My invention relates in general to the canning industry and has particular reference to a method and apparatus for cooking and cooling food stuffs in hermetically sealed cans, or other containers.

According to present day methods of processing food stuffs in hermetically sealed cans to preserve them, it is the customary practice to subject the filled cans, after sealing, to a cooking operation, during which time the cans are subjected to a sufficient temperature for the proper length of time to effect sterilization of their contents. Not all commodities require the application of the same temperatures for sterilization, but in general, temperatures above 212 degrees F. are employed for this purpose, either because required for proper sterilization, or in order to limit the time required for its accomplishment. The application of such temperatures to the cans causes an increase in their internal pressures which may result in expanding the ends of the cans beyond their elastic limit so that they remain permanently bulged outwardly, a condition not acceptable to the trade. In order to avoid this, it is the customary practice to apply a pressure externally of the cans during the cooking sufficiently above atmospheric to counterbalance or partially counterbalance the internal pressures developed in the cans, thus relieving the strain on the can heads. Devices for carrying out the cooking under pressure are known in the art as pressure cookers.

Upon the completion of the cooking of the cans they are transferred to a cooler, and it has been found necessary to maintain a pressure above atmospheric in the cooler also in order to prevent excessive outward bulging of the can heads by the force of internal pressure, which might otherwise occur from the sudden shock if the cans were suddenly relieved of the external pressure applied in the cooker by delivering them into the atmosphere. Coolers of this character are known as pressure coolers.

Heretofore it has been the practice to maintain a uniform pressure throughout the cooker to which the cans were subjected during their entire travel through the cooler, and I have discovered that this practice is directly accountable for a considerable proportion of the spoilage which has heretofore occurred in a certain percentage of the cans subsequent to processing. I attribute this to the fact that as the cooling of the cans progresses their internal pressures decrease, and since the external pressure applied to them remains constant, the difference between the external and internal pressures progressively increases as the cooling progresses.

As is well known, it is customary in many instances to subject the filled cans just prior to sealing to a heating, or exhausting, process, for the purpose of driving the air from the contents of the cans to produce a vacuum condition in the sealed cans when they are finally cooled. Consequently, it will be seen that at some point during the cooling process and prior to the time that the cooling is completed the internal pressure in the cans will have been reduced to atmospheric, and from this point on, as the cans are further cooled, they are subjected to the combined strain of both the internal and external pressures which may result in forcing some of the cooling liquid into the contents of the cans past the can seals which have not yet become fully set, thereby causing recollection and subsequent spoilage of the can contents.

I have discovered that this spoilage can be substantially eliminated if the pressure applied externally of the cans is reduced during cooling so as to maintain the difference between the internal and external pressures well within the strength of the can seals, and it is, accordingly, an object of this invention to provide a method of cooling hermetically sealed, filled cans, subsequent to the cooking operation, by applying to them an initial external pressure sufficiently above atmospheric to prevent overstraining of the can heads by the internal pressure generated during the cooling process, and by reducing the pressure thus applied as the cans are cooled, sufficiently to prevent the forcing of cooling liquid past the can seals by excessive differences of internal and external pressures.

It is also an object to provide a method of cooling the cans as above stated in which the external pressure is applied either wholly or in part by means of a body of cooling liquid beneath which the cans are introduced for cooling, and through which they are elevated so as to reduce the external pressure applied at a rate sufficient to prevent forcing of cooling liquid past the can seals by excessive differences between internal and external pressures.

Another object is to provide a method of processing food stuffs in hermetically sealed cans, in which the cans are cooked under pressure above atmospheric and then subjected to a cooling process in which the cans are elevated through a body of cooling liquid, the cans being transferred from the cooking zone to a point beneath the surface.
of the cooling liquid without loss of external pressure on the cans sufficient to result in over
straining the can heads.

It is a further object to provide an apparatus
for carrying out the above methods, and more
particularly to provide an apparatus for cooling
the cans under a diminishing external pressure,
subsequent to the cooking operation, by the pro-
vision of means for introducing the cans directly
into submergence beneath the surface of a body
of cooling liquid and passing the cans upwardly
through the liquid so as to diminish the pressure
exerted externally of the cans as the cooling
progresses.

