

[54] **STERILIZING DEVICE FOR FILLING MACHINES**

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**Related U.S. Application Data**

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[52] U.S. Cl. .... 53/167, 21/80, 53/94, 53/112 R

[51] Int. Cl. .... B65b 55/06, B65b 55/08

[58] Field of Search ..... 53/86, 89, 90, 91, 53/94, 97, 101, 167, 112 R; 21/80

[56] **References Cited**

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[57] **ABSTRACT**

An automatic machine for filling and capping containers for food and other materials is provided with special sterilizing means without interfering with the rapid filling and capping of containers. A combination of heat and sterilizing rays is used in a special tunnel formation in which an elevated temperature exists sufficiently high to effect sterilization of the containers passing therethrough and incorporated into the machine. Certain zones within the tunnel are maintained at predetermined controlled temperatures. The machine is particularly designed for aluminum containers having aluminum lids or caps, but is applicable to containers composed of other materials such as plastic. The entire machine is shrouded to permit pre-sterilization for a period of one-half hour to one hour prior to operation of the machine and during operation is kept sterile by providing a constant pressure on the air in the machine, whereby air can only flow out thus preventing contamination by bacteria outside the machine.

**11 Claims, 7 Drawing Figures**

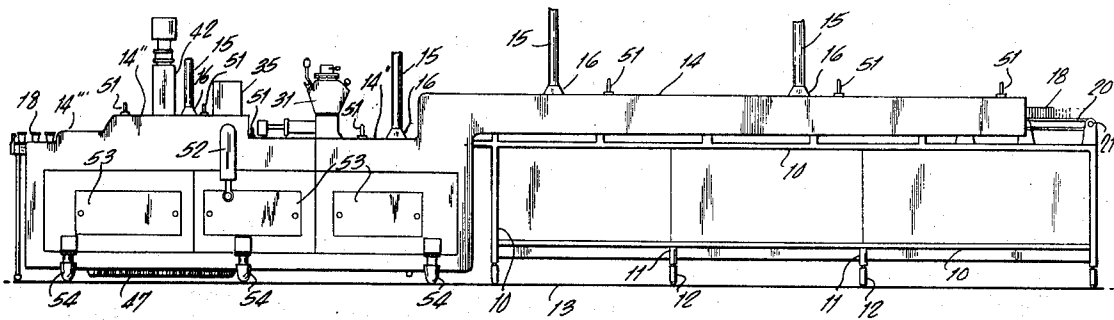


FIG. 1

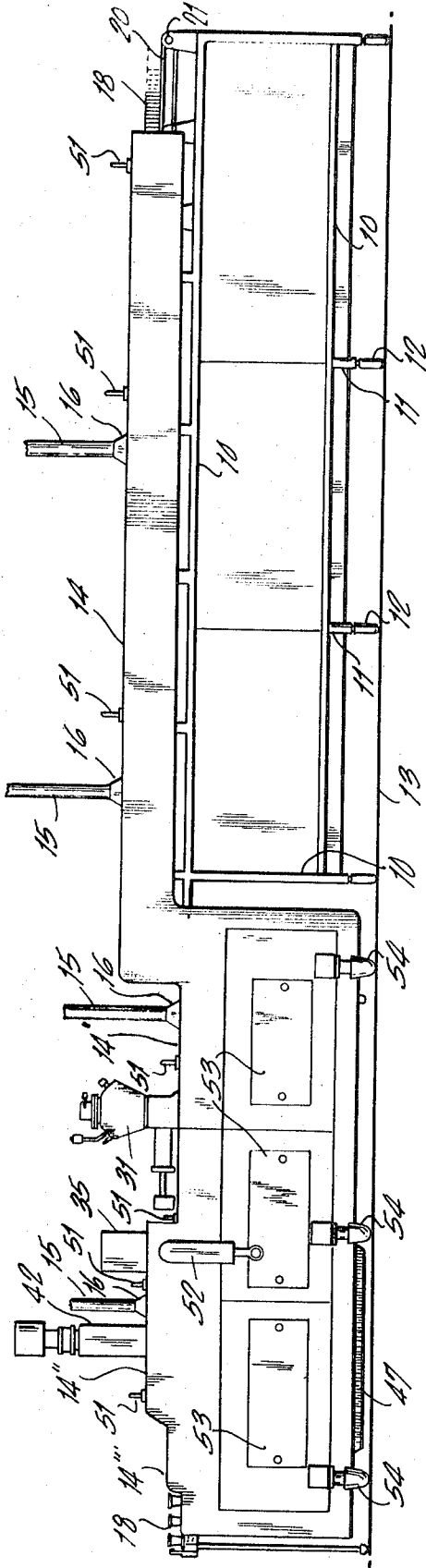


FIG. 2

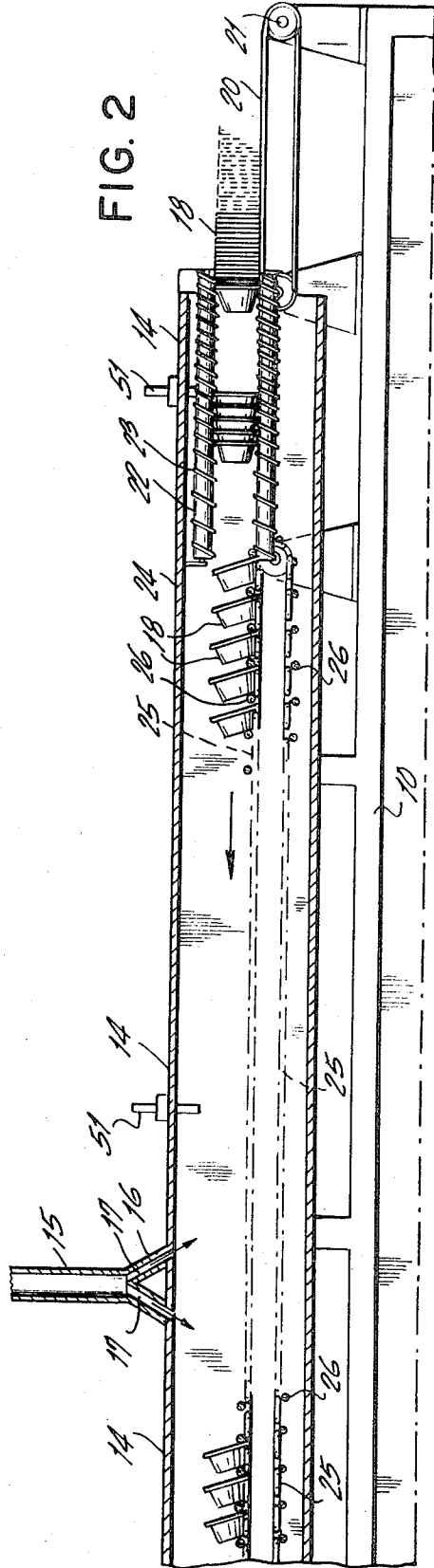
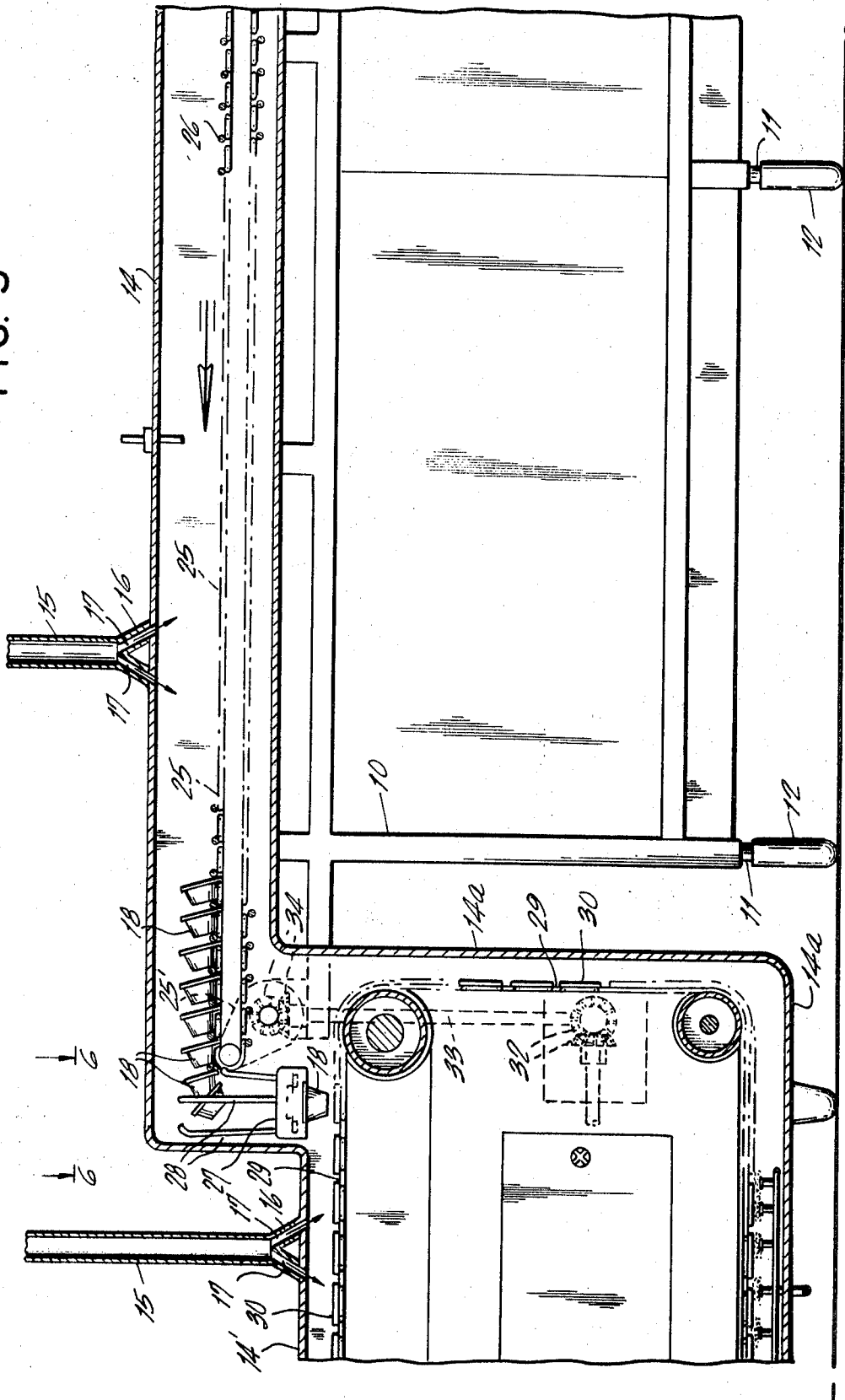
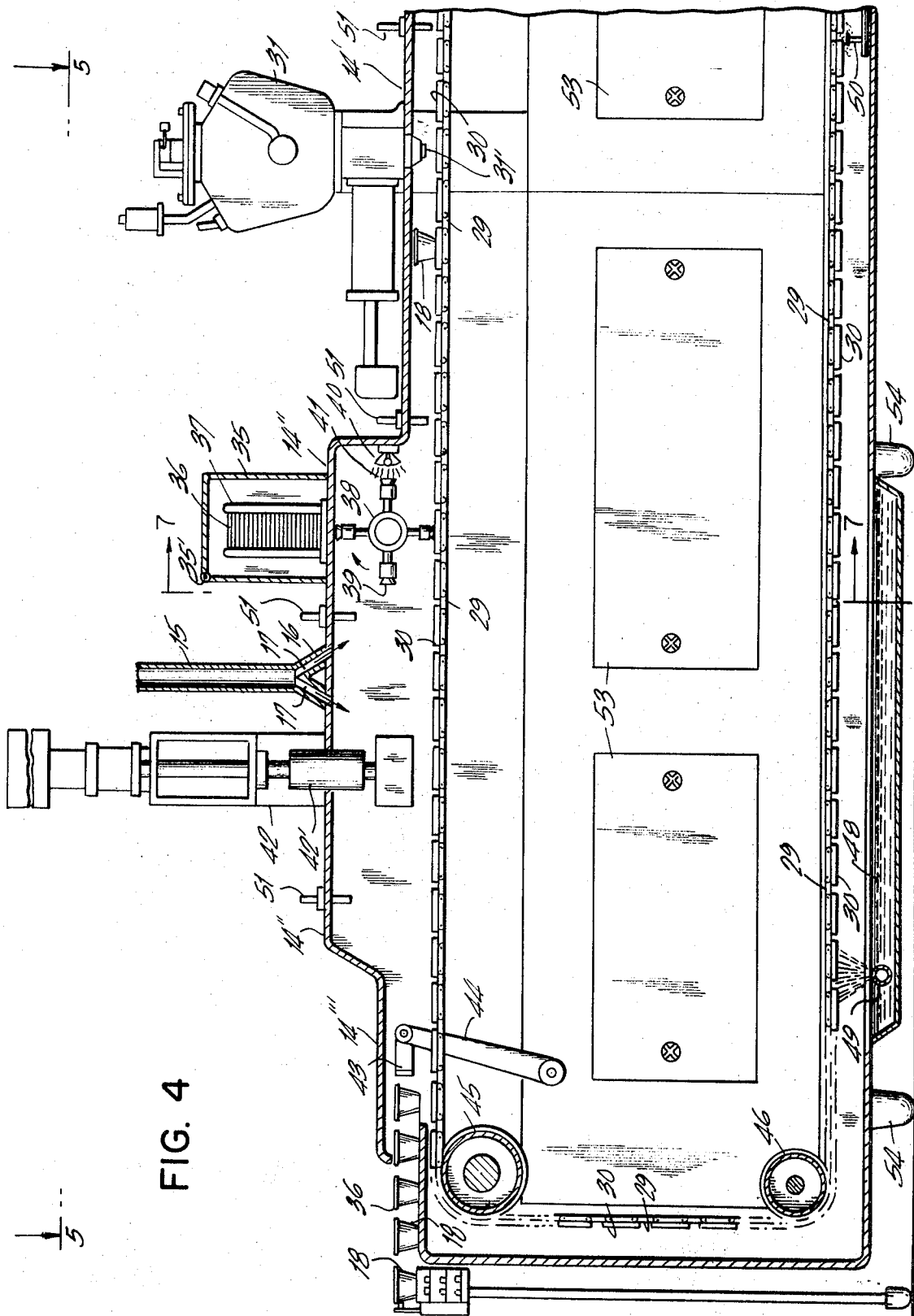


