 83 as the topping or sealing block, because its function is to seal the cylinders 66 and 67 at the edges 73, as will presently be explained. The block 83 is fixed on the rod 78 so as to move therewith. The downward movement of rod 78 is arrested when the block 83 strikes the disk 56 on which the block normally rests, as shown in Fig. 7. To the top of rod 78 is fixed a centering disk 85 of refractory material, such as carbon, emery, and the like. A screw 86 is sufficient to hold the centering disk 85 rigidly in place. The outer diameter of disk 85 is just slightly less than the inner diameter of the neck 74 of the filler, so that the two cylinders 66 and 67 are positively held in alignment with respect to the sealing groove 84 of block 83. The disk 86 moves up and down in the neck of the filler during the vertical movements of rod 78, whereby the correct position of the filler is insured at all times.

Referring to Figs. 6, 7 and 12, I shall now describe the connections for operating the topping block 83 to seal the glass cylinders 66 and 67 at the rims 73. Each rod 78 is raised at the proper moment by a pin 87 movable in a bearing 88 mounted on the base plate 10. The pin 87 has an extension 89 adapted to strike the lower end 79 of rod 78 when the pin 87 is suddenly raised. The lower end of pin 87 carries a collar 90 having a screw or stud 91 arranged to engage in the slotted end 92 of a lever 93. The base plate 10 carries a depending bracket 94 having a pin 95 on which the lever 93 is pivoted. The rear end of lever 93 terminates in a downward extension 96 which carries a roller 97 arranged to ride over the periphery of a cam 98 fixed on the main cam-shaft 14. A coil spring 99 holds the roller 97 constantly against the cam 98. One end of spring 99 is attached to the lever 93 at 100, and the other end of the spring is fastened to a bracket 101 depending from the base plate 10. This is clearly shown in Fig. 12. The cam 98 has a cut-out section 102 into which the roller 97 drops once in every revolution as the cam rotates in a clockwise direction (as viewed in Fig. 12). It is clear that when the roller 97 drops into the cam recess 102, the front end of lever 93 is suddenly thrown up to elevate the pin 87.

Sealing operation

The operation of the topping mechanism above described is as follows: We shall here assume (see Fig. 2) that a bottle has traveled from the loading position I to the topping position VII. In the intermediate positions II to VI, the glass cylinders have been progressively heated at the lower ends 73 until the glass at that point is sufficiently plastic

to permit sealing. The heating means will be described later on. Referring to Fig. 7, when the pin 87 is suddenly thrown up by the connections previously described, it strikes the rod 78 so forcibly that the impact throws the rod out of contact with the pin extension 89. Therefore, although the full throw of pin 87 is the distance indicated by the dotted lines 103 in Fig. 7, the block 83 is actually thrown up from the rest position shown in Fig. 7 to the dotted position 83^a in Fig. 13. The upward movement of block 83 carries with it the filler F which is lifted off the asbestos ring 77, as roughly indicated by the dotted outline F^a in Fig. 13. In this view, the sealing block 83 is shown in full position as just engaging the bottle. The dotted outline 83^b represents the position to which the block falls when the lower end of rod 78 rests on the upper end of pin 87, which is still in raised position. When the plastic rims 73 of the glass cylinders 66 and 67 enter the bevelled groove 84 of block 83, they are automatically forced together into sealing contact to form a sealed joint 73'. Since the weight of the filler rests in the groove 84, there is sufficient pressure at the melted ends 73 to cause the same to flow together into a substantially uniform seal without strain.