A further object is to provide an apparatus
for processing canned goods including a pressure
cooker, a cooler containing a body of cooling li-
quid beneath the surface of which the cans are
introduced by a pocketed transfer valve, and
means for preventing excessive loss of pressure
in the transfer valve during transfer of the cans
from the cooker to the cooler.

A still further object is to provide an apparatus
for processing canned goods including a cooker
and a cooler containing a body of cooling liquid,
in which a pressure tight pocketed valve is utili-
zed to transfer cans from the cooker into sub-
mergence beneath the cooling liquid, and means
is provided for freeing the valve pockets of li-
quid carried out of the cooler to prevent its intro-
duction into the cooler.

Various other objects and advantages will be
hereinafter become apparent as the description
progresses in connection with which attention is
directed to the accompanying drawing, in which:

Figure 1 is a side elevation of a combined coo-
er and cooker, a portion of the shell of the cooler
being broken away to illustrate certain features
of its construction.

Figure 2 is a top plan view of the apparatus
disclosed in Figure 1.

Figure 3 is a side elevation, partly broken away,
of the top portion of a modified form of cooler.

Figure 4 is a fragmentary side elevation of the
lower portion of a modified form of cooker.

Referring to Figures 1 and 2, the vertical cylin-
drical shell 1 of a pressure cooker A is supported
by a base 2, and closed at its opposite ends as by
heads 3 and 4 so as to provide a closed cooking
chamber into which the cans are introduced by a
rotary pressure tight valve 5, provided with can
pockets 6, and from which they are discharged
by a similar valve 7, having can pockets 8. Since
the construction and operation of such valves is
well known in the art, it is not deemed necessary
to illustrated further details of their construction.

Live steam under pressure is introduced into the
interior of the cooker by means of the steam pipe
9, and the condensate may be drained away by
the drain coil of valve 11 of a well known type which permits the passage of liquid but prevents the passage of steam. The
steam admitted to the cooker provides the neces-
sary cooking temperature, and being admitted
under pressure also provides for the application
of pressure above atmospheric externally of the
cans so as to prevent overstraining of their heads,
from pressure generated within them during the
cooking process.

A mechanism for advancing the cans through the cooler comprises the well-known reel and spiral construction which, being identical
with that utilized in the cooler, has not been il-
ustrated; reference being had to the cooler
illustrated for its details of construction. The
cooker reel is driven in the direction indicated
by the arrow by means of a gear 12, secured to
the upper end of the reel shaft 13, and driven in
from the shaft 14 through the train of re-
ducing gears 15. The shaft may be driven from
any suitable source of power, applied to a pulley
16. The inlet valve 5 is driven by a gear 17, se-
cured to the upper end of the valve shaft 18, and
intermeshing with the gear 12. The discharge
valve 7 is driven from the valve shaft 19 by means
10 of the pinion 20 intermeshing with a gear 21, se-
cured to the lower end of the reel shaft 13.

The cans are discharged from the cooker reel
directly into the shell 22 of the cooler B by means
of the valve 7 which, as above noted, is pressure
light, whereby the transfer is effected without
exposing the cans to the atmosphere and without
interchange of pressures between the cooker and
cooler.

In the embodiment shown in Figures 1 and 2, 20
the cooler is closed at the bottom by the head 23,
but its top is open to the atmosphere. Within
the cooker shelf 22 and extending around its Inner
circumference is a fixed helically directed rail or
can track 24, forming a continuous shelf upon 25
which the cans are received and advanced up-
wardly through the cooler from the inlet valve 7 to
the point of discharge, where they are re-
moved from the cooler by the rotating shelf wheel
25, which need not be pressure tight since the
interior of the cooler is open to the atmosphere.
The cans are advanced upwardly along the can
track 24 by a rotatable reel 26, supported by a
reel shaft 27 and provided with a peripheral series
of pusher bars 28, extending longitudinally of the
reel axis and preferably formed of angle iron, so
as to engage and advance the cans while sim-
ultaneously assisting to support them on the
track 24. The reel shaft 27 is driven in the
direction indicated by means of the gear 29 inter-
meshing with the valve pinion 20.

