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Wieser et al.

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[54] **INSTALLATION FOR STERILIZING PACKAGES FILLED WITH MATERIALS, ESPECIALLY FOODSTUFFS OR SEMI-LUXURIES**

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[73] Assignee: **Hero Conserven Lenzburg,** Lenzburg, Switzerland

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[51] **Int. Cl.** **A23l 3/08,** B65b 55/22, B65b 61/28

[58] **Field of Search** 53/127; 93/59 ES; 99/214, 249, 99/361, 366, 368, 331–333, 483, 484, 492

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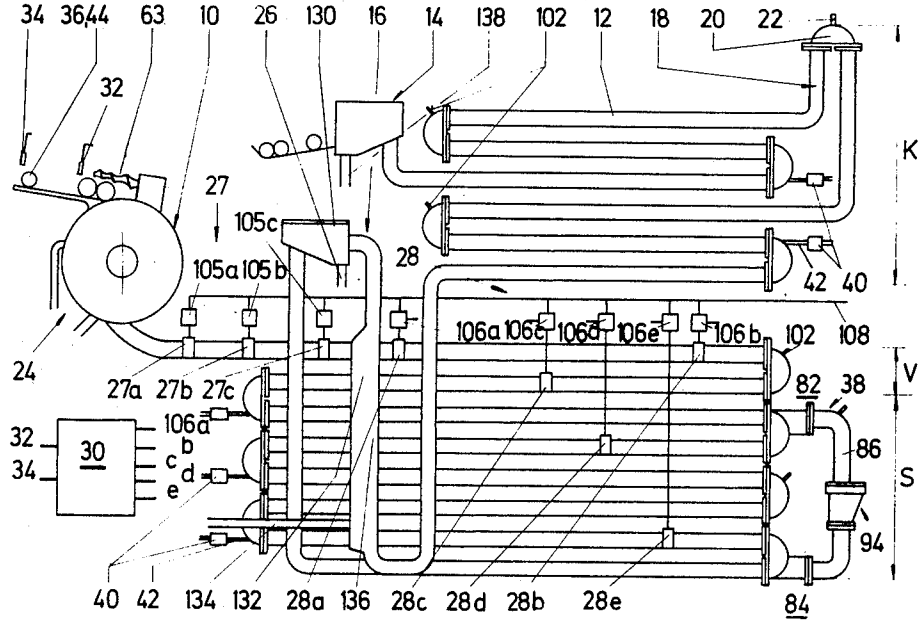
Attorney, Agent, or Firm—Werner W. Kleeman

[57] **ABSTRACT**

An installation for the sterilization of packages filled with materials, especially with foodstuffs or semi-luxuries, wherein such installation is equipped with a conveying channel which extends between an inlet sluice and a free outlet, this conveying channel possessing a pre-heating zone, a sterilization zone and a cooling zone. The packages are transported through the conveying channel solely by means of a through-flowing fluid medium serving as an energy transmission agent. The conveying channel extends through such a tortuous or twisted path and through such elevational positions that the pressure at the sterilization zone is greater than at the pre-heating zone and cooling zone. The pre-heating zone and the sterilization zone collectively possess their own heatable fluid medium circulation system which is separated by a pressure sluice from the fluid medium circulation system of the cooling zone.

