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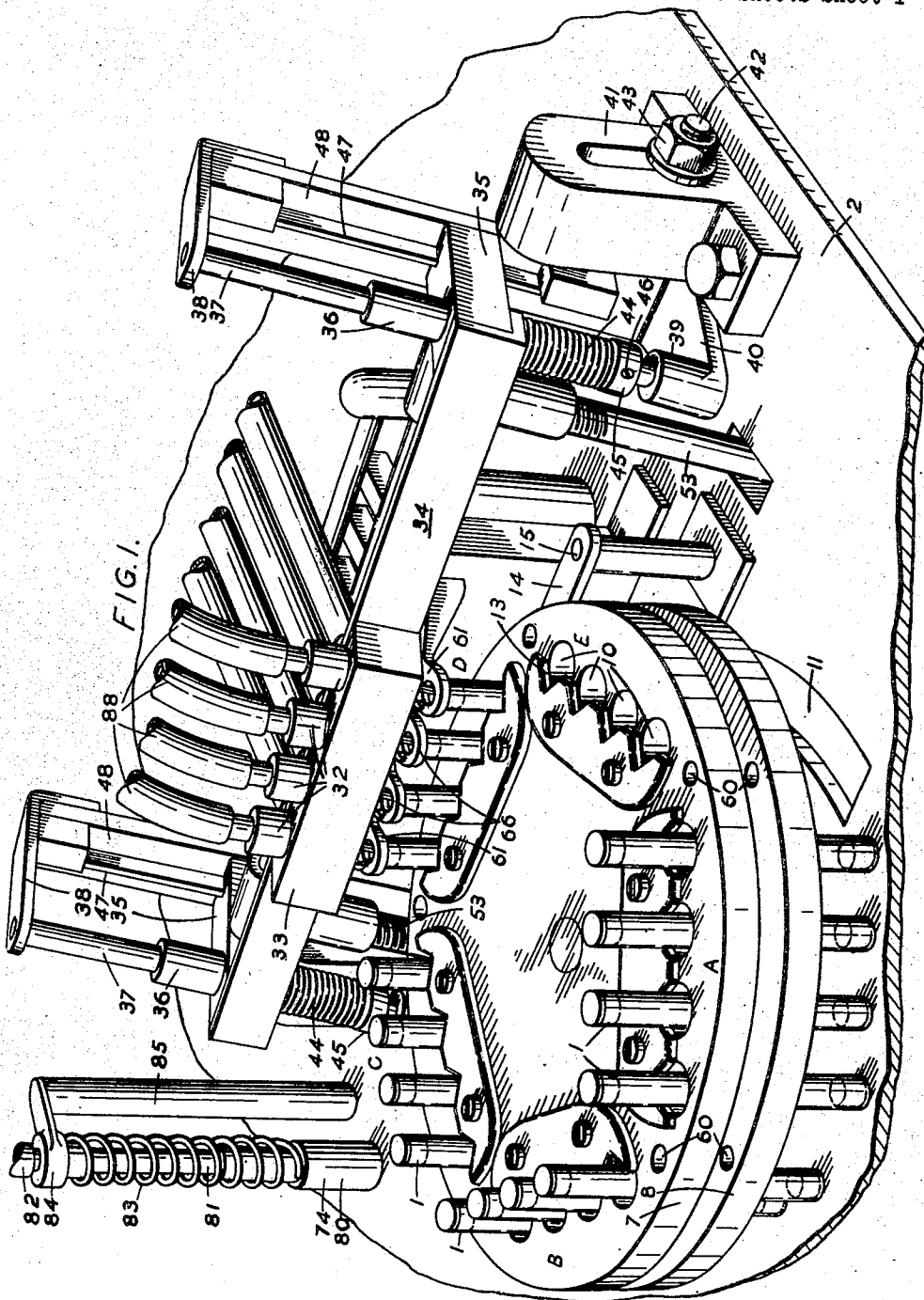
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2,562,815