After the sealing block 83 has jumped to position 83^a due to the first impact of pin 87 against rod 78, the latter descends by gravity until it rests on the top of pin 87, which is still in raised position. As the pin 87 descends during the travel of roller 97 in the gradually rising cam recess 102 (see Fig. 12), the rod 78 follows the downward movement of pin 87, so that the filler F is lowered until it rests again on the asbestos seat 77. Referring to Fig. 13, when the block 83 reaches the dotted position 83^b, the filler F rests on its seat, and further downward movement of block 83 leaves the sealed joint 73' clear of the sealing block. During the up and down movements of block 83, the refractory disk 85 insures the concentric alignment of the rims 73 with the bevel sealing groove 84, so that a seal of substantially uniform thickness is obtained. There is a particular advantage in sealing the cylinders in inverted position. The soft glass at rim 73 tends to flow downwardly and thereby attenuate the rim. Now, the upwardly moving block 83 catches this soft glass and pushes it back up, so that a sealed joint of substantially uniform and requisite thickness is produced.

Heating connections for topping table

As the glass cylinders move intermittently from loading position I to the final or unloading position X, the joints to be sealed are gradually heated by gas flames to the sealing temperature in position VII, and the heating continues during positions VIII and IX (see Fig. 2), where the sealed joint is finished or smoothed off before the sealed bottle is transferred to the annealing table. The gas and air supply for the various burners is led into a main gas pipe 104 and a main air pipe 105, which are supported on the rear legs of table 10 by suitable brackets 106, as shown in Figs. 4, 5, 6 and 12. From the main pipes 104 and 105 extend two branch pipes 107 and 108, which are attached to one of the front legs 12 by a bracket 109. As shown in Figs. 2, 3 and 5, the table or base plate 10 is provided at the right side with brackets 110, which support three burner pipes 112, 113 and 114. Each burner is fed with a gas and air mixture through a pair of tubes 115 and 116 connected to the gas pipe 107 and air pipe 108, respectively, as may be seen in Fig. 3. A suitable valve 117 regulates the proper supply of fuel. The three burners 112, 113 and 114 direct flames against the neck rims of the inverted fillers in positions II, III and IV, as shown in Fig. 2. It should be remembered that during this progressive heating process, the fillers are continuously rotated (in this particular machine at a speed of 60 R. P. M.) through the driving connections previously described in detail. The rims of the rotating glass cylinders are heated uniformly by the gas flames, this heat progressively increasing as the cylinders are moved forward from one position to the next.

Three additional burner pipes 118, 119 and 120 are supported at the rear of table 10 by suitable brackets or arms 121. The pipe 118 is a single burner to project a flame against the filler in position V, but the burner 119 terminates in a triple extension 122 to direct three converging flames against the bottle, and the pipe 120 has two pairs of burners 123 and 124 which concentrate flames against the lower rim of the filler when the same is in topping position VII. The upper pair of burners 123 is shown in Fig. 2, and the position of the lower pair 124 is indicated in Fig. 12. When the filler is in position VII, the lower rims of the glass cylinders are sufficiently plastic to be united by fusion into an integral seal by the grooved sealing block 83, as already described. The burner pipes 118, 119 and 120 are each fed with a fuel mixture of gas and air through a pair of tubes 125 and 126 connected to the main gas and air pipes 104 and 105, as best shown in Fig. 12.

In position VIII of the filler, the sealed joint is heated by five flames from a burner pipe 127 supported by an arm 128 (see Figs. 2, 4 and 5) secured to the supporting bracket 13. The pipe 127 has two lower burners 129 and three upper burners 130, which concentrate flames against the sealed joint to maintain the same at high heat as the filler passes to the final finishing stage in position IX.

The burner pipe 127 is at its lower end connected to a gas tube 131 and an air tube 132 (see Fig. 4). The gas tube 131 is connected to an extension 133 of the main gas pipe 104, and the air tube 132 is connected to an extension 134 of the main air pipe 105, as will be understood from Fig. 2. The burners 129 and 130 are regulated by suitable valves 135 at the lower end of pipe 127 (see Fig. 4).