49 Claims, 12 Drawing Figures



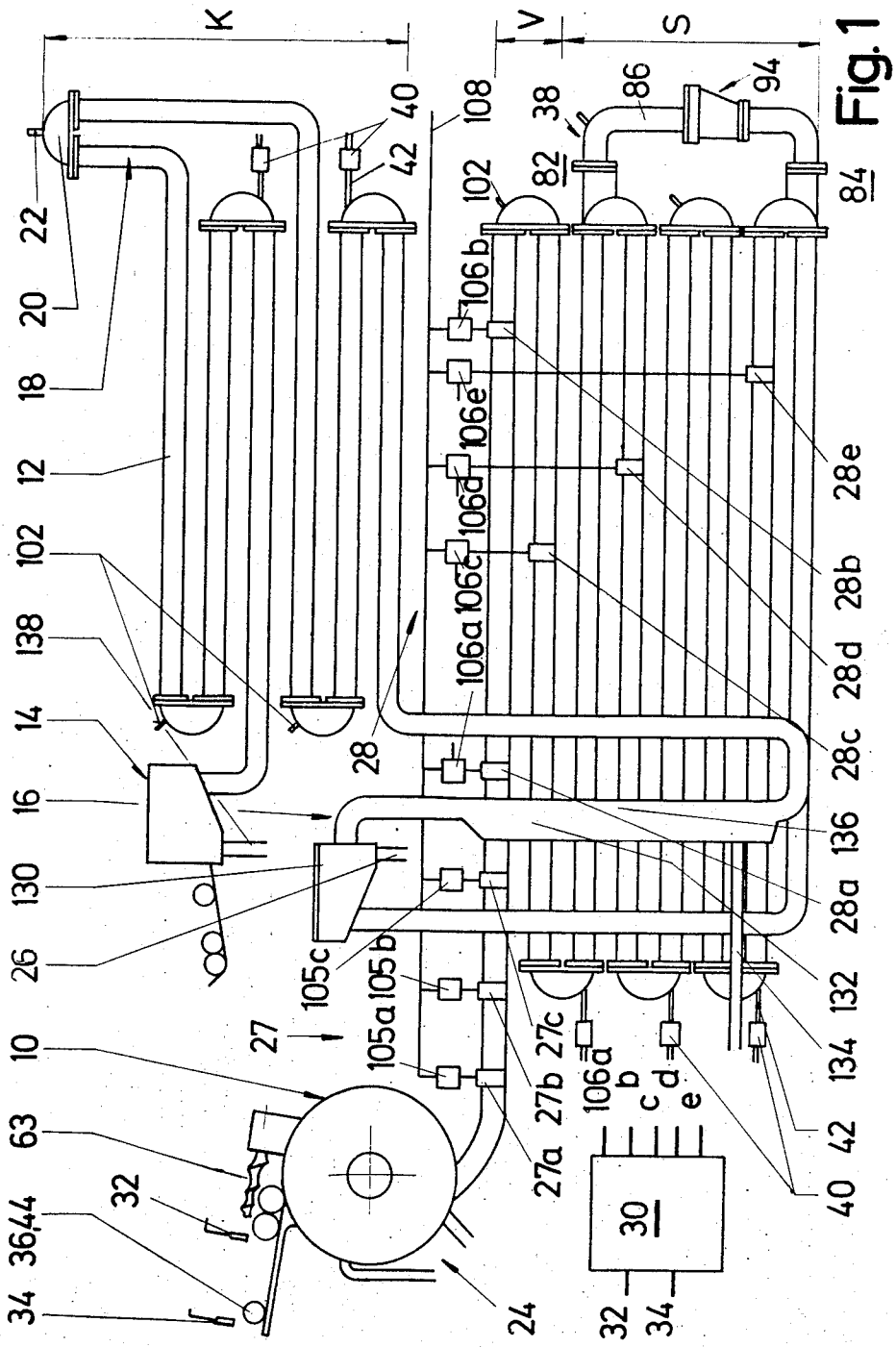

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Fig. 1

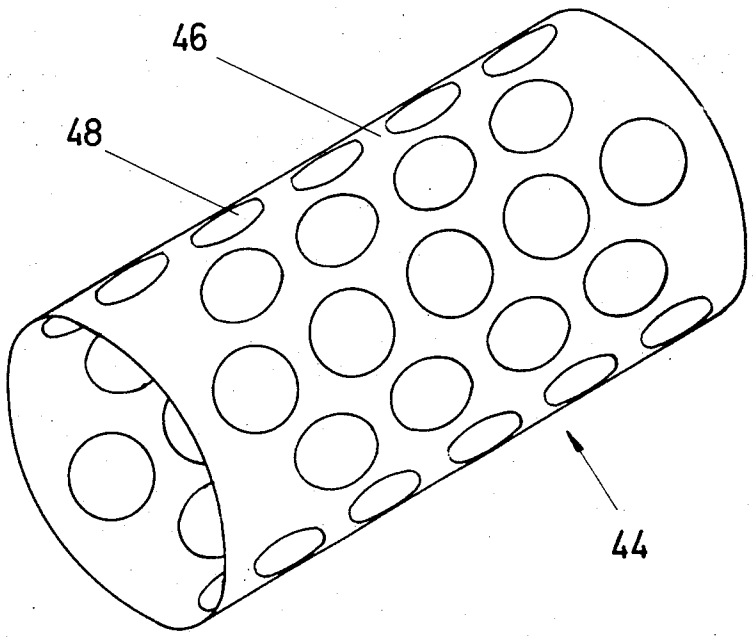

Fig. 2

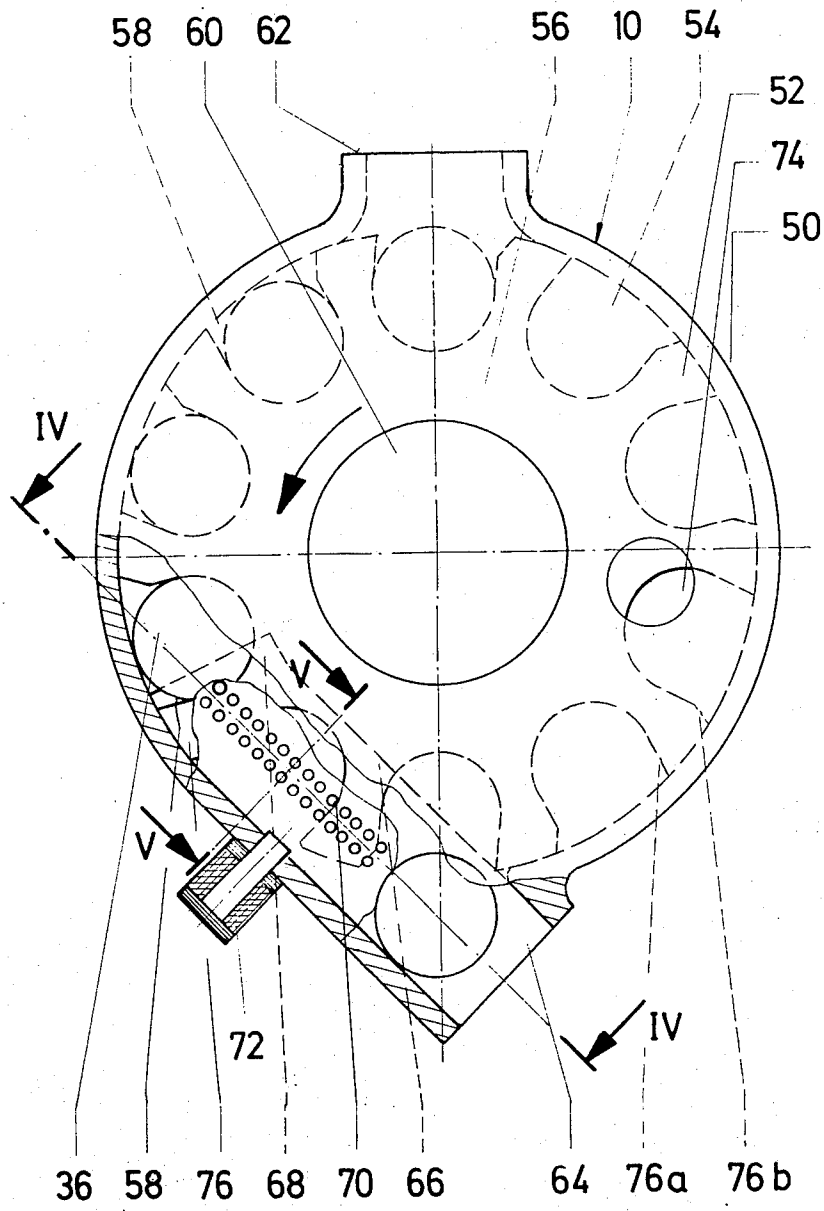

Fig. 3

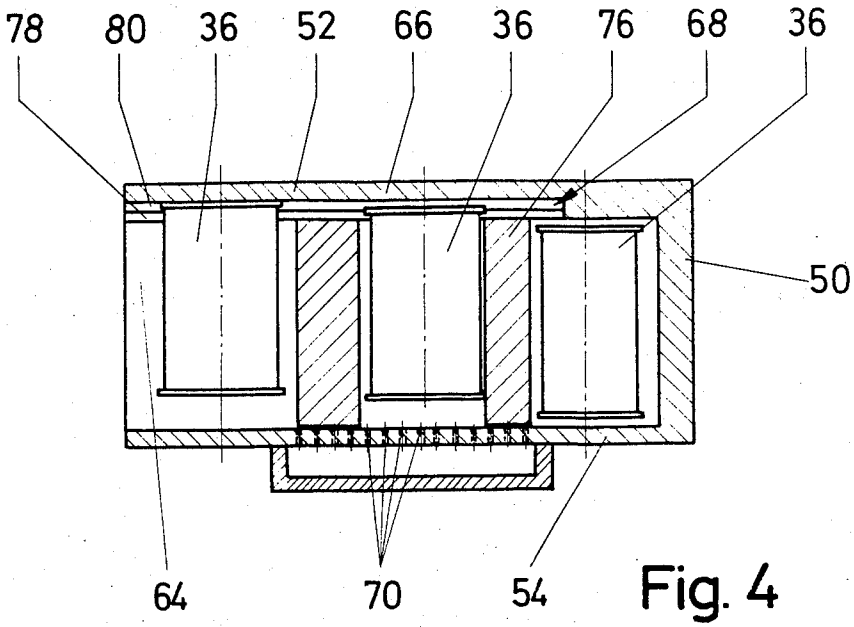

Fig. 4

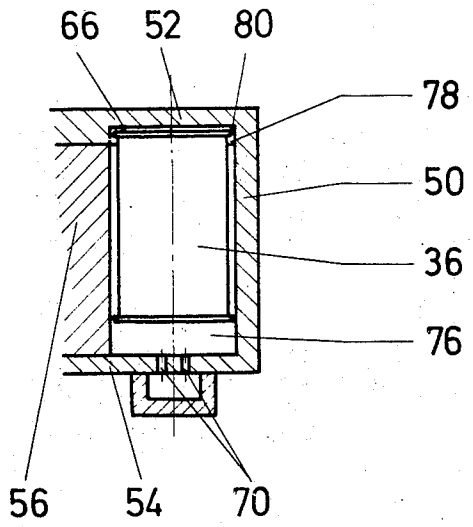

Fig. 5

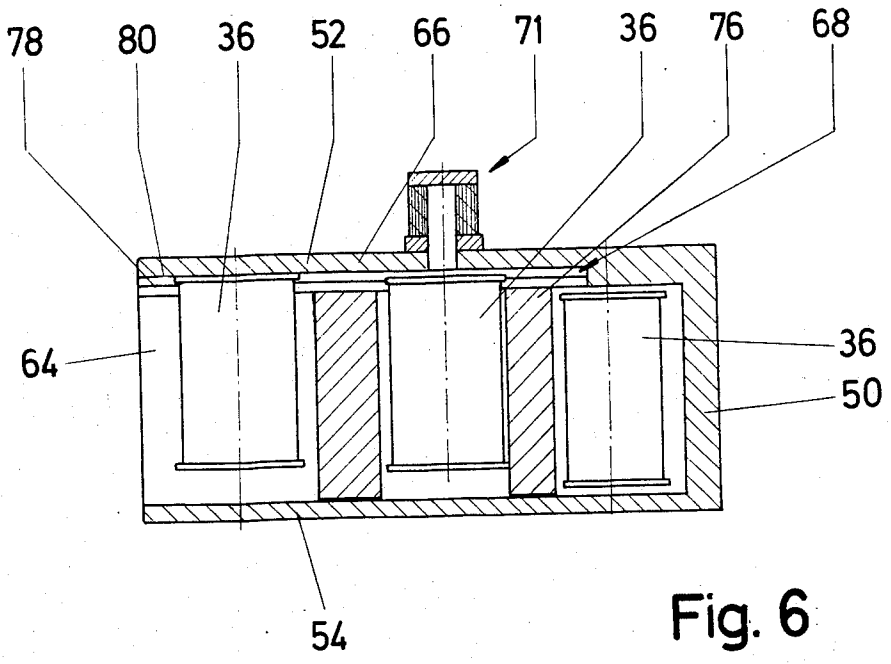
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Fig. 6

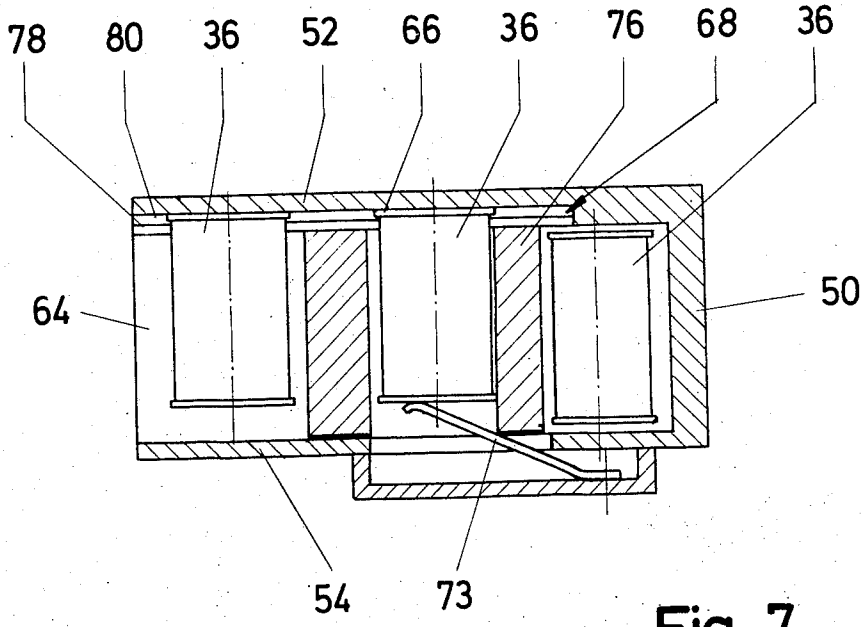
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Fig. 7