FIG. 3





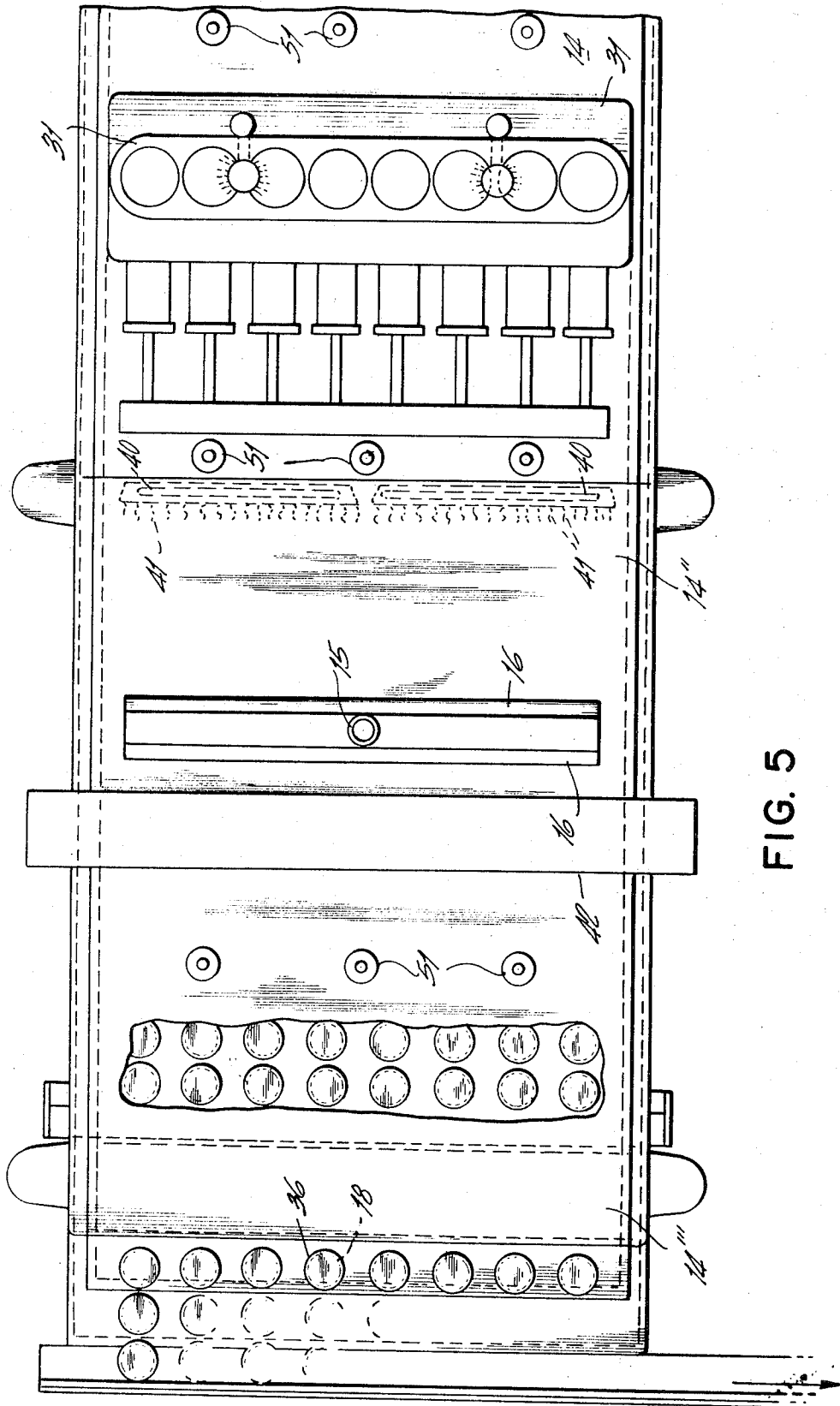