As the cans emerge from the valve 7 into the
cooler shell 22, they are relieved from the ex-
ternal pressure to which they have theretofore
been subjected in the cooker and, consequently
it is necessary that a pressure be applied in the
cooler which will sufficiently oppose the internal
pressure within the cans to preclude overstrain-
ing the can heads.

It is contemplated that such pressure may be
applied either by compressed air or by the hydro-
static pressure of a body of cooling liquid, but
since it is necessary to provide for the applica-
tion of diminishing pressures to the cans during
their progress through the cooler, it will be seen
that if compressed air were to be used it would be
necessary to divide up the cooler into a plu-
rality of separate compartments and maintain a
different air pressure in each one. By utilizing
liquid pressure, however, such construction is not
necessary as the diminishing forces required may be applied simply by elevating the cans
through the liquid.

Preferably, therefore, the pressure is supplied
by a body of cooling liquid 30 beneath the sur-
face 31 of which the cans are introduced by the
valve 7, and through which they are elevated as
the cooling progresses, at such a rate as to pre-
vent variation between the pressures internally
and externally of the cans to a sufficient extent to
force cooling liquid into the can past the can
seals, the speed of the reel being suitable for this
purpose.

I have found that when the steam filled pock-
ets of the transfer valve are brought into com-
communication with the cooling liquid in the cooler, the initial irrush of liquid into the pockets causes the steam to be rapidly condensed, and under certain conditions, as for example where the apparatus is operating at reduced speed, this condensation may result in producing a vacuum in the valve pockets for a brief instant before the pocket completely fills with cooling liquid. This sudden decrease in external pressure, even though only momentary in nature, may result in overstressing of the can heads by the internal pressures within the cans, and to avoid this I provide, as shown in Figs. 1 and 2, a pipe 31 leading from any suitable source of air pressure, and communicating with the interior of the valve casing 32 so as to communicate with the valve pockets at an intermediate point in their travel from the cooker to the cooler. By the introduction of sufficient air into the pockets by way of the pipe 31 just prior to the time they are brought into communication with the cooling liquid, excessive loss of pressure due to steam condensation is avoided.

The proper amount of air to be introduced into the valve pockets by way of the pipe 31 will depend upon operating conditions, as for example, the steam pressure in the pockets, the temperature of the air introduced, the internal pressures in the cans, and the strength of the cans, but as an illustrative example, assuming that the internal pressure within the cans entering the transfer valve 7 to be 35 pounds per square inch, the steam pressure in the cooker 15 pounds per square inch, and that the can seals will safely withstand a pressure of not more than 30 pounds per square inch, then if the pipe 31 carries an air pressure of 25 pounds per square inch, sufficient air will be introduced into the valve pockets to raise the pressure within them from 15 pounds per square inch to 25 pounds per square inch. When the pockets are then presented to the cooling liquid it has been found that the condensation of the steam in the pockets causes a momentary drop in pressure of only about 20 pounds, thus preventing externally of the cans to prevent overstraining in the moment before the liquid from the cooler completely fills the pocket. As soon as the pocket is filled with the liquid the pressure becomes the same as that in the cooler. As will be understood from the particular numerical example given above is illustrative only, and under some conditions the amount of air required to be introduced into the valve pockets in order to prevent excessive loss of pressure from steam condensation when the pockets are presented to the cooling liquid may not necessarily have to be sufficient to increase the pressure in the valve pockets, depending upon particular operating conditions. For example, under some conditions, the introduction of the air into the steam filled valve pockets may result in more or less condensation of steam, depending upon the relative temperature of the air introduced, and the extent of such condensation may be such that it would not be necessary to increase the pressure in the valve pockets in order to mix sufficient air with the steam to prevent excessive loss of pressure in the valve pockets from steam condensation when the pockets are presented to the cooling liquid. It will thus be seen that the quantity of air required to be introduced by way of the pipe 31 will largely depend upon the operating conditions of each individual case, the essential requirement being that sufficient air be mixed with the steam in the pockets to insure that condensation of the steam when the pockets are presented to the cooling liquid will not result in sufficient loss of pressure to permit overstraining of the cans by force of internal pressures within them.