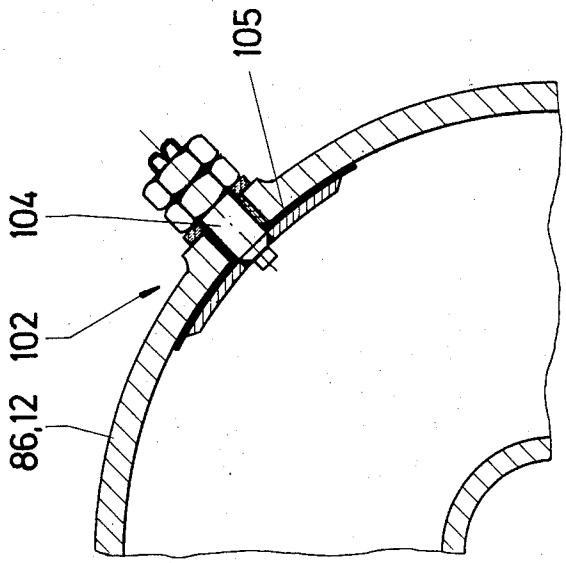

Fig. 9

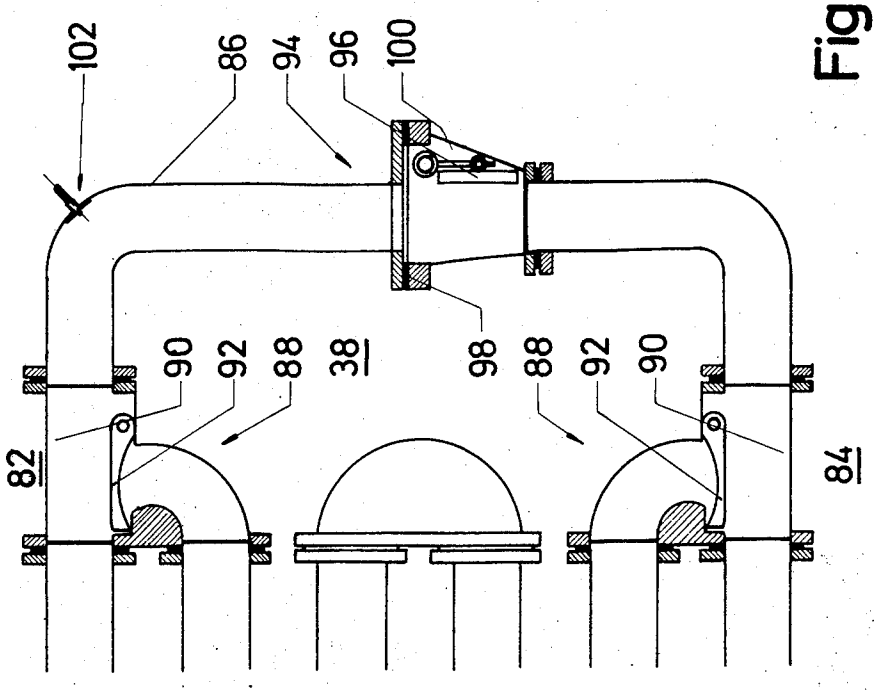

Fig. 8

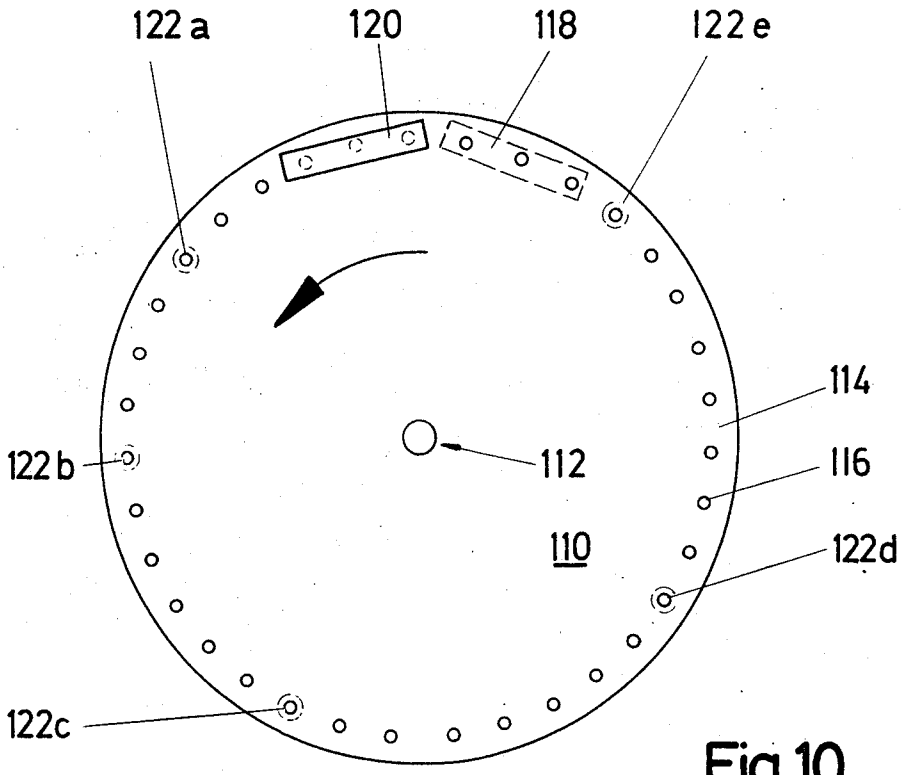
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Fig.10

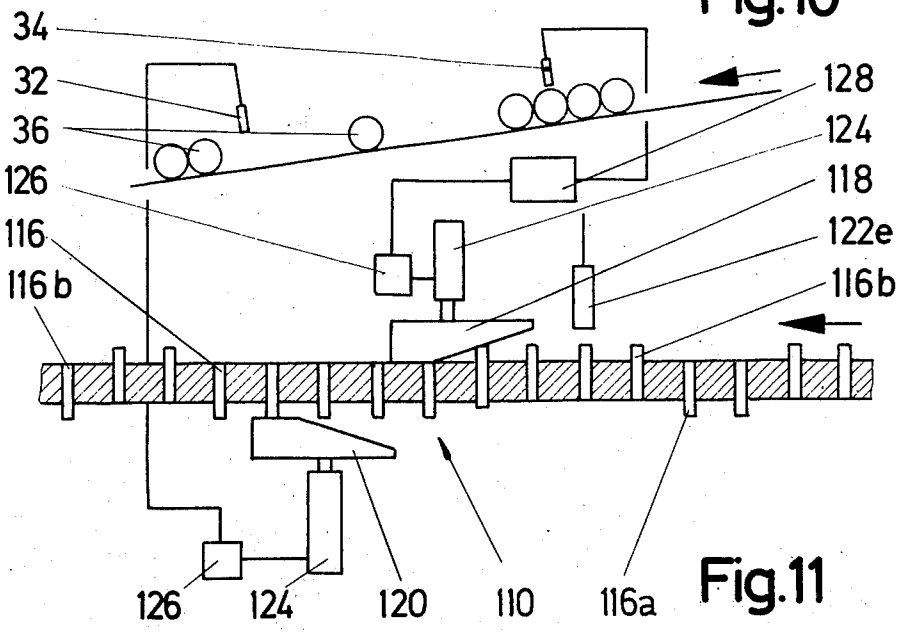
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Fig.11