In position IX the sealed neck of the filler is subjected to a series of finely pointed flames from two sets of burners 136 and 137 arranged diametrically opposite, as will be seen in Fig. 2. Each set comprises four burners arranged to concentrate flames against the sealed neck to finish it off in a smooth even edge. The burners 136 are supplied with fuel through a pipe 138 supported on a bracket 139 which projects from the left side of base plate 10. Referring to Fig. 4, it will be seen that the burner pipe 138 has an extension 140 attached by a bracket 141 to the adjacent table leg 12. The lower end 141 of burner pipe 138 is connected to the gas and air pipes 104 and 105 through tubes 142 and 143, respectively. These tubes are attached near their front end to one of the table legs 12 by a bracket 144. The burners 137 are fed through a pipe 145, which passes through the hollow shaft 34 in such a way that the shaft rotates while the pipe is stationary. The lower end of the central burner pipe 145 is supported by a bracket 146 (see Figs. 3 and 6) extending beneath the base plate 10. A lateral extension 147 of pipe 145 connects with a pair of tubes 148 and 149, which lead from the gas pipe 107 and air pipe 108, respectively, as will be seen in Figs. 1 and 6.

Supply of air pressure to filler in position IX

When a sealed filler is in position IX for the final smoothing off or finishing of the sealed joint, it is advisable to blow air under pressure into the annular space between the glass cylinders to prevent the seal from collapsing. This inner air pressure is supplied through a pipe 150, whose outlet nozzle 151 is arranged to blow a continuous stream of air under pressure into the annular chamber of the open bottle. The air pressure thus provided on the inner side of the seal counterbalances the pressure exerted by the flames from burners 136 and 137, so that the finished seal is smooth, even and substantially uniform in thickness.

Referring to Fig. 18, the air pipe 150 is adjustably mounted in a pipe 152 which is supported in a rod or closed tube 153. A lug or bracket 154 on base plate 10 supports the rod 153 in vertically adjusted position by means of a set-screw 155, or otherwise. The pipe 152 is provided with a lateral extension 156 (see Figs. 4 and 18), which is connected through a tube 157 with the upper end of air pipe 143. As previously explained, the air pipe 143 is connected to the air supply pipe 105. A suitable valve 158 controls the air pressure in pipe 150.

Annealing table

The horizontal bracket 13 has a vertical sleeve or bearing 159 in which a shaft 160 is rotatably supported. A flange or collar 161 on shaft 160 rests on top of the bearing 159 (Fig. 3). An annular table 162 is mounted on the upper end of shaft 160 by means of a sleeve or hub 163 rigidly secured to the shaft. The table 162 is here shown in skeleton form, having arms or spokes 164 which connect the outer annular section of the table with the hub 163. For distinction I shall refer to the rotary part 162 as the annealing table, since the bottles are annealed at the sealed joint as they are carried by the table in a circular path from loading to discharge position. This will presently be explained in detail.

The table 162 is provided with a series of circular openings 165, of which there are twenty in the present machine. In each opening 165 is supported a sheet metal cylinder 166. Since the cylinders are of like construction, a description of one will suffice for all. Referring to Figs. 22 and 23, the cylinder 166 is formed with an outer bead 167 near the top and with an inner bead 168 near the bottom. The outer bead 167 forms means for supporting the cylinder on table 162. After the cylinders are inserted in the openings 165, a metal block 169 is inserted between each pair of cylinders and held in place by a screw 170 or otherwise. As seen in Figs. 23 and 24, each block 169 engages the outer beads 167 of adjacent cylinders, thereby locking them firmly on the table 162. The inner bead 168 of each cylinder is adapted to support an asbestos pad 171 for receiving a sealed filler F'. I might here mention that for distinction I have used the reference character F to designate the fillers on the sealing table 38, and F' designates the sealed fillers on the annealing table 162. Each cylinder 166 is provided at the top with a removable metal ring 172 having an internal diameter 173 of predetermined size to accommodate fillers of certain outside diameter. To support different-sized bottles in cylinders 166, rings 172 of corresponding internal diameter are inserted.