APPARATUS FOR FILLING TUBES WITH LIQUIDS

Filed April 26, 1948

3 Sheets-Sheet 1



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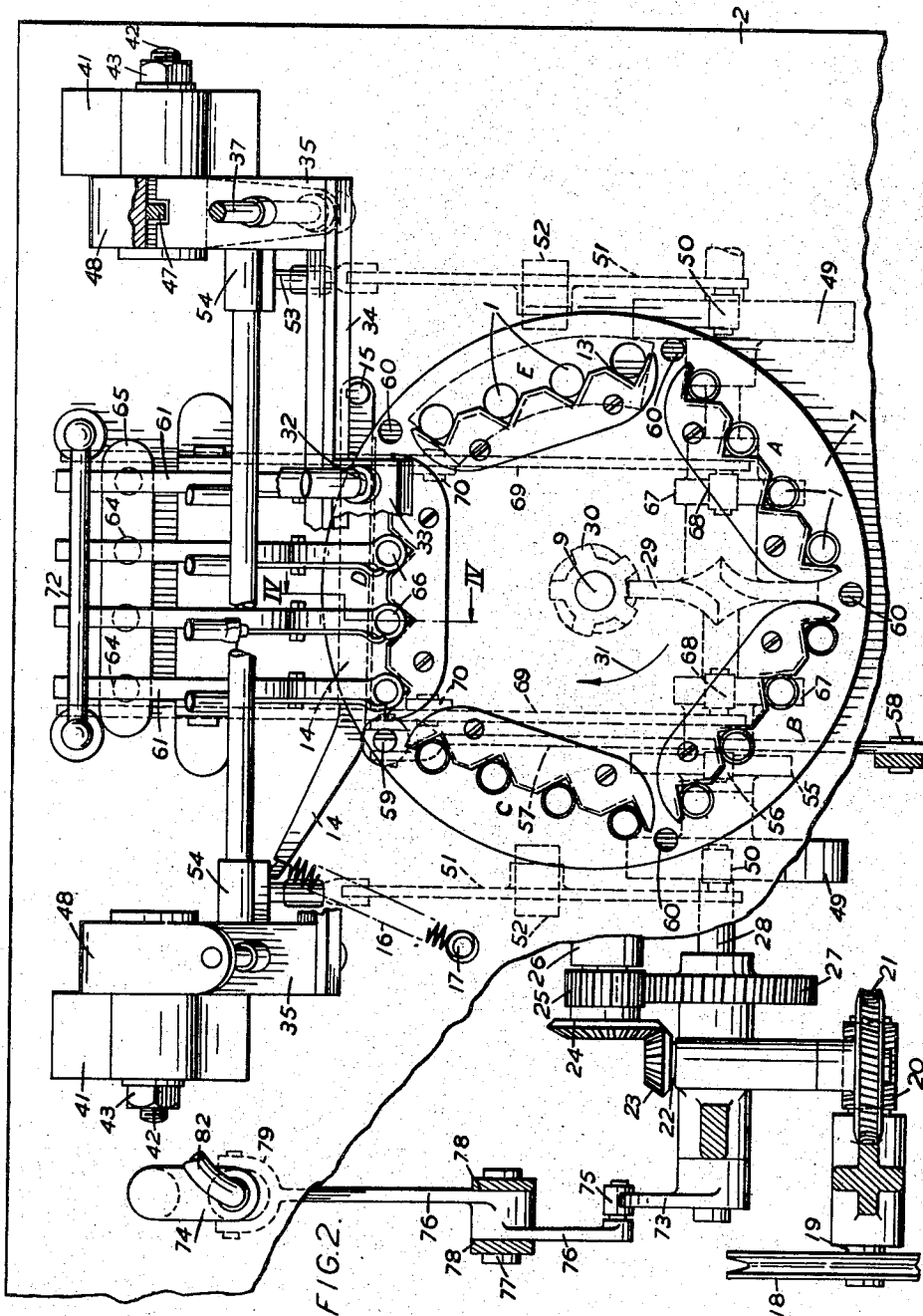
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3 Sheets-Sheet 2