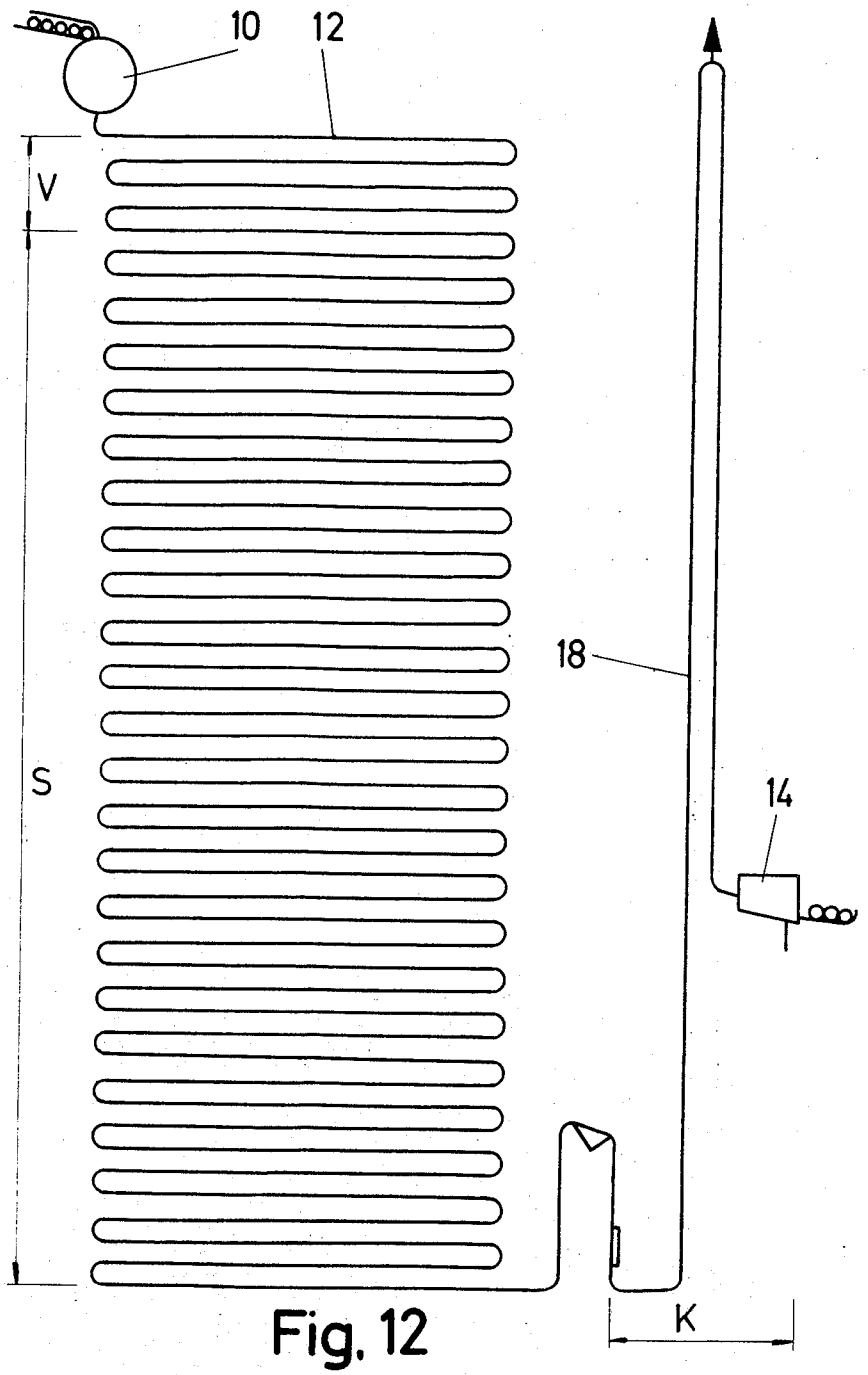

Fig. 12

INSTALLATION FOR STERILIZING PACKAGES FILLED WITH MATERIALS, ESPECIALLY FOODSTUFFS OR SEMI-LUXURIES

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a new and improved installation for the sterilization of packages filled with materials, especially with foodstuffs or so-called semi-luxuries. In the context of this disclosure the term "semi-luxuries" are intended to designate products or materials which are not especially consumed for nutritional reasons, typically well known examples thereof are coffee, tea, tobacco, alcohol, some medicines and the like. The invention is considered to have utility for the handling of packages or the like the contents of which desirably should be sterilized.

It is a primary object of the present invention to provide a particularly advantageous installation for the sterilization of packages filled with materials, especially foodstuffs or semi-luxuries.

Another and more specific object of the present invention relates to a new and improved construction of installation for the sterilization of packaged articles in an extremely reliable, efficient and economical fashion.

Still a further significant object of the present invention relates to a novel construction of sterilization installation for goods which is relatively simple in construction, economical to manufacture, not readily subject to breakdown, and provides for an efficient and controlled sterilization of the goods.

Now in order to implement these and further objects of the invention, which will become more readily apparent as the description proceeds, the inventive installation is of the type comprising a conveying channel extending between an inlet sluice and a free outlet. This conveying channel embodying a pre-heating zone, a sterilization zone, and a cooling zone and through which the packages are conveyed solely by means of a throughflowing fluid medium serving as an energy transmission agent. The conveying channel extends through such a tortuous or twisted path and at such elevational positions that the pressure at the sterilization zone is greater than at the pre-heating zone and at the cooling zone. The pre-heating zone and sterilization zone collectively exhibit their own heatable fluid medium circulation system which is separated from the fluid medium circulation system of the cooling zone by means of a pressure sluice.

Water has advantageously been found to constitute a useful fluid medium agent for the transmission of heat and for conveying the packages through the conveying or transport channel, this water, if desired, can have added thereto suitable additives for the purpose of changing the boiling temperature, for corrosion inhibitng purposes, for the killing of germs and the like. Still, by way of completeness, it should however be mentioned that other fluid mediums for the transmission of heat and for the conveying action can be employed, such as, for instance, oil, especially if high-sterilization temperatures are desired.

Although the installation of this development is especially suitable for the sterilization of packages filled with foodstuffs and semi-luxuries, it can be also used for the sterilization of other goods or articles, such as

for instance infusion solutions or other medications. Moreover, the term "packages" as employed herein is used in its broader sense as relating to any suitable type of enclosure for the materials to be sterilized.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. **1** is a schematic side view of a preferred embodiment of inventive sterilization installation;

FIG. **2** is a perspective view of a container for receiving one or more packages;

FIG. **3** is a side view, partially in section, of the inlet sluice of the sterilization installation depicted in FIG. **1**;

FIG. **4** is a cross-sectional view of the inlet sluice of FIG. **3**, taken substantially along the line IV—IV thereof;

FIG. **5** is a cross-sectional view of the inlet sluice depicted in FIG. **3**, taken substantially along the line V—V thereof;

FIG. **6** is a cross-sectional view of the inlet sluice, similar to the showing of FIG. **4**, and with an electromagnet as the infeed device;

FIG. **7** is a cross-sectional view of the inlet sluice, similar to the showing of FIG. **4**, and with a resilient or spring element serving as the infeed device;

FIG. **8** is a side view, also partially in section, of a bypass or bridging mechanism at the sterilization zone of the sterilization installation of FIG. **1**;

FIG. **9** is a fragmentary view on an enlarged scale and also in cross-section of a control element arranged in the conveying channel;

FIGS. **10** and **11** schematically illustrate the control mechanism for controlling the heating devices for the pre-heating zone and the sterilization zone;

FIG. **12** is a schematic view of a further embodiment of sterilization installation designed according to the teachings of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in FIG. **1** there is schematically illustrated in side view a sterilization installation designed according to the concepts of this invention and which will be seen to contain an inlet sluice **10**, a conveying channel **12**, and a free outlet or discharge **14**. The conveying channel **12** extends in coils in a zigzag or serpentine configuration from the inlet sluice **10** and initially passes through a first zone or region defining a pre-heating zone V, then through a further zone or region of progressively decreasing elevation which defines a sterilization zone S. At the end of the sterilization zone S, the conveying channel **12** is connected through the agency of a pressure sluice **16** with a cooling zone K. This cooling zone K will be understood to embody a riser or upright column **18**, at the topmost or culmination point **20** of which there is arranged a conventional aeration device **22**. This riser **18** subdivides the cooling zone K into a rearward pressure zone and a forward pressureless zone.

The pre-heating zone V and the sterilization zone S are equipped with their own fluid medium-circulation system. In the embodiment under consideration, the

circulating fluid medium is considered to be water, the infeed **24** of which is provided at the infeed sluice **10** and the outfeed or discharge **26** of which is provided at the pressure sluice **16.** In order to heat up the water serving both as a conveying agent and thermal energy-transmission agent there is provided a primary or main heater means **27** and an auxiliary heater means **28.** The primary heater means **27** will be seen to be equipped with heating devices **27***a*, **27***b*, and **27***c* which are locally distributively arranged along the length of the conveying channel **12,** and which are actuated through the agency of any suitable non-illustrated temperature feeler which measures the temperature of the water flowing through the conveying channel or conduit arrangement **12.** The auxiliary heater means **22** likewise contains a series of heating devices **28***a*, **28***b*, **28***c*, **28***d* and **28***e*, which are locally arranged in distributed fashion along the length of the conveying channel **12,** these heating devices being actuated through the agency of a control mechanism **30.** The actuation thereof occurs as a function of the throughput of the packages or containers conveyed through the conveying channel **12.** To this end, the control mechanism **30** receives pulses from the feelers **32** and **34** (FIGS. **1** and **11**), which respond to the infed number of packages **36** or containers **44.** A detailed description of the heating system will be undertaken hereinafter in conjunction with FIGS. **10** and **11.**

Now in order to be able to guide packages which do not require any long sterilization time, much more quickly through the sterilization installation, and without having to increase the conveying speed and therefore the velocity of the water, there are advantageously providing briding or by-pass devices **38,** as such have been shown in FIG. **1** for the sterilization zone S. Furthermore, at suitable selected points along the conveying channel **12** there are arranged inlet studs or connections **42** which are preferably different from one another and which can be closed by slides **40** or equivalent devices. By means of these inlet studs **42,** water can be introduced into the channels in the event that in a rearwardly or upstream situated portion, the flow of the conveying fluid medium agent is interrupted owing to malfunction, such as a clogging situation arising. By virtue of these measures, it is possible to complete at any time the sterilization process for the packages which are still freely movable through the sterilization apparatus.