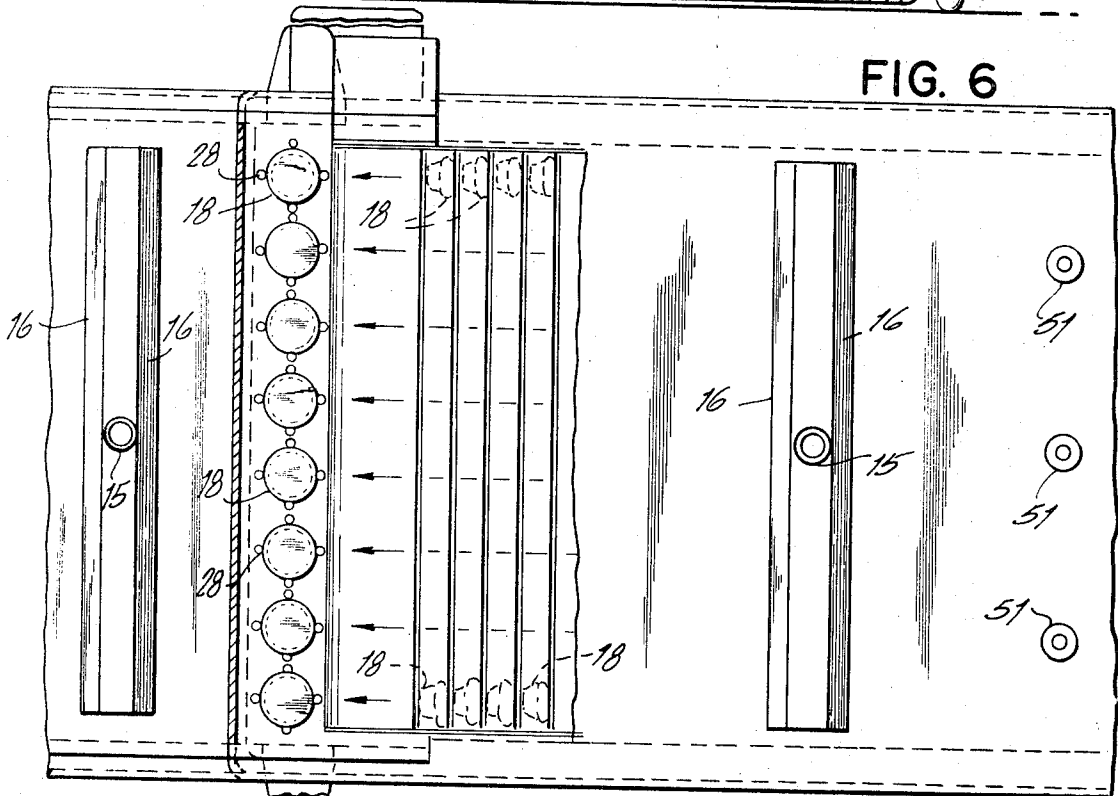
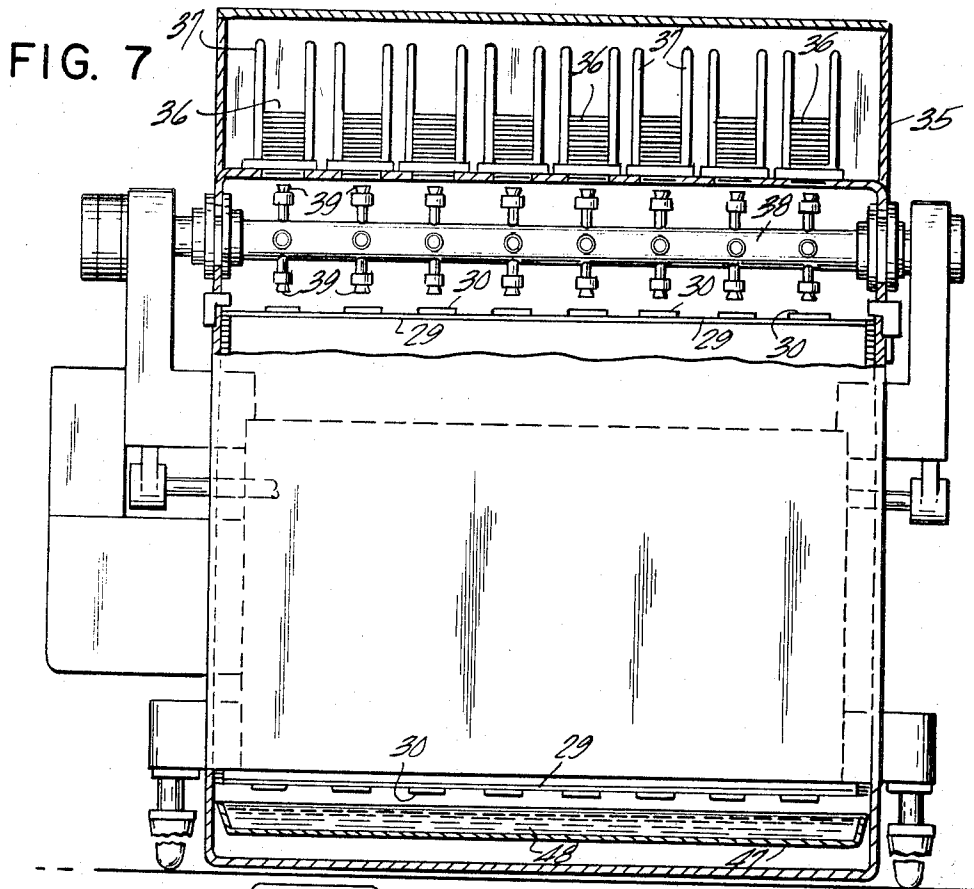