The annealing table 162 is moved intermittently a certain amount by means of the following connections, reference being had to Figs. 1, 3 and 6. On the lower end of shaft 160 is fixed a ratchet wheel 174 adapted to be actuated by a pawl 175 pivoted on an arm 176, which is rotatably mounted on shaft 160 by means of a hub 177 arranged between the bearing 159 and ratchet wheel 174. The pawl

arm 176 is connected at its outer end to one end of a link 178 by means of a vertical rod 179. The other end of link 178 is pivoted at 180 to the outer end of an arm 181. As shown in Fig. 19, the arm 181 has a sleeve or hub 182 rotatably mounted in the bearing 183 of a vertical bracket indicated as a whole by 184. This bracket has a lateral extension 185, by means of which it is secured to the top of base plate 10 at the left side, as will be understood from Figs. 1, 3 and 4.

The pivoted arm 181 is actuated by a cam 186 fixed on shaft 14. As seen in Fig. 4, this cam has an outer concentric section 187 and an inner concentric section 188, these sections being connected by sloping sides 189 and 190. The cam 186 always rotates in a counterclockwise direction (as viewed in Fig. 4). A depending arm 191 is pivoted at its upper end 192 to a cross-piece 193 carried by the main supporting bracket 13. The lower end of arm 191 is pivotally connected at 194 to the front end of a link 195. The rear end of this link is pivoted at 196 to the horizontally swinging arm 181. A roller 197 on arm 191 is always in contact with the edge of cam 186.

The hub or sleeve 159 of bracket 13 is provided with a pair of integral lateral extensions 198, which are connected to the two left legs 12 of the main frame by a pair of stay rods 199, as best shown in Fig. 6. A tensioned coil spring 200 is connected at one end to the front stay rod 199 and at the other end to the vertical connecting rod 179. The tensioned spring 200 normally pulls the arm 176 and all connected parts toward the front of the machine, so that the roller 197 is constantly pressed against the edge of cam 186. A light spring 201 presses the free end of pawl 175 against the teeth of ratchet wheel 174.

Intermittent operation of annealing table

Looking at Fig. 4, it is clear that, as long as the roller 197 rides over the inner concentric track 188 of cam 186, the pawl arm 176 and its connected parts are held stationary and there is no movement of annealing table 162. When the roller 197 rides over the inclined edge 189 of cam 186, the depending arm 191 is swung to the rear, whereby the arm 181 is rocked rearward (clockwise, as viewed in Fig. 6) and pulls the pivoted arm 176 toward the rear. The pawl 175 moves the ratchet wheel 174 in a counterclockwise direction, as viewed in Fig. 6. The transmission ratio between cam 186 and shaft 160 is such that, for every revolution of the cam, the annealing table 162 is rotated through an arc equal to the distance between the centers of adjacent openings 165, which in this case amounts to one-twentieth of a revolution.

During the interval that the roller 197 rides over the outer concentric track 187 of cam 186, the pawl arm 176 remains in rearward actuated position. As the roller 197 rides over the inclined edge 190 in passing from the outer to the inner concentric track of the cam, the tensioned spring 200 pulls the connected parts forward to the position shown in Fig. 6. The return swing of arm 176 produces no movement of ratchet wheel 174, since the pawl 175 rides idly over the ratchet teeth.

To prevent the turntable from being thrown too far under the action of cam 186 and return spring 200, I provide a retarding arm 197′ pivoted at 198′ on the lower end of extension 199′ of one of the cross-arms 198, as will be understood from Figs. 3 and 6. The arm 197, carries a weight 200′ at its free end, and is provided with a friction pad 201′ near its pivotal support. The pad 201′ is forced by the weight 200′ against the ratchet wheel 174 to retard its motion and thereby insure the proper step-by-step movement of the annealing table 162.