The individual packages **36** can be serially processed one after the other in the sterilization installation, and thus the packages essentially fill the cross-section of the conveying channel **12.** In the event it is desired to process packages having a smaller cross-sectional dimension than the cross-section of the conveying channel, then it is recommended to arrange such packages in a container **44** of the type illustrated in FIG. **2,** and the cross-section of which essentially corresponds to the cross-section of the conveying channel **12.** One such container **44** can accommodate either only a single package or, if desired, a number of packages. Under certain circumstances, it is advantageous to equip the container with appropriate inserts which render possible a positional fixing of one or a number of such packages. The container **44** is preferably equipped with a perforated wall **46** having bores or openings **48,** the relationship between these openings **48** and the solid parts of the wall **46** being calculated such that a sufficient flushing of the container **44** with water is insured for and, on the other hand, the container still provides a sufficient flow resistance to the water that it will be entrainable conveyed by such water. While as a general rule such container **44** would be provided with a floor or bottom, it is not necessary in every instance to also equip such with a cover portion, since sliding out of the packages is prevented by the wall portions of the conveying channel.

In order to simplify the description to follow the discussion will be only conveniently related to the packages **36.** Yet, in the context of the explanation given hereinafter, the term "packages" is also intended to encompass containers or the like, particularly the containers **44** of the type illustrated in FIG. **2** and which can accommodate one or a number of such packages. Through the use of containers, it is possible to appreciably increase the possibilities of use of the sterilization installation. Hence, it is not only possible to sterilize packages of different format and shapes, rather, if desired, it is possible to transport a number of packages in a single container. This considerably increases the throughput of the installation.

Now, details of the construction of the inlet sluice have been illustrated in FIGS. **3–7.** FIG. **3** illustrates the inlet sluice **10** in side view and partially broken away. This inlet sluice **10** will be seen to comprise a hollow cylindrical housing **50** which is closed in fluid tight manner at both ends or sides by means of the housing side portions or end walls **52** and **54.** A pocket impeller or pocket wheel **56** is suitably rotatably mounted within housing **50,** this pocket impeller **56** having a plurality of pockets **58** for receiving the packages **36,** for instance in the form of food cans. Pocket wheel **56** is driven by any suitable and therefore schematically depicted drive mechanism **60.** Further, pocket wheel **56** is disposed to rotate in an at least approximately vertical plane.

The upper end of inlet sluice **10** is equipped with an inlet stud or connection **62** with which there is coupled an infeed or delivery mechanism **63** of the type illustrated in FIG. **1.** The packages **36** move from this location into the individual pockets **58** of the pocket wheel **56.** At the lower end of inlet sluice **10** there is provided an outlet or discharge stud **64,** at which location the packages are transferred to the conveying or conveyor channel **12.** Whereas the inlet stud **62** advantageously extends radially with respect to the housing **50,** the outlet stud or connection **64** is arranged tangentially with regard to this housing. In order to withdraw the packages from the pocket wheel **56,** a guide groove **66** is machined or otherwise provided at the housing side portion **52.** This guide groove **66** extends tangentially from the outlet stud **64** at least up to the circular-shaped conveying or transport path for the packages **36** determined by the pocket wheel **56.** It is advantageous if the guide groove **66** extends over a portion of this circular-shaped conveying path. There is provided a preferably uniform transition **68** from the circular-shaped conveying path into the guide groove **66.** This transition location **68** is advantageously disposed at the region of the guide groove **66** which follows the circular-shaped conveying path.

At the housing side portion **54** situated opposite the housing side portion **52** there are arranged nozzles **70** for the discharge of water jets. These nozzles **70** are located at the region of the guide groove **66** and are di-

rected towards such guide groove. Further, such nozzles **70** are provided preferably at least approximately over the entire length of such guide groove **66.**

The pocket wheel **56** is guided in a fluidtight fashion at least directly before and after the zone determined by the guide groove **66.** This can be realized in a conventional manner, for instance through the use of suitable sealing ledges arranged in the housing and/or at the pocket wheel **56.** In this way, it is possible to prevent the fluid medium departing under pressure from the nozzles **70,** and which is present at the pockets at the region of the guide groove **66,** from wandering towards the inlet stud **62.** The inlet stud **62** as well as the pockets **58** of the pocket wheel **56** located at this region are essentially free of liquid. In FIG. **4** it will be seen that the radially outwardly disposed side of the guide groove is equipped with radially inwardly directed ledge means **78** forming a lateral groove means **80** within such guide groove.

Now viewed in the direction of conveying, there is arranged between the outlet stud **64** and the inlet stud **62** a suction opening **74** for the purpose of sucking water out of the pockets **58.** It is preferable if the suction opening **74** is located at a housing portion and specifically at the region of the base of the pockets **58.**

The function of the inlet sluice is as follows: At the inlet stud or connection **62** packages **36** are introduced from the delivery mechanism **63** into the individual pockets **58** of the pocket wheel **56.** This pocket wheel **56** rotates continuously in a counterclockwise direction, so that the packages **36** ultimately arrive at the outfeed region of the inlet sluice **10** provided with the guide groove **66.** At this location, the packages are subjected to the influence of the pressurized fluid medium emanating from the nozzles **70,** so that the packages **36** are pressed into the guide groove **66.** The arms **76** of the pocket wheel **56** which define the pockets **58** thereof move the packages further, but since the latter, however, now engage with the guide groove **66,** they can no longer follow the circular path of travel of the pocket wheel, rather wander tangentially in the direction of the outlet stud or connection **64.** Conveying of the packages **36** through the action of the arms **76** is assisted by the water streams emanating from the nozzles **70.**

In order to facilitate ejection of the packages **36** out of the pockets **58** and the conveying thereof, the arms **76,** viewed in the direction of conveying, are preferably inclined at their rear side **76***a*, in a direction opposite to the conveying direction and at their front side are beveled at the outer portion **76***b* opposite the conveying direction, as best seen by referring to FIG. **1.**

Furthermore, as particularly well illustrated in FIG. **5,** it has been found to be particularly advantageous if the guide groove **66** is provided at its radially outwardly situated side with a radially inwardly directed ledge **78,** by means of which there is formed within the guide groove a lateral groove **80** with which engages the flanged edge of the bottom or top of the package which has been ejected into the guide groove. By virtue of these measures, there is considerably improved the guiding of the package during its delivery, especially with regard to any possible canting thereof.

The water which discharges through the nozzles **70** preferably possesses that temperature necessary for sterilization. This water flows further into the preheating zone V and sterilization zone S and thus entrains the package **36.** The water emanating from the end of the sterilization zone S at the location of the discharge **26** can be again heated-up by means of any suitable non-illustrated heating device and reintroduced via the nozzles **70** into the inlet sluice **10.**

In contrast to the illustrated exemplary embodiment, the inlet sluice can also be designed with certain modifications. Now in accordance with an advantageous variant constructional form of the inlet sluice as depicted in FIG. **6,** the infeed device is constituted by a magnet **71** arranged at the guide groove at the region of the pocket wheel. This magnet **71** can be a permanent magnet, although it is preferable to use an electromagnet. Now if a package **36** is conveyed by the pocket wheel **56** into the region of the guide groove **66,** then the package, which of course in this case is at least partially formed of a ferromagnetic material, will be acted upon by the magnetic lines or force or magnetic field of the electromagnet **71,** and will be drawn into the guide groove. An advantageous constructional form is realized if a portion of the magnet extends up to the housing side portion situated in front of the guide groove. Another possibility can be realized, either for itself or in addition to the above magnet arrangement, if a permanent magnet or electromagnet **72** is arranged in the side wall of the outlet stud **64** and which withdraws the packages out of the pockets **58** of the pocket wheel **56** and guides such into the guide groove, as such has been additionally indicated in FIG. **3.** If desired, the guide groove can be omitted.

A particularly simple further embodiment of the inlet sluice is obtained, according to the showing of FIG. **7,** if the introduction device is constituted by a spring mechanism **73,** preferably a blade or leaf spring, which is arranged at the region of the guide groove **66,** and specifically opposite such guide groove **66** at the housing side portion **54,** as shown. The arrangement is undertaken such that the spring device **73** presses the packages **36** conveyed by the pocket wheel **56** at the region of the guide groove **66** against such guide groove. In so doing, the spring device **73** can be advantageously designed in such a manner that it can be brought into its rest position by the arms **76** of the pocket wheel **56.**

It also can be advantageous to construct the inlet sluice in such a way that the introduction device, instead of embodying the spring mechanism **73** of FIG. **7,** is a cam-or plunger device, which has not been particularly illustrated, and which is arranged at the region of the guide groove and the housing side portion situated opposite such guide groove. The cam-or plunger device is controlled in such a way that it presses the packages into the guide groove as soon as such are located at the operable zone of such guide groove.