FIG. 5



## STERILIZING DEVICE FOR FILLING MACHINES

This application is a continuation in part of my copending application Ser. No. 175,663 filed Aug. 27, 1971.

The present invention relates to an automatic filling and capping machine for filling aluminum containers with liquid or semi-liquid food products or other materials under aseptic conditions to avoid contamination by undesirable microorganisms and to inhibit the growth of or destroy any microorganisms which are present. The invention will be described in connection with the filling and capping of aluminum containers of per se known nature with the understanding that this does not constitute a limitation on the invention.

In general according to the present invention, an automatic machine for filling and capping containers is modified to provide sterilizing means in the general form of an elongated tunnel of rectangular cross-section through which the aluminum containers are fed to a filling station, then to a capping station and finally discharged while maintaining temperature conditions within the tunnel such that the filled and capped containers are sterilized and discharged in a sterilized condition. The significance of the invention is very important as will be understood since it is essential for the public health and welfare to avoid the sale and distribution of containers having edible materials therein which might impart or cause infection or disease to consumers.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

FIG. 1 is a side elevational view on a reduced scale of a filling and capping machine embodying sterilizing means;

FIG. 2 is a fragmentary view on an enlarged scale of the right hand portion of FIG. 1, parts being in section and parts being diagrammatic;

FIG. 3 is a view similar to FIG. 2 of a forward adjacent portion of the machine of FIG. 1, wherein the containers are subjected to a directional change in their travel through the tunnel;

FIG. 4 is an elevational view partly in section of that portion of the machine of FIG. 1 wherein the containers are filled, the caps or lids are sterilized and applied to the containers and the filled and capped containers are discharged and the conveyor system on which the containers travel is sterilized for re-use;

FIG. 5 is a plan view taken on line 5—5 of FIG. 4 with portions broken away to show the underlying construction;

FIG. 6 is a fragmentary plan view partly in section taken along line 6—6 of FIG. 3; and

FIG. 7 is a vertical sectional view taken on line 7—7 of FIG. 4.

In the drawings, numeral 10 designates any suitable framework for the feed-in end of the machine having legs 11 with adjustable foot elements 12 which rest on a supporting surface 13 such as flooring or the like while being able to maintain the machine level or at any desired inclination where the latter might be desired. Mounted on the framework 10 is a tunnel 14 preferably of rectangular cross-section, and which widens or expands at and beyond the capping station (see FIGS. 1 and 4) and this tunnel is composed of rustproof or corrosion resistant material such as a stainless steel alloy which can be readily cleaned and sterilized and at

spaced intervals, as seen in FIG. 1, are inlet pipes or conduits 15, four such being shown, which are connected to a source of superheated steam or hot dry air or any other desirable or sterilizing fluid medium of which either superheated steam or hot dry air is preferred as both have been found to be entirely satisfactory. As will be observed from FIGS. 3 and 4, the frustoconical lowermost portions 16 of pipes 15 are divided or bifurcated so as to provide two angularly disposed inlet passageways 17 through which the sterilizing medium enters the tunnel 14 through openings therein and it has been found highly desirable to have the sterilizing medium enter the tunnel at angles such as those indicated since more complete and efficient sterilization can be accomplished both as the container approaches the particular pipe 15 and as it is leaving the vicinity thereof. Since suitable sources of superheated steam or hot dry air are well known, such have not been illustrated in the drawings.

Referring further to FIGS. 1 and 3, it will be seen that tunnel 14 after it passes to about the midpoint or a little forwardly thereof with relation to the entire length of the machine makes a right angled downward turn and widens into a compartment bounded by wall 14a which as will be clear becomes an integral enclosure for the forward or filling, capping and discharge areas of the machine. It will be further noted from FIGS. 3 and 4 that the tunnel 14 extends forwardly at a lower level indicated at 14' and then again rises to a somewhat elevated level 14'' and at its forwardmost end again descends to a lower level 14''' where the filled, capped and sterilized containers leave the protective sterilizing enclosure formed by the tunnel and its extensions as just described.