Burner connections for annealing mechanism

Referring to Figs. 1, 2, 3 and 5, there is a three-armed spider 202 mounted on the upper end of the vertical bearing 159 by means of a hub 203, which is rigidly held against rotary movement by a screw 204 or otherwise. The arms 202 carry a ring 205 which supports a series of short burner pipes 206. In the present machine there are twenty of these burner pipes, because the capacity of the annealing table 162 is twenty fillers. The arms 203 also carry a hollow ring 207. From the underside of this ring extend valve-controlled pipes 208, one for each burner pipe 206. The burner pipes 206 are connected to the gas pipes 208 by flexible tubes 209, which may simply be suitable lengths of rubber hose. The gas ring 207 is connected to the extension 133 of the gas supply pipe 104, as will be seen in Fig. 5.

The burner pipes 206 carry gas burners 210 of suitable construction, the details of which need not be described, since they form no part of my present invention. Any practical kind of burner may be used. Figs. 22 and 25 show the details of the burners 210 used in the particular machine that I am describing. The burners 210 are arranged in alignment with the cylinders 166 carried by the annealing table 162. The flames of the gas burners 210 are so regulated that the sealed joints of the fillers F′ are properly annealed as each filler passes from the loading position XI from burner to burner until it has completed the cycle and reaches position XII (see Fig. 2), whence it is removed by the operator.

Transfer mechanism

When a sealed filler on the topping table 38 has reached position X, it is automatically transferred to an empty cylinder 166 in position XI on the annealing table 162 (Fig. 2).

This transfer is accomplished by a swinging arm 211, which is actuated in properly timed relation to the movements of the topping table and the annealing table. I shall now describe in detail the connections for operating the transfer arm 211.

I have already referred to the bracket 184 on which the arm 181 is pivoted. This bracket, as will be seen in Fig. 19, has an upper bearing 212 carrying a rotary sleeve 213 in vertical alignment with the lower sleeve 182. A square shaft 214 is mounted in the rotary sleeves 182 and 213. This shaft is of considerable length, extending almost to the bottom of the main supporting table, as will be seen in Fig. 4. The lower end of shaft 214 rests on a spring-pressed support 215 mounted in a bracket 216. The spring-pressed support 215 is adapted to take up the shock of the descending shaft 214. This shaft has a vertical or axial movement and a horizontal rotary movement, these movements being automatically executed at the proper time.

The vertical movements of shaft 214 are controlled by the following connections: Referring to Figs. 19 and 21, it will be seen that shaft 214 carries a bearing 216, which is rigidly secured to the shaft by a set-screw 217 or otherwise. On bearing 216 is mounted a sleeve 218 held in place by a collar 219. In this way, the sleeve 218 is rigidly connected to the shaft 214 to move the same axially up and down, and yet the shaft is free to rotate around the sleeve 218. This sleeve carries a pivot pin 220, to which one end of a link 221 is connected. The other end of link 221 is connected by a pivot pin 222 to the rear end of an arm 223. The front end of arm 223 is connected to a fixed pivot 224 carried by a bracket 225, which projects from a left front leg 12 of the main supporting framework. As best shown in Figs. 4 and 6, the arm 223 carries a roller 226 arranged to engage a cam 227 fixed on the main driving shaft 14. The cam 227 has a pair of outer concentric sections 228 and a pair of inner concentric sections 229. These two pairs of concentric sections, which are in diametrically opposite relation, are connected by two lifting sections 230 and two dropping sections 231. The cam 227 always rotates in a counterclockwise direction as viewed in Fig. 4.

It is clear that when the roller 226 of arm 223 rides over the inner concentric sections 229, the transfer shaft 214 is in lowermost position. Following the movement of cam 227 in Fig. 4, we see that, as the roller 226 rides over the rising section 230, the arm 223 is lifted until the roller reaches the outer concentric section 228. As the inner end of arm 223 is raised, it lifts the transfer shaft 214 a predetermined amount. The shaft 214 remains in raised position as long as the roller 226 rides over the outer track 228 of cam 227. When the roller moves over the dropping section 231 of the cam, the rear end of arm 223 is lowered and the shaft 214 drops until the roller reaches the inner concentric section 229. It is thus clear that the transfer shaft 214 is raised and lowered twice during each revolution of the controlling cam 227. The weight of shaft 214 and the connected parts is sufficient to hold the roller 226 constantly in firm contact with the edge of cam 227.