It is not absolutely necessary to construct the sluice with a pocket wheel rotating in a vertical plane. Quite to the contrary, reposed arrangements are also possible, whereby advantageously the nozzles **70** for introducing the water stream are arranged above and the guide groove below. With such arrangement, the suction opening **74** is arranged at the lower housing side portion **54.** The mutual arrangement of the inlet-and outlet stud can also take place other than as shown in the illustrated embodiment. However, the depicted embodiment constitutes a preferred arrangement.

Further, it is possible to also construct the inlet side of the sluice to be wet, that is to say, the inlet side also

can be immersed in water, for instance at a lower pressure, and the packages can be fed into a water stream of higher pressure.

The inlet sluice affords the advantage that the outfeed or delivery of the packages to be transported, for instance, the canned goods, always occurs quickly and in a trouble-free manner owing to the infeed or introduction mechanism so that a high throughput or capacity is guaranteed for the installation.

FIG. **8** illustrates details of the bridging or by-pass mechanism **38** depicted in FIG. **1**, and which bridges or by-passes four of the superimposed coils or windings of the conveying channel of the sterilization zone S. The infeed **82** and the outfeed **84** of the by-pass conveying channel **86** are formed by a respective curved pipe **88** having an associated branch line **90.** The curved pipe means **88** is located at the conveying channel of the sterilization zone S.

When the by-pass conveying channel arrangement **38** is switched-out of operation, then flap means **92** close the access to the branch line **90.** The side of the flaps **92** which face the main conveying channel is profiled in such a way that it forms a practically continuous wall portion of the main conveying channel. When the by-pass conveying channel **86** is switched-in then the flap of the infeed **82** and the outfeed **84** are positionally reversed, and now close the flow cross-section of the main conveying channel and simultaneously form a practically continuous wall portion to the branch line **90.** In this way, both the water as well as also the therewith entrained packages are directly conveyed into the by-pass conveying channel **86.**

At the by-pass conveying channel **86** there is preferably arranged a shut-off element **94** by means of which, with the by-pass conveying channel switched-out, it is possible to suppress any streams of leakage water. This shut-off element **94** is constituted by a blocking flap member **96** which preferably opens in the feed or conveying direction of the water. In the closed condition of this blocking flap member **96** such bears against a stop or impact member **98.** In the open condition thereof the shut-off or blocking flap member **96** is disposed within a wall recess **100,** so that such blocking flap member forms a straight and unhindered through-passage for the packages.

Now a control element **102** is provided at the by-pass mechanism **38** as well as also at the other portions of the conveying channel, and which control element **102** indicates the throughput or passage of a package **36.** This control element **102** is depicted on an enlarged scale in FIG. **9.** It will be seen to encompass a feeler member **104** disposed in the wall of the conveying channel **86** in the case of the by-pass mechanism **38,** and in the case of the main conveying channel **12** in the wall thereof. This feeler member **104** can be constituted by a regulatable contact switch which, upon passage of a package, suitably mechanically closes a switching contact. It is also possible to use as the feeler member **104** a proximity initiator which responds to the passage of metallic objects by changing a switching condition, as is well known for such type devices. It is a particularly simple and operationally reliable solution to use as the feeler only a contact element which, as indicated in FIG. **9,** by means of the insulation member **105,** is situated isolated in the wall of the conveying channel and at which a metallic package produces an electrical connection between the wall of the conveying channel and the contact element of the feeler. The control element **102** can be electrically connected with a switching panel or board and at that location can illuminate a control lamp upon passage of a package. In this way it is possible to ascertain at any instance of time whether and where, if need be, disturbances have arisen with regard to the throughflow of the packages.

As already has been explained in conjunction with FIG. **1,** depicting the complete illustration of the sterilization installation or apparatus of this invention, a main or primary heater means **27** and an auxiliary heater means **28** are provided for controlling the heat content of the sterilization installation. The heating devices **27***a* to **27***c* and **28***a* to **28***e* of the main heater means **27** and the auxiliary heater means **28,** respectively, which are arranged along the length of the conveying channel **12,** can be of different type construction. Thus, for instance, the heating devices can be in the form of resistor heaters which are arranged locally about the conveying channel. Also induction heating devices could be conceivably employed. A particularly advantageous manner of heating can be realized by locally infeeding hot steam into the water of the conveying channel. With the embodiment illustrated in FIG. **1,** there are provided valves **105***a* – **105***c* and **106***a* – **106***e*, which release the infeed of vapor from a vapor or steam line **108** to the individual heating devices **27***a* – **27***c* and **28***a* – **28***e* respectively.

The main heater means **27** serves for maintaining a certain temperature of the water in the conveying or transport channel **12.** This temperature is monitored by means of one or a number of conventional temperature feelers. In the event that the water cools down, then, through the agency of one or a number of the heating devices **27***a* – **27***c*, thermal energy, i.e., in the present exemplary embodiment under consideration, hot steam or vapor is infed, until the temperature feeler again indicates the desired temperature.

As illustrated in FIGS. **10** and **11** and as will be more fully explained hereinafter, the auxiliary or supplementary heater means **28** serves for balancing out thermal losses which occur owing to the heating-up of each individual package. Accordingly, at each heating device **28***a* – **28***e*, upon passage of a package through such heating device, only so much hot vapor or steam is infed as has been withdrawn or consumed by the package for heating such up at the associated region of the conveying channel. This quantity of thermal energy of the water which has been consumed by the package can be previously calculated and/or experimentally determined and, of course, varies for different packages and different goods contained therein. The auxiliary heating means provides for a really good maintenance of a constant temperature of the water in the conveying channel since it responds practically without any time-delay to each load of the sterilization installation.

More particularly, the control of the heating devices **28***a* – **28***e* and the associated valves **106***a* – **106***b* takes places through the agency of the control device **30** illustrated in detail in FIGS. **10** and **11.** The feeler **32** situated in front of the infeed or inlet sluice **10** determines the presence of each incoming package **36** and upon throughpassage of each such package delivers a pulse to a storage **110.** This storage **110** embodies a time-delay element **112** which only then releases the stored pulse to the individual heating devices **28***a* – **28***e* when

the associated package **36** has at least approximately arrived at such heating devices. The magnitude of the infeed of thermal energy, that is, the quantity of hot steam or vapor which is delivered, can be regulated at each heating device in accordance with the momentary heat consumption of the packages.

As clearly seen by referring to FIGS. **10** and **11**, the storage means **110** of this embodiment incorporates a rotatable disc **114**, the velocity of which can be adjusted, and which at the region of its periphery is equipped with a continuous series of switching pins or bolts **116**. At one side of this disc **114** there is provided an extinguishing head **118** which resets all switching bolts **116** set at the other side of the disc **114**. At the other side of this disc **114**, there is arranged a setting head **120** which is operatively coupled with the feeler **32** and, viewed in the direction of travel of the disc **114**, is disposed after the extinguishing head **118**. This setting head **120**, upon the presence of a package **36**, pushes through at least one switching bolt **116** to the side of the extinguishing head **118**. At the side of the extinguishing head **118**, there is further arranged along the switching bolt row, switches **122***a* – **122***e* which are spaced from one another an amount proportional to the spacing of the heating devices **28***a* – **28***e*. In each instance, one of the switches **122***a* – **122***e* is coupled with one of the heating devices **28***a* – **28***e* and is actuated by the set switching bolts **116***b*. The non-set or reset switching bolts **116***a* cannot influence the switches **122***a* – **122***e*. The setting head **120** and the extinguishing head **118** can be electromagnetically actuated or, as shown in the illustrated embodiment, actuated by means of a cylinder-piston unit **124**, the control of which is undertaken through the action of an electromagnetic valve means **126**.

Continuing, it should be further understood that the control mechanism **30** possesses an additional feeler **34** which is arranged at a spacing in front of the infeed or inlet sluice **10**, and this feeler **34** delivers a pulse to a timing element **128** each time that a package is conveyed past such feeler **34**.

Now this timing element **128** is placed into operation each time a package moves past it and, upon the occurrence of a gap or space between two packages, falls back to null. In the event that there is continuously present a series of packages **36** without any gaps therebetween, then, the timing element **128** operates continuously and following an adjustable predetermined time-interval, delivers a withdrawal pulse to the extinguishing head **118**, by means of which the latter is retracted out of its extinguishing position, so that all set switching bolts **116***b* can pass without obstruction. The setting head **120** which is actuated through the agency of the feeler **32** is also operable through the agency of the feeler **34** and the timing element **128** even during retraction of the extinguishing head **118**, so that upon throughpassage of a package the switching bolts **116** will be continuously set by the setting head **120**. Since, however, the extinguishing head **118** in its retracted position does not reset any set switching bolt **116***b*, the extinguishing head **118** at the region of the set switching bolts **116***b* travels empty, so that the storage **110**, that is to say, the extinguishing head **118**, the switching bolts **116**, the rotating disc **114**, and the setting head **120** are protected.