The present machine is of the type which handles eight rows or lines of containers fed from the top of eight vertical stacks as shown in my said copending application, the contents of which are hereby made a part thereof, although it is to be understood that machines of this general type are known for use with lesser numbers of rows or lines of containers depending upon the size of the operation involved and the requirements for filled and capped containers. Each of the eight rows of containers 18 represents a relatively large series of nested containers held in desired position by upstanding vertical guides 19 (not visible) and it will be appreciated that the machine operates continuously or for one or more shifts and that as containers are taken from the said stacks and received in tunnel 14, they are replenished from below in known manner. It will be observed that the tunnel 14 is likewise constructed to receive eight rows of containers and these containers are pushed upwardly from the tops of the stacks and shown as having already passed onto endless conveyor belts 20 which are supported as shown at the proper height and provided with the usual means 21 for maintaining the belts 20 in continuous operation so that the containers 18 passing therealong and still in nested condition (FIG. 2) enter tunnel 14 and are received by a worm formed from shafts 22 provided with helical ribs 23 and which shafts are suitably mounted as by means of brackets 24 in such manner that as the nested containers travel between the helically ribbed shafts 22 they are separated gradually according to the pitch of the helical ribs 23 so that when the containers emerge from between the helically ribbed shafts, they are each separate and independent and spaced 15—20 mm from

one another and are picked up individually by conveyor 25 having cross-rods 26 spaced therealong so as to hold the individual containers in a forwardly inclined position as will be clear from FIG. 2 and while on the said conveyor 25, they pass under the first pipe 14 and angular passageways 17 for the sterilizing action thereon of superheated steam or hot dry air or other desired sterilizing medium. The containers continue to pass internally along tunnel 14 and continue to be subjected to sterilizing medium as shown at the left hand portion of FIG. 2 and then pass through the influence of the next pipe 15 and its angular passageways 17 (FIG. 3) to continue the sterilization and then the containers while still positioned as described pass off of the conveyor 25 and make a right angled downward turn into the container magazines 27 which have vertical extending guide elements 28 so that each individual container is deposited in an upright position on a further conveyor 29 individually and successively, the conveyor 29 being provided with a succession of slightly spaced apart flat bars or slats 30 each of which receives a container and moves it forwardly of the machine. It will be seen from the left hand portion of FIG. 3 that individual containers 18 deposited on bar members 30 pass under another pipe 15 with its angular passageways 17, the continuation of the tunnel portion 14' being shown at the right hand side of FIG. 4 from which it will be clear that each of the thus treated containers on the conveyor bar 30 passes under filling station 31 which may be of per se known nature and hence is not described in detail, but is a rotary membrane piston proportioner with twin valve controls and also in per se known manner each container as it passes into alignment with the filling station 31 for the reception of a predetermined quantity of food product or other filling material, dwells for a brief but sufficient period of time under nozzles or spouts 31' to enable the container to be filled with the predetermined quantity of liquid or semi-liquid material and the conveyor 29 which may, for example, be of articulated linkages of known type is driven and controlled by a bevel gearing system 32 shown diagrammatically in FIG. 3 and one shaft 33 of which through another set of bevel gears 34 effects feeding of the individual containers successively into the container magazines 27 above mentioned through the medium of belts 25' which synchronize conveyors 25 and 27.

Forwardly of the filling station 31 and its filling spouts 31' the individual filled container on conveyor bars 30 travel to a position under portion 14'' of the tunnel, which portion is provided thereon with a housing 35 hinged at 35' and within which a disposed eight stacks of lids or caps 36 within the vertical guides 37 and the mechanism 38, which is per se known and hence not described in detail, picks lids or caps 36 from the bottoms of the stacks, hold the caps temporarily by means of vacuum cups 39 which mechanism rotates in the direction of the arrow to bring the underside of individual lids past the radiation means 40 for sterilizing the lids or caps particularly the underside thereof and holding them still for 1.6 seconds and while this may be of any desired nature it preferably employs infrared radiation indicated at 41 and thereafter the capped and sterilized containers continue to pass through section 14'' of the tunnel below the pneumatic sealing station 42 having air cylinders 42' with sealing heads above the tunnel, which is also of known nature and is thus not

described in detail and which acts to ensure that the lids or caps are firmly placed on the containers to seal them closed and subsequently each such container is propelled by the horizontal extension 43 of the pivoted arm 44 whereupon the containers are pushed out of the machine and are received and packed in cartons or containers or in any other desired manner.