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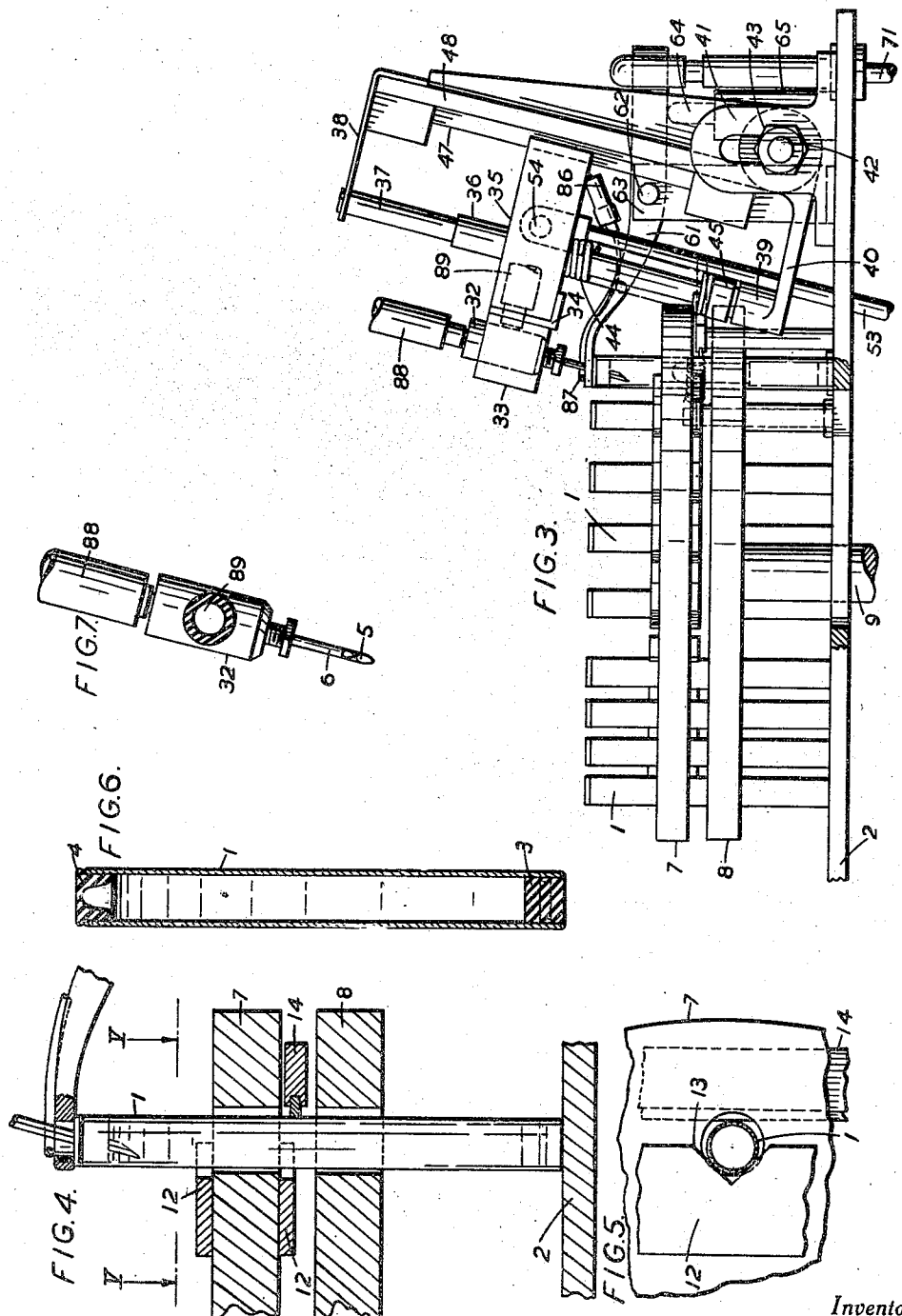
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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APPARATUS FOR FILLING TUBES WITH LIQUIDS

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13 Claims. (Cl. 226—93)

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This invention is concerned with the filling of tubes with liquid and has particular application to filling tubes with liquids which are to be used for hypodermic injection.