The transfer arm 211 is rigidly connected to the upper end of shaft 214 by means of a hub 232. The front end of arm 211 carries a bushing 233 which supports a pipe 234 adapted to communicate with a vacuum pump through connections that will presently be described. The lower end of pipe 234 carries a suction pad or cup which is best shown in Fig. 16. A sleeve 235 slidably mounted on pipe 234 is formed with an inwardly turned flange 236 adapted to support a rubber suction cup 237, which is shaped to fit over the spherical base of the inner cylinder 67. The cup 237 has a chamber 238 open to pipe 234. A coil spring 239 surrounds pipe 234 between the sleeve 235 and a fixed collar 240, and the tendency of this spring is to push the sleeve 235 downward. A flange 241 at the lower end of pipe 234 holds the sleeve 235 on the pipe.

When the transfer shaft 214 is dropped from its raised position the suction cup 237 is forced into airtight contact with the inner cylinder 67. The slidable mounting of sleeve 235 on rod 234 allows the latter to descend slightly after the cup has come in contact with the filler. This gives the tensioned spring 239 a chance to press the suction cup firmly against the filler in airtight contact. Since the pipe 234 is at this time open to the vacuum (by connections to be presently explained), the lifting of shaft 214 causes the filler to adhere by suction to pipe 234 until the vacuum is cut off. This does not occur until the arm 211 carrying a sealed filler has been swung over to the annealing table and lowered to deposit the sealed filler in position XI.

The connections for rotating the transfer shaft 214 have already been described, and I therefore need only mention that the movements of arm 181 by cam 227 produce rotation of the shaft through a definite angle. When the arm 181 is in the position shown in Fig. 2, the outer end of arm 211 is in alignment with a filler in position X on the topping table. When the arm 181 is swung rearward, as previously explained, the square shaft 214 is turned to carry the transfer arm into position 211′ over a filler in position XI on the annealing table. During this movement of transfer arm 211, the shaft 214 is in elevated position as indicated by dotted lines 214′ in Fig. 4. The elevated position 211^a of the transfer arm is such that the supported filler is clear of the machine and free to swing over to the annealing table.

Still referring to Fig. 4, it will be observed that the vertical movements of roller 226 over the inclined cam edges 230 and 231 are multiplied at the rear end of the lever 223, which therefore raises and lowers the transfer shaft 214 through the required distance.

Vacuum control for suction cup

The transfer arm 211 carries a pipe 242, which may conveniently be clamped between the rear extensions 243 of the arm. The horizontal portion of pipe 242 is secured to the arm 211 by straps 244 or otherwise. A rubber tube 245 connects the front end of pipe 242 with the top of pipe 234, as best shown in Fig. 4. The lower end of pipe 242 is connected to the rear end of a pipe 246 through a tube 247. The other end of pipe 246 is connected to a valve mechanism indicated as a whole by 248 (Figs. 4 and 14). This mechanism comprises a cylindrical housing 249 secured to the left edge of base plate 10 by lugs 250 and screws 251. The housing 249 has a pair of horizontally aligned holes 252 and 253. The top of housing 249 has one or more air vents 254. In housing 249 operates a valve member 255 provided with a straight passage 256 and an angular passage 257. The lower end of valve 255 carries a link 258 connected by a pin 259 to the rear end of a lever 260, which is pivoted at 261 on a bracket 262 suitably secured to the base plate 10. The lever 260 has a vertical front portion 260′ which carries a roller 263 arranged to ride over the edge of a cam 264 fixed on the main driving shaft 14. The cam 264, which always turns counterclockwise (as viewed in Fig. 14), has an inner concentric section 265 and an outer concentric section 266. A coil spring 267 always tends to move the rear end of lever 260 upward and thereby holds the roller 263 in firm contact with cam 264.