The modification disclosed in Fig. 4 illustrates an alternative method of providing against loss of pressure in the transfer valve. Referring to that figure, the drain pipe 10a is connected with the interior of the cooler at a point slightly above the top of the valve casing 32 so as to maintain a body of liquid in the bottom of the cooler to a level just above the valve. The liquid may be introduced as desired by a valve controlled pipe 33 although condensation of steam will materially assist in maintaining the liquid to the proper level. Overflow is cared for by the pipe 10b controlled by a valve 11a similar to valve 11.

By the construction just described, as illustrated in Fig. 4, the air pipe 31 may be dispensed with since the pockets of the valve 1 fill with liquid from the cooler thereby maintaining the pressure externally of the cans during transfer without danger of the creation of the vacuum condition when the pockets open into the cooler as in the case when the pockets are filled with steam.

The proper depth of cooling liquid to be maintained within the cooler will depend upon the circumstances of each individual case, but in any event the pressure exerted by the liquid at the point where the cans are introduced into the cooler must be at least sufficient to overcome the internal pressure of the cans to such an extent as to preclude overstraining of the can heads. It will be obvious that the pressure thus required will depend upon the internal pressure generated in the cans by the temperature employed in the cooler, and also upon the size and shape of the cans undergoing treatment.

Although the depth of the cooling liquid must not be less than the minimum required to produce a pressure on the incoming cans sufficient to prevent overstraining the can heads, it will be understood that it may be increased if desired without injury to the cans or heads up to a point where the pressure applied to the incoming cans equals their internal pressures, or even beyond this point, although preferably not far beyond. Since it is desirable to maintain the speed of the cooler at a rate corresponding with other machinery in the canning line, it will be seen that by varying the depth of liquid between the limits mentioned, a corresponding range of reel speeds is available, while at the same time applying proper pressures to the incoming cans. The range of permissible reel speeds may also be increased to some extent by varying the rate of circulation of the cooling liquid, which is introduced by means of the spray pipe 34 and overflows by way of the overflow pipe 35, thus varying the rate of cooling.

It will be noted that the cooler is constructed tall enough so that a substantial portion of the travel of the cans will be above the average liquid level, and this is to provide for variations in liquid level according to requirements, and also to provide for a portion of the cooling by liquid sprays.

As heretofore pointed out, on account of the preliminary exhausting of the cans prior to sealing them, the pressure within the cans will be reduced to atmospheric at some time prior to completion of the cooling process and, consequently, it is not desirable to continue the application of pressure externally of the cans beyond this point...
If it can be avoided; since such pressure only adds to the strain on the can seals, to which they are thereafter subjected by the vacuum obtaining within them. For this reason, it is ordinarily desirable, if possible, to complete the cooling of the cans after they emerge from the cooling liquid under atmospheric pressure, and in the cooler illustrated in Figs. 1 and 2, this is accomplished by applying to the cans after they emerge from the cooling liquid, and during the balance of their travel through the cooler, sprays of cooling water directed downwardly onto the cans from the annular spray pipe 34 arranged at the top of the cooler directly over the can track 24.

As each pocket of the valve 7 comes into registry with the can inlet of the cooler and discharges its can therethrough, it will be seen that the pocket fills with cooling liquid from the cooler, which liquid would be carried around and discharged into the cooler unless some means were provided for its disposal. The continuous discharge of the cooling liquid into the cooler by the valve pockets would lower the cooler temperature and necessitate an excessive consumption of steam in order to keep the cooler interior at the desired temperature and pressure, and in order to avoid this a drain pipe 35 communicates with the lower portion of the valve casing 32 surrounding the valve 7 whereby to drain the valve pockets of liquid carried out of the cooler, and prevent its introduction into the cooling liquid.

From the foregoing description it will be understood that in operation the cans of filled product, after being sealed, are successively delivered into the cooler A by the inlet valve 8, and after passing through the cooler, within which they are subjected to the required heat treatment under proper pressure, they are transferred, without detrimental relief of pressure, into the cooler B by the pressure tight valve 7.

Within the cooler a minimum depth of liquid will be maintained such as to apply sufficient pressure externally of the cans entering it from the valve 7 to preclude overstraining the can heads by internal pressure. For example, suppose the pressure within the cans entering the cooler to be 35 pounds per square inch above atmospheric, and that the can seals will withstand a pressure of not more than 30 pounds per square inch with safety under such conditions, the minimum depth of liquid maintained in the cooler would have to exist at a pressure of at least 5 pounds per square inch externally of the containing cans, thus requiring a minimum depth of approximately 11 1/2 feet of water above the can inlet; assuming water weighs .433 pound per square inch per foot of head.