It is customary to put up liquid anaesthetics in plan straight glass tubes closed by a stopper at one end and provided at the other with an inserted disc or diaphragm of rubber or like soft material which can be pierced by a syringe needle in order to take up the liquid for use. Such tubes are commonly filled with the stopper and diaphragm in place by the use of a head fitting comprising a body and a projecting hollow piercer in which there are two passages; these passages emerge as tubes which are connected respectively to a vacuum pump or source of reduced pressure and to a store of the filling liquid so that as air is withdrawn from the tube, the air is replaced by the liquid which flows in to fill the tube.

The object of the invention is to improve that kind of apparatus so that the filling can be effected more expeditiously and without any particular difficulties by relatively unskilled labour.

According to the invention, a carrier for the tubes to be filled is mounted to move relatively to a filler head so that sockets for the tubes move from a position in which the tubes are inserted, to a position in which they are filled with liquid and then into a position for discharging the filled tubes. In a preferred form, the carrier is a rotary plate which is turned on a stud on the baseboard of the machine by intermittent or step-by-step gearing and has a number of tube sockets, for example, four formed in its flat face near the rim.

The filler head bears a number of piercers corresponding to the number of tubes to be filled, each fitting being generally of the known form with the passages in the filler head casting and each having a connection to the vacuum pump and a connection to the source of filling liquid. The carrier is turned to bring the tubes below the piercers when the head is depressed and all the tubes are filled at the same time. The head is raised and the carrier plate rotated whereupon the filled tubes are pushed through the plate and discharged down a delivery chute.

Difficulty has been sometimes experienced owing to the filling piercer being tight in the rubber diaphragm in the tube so that on withdrawing the piercer, the rubber diaphragm comes away with it. In order to obviate this drawback, a spring-loaded doffer is provided in accordance with the invention. The doffer may consist of a number of hold-down levers pivoted about a

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common horizontal axis, one lever for each tube and formed with a fork or ring-shaped flat forward end to press on and retain the rubber diaphragm of the tube and to permit the needle to move down and pierce the diaphragm for the filling operation. It is preferred for the levers to be pushed down by spring pressure and to be positively lifted by cam action after the filling needles have been withdrawn.

The carrier plate may be registered in the filling position or positions by a cam-operated registering or locating pin engaging one or more holes in the carrier plate and the tubes during the actual filling are preferably clamped resiliently in V-notches in plates or strips secured to the upper and lower faces of the carrier plate on the inward side of the tube sockets. The clamping is then effected by means of a presser bar held by a spring against the outer sides of the tubes in the filling position and pivoted about a vertical pin upstanding from the baseboard of the machine.

It has been found to be advantageous and to facilitate the insertion and withdrawal of the filling needles to feed a small quantity of lubricant to the upper surfaces of the rubber diaphragms in the top of the tubes. This may be effected by means of a small pump or syringe having its plunger operated by a cam at each filling operation and having a flexible delivery tube delivering into feed tubes leading to the neighbourhood of the front end of each doffer lever.

In order that the invention may be clearly understood and readily carried into effect, an example of the filling machine according to the invention will now be more fully described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of the parts of the machine appearing above the baseboard;

Figure 2 is a plan of the machine with the baseboard shown partly broken away to disclose the driving mechanism;

Figure 3 is a side elevation seen from the right of Figure 1;

Figure 4 is an enlarged vertical section taken on the line IV—IV in Figure 2;

Figure 5 is a sectional plan taken on the line V—V in Figure 4;

Figure 6 is an enlarged axial section of one of the tubes; and

Figure 7 is an enlarged side elevation of one of the needle holders.

The parts of the machine which convey the

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tubes 1 to be filled and operate upon them are assembled on a baseboard 2 below which is located the driving and actuating mechanism. The form of tube is shown in detail in Figure 6 which shows the plain straight tube 1 closed by a stopper 3 at the bottom end and having a rubber disc or diaphragm 4 inserted into its upper end, the disc being moulded with a thin central portion to facilitate piercing of the disc by the needle 5 through which the liquid is supplied and the needle 6 through which the air is extracted from the tube.