A pipe 268 is at its upper end connected to the opening 253 of valve 248. The lower end of that pipe is connected to a vacuum pump indicated diagrammatically at 269 at Fig. 4. This pump may be of any practical construction and located in any convenient place. The tube 270 represents any suitable connection between the vacuum pump and the pipe 268.

The operation of valve 255 to control the vacuum connection of suction cup 237, is in the following manner, reference being had to Fig. 14. When the roller 263 rides over the concentric inner track 265 of cam 264, the passage 256 of valve 255 connects the pipe 246 with the vacuum, so that the suction cup 237 is able to hold the filler which it engages. During the interval in which the roller 263 rides over the cam track 265 (almost half a revolution of the cam), the transfer arm 211 is raised to position 211ª (Fig. 4) carrying a sealed filler, is then swung over to position 211′ over the annealing table 162 (Fig. 2), and is finally lowered to deposit the filler into a cylinder 166 in position XI. When a sealed filler has thus been placed on the annealing table by the transfer arm 211, the roller 263 rides over the inclined track 271 of cam 264, whereby the valve 255 is lowered to cut off the vacuum and bring the right-angled passage 257 in line with valve opening 252. This opens the suction cup 237 to the outer air through pipe 246 and vents 254, so that the filler is released from the transfer arm 211.

During the interval in which the roller 263 rides over the outer concentric track 266, the vacuum is cut off and the suction cup 237 is open to the air. As soon as the suction cup has thus been opened to the air after depositing the filler in position XI on the annealing table, the transfer arm 211 is raised and moved back to the position shown in full lines in Fig. 2. The arm is then lowered to bring the suction cup into contact with the filler in position X. These three movements of the empty transfer arm 211 from the annealing table back to the topping table take place while the roller 263 of lever 260 travels over the cam section 266, which encompasses not quite half a revolution of cam 264. After the vacuum cup 237 has been lowered into contact with the sealed filler in position X, the roller 264 leaves the cam track 266 and rides down the inclined track 272, thereby moving the valve 255 up into the position shown in Fig. 14. This means that the air is off and the vacuum is on again, so that the filler adheres to the suction cup 237. The cycle of operations above described is now repeated and the transferring of sealed fillers from the topping table to the annealing table goes on automatically as long as the machine operates. All that the attendant has to do is to load fillers in position I on the topping table and to remove the annealed fillers from position XII on the annealing table.

General operation

In the detailed description of the machine as above set forth, the functions of the various mechanisms have been explained, so that the operation of the machine as a whole will be understood. For convenience, however, I shall recapitulate the operation of the machine from the time a filler is put on the topping table 38 until it is removed from the annealing table 162. After an assembled filler has been loaded in position I on the topping table, it is carried forward by the intermittent movements of the table through positions II, III, IV, V and VI, in which the lower rims of the rotary glass cylinders are progressively heated to the required temperature. When a filler reaches position VII, the topping mechanism shown in Fig. 7 automatically unites the rims 73 in a sealed joint. The sealed bottle is then moved

through position VIII to position IX where the sealed joint receives its final smoothing off. When the sealed filler reaches position X, the transfer arm 211 automatically carries it to position XI on the annealing table 162. Here the bottle is slowly carried around while subjected to the annealing heat of the burners 210. When the bottle reaches position XII, the attendant removes it.

This cycle of operation goes on continuously and automatically. The only attention that the machine requires is the loading of fillers on the topping table and the removal of sealed fillers from the annealing table. The present machine has a capacity of ten bottles on the topping table and twenty bottles on the annealing table, but it is evident that the capacity of the machine may be varied to suit specific conditions and requirements.