The delay of the time-delay element **112** of the storage **110** is determined by the drive of the rotating disc **114** which has not been particularly shown. This drive can be adjusted with regard to its speed of movement in such a manner that one revolution corresponds exactly to the throughpassage of a package from the feeler **32** up to the region of the last heating device **28***e*. In the event that the conveying channel possesses a greater throughpassage velocity then it is possible to appropriately more quickly rotate the disc **114**.

Instead of using the storage **110** and the delay element **112** described in conjunction with FIGS. **10** and **11**, it would also be possible to use conventionally known electronic components.

The described control mechanism for the heating devices enables a considerably more precise and simpler heating of the pre-heating zone and the sterilization zone. The previously known prior art control devices, based solely upon thermostatic feelers, were much too sluggish and notwithstanding complicated constructions, did not provide for any exact temperature conditions, that is, they were not capable of balancing out quickly enough the disturbance or error magnitudes caused by the packages. On the other hand, in the embodiment under consideration, the necessary measures for heating at certain sections of the conveying channel, have been directly taken into account. The heating device of the instant invention works practically without any time-delay, since, at the given sections of the conveying channel, at the moment there is present a fault in the heat or thermal content occasioned by the packages there will again be delivered a correspondingly larger amount of thermal energy or heat.

As already mentioned above, the sterilization installation of this development possesses two separate water cycling or circulation systems, and specifically, one circulation system for the pre-heating zone V and the sterilization zone S and another circulation system for the cooling zone K. By virtue of these measures, it is possible to collect the water arriving from the sterilization zone, and to again deliver such into the system. Indeed, it would be possible to again heat up the collected water prior to reintroducing such into the conveying channel, but the water however is hot enough to be infed to the inlet sluice. The actual heating up for balancing out the thermal losses during collection of the water preferably only then takes place by means of the main heater **27**. Since the water departing from the sterilization zone is naturally quite hot, the provision of a separate water circulation system for the pre-heating and sterilization zones allows for a considerable saving in steam and therefore energy.

The double water guide arrangement presupposes that a pressure sluice **16** is provided between the sterilization zone S and the cooling zone K as such has been illustrated in FIG. **1**. Such pressure sluice **16** will be seen to be provided with a separation compartment **130** arranged at the end of the conveying channel of the sterilization zone S, at which there is provided a pressure line as an outflow or discharge **26** for the water and which conducts the water into a non-illustrated pressure container. The pressure in the pressure line and in the pressure container essentially is dependent upon the hydrostatic and dynamic pressure of the sterilization installation. The packages separated from the water arrive at a drop tube **132** which is at an overpressure, such drop tube **132** being supplied with cooling water at its lower end through the agency of the

infeed line or conduit **134.** An air cushion **136** further insures for a separation of both water infeeds.

In the illustrated embodiment of FIG. **1,** the pressure region of the cooling zone K is disposed preferably higher than the level of the inlet or infeed sluice **10,** and moreover, possesses a riser column **18,** by means of which there can be determined the hydrostatic pressure of the entire sterilization installation. At the top or culmination point of this riser **18,** there is provided, as previously considered, an aeration device **22,** by means of which the water can escape freely out of the riser column **118,** that is, without any suction action exerted upon the water at the rearward portion of the sterilization installation. At the second portion of the cooling zone K, the packages are delivered through the agency of a number of coils or windings of the main channel **12** and practically without any appreciable overpressure, to an outlet **14** which is likewise contructed as a separation compartment or chamber. Here the packages **36** arrive through the agency of a slide into the open and the cooling water is withdrawn by means of the discharge conduit or line **138.**

The described sterilization installation of this invention possesses a whole spate of advantages which have already been mentioned for the most part heretofore. In summation, it is once again mentioned that the sterilization installation, owing to the tortuous guiding of the conveying channel, can be extremely easily and simply accommodated to each constructional situation encountered. Moreover, the guiding of the channel permits matching the length of the conveying channel and its height with respect to one another such that there is possible the greatest possible accommodation of the fluid medium pressure in the conveying channel to the internal pressure of the package which increases with increasing heating. The installation can be guided or configured for very complicated paths of travel or courses for the packages since, for the purpose of conveying the packages, there is only used water which, in contract to mechanical conveying installations, can be despatched in the most simple way over very complicated paths. The absence of mechanical conveying devices along the conveying path considerably simplifies the installation, both with regard to its construction as well as to its maintenance. The sterilization installation of this development is not subjected, as a practical matter, to any wear and requires only a minimum amount of servicing. The temperature control of the sterilization installation is extremely simple and works quite accurately.

The use of containers considerably increases the versatility of the sterilization installation with regard to the number and shape or configuration of the packages which can be sterilized. Especially, if a number of packages are arranged in such container, then, it is possible to considerably increase the throughput or capacity of the conveying installation.

As already explained, the installation, on the one hand, by virtue of its continuous and intermittent operation possibilities, and, on the other hand, by virtue of the arrangement of the by-pass devices, is extremely versatile, so that it can be used for the most different kinds of good which are required to be sterilized. Through the switching-in of these by-pass or shunt devices, a package containing goods or materials which should be rapidly sterilized can be conducted much more quickly through the installation, without having to increase the conveying speed of the water. This takes place solely by shortening the conveying path by means of such by-pass or shunting mechanisms, as discussed above. Moreover, by means of the sterilization installation of this invention it is also possible to treat or handle packages which require very long sterilization times. In such case, the installation can be intermittently operated, whereby the travel periods, for instance, of one time unit, and the standstill periods of for instance two time units, can be continuously alternated or changed. In this way it is possible to have long residence times, without having to reduce the water- and therefore the conveying speeds below a minimum value which is still acceptable for the installation.

Finally, in FIG. **12,** there is illustrated a further embodiment of sterilization installation which is suitable for high throughput velocities or long sterilization times. A high throughput requires a high conveying speed, whereby with predetermined treatment times, long conveying paths are required. This leads to extremely long conveying channels. The same results are obtained with continuously operating sterilization installations, in which packages should be processed, the contents of which require an extremely long sterilization time.

With very long conveying channels, there is required an exceptionally high starting pressure in order to be able to overcome the flow- and friction losses which occur with such long conveying channels. High starting pressures, however, can result in destruction of the packages. These difficulties are overcome by the use of a sterilization installation of the type depicted in FIG. **12,** wherein the inlet sluice is disposed at such a distance over the lowest point of the sterilization zone S that the hydrostatic pressure of the pre-heating zone V and the sterilization zone S corresponds to the conveying pressure of the sterilization installation. In this way, the packages can be introduced at a normal overpressure into the main channel and, by virtue of the progressively increasing heating up, arrive at the regions of higher hydrostatic pressure. The total pressure at the conveying channel, however, does not increase proportionally with the decrease of the elevational position of the conveying channel, that is, with an increase of the hydrostatic pressure, rather reduces by the amount of the friction in the conveying channel. By virtue of this arrangement, the required pressure can be maintained at a usable magnitude along the entire conveying channel.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. An installation for the sterilization of packages filled with materials, especially with foodstuffs or semiluxuries, comprising an inlet sluice and a free outlet, a conveying channel extending between said inlet sluice and said free outlet, said conveying channel comprising a pre-heating zone, a sterilization zone and a cooling zone, the packages being transported through said conveying channel solely by means of a through-flowing fluid medium serving as an energy transmission agent, said conveying channel extending through a tortuous path and through such elevational positions that the pressure at said sterilization zone is greater than at said

pre-heating zone and said cooling zone, said inlet sluice comprising a housing closed in a fluid tight fashion including a pair of side walls, an inlet stud and an outlet stud for introducing packages containing the material to be sterilized into said conveying channel, said housing being in the form of a substantially hollow cylindrical body member, a wheel rotatably mounted within said housing providing a circular shaped transport path for said packages, and including a plurality of spaced pockets at the outer periphery of the wheel for guidably transporting said packages from inlet stud to outlet stud, means within said housing for preventing fluid at the outlet stud from reaching the inlet stud, means defining a guide groove formed in one of said side walls of said housing, said guide groove extending tangentially from said outlet stud at least up to the circular shaped transport path of said packages for the purpose of guidably and positively withdrawing said packages out of said pocket wheel, and a mechanism at the region of said guide groove for introducing said packages into said guide groove.

2. The installation as defined in claim **1**, wherein said sterilization installation is constructed to operate continuously.

3. The installation as defined in claim **1**, wherein said sterilization installation is constructed to operate intermittently.

4. The installation as defined in claim **1**, further including container means for receiving at least one package, said container means having a cross-sectional configuration which approximates the cross-sectional configuration of said conveying channel, said container means having a perforated wall provided with spaced bores arranged in such a manner that there is insured for a flushing of the container means and at the same time said container means providing sufficient resistance to the flow of the fluid medium through said conveying channel to promote conveying of said container means by said fluid medium flowing through said conveying conduit.