As hereinbefore noted, this depth may be increased if desired so as to allow for changes in real speeds; although I prefer not to increase the depth materially beyond that which would apply a pressure to the incoming cans equal to their internal pressures, for the reason that the can seals are generally more loosened by excessive external pressure than by excessive internal pressure, particularly before the seals have finally become set by cooling.

As the cans are passed into the cooler they are received upon the helical can track 24 and advanced upwardly therealong by the pusher bars 28 at a rate such as to insure decrease of the liquid pressure at a sufficient rate to prevent such variation between internal and external pressures as would overstrain the cans. That is to say, the cans should be elevated fast enough to decrease the liquid pressure to such extent that it cannot overstrain the can seals by reason of the decrease in internal pressure, and thus force cooling liquid into the cans, and slow enough so that the liquid pressure will not be relieved sufficiently to permit overstraining the can heads by force of internal pressures. The specific pressures represented by these limits will, of course, vary according to conditions in each individual instance, being dependent upon the liquid depth, the rate of cooling, and the strength of the cans and seals, and any speed between such limits may be set as desired. Preferably, although not essentially, that speed should be selected between these limits which will bring the cans out of the liquid into the atmosphere above at about the time the internal pressures reach atmospheric, and in practice it is also desirable to select a speed in accordance with the speeds of other machinery in the canning line. It will be seen that by regulating the depth of the liquid within the permissible limits above stated, or by varying the rate of cooling as, for example, by varying the rate the fresh cooling liquid is delivered by the spray pipe 34, a wide variety of speeds is available to choose from, according to requirements.

After the cans emerge from the cooling liquid, and during the balance of their travel through the cooler, they are subjected to atmospheric pressure and the cooling is completed by the application of sprays of cooling liquid issuing from the spray pipe 34.

It is believed that the superiority of the above described method and apparatus over those previously known, as well as the many advantages resulting from their use will now be apparent. By providing for a reduction in the pressure applied externally of the cans during the cooling process it is possible to apply to the cans at the start of the cooling sufficient pressure to prevent overstraining their heads from internal pressures, while at the same time overstraining the seals during the latter part of the cooling process, with resultant spoilage, is avoided. Also, by applying the pressure medium in the form of a body of cooling medium, then apparent, when the cans are elevated during cooling, the proper reduction in pressure is readily and effectively accomplished, and makes possible the use of a greatly simplified cooling apparatus. As may be seen, where the pressure is applied by liquid instead of compressed air, a lighter cooler shell may be used, and the necessity of providing pressure tight bulkheads is dispensed with. Further, no compressor mechanism or pressure control apparatus is required, and a pressure tight discharge valve is not necessary.

Although where possible I prefer to operate the cooler under atmospheric pressure, it should be understood that the principle of the invention is not limited thereto, but may be employed also to advantage in combination with the use of air pressure on the liquid pressure. Thus it may be found desirable in some instances to apply air under pressure to the surface of the cooling liquid as for example, where it is desired to increase the pressure applied to the cans entering the cooler without necessitating an increase in the height of the cooler to the extent which would be required if the increase in pressure were to be provided entirely by liquid pressure alone.

In the modification illustrated in Fig. 3, there is illustrated the top of a cooler 37 identical with that shown in Figs. 1 and 2, except that...
provision is made for operation either under atmospheric pressure or under pressure above atmospheric. The top of the cooler is closed by a head 38 so as to provide a closed cooling chamber. When a steam or air pressure is admitted to the atmosphere through the pipe 39 by opening the valve 40, or may be maintained under air pressure above atmospheric by closing the valve 40 and opening valve 41 to admit compressed air from the pipe 42. The discharge valve 43 is similar to the valves 5 and 7, being pressure tight for obvious reasons.