The automatic seal produced by the topping mechanism of my invention is superior to the seal produced by the old hand method where the operator used a carbon tool to force the walls of the glass together. Not only was that old method a slow process, but the seal made in that way was thick, uneven and frequently caused strains in the glass. The seal produced according to my invention is much thinner, has greater uniformity, and produces less strains in the glass. In other words, considering my invention from a practical standpoint, it is capable of sealing double-walled vacuum bottles in a better and quicker way than was heretofore possible.

Although I have shown and described a specific construction of machine, I want it distinctly understood that my invention is not limited to the details set forth. The important features of my invention can be embodied in various other constructions without departing from the scope of the invention as defined in the appended claims.

I claim as my invention:

1. In a machine of the class described, the combination of a rotary frame for supporting a pair of nested glass cylinders in inverted position, means for heating the lower rims of said cylinders to a plastic condition, a hollow post on which said frame is rotatably mounted, a vertically movable rod extending through said post, a member mounted on the upper end of said rod and adapted to be moved into contact with the plastic ends of said cylinders to unite them in a seal joint, mechanism for rotating said frame, connections for raising said rod at predetermined intervals, and a common power shaft for operating said mechanism and said connections.

2. In a machine for sealing double-walled vacuum bottles of glass at the neck, the combination of a frame having means for supporting a pair of nested glass cylinders in inverted position, said supporting means engaging a shoulder on the outer cylinder whereby the nested cylinders are capable of vertical movement in the frame, a vertically movable rod mounted below said frame in axial alignment with said cylinders, a weighted block slidably mounted on the upper end of said rod and having a circular beveled groove on top for receiving the plastic lower ends of said cylinders and uniting them in a sealed joint, and means for imparting a sudden upward movement of said rod to throw said block into sealing contact with the cylinder ends, the quick upward movement of said block lifting the cylinders during the sealing operation, said block and cylinders dropping by gravity to normal position.

3. In a machine of the class described, means for supporting a plurality of glass units in inverted position, each unit comprising a pair of nested cylinders, timed mechanism for intermittently moving said units from one position to the next, a plurality of spaced heating means for progressively heating the lower rims of said cylinders to a plastic condition, a weighted member provided with means for engaging the plastic ends of the cylinders and automatically uniting them in a sealed joint, a vertically movable rod on which said sealing member is slidably mounted, whereby a sudden upward movement of said rod throws said member upward on the rod into sealing contact with said cylinders, said member dropping by gravity away from the sealed joint, and connections for operating said rod in timed relation to said mechanism.

4. In a machine of the class described, the combination of rotary means for supporting a pair of nested cylinders in inverted position, means for heating the end of the rotating cylinders to a plastic condition, a member having a bevelled groove for receiving the plastic ends of said cylinders a vertically movable rod for raising said member into sealing position, a pivoted lever for operating said rod, a power shaft, and a cam operated by said power shaft for rocking said lever and thereby moving said member at a predetermined moment into pressure contact with the plastic ends of said cylinders to seal the same.

5. In apparatus for sealing double-walled vacuum bottles of glass at the neck, the combination of a rotary support for a pair of nested cylinders, means for heating the rims of said cylinders while being rotated until they are plastic, a movable member for simultaneously engaging the plastic rims in pressure contact and forcing them together in a sealed joint a vertically movable rod on which said member is mounted and raised into sealing position, a lever pivoted below said support for operating said rod, a power shaft, connections between said power shaft

and said bottle support for rotating the same, and connections between said power shaft and said lever for automatically operating the same at a predetermined moment.

6. In a machine of the class described, the combination of a main driving shaft, a rotary carrier having means for supporting a plurality of double-walled glass cylinders to be sealed at the neck, connections between said shaft and said carrier for rotating the latter at predetermined intervals to move the cylinders from one position to the next, means for heating the rims of said cylinders to be sealed, a vertically movable member adapted to engage the heated rims and seal the same, and timed connections between said shaft and said member for automatically actuating the latter into sealing position at predetermined intervals, said last-named connections including a pivoted lever controlled by a rotary cam which is operated by said driving shaft.

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