5. The installation as defined in claim **4**, wherein said container means is provided with insert means for receiving at least one package.

6. The installation as defined in claim **1**, wherein the fluid medium for conveying the packages at least at the region of said preheating zone and sterilization zone is water.

7. The installation as defined in claim **1**, wherein the fluid medium for conveying the packages through the conveying channel at least at the region of said cooling zone is water.

8. The installation as defined in claim **1**, especially for sterilization of packages over prolonged sterilization times and/or with high throughput of the packages through the installation, wherein said conveying channel extends at least throughout a major portion of its extent through a substantially tortuous path, and wherein said inlet sluice is elevationally situated to such an extent above the lowest point of the sterilization zone that the static pressure of the column of fluid medium between the inlet sluice and the lowest point of said sterilization zone practically corresponds to the conveying pressure.

9. The installation as defined in claim **1**, further including by-pass means which, when placed into operation, shunt a portion of said conveying channel.

10. The installation as defined in claim **9**, wherein said conveying channel defines a main conveying channel means having an infeed location and an outfeed location, said by-pass means providing a by-pass conveying channel, a respective flap member for connecting said by-pass conveying channel with said infeed and outfeed locations of said main conveying channel means, said flap members being movable between a switching-out position and a switching-in position, said flap members when assuming said switching-out position blocking said by-pass conveying channel and forming a portion of the wall of said main conveying channel means, said flap members when assuming said switched-in position blocking said main conveying channel means and forming a portion of said by-pass conveying channel.

11. The installation as defined in claim **9**, further including a shut-off element arranged at said by-pass conveying channel.

12. The installation as defined in claim **11**, wherein said shut-off element is a closure flap which opens in the direction of conveying of the packages.

13. The installation as defined in claim **1**, further including a number of control means which are distributively arranged along the length of said conveying channel, said control means being responsive to the movement of packages or containers moving therepast.

14. The installation as defined in claim **13**, wherein said control means comprise respective feelers.

15. The installation as defined in claim **1**, further including a plurality of inlet connections for the conveying fluid medium distributively arranged along the length of said conveying channel.

16. The installation as defined in claim **1**, wherein said introduction mechanism comprises a magnet arranged at said guide groove at the region of said pocket wheel.

17. The installation as defined in claim **16**, wherein said magnet is an electromagnet.

18. The installation as defined in claim **16**, wherein a portion of said magnet is arranged at the region of the housing situated in front of said guide groove.

19. The installation as defined in claim **1**, wherein said introduction mechanism comprises a magnet situated opposite said pocket wheel at an end wall of said outlet stud.

20. The installation as defined in claim **19**, wherein said magnet is a permanent magnet.

21. The installation as defined in claim **1**, wherein said introduction mechanism comprises a resilient device arranged at the region of said guide groove and a portion of said housing situated opposite said guide groove, and wherein said resilient device presses the packages conveyed by said pocket wheel to the region of said guide groove against such guide groove.

22. The installation as defined in claim **21**, wherein said resilient device comprises a blade spring.

23. The installation as defined in claim **1**, wherein said introduction device comprises means arranged at the region of said guide groove and a portion of said housing situated opposite said guide groove for pressing said packages into the guide groove as soon as such have arrived at the region of said guide groove.

24. The installation as defined in claim **1**, wherein said introduction device comprises nozzle means for the outflow of streams of fluid medium, said nozzle

means being located at a side of said housing which is located opposite said guide groove and at the region of said guide groove, said nozzle means being directed towards guide groove.

25. The installation as defined in claim **1**, wherein said outlet stud is arranged tangentially at said housing, and wherein said guide groove extends substantially tangentially from said outlet stud at least up to the circular-shaped path of travel for the packages or containers defined by said revolving pocket wheel.

26. The installation as defined in claim **1**, wherein said guide groove forms a transition zone to the substantially circular-shaped path of travel defined by said revolving pocket wheel.

27. The installation as defined in claim **26**, wherein said guide groove extends over a portion of said circular-shaped path of travel, and wherein said transition zone is located at said portion of said circular path of travel.

28. The installation as defined in claim **1**, wherein said guide groove possesses a radially outwardly disposed side equipped with radially inwardly directed ledge means forming a lateral groove means within said guide groove.

29. The installation as defined in claim **24**, wherein said nozzle means are arranged at least approximately over the entire length of said guide groove.

30. The installation as defined in claim **1**, further including a gas separator arranged after said outlet stud.

31. The installation as defined in claim **1**, wherein said pocket wheel is guided in a fluidtight fashion at least at regions directly in front of and after said guide groove.

32. The installation as defined in claim **1**, wherein said pocket wheel comprises a number of receiving pockets formed by arm means, and wherein said arm means of said pockets, viewed in the direction of conveying of the material, are inclined at their rearward side opposite to the direction of conveying and are beveled in a direction opposite to the direction of conveying of the materials at their front side at the outer portion of said arms.

33. The installation as defined in claim **1**, wherein said pocket wheel has a plurality of receiving pockets, means defining a suction opening which, viewed in the direction of conveying of the materials, is arranged between said outlet stud and said inlet stud, said suction opening serving for sucking out fluid medium located in said pockets of said pocket wheel.

34. The installation as defined in claim **33**, wherein said suction opening is arranged at the region of the base of said pockets.

35. The installation as defined in claim **1**, wherein said inlet stud is designed for the dry infeed of packages or containers housing the material to be sterilized.

36. The installation as defined in claim **1**, wherein said pocket wheel is disposed to rotate in an approximately vertical plane.

37. The installation as defined in claim **1**, wherein said inlet stud is arranged at the top and said outlet stud is arranged at the bottom of said housing.

38. The installation as defined in claim **1**, wherein said inlet sluice is arranged horizontally.

39. The installation as defined in claim **1**, further including a main heating means incorporating a number of temperature feeler controlled heating devices for heating the fluid medium flowing through said conveying channel, said heating devices being arranged along said conveying channel.

40. The installation as defined in claim **39**, wherein said heating devices are arranged along said preheating zone of said conveying channel.

41. The installation as defined in claim **39**, wherein said heating devices are arranged along said sterilization zone of said conveying channel.

42. The installation as defined in claim **1**, further including an auxiliary heating means incorporating a number of heating devices arranged along said conveying channel, said heating devices being adjustable with respect to the delivery of heat therefrom, and control means for actuating said heating devices as the function of the conveyed packages whereby the quantity of heat absorbed by a package which passes the region of said heating devices is supplemented.

43. The installation as defined in claim **42**, wherein said heating devices comprise steam inlet connection means, and valve means for controlling the opening of said steam inlet connection means.

44. The installation as defined in claim **42**, wherein said control means for each heating device comprises a feeler responding to each throughpassing package or container and delivering a pulse for switching-in said heating devices.

45. The installation as defined in claim **42**, wherein said control means comprises a feeler, a storage means, said feeler delivering a pulse to said storage means each time a package or container moves past such feeler, said storage means storing said pulse and with an adjustable time-delay delivering in succession actuation pulses to said heating devices.

46. The installation as defined in claim **45**, wherein said feeler is arranged behind said inlet sluice.

47. The installation as defined in claim **45**, said storage means incorporating a rotatable disc member, the speed of rotation of which can be adjusted, said rotatable disc member being provided at the region of its periphery with a continuous series of switching pins, a resetting head disposed at one side of said disc member for resetting all switching pins which have been set at the other side of said disc member, and a setting head arranged at the other side of said disc member which upon the presence of a package pushes at least one switching pin through to the side of said resetting head, said setting head being coupled with a first feeler and viewed in the direction of travel of said disc member being arranged after said resetting head, and wherein the side of said resetting head there are arranged along the series of switching pins and at a spacing corresponding to the spacing of the heating devices from one another switch means which are coupled with said heating devices and are closed by the set switching pins.

48. The installation as defined in claim **47**, wherein said control means comprises a second feeler disposed behind said first feeler, a timing element, said second feeler delivering pulses to said timing element, said timing element in the presence of the passage of a number of packages without any gaps therebetween delivering a restoring pulse to said resetting head, whereby said resetting head is moved back out of its resetting position.

49. The installation as defined in claim **1**, including a heatable fluid medium circulation system for both the

pre-heating zone and the sterilization zone, a fluid medium circulation system provided for the cooling zone, and a pressure sluice for separating the fluid medium circulation system of the pre-heating and sterilization zone from the fluid medium circulation system of the cooling zone, said pressure sluice comprises a separation compartment arranged at the end of said sterilization zone between said sterilization zone and said cooling zone, a pressure line connected with said separation compartment for the separated-out conveying fluid medium, and a drop tube arranged in pressure-tight fashion at said cooling zone serving for transporting the separated-out packages, and an infeed line for cooling fluid medium provided at the end of said drop tube.

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