It will be seen from the left hand portion of FIG. 4 that the conveyor 29 and the cross bars 30 pass around roll 45 vertically downwardly and then around roll 46 from which it extends horizontally over the trough 47 containing a heated liquid such as hot water 48 and one or more splash tubes 49 which spray the hot liquid onto the conveyor 29 and bars 30 thereby not only keeping them in aseptic condition, but washing off any food product or other filling material which might have been spilled or deposited thereon. The conveyor 29 and its cross bars 30 then pass over a drying element 50 which projects dry heated air or any other desired drying medium onto the conveyor and its cross bars thereby making it ready for re-use in its continuous cycle of operation.

The temperature control probes 51 determine the particular temperature within the tunnel around its area and are connected to recording instruments (not shown). They are shown only schematically because they are of known construction and operation. As will be observed from FIG. 1, there are seven probes 51 which, from right to left, establish and maintain temperatures of about 90°C, 150°C, 150°C, 90°C, 90°C, 90°C and 60°C. Other orders of elevated temperatures can be used where circumstances make such desirable. In addition the entire system can be carried out in a closed atmosphere at a constant pressure of 0.15-0.20 atmospheres.

The left hand portion of the machine is provided with suitable accessories such as a temperature gauge 52, doors or removable plates 53, supporting feet 54, etc.

It is to be understood that the sterilization above described is essentially a function of time and temperature, the higher the temperature the less the time required. The upper temperature used is related to the material of which the containers and caps or lids are made and the coating thereof. Preferably, aluminum containers and caps or lids are used but other materials such as plastic may be employed. The temperature in the tunnel is preferably kept substantially constant and sufficiently high to ensure thorough sterilization of the containers.

The entire machine is shrouded to permit presterilization for a period of one-half hour to one hour prior to operation of the machine and during operation is kept sterile by providing a constant pressure on the air in the machine, whereby air can only flow out thus preventing contamination by bacteria outside the machine.

What is claimed is:

1. An automatic machine for sterilizing successions of containers and their lids which comprises an elongated tunnel forming a part of the machine, means for receiving rows of empty containers from stacks thereof arranged in a plurality of rows in nested condition into one end of said tunnel and for propelling them through said tunnel and out the other end thereof, means at the entrance end of the tunnel for separating the nested containers so that their further travel is as individual spaced containers, means within the tunnel for altering



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the position of the thus separated containers into upright position for receiving material to be filled thereinto, each such upright container resting on a flat, conveyor crossbar, means for sterilizing the empty containers during their passage through the tunnel, means con-

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tending into the tunnel for filling the containers, a driven, endless conveyor system having said flat bars thereon and controlled to cause the container to dwell at the position where it is filled for a sufficient length of time to receive a predetermined amount of filling material, means for supporting a pile of lids accessible through the tunnel, and means for sterilizing a lid for each container and for applying a sterilized lid to a filled container.

2. An automatic machine according to claim 1 further comprising a shroud enclosing the remaining parts of the machine whereby to prevent contamination of the machine by outside bacteria.

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3. An automatic machine according to claim 1, wherein the tunnel is of rectangular cross section and is provided along its upper surface with a plurality of spaced inlet pipes adapted to be connected to a source of gaseous sterilizing medium.

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4. An automatic machine according to claim 3, wherein each inlet pipe has a frustoconical bottom portion with angular passageways communicating with the interior of the tunnel.

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5. An automatic machine according to claim 3, wherein the sources of gaseous sterilizing medium are adapted to raise the temperature in that part of the tunnel to a predetermined elevated temperature in the range of about 90°C to 150°C.

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6. An automatic machine according to claim 5,

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wherein the temperatures at the locations of the said pipes vary from about 90°C near the entrance end of the tunnel to about 150°C at the central part of the tunnel and thereafter again becoming about 90°C with the final temperature of discharge of the filled, capped and sterilized containers being about 60°C.

7. An automatic machine according to claim 1, wherein the tunnel is of non-uniform cross sectional area at different portions thereof and being of larger internal area where the lids are applied to the containers, an irradiating means being provided thereat for sterilizing the underside of each lid.

8. An automatic machine according to claim 1, wherein the endless conveyor system follows a generally rectangular path of travel and during its return travel is subjected to cleaning and drying.

9. An automatic machine according to claim 1, wherein the endless conveyor system follows a generally rectangular path of travel and during its return travel is subjected to cleaning and drying by passing over a trough containing a hot flushing liquid and thereafter over a blast of hot air.

10. An automatic machine according to claim 1, wherein the containers and lids are fabricated from aluminum.

11. An automatic machine according to claim 1, wherein the containers and lids are fabricated from thin aluminum sheet material, the said means for handling, conveying and sterilizing the said containers and lids being of such nature as not to deform said containers and lids.

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