The rotatable carrier comprises two circular plates, an upper plate 7 and a lower plate 8 secured to the upper end of a vertical shaft 9 (Figure 3). In the example illustrated, four tubes 1 are filled at one time and the carrier is provided with five sets of sockets 10 formed in the plates 7, 8 and uniformly spaced around them. The tubes 1 in the sockets 10 rest on the upper surface of the baseboard 2 at the loading station A, at two resting stations B, C and at the filling station D, while at the station E the filled tubes are permitted to fall through a slot 11 in the baseboard 2 down a delivery chute. On the inner side of each set of sockets 10, two plates or strips 12 are fixed to the upper and lower faces of the upper circular plate 7 (Figures 1, 2 and 4) and are formed each with four V-notches 13. At the stations A, B, C, the tubes 1 are loose and free to accommodate themselves but at the filling station D, they are resiliently clamped in the notches 13 by a presser-bar 14 which lies between the upper and lower plates 7, 8 and is pivoted about a vertical pin 15 secured in the baseboard 2. As seen in Figure 2, the left-hand end of the bar 14 has attached to it a coiled tension spring 16 anchored to a fixed pin 17. The spring 16 therefore draws the presser-bar into contact with the tubes 1 at the filling station D and holds them resiliently but firmly located in the V notches 13.

The drive for the machine is derived from a pulley 18 driven by a belt (not shown) and fixed to a horizontal stub shaft 19 which also carries a worm 20. The latter meshes with a worm wheel 21 secured to a transverse horizontal shaft 22 to which a bevel wheel 23 is fixed at its opposite end. The bevel wheel 23 drives a larger bevel wheel 24 integral with a spur pinion 25 on a stub shaft mounted in a bearing 26 and the pinion 25 drives a spur wheel 27 secured to the main shaft 28 of the machine.

The shaft 28 bears a driving member 29 which is in effect a mutilated worm with two teeth engaging a five-toothed wheel 30 fixed to the vertical shaft 9. Thus, at each revolution of the main shaft 28, the wheel 30 is turned by the amount of one tooth, that is to say by one-fifth of a revolution in the clockwise direction as seen in plan and as indicated by the arrow 31 in Figure 2. Thus each set of tubes 1 is moved from one station A, B, or C to the next and dwells there while one set of tubes is filled at the station D.

The four needle heads 32 are mounted in a block 33 secured to a horizontal bar 34. The latter is fixed at each end to a block 35. These blocks carry upwardly extending sleeves 36 by means of which they are guided on cylindrical rods 37 which are fixed at their upper ends to brackets 38 and at their lower ends are carried on blocks 39 at the ends of arms 40 which are secured to brackets 41 by bolts 42 and nuts 43. The blocks 35 are urged upwardly by coiled compression springs 44 surrounding the rods 37 and bearing between the blocks 35 and collars 45 fixed to the rods 37 by set-

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screws 46. The blocks 35 are further guided by ribs 47 projecting inwardly from fixed plates 48 and engaging grooves formed in the rear faces of the blocks 35. Thus the upward or withdrawing movement of the needles 5, 6 is produced by the springs 44. Their downward or piercing movement is provided by two cams 49 on the main shaft 28. Cam followers 50 are held on the cams and are carried by levers 51 pivoted at 52 and hinged to rods 53 connected to the head blocks 35 at 54. Thus as the cams 49 lift the followers 50, the rods 53 are drawn down and cause the needles 5, 6 to descend while the springs 44 are compressed.

A further cam 55 is carried by the main shaft 28 and acts to raise a cam follower 56 carried by a lever 57 which is pivoted at one end at 58. The follower 56 is held on to the cam 55 by a tension spring, not shown. The lever 57 is pivoted at its opposite end to a vertical registering or locating pin 59 which is in position to engage one pair of the holes 60 in the upper and lower plates 7, 8 to locate those plates when one set of tubes is at the filling station D.