The operation of the modified form of cooler, when opened to the atmosphere through the pipe 33, is the same as that illustrated in Figs. 1 and 2. When it is desired, however, to increase the pressure, as shown by the corresponding cans to such an extent as would necessitate an increase in the height of the cooler, if the pressure were entirely supplied by liquid pressure, this may be done if desired by closing the cooler to the atmosphere and admitting compressed air from the pipe 42. In such event, it is important that the maximum air pressure admitted be not more than may safely be applied to the cans when they have cooled sufficiently for discharge from the cooler. For example, if it is desired to apply a pressure of 10 pounds per square inch to the cans entering the cooler, then such cans have been exhausted prior to sealing so as to provide a vacuum within them, after being cooled, of 7 pounds per square inch below atmospheric, the air pressure applied to the surface of the liquid should not be more than 3 pounds per square inch below atmospheric, assuming that the can seals will withstand not more than 10 pounds per square inch with safety. The minimum depth of liquid above the can inlet would then be that required to supply 7 pounds per square inch pressure or approximately 10 feet, without the air pressure, the liquid depth required would be approximately 23 feet. The use of the air pressure to augment the liquid pressure thus makes it possible to use a cooler approximately 7 feet shorter than if liquid pressure alone were relied upon.

As may be seen, the rate of advance of the cans through the cooler, and the depth of liquid necessary, are determined in the same manner where the air pressure is used as in the case where the cooler is operated open to the atmosphere except that the depth of liquid required may be reduced according to the air pressure utilized, and variation of reel speeds may be made as before.

It should be noted that where the cooler is operated under air pressure in the manner just described it is also advantageous to carry out the latter portion of the cooling by liquid sprays as it is when the cooler is operated under atmospheric pressure. This is for the reason that if for any reason any of the can seams should temporarily weaken under the air pressure, there is less chance of recontamination by the spray liquid which, being taken from the city mains, is relatively pure as compared with the body of cooling liquid in which the cans are submerged.

It will be understood that the invention is not limited to the employment of the particular numerical examples stated, which are given for purposes of illustration only, but may be varied according to requirements in accordance with the principle of the invention as hereinafore explained.

Having now described my invention and in what manner the same may be used, what I claim as new and desire to protect by Letters Patent is:

1. The method of processing foodstuffs in sealed containers which comprises sterilizing the same by heat treatment applied under pressure above atmospheric, then subjecting the containers to a cooling medium while exposing them to pressure above atmospheric, and reducing the external pressure on the containers during the initial portion of the cooling period at such a rate as to prevent overstraining of the container seals by such pressure.

2. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under external pressure above atmospheric, then transferring them while under such external pressure into a cooling medium having a pressure sufficient to prevent overstraining of the containers by differences of internal and external pressures, and gradually reducing the pressure of the cooling medium during the initial portion of the cooling period at a rate sufficient to prevent overstraining of the can seals by differences between internal and external pressures.

3. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under external pressure above atmospheric, then transferring them while under such external pressure into a liquid cooling medium at a point sufficiently below the surface thereof so that the pressure applied by the liquid at such point will be sufficient to prevent overstraining of the containers by differences of internal and external pressures, and gradually reducing the external pressure on the containers as the cooling progresses by passing them through a path extending upwardly from the point of introduction of the containers toward the surface of the liquid at such a rate as to prevent overstraining the can seals by differences between internal and external pressures.

4. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under external pressure above atmospheric, then transferring them while under such external pressure into a liquid cooling medium at a point sufficiently below the surface thereof so that the pressure applied by the liquid at such point will be sufficient to prevent overstraining of the containers by force of internal pressure, and gradually reducing the external pressure as the cooling progresses by passing them through a path extending upwardly through the liquid from the point of introduction of the containers toward the surface of the liquid.

5. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under steam pressure above atmospheric, then transferring said containers while under steam pressure into a body of cooling liquid at a point below the surface thereof, maintaining sufficient pressure externally of the containers during transfer to prevent overstraining them by differences between internal and external pressures, and gradually reducing the pressure applied to said containers by said cooling liquid as the cooling progresses by passing them through a path extending upwardly through the liquid from the point of introduction of the containers toward the surface of the liquid.

6. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under steam pressure, then transferring the containers while un-
der steam pressure into a liquid cooling medium at a point below the surface thereof, and mixing sufficient air with the steam applied to the cans during transfer to prevent excessive loss of external pressure from steam condensation when the containers are presented to the cooling liquid.

7. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under steam pressure above atmospheric, isolating said containers from the heating zone and transferring them into a body of cooling liquid at a point below the surface thereof while maintaining them under steam pressure sufficient to prevent overstraining the cans by differences between internal and external pressures, and mixing sufficient air with the steam applied to the cans during transfer to prevent excessive loss of external pressure from steam condensation when the containers are presented to the cooling liquid.

8. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under pressure above atmospheric, isolating said containers from the heating zone, and transferring them while so isolated into a body of cooling liquid at a point below the surface thereof and maintaining said containers under liquid pressure sufficient to prevent overstraining of the cans by differences between internal and external pressures during the transfer.

9. The method of processing foodstuffs in sealed containers which comprises sterilizing the same by heat treatment applied under pressure above atmospheric, then subjecting the containers to a cooling medium while exposing them to pressure above atmospheric, partially cooling the containers, reducing the external pressure to atmospheric throughout the period of such partial cooling at such rate as to prevent overstraining of the container seals by the difference between internal and external pressures, and then continuing the cooling by the application of a cooling medium while exposing the containers to atmospheric pressure.

10. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under pressure above atmospheric, then transferring them while under such pressure into a liquid cooling medium at a point sufficiently below the surface thereof, so that the pressure applied by the liquid at such point will be sufficient to prevent overstraining of the containers by force of internal pressure, partially cooling the containers while gradually reducing the external pressure on them by elevating them through a path extending upwardly from the point of introduction of the containers through and out of the cooling liquid at such a rate as to prevent overstraining the container seals by differences between internal and external pressures, and completing the cooling by the application of a cooling medium while exposing the containers to atmospheric pressure.

12. The method of processing foodstuffs in exhausted sealed containers which comprises sterilizing the same by heat treatment applied under pressure above atmospheric, then subjecting the containers to a cooling medium while exposing them to pressure above atmospheric, reducing the external pressure during cooling to reach atmospheric at approximately the time the internal pressures of the containers have been reduced to atmospheric, and then completing the cooling by the application of a cooling medium while exposing the containers to atmospheric pressure.

13. An apparatus for cooling canned goods comprising a shell, means for maintaining a body of cooling liquid in said shell, a can inlet in said shell below the level of the liquid, a can outlet in the shell above the inlet, and means within the shell for conveying cans along a path extending upwardly through the cooling liquid from the inlet to the outlet.

14. An apparatus for cooling canned goods comprising a vertical shell, means for maintaining a body of cooling liquid therein, a can inlet in said shell below the level of the liquid, a can outlet in the shell above the inlet, a helical can track within the shell extending upwardly through the cooling liquid from the can inlet to the can outlet, and means for propelling cans upwardly along the can track from the inlet to the outlet.

15. An apparatus for cooling canned goods comprising a shell, means for maintaining a body of cooling liquid under atmospheric pressure therein, a can inlet in the shell below the level of the liquid, a can outlet in the shell above the surface of the liquid, a canway within the shell extending upwardly through the liquid from the can inlet to the can outlet, and means for propelling cans upwardly along the canway from the inlet to the outlet.

16. An apparatus for processing canned goods comprising a pressure cooker, a cooler having a can inlet in its lower portion, means for transferring cans from the cooker to the cooler inlet without relief from pressure, means for maintaining a body of cooling liquid in the cooler of a depth above the inlet such as to exert sufficient external pressure on cans introduced therethrough to prevent overstraining the cans from internal pressure, a can outlet in the cooler above the inlet, and means within the cooler for conveying cans upwardly through the cooling liquid from the can inlet to the can outlet.

17. An apparatus for processing canned goods comprising a pressure cooker, a cooler having a can inlet in its lower portion, a pressure tight valve for transferring cans from the can inlet in the cooler while under pressure, means for maintaining a body of cooling liquid in said cooler to a depth above the inlet such as to exert sufficient external pressure on cans introduced therethrough to prevent overstraining the cans from internal pressure, a can outlet in the cooler above the inlet, and means within the cooler for conveying cans upwardly through the cooling liquid from the can inlet to the can outlet.
the cans upwardly through the cooling liquid from the can inlet to the can outlet at a rate sufficient to prevent overstraining the can seals by differences between internal and external pressures.