The four doffer or hold-down levers 61 are pivoted at 62 on brackets 63 (Figure 3) and their rear ends are pressed up by plungers 64 by compression springs in a box 65 so as to press the ring-shaped front ends 66 of the levers 61 resiliently on to the rubber discs 4. The ends 66 are lifted from the discs by cams 67 (Figure 2) which lift cam followers 68 carried on levers 69 pivoted on fixed brackets at 70. Thus the rear ends of the levers 69 are drawn down and carry with them a pair of rods 71 which are united by a horizontal bar 72 which engages the upper surfaces of the four doffer levers 61 and pulls them down so as to lift the front ends 66 of those levers.

Finally the main shaft 28 carries a cam 73 which operates the lubricant pump 74 to force a small quantity of glycerine on to the top surfaces of the rubber discs 4 in the neighbourhood of the points of the needles 5, 6. The cam 73 engages a cam follower 75 carried by a lever 76 pivoted at 77 to a fixed bracket 78. The other end of the lever 76 is forked as shown at 79 and is pivoted to the barrel 80 of the pump 74 which is thus caused to slide up over the hollow plunger 81 of the pump and thus force glycerine out of the top of the plunger 81 into a flexible delivery pipe 82. The barrel 80 is returned downwardly by a compression spring 83 which bears between the top of the barrel 80 and a fixed arm 84 integral with a pillar 85 fixed to the baseboard 2. The spring 83 thus also holds the follower 75 on the cam 73. The delivery pipe 82 leads to a manifold duct (not shown) from which four branches 86 (Figure 3) lead to nozzles 87 which are carried by hold-down levers 61 in a position to deliver the glycerine onto the top of the rubber discs 4.

Each needle head 32 as best seen in Figure 7 carries a needle 5 for feeding the filling liquid to the tubes 1 and a needle 6 from leading away the air from the tubes. The liquid is supplied through four flexible pipes 88 to the tops of the heads from a liquid reservoir (not shown) and the pipes 88 communicate with the needles 5. The air is drawn away by a suction pump (not shown) through pipes 89 connected to the sides of the heads 32.

In operation, the machine is started and tubes are loaded into the sockets 10 at station A. After three revolutions of the main shaft 28, they arrive at the filling station D having engaged the presser-bar 14 which holds them firmly for filling.

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The cams 67 permit the plungers 64 to bring the doffer levers 61 down into contact with the discs 4 and while they are thus held, the cams 49 cause the needles 5, 6 to descend and pierce the discs 5, 6, and then the needles and doffer lever dwell during the filling operation. Then the cams 49 permit the needles 5, 6 to be withdrawn and thereupon the cams 67 lift the doffer levers 61. The gearing 29, 30 rotates the plates 7, 8 through a further step to bring the filled tubes 1 to the discharging station E at which the tubes drop away from the plates 7, 8 through the slot 11 into the delivery chute and collecting receptacle.

I claim:

1. An apparatus for filling tubes with liquid comprising in combination, a stationary frame, a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a horizontal baseboard, a vertical shaft extending upwardly through said baseboard, a rotary tube carrier plate affixed to said shaft, formed with a plurality of peripheral holes to receive tubes to be filled and adapted to transport said tubes supported on said baseboard from a loading station to a filling station with said tubes each below one of said piercers and to a discharge station, actuating means for lowering said filling head to cause said piercers to enter said tubes and for raising said filling head to retract said piercers, a horizontal drive shaft, intermittent gearing connecting said drive shaft to said vertical shaft for rotating said carrier plate in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a doffer comprising a plurality of levers pivoted about a common axis and each having an apertured end located to engage a stopper in one of said tubes at said filling station, a plurality of spring-pressed plungers, each engaging one of said levers to urge the same into contact with the respective stopper, a further cam affixed to said drive shaft, a member located to engage said levers and a linkage connected to said member and in operative relationship with said further cam to actuate said member and to withdraw said levers from the respective stoppers.

2. An apparatus for filling tubes with liquid comprising in combination, a stationary frame, a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a horizontal baseboard, a vertical shaft extending upwardly through said baseboard, a rotary tube carrier plate affixed to said shaft, formed with a plurality of peripheral holes to receive tubes to be filled and adapted to transport said tubes supported on said baseboard from a loading station to a filling station with said tubes each below one of said piercers and to a discharge station, actuating means for lowering said filling head to cause said piercers to enter said tubes and for raising said filling head to retract said piercers, intermittent driving mechanism

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for said shaft and for rotating said carrier plate in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a locating pin mounted for vertical movement below the periphery of said carrier plate and means for raising said locating pin when said tubes are at the filling station, said carrier plate being provided with an aperture to receive said locating pin and thereby being locked with said tubes at the filling station.

3. An apparatus for filling tubes with liquid comprising in combination, a stationary frame, a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a horizontal baseboard, a vertical shaft extending upwardly through said baseboard, a rotary tube carrier plate affixed to said shaft, formed with a plurality of peripheral holes to receive tubes to be filled and adapted to transport said tubes supported on said baseboard from a loading station to a filling station with said tubes each below one of said pairs of piercers and to a discharge station, a horizontal drive shaft, intermittent gearing connecting said drive shaft to said vertical shaft for rotating said carrier plate in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a cam affixed to said drive shaft, a linkage connected to said filling head and in operative relationship with said cam, a locating pin mounted for vertical movement below the periphery of said carrier plate, a registering cam affixed to said drive shaft and a lever connected to said locating pin and in operative relationship with said registering cam and timed to raise the latter when said tubes have been transported to said filling station, said carrier plate being formed with an aperture to receive said locating pin and to be locked thereby with said tubes at the filling station.

4. An apparatus for filling tubes with liquid comprising in combination, a stationary frame, a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a tube carrier formed with a plurality of sockets to receive tubes to be filled and movable to transport said tubes from a loading station to a filling station with said tubes each below one of said piercers and to a discharge station, actuating means for causing said piercers to advance to enter said tubes and to be retracted therefrom, intermittent driving mechanism for moving said carrier in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a tube registering plate rigidly mounted on said tube carrier to one side of said tubes and notched to receive said tubes and a pivoted presser bar located to engage said tubes on the opposite side when at the filling station and resilient means for maintaining said presser bar in contact with said tubes.

5. An apparatus for filling tubes with liquid comprising in combination, a stationary frame,

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a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a horizontal baseboard, a vertical shaft extending upwardly through said baseboard, a rotary tube carrier plate affixed to said shaft, formed with a plurality of peripheral holes to receive tubes to be filled and adapted to transport said tubes supported on said baseboard from a loading station to a filling station with said tubes each below one of said piercers and to a discharge station, actuating means for lowering said filling head to cause said piercers to enter said tubes and for raising said filling head to retract said piercers, a horizontal drive shaft, intermittent gearing connecting said drive shaft to said vertical shaft for rotating said carrier plate in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a plate rigidly secured to the surface of said carrier plate on the inside of said tubes and formed with a plurality of V-notches each to receive one of said tubes, a pivoted presser bar located to engage said tubes on their outer sides when at the filling station and a spring actuating said presser bar to cause same to engage said tubes and hold same in said V-notches.

6. An apparatus for filling tubes with liquid comprising in combination, a stationary frame, a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a tube carrier formed with a plurality of sockets to receive tubes to be filled and movable to transport said tubes from a loading station to a filling station with said tubes each below one of said piercers and to a discharge station, actuating means for causing said piercers to advance to enter said tubes and to be retracted therefrom, intermittent driving mechanism for moving said carrier in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a lubricant pump, a plurality of lubricant nozzles located to deliver at points adjacent the ends of said tubes, a branched delivery pipe connecting said pump to said lubricant nozzles and means for operating said pump at each step of movement of said carrier.

7. An apparatus for filling tubes with liquid comprising in combination, a stationary frame, a filling head mounted for rising and falling movement in said frame, a plurality of hollow piercers each comprising a pair of longitudinal passages carried in said filling head and protruding downwardly therefrom, a conduit connecting a source of liquid supply to one passage of each of said piercers, a suction conduit connected to the other passage of each of said piercers, a horizontal baseboard, a vertical shaft extending upwardly through said baseboard, a rotary tube carrier plate affixed to said shaft, formed with a plurality of peripheral holes to receive tubes to be filled and adapted to transport said tubes supported on said baseboard from a loading station to a filling station with said

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tubes each below one of said piercers and to a discharge station, a horizontal drive shaft, intermittent gearing connecting said drive shaft to said vertical shaft for rotating said carrier plate in steps to transport said tubes from said loading station to said filling station and then to said discharge station, a cam affixed to said drive shaft and a linkage connected to said filling head and in operative relationship with said cam, a lubricant pump, a plurality of lubricant nozzles located to deliver to points adjacent the ends of said tubes, a branched delivery pipe connecting said pump to said nozzles, a pump-operating cam affixed to said drive shaft and a linkage connected to the moving member of said pump and in operative relationship with said last-mentioned cam.

8. An apparatus for filling tubes with liquid comprising in combination a stationary frame, a filling head mounted for rising and falling movement in said frame, a hollow piercer protruding downwardly from said filling head and comprising a pair of longitudinal passages, a conduit connecting a source of liquid supply to one of said passages, a suction conduit connected to the other of said passages, a horizontal base board mounted in fixed position on said frame, a tube carrier plate mounted in vertically spaced relationship above said base board and formed with a plurality of holes to receive tubes to be filled and adapted to support said tubes in a vertical position with their bases seated on said base board and to transport said tubes on said base board from a loading station to a filling station with one of said tubes located below said hollow piercer and then to a discharge station, intermittent driving mechanism for moving said carrier plate in steps to transport said tubes from said loading station to said filling station and then to said discharge station with a period of dwell at each station, and actuating means operated in timed relation with said driving mechanism for lowering said filling head to cause said piercer to enter said tube in said filling station and for raising said filling head to retract said piercer during each dwell period.

9. Apparatus according to claim 8 and including means at said filling station operated in timed relation with said driving mechanism for depositing a quantity of lubricant upon the closure of the tube in the filling station in advance of the lowering of said piercer.

10. Apparatus according to claim 8 wherein said tubes are carried loosely in the holes of said tube carrier, and including means at said filling station for resiliently pressing the tube against the wall of hole in which it is carried.

11. Apparatus according to claim 8 wherein said tubes are carried loosely in the holes of said tube carrier and said base board is apertured at said discharge station to permit said tubes to pass downwardly through said aperture at the discharge station.

12. In apparatus for filling sealed tubes with liquid by means of a hollow piercer which pierces the closure of said tubes, the combination of means for supporting a sealed tube, means supporting said piercer above said tube and for reciprocating said piercer into filling position and back to normal position, a source of lubricant, and means operated in timed relation with the reciprocation of said piercer for depositing a quantity of lubricant upon said closure in advance of the piercing of said closure by said piercer.

13. An apparatus for filling tubes with liquid comprising in combination a stationary frame, a filling head mounted for rising and falling movement in said frame, a hollow piercer protruding downwardly from said filling head and comprising a pair of longitudinal passages, a conduit connecting a source of liquid supply to one of said passages, a suction conduit connected to the other of said passages, a horizontal base board, a vertical shaft extending upwardly through said baseboard, a rotary tube carrier plate affixed to said shaft in vertically spaced relationship above said base board and formed with a plurality of holes to receive tubes to be filled and adapted to support said tubes in a vertical position with their bases on said base board and to transport said tubes in a circular path on said base board from a loading station to a filling station with one of said tubes located below said hollow piercer and then to a discharge station, intermittent driving mechanism for rotating said shaft to move said carrier plate in steps to transport said tubes from

said loading station to said filling station and then to said discharge station with a period of dwell at each station, and actuating means operated in timed relation with said driving mechanism for lowering said filling head to cause said piercers to enter said tubes and for raising said filling head to retract said piercers during each dwell period.

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