18. An apparatus for processing foodstuffs in sealed containers comprising a pressure tight cooking chamber, means for introducing steam under pressure into said chamber, a cooling chamber having a container inlet, means for maintaining a body of cooling liquid in the cooling chamber to submerge the container inlet, a pressure tight pocketed valve for transferring containers under steam pressure from the cooking chamber to the container inlet of the cooling chamber, and means for introducing air under pressure into the valve pockets as they travel from the cooker to the cooler.

19. An apparatus for processing foodstuffs in sealed containers comprising a cooking chamber having a container inlet and a container outlet, means for maintaining a body of liquid in said cooking chamber to submerge the container outlet, means for conveying cans through the cooking chamber from said inlet to said outlet, a cooling chamber having a lower container inlet and an upper container outlet, means for maintaining a body of cooling liquid in the cooling chamber to submerge its container inlet, means for conveying containers upwardly through the cooling chamber from its inlet to its outlet, and a pressure tight valve for transferring containers from the outlet of the cooker to the inlet of the cooling chamber.

20. An apparatus for cooling canned goods comprising a shell, means for maintaining a body of cooling liquid under atmospheric pressure therein, a can inlet in the shell below the level of the liquid, a can outlet in the shell above the surface of the liquid, means within the shell for conveying cans upwardly through the cooling liquid from the can inlet to the can outlet, and means for spraying cooling liquid against the cans during their passage from the surface of the liquid to the can outlet.

21. An apparatus for processing foodstuffs in sealed containers comprising a cooking chamber, means for heating said chamber, a cooling chamber, means for maintaining a body of cooling liquid in said cooling chamber, a pocketed pressure tight valve connecting said chambers whereby to transfer containers from the cooking chamber into the cooling chamber at a point below the surface of the cooling liquid, and means for freeing the valve pockets of liquid carried out of the cooling chamber to prevent its introduction into the cooking chamber.

22. The method of processing foodstuffs in sealed containers which comprises subjecting the containers to heat treatment under external pressure above atmospheric, then transferring them while under such external pressure into a body of liquid cooling medium at a point below the surface thereof, and gradually reducing the pressure applied to said containers by said cooling liquid throughout the period of submergence of said containers therein by passing the containers through a path extending upwardly through the liquid from the point of introduction of the containers toward the surface of the liquid.

23. In a method of processing hermetically sealed canned goods wherein the cans are subjected to heat treatment of such character as to generate pressures internally of the cans in excess of the normal strength of the can seals, while applying pressure externally of the cans sufficient to prevent overstraining the can seals by internal pressures, the steps of maintaining such external pressure on the cans while passing them into a cooling medium having an initial pressure sufficient to prevent overstraining of the can seals by internal pressures, subjecting the cans to said cooling medium for a sufficient length of time to reduce the pressures internally of the cans to within the normal strength of the can seals, and reducing the pressure applied externally of the cans during the said cooling period at such rate relative to the rate of reduction of the pressures internally of the cans as to maintain the difference between the internal and external pressures within the normal strength of the can seals.

24. In a method of processing hermetically sealed canned goods wherein the cans are subjected to heat treatment of such character as to generate pressures internally of the cans in excess of the normal strength of the can seals, while applying pressure externally of the cans sufficient to prevent overstraining of the can seals by internal pressures, the steps of maintaining such external pressure on the cans while passing them into a liquid cooling medium at a point below the surface thereof where the pressure applied to the cans by the liquid is sufficient to prevent overstraining of the can seals by internal pressures, subjecting the cans to the cooling effect of said liquid cooling medium for sufficient length of time to reduce the pressures internally of the cans to within the normal strength of the can seals, and reducing the pressure applied externally of the cans during the said cooling period by passing the cans upwardly through the cooling liquid at such a rate relative to the rate of reduction of the pressures internally of the cans as to maintain the difference between the internal and external pressures within the normal strength of the can seals.

25. In a method of processing hermetically sealed canned goods wherein the cans are subjected to heat treatment under externally applied pressure above atmospheric, thereby generating pressure internally of said cans, the steps of thereafter subjecting said cans to a cooling treatment under externally applied pressure above atmospheric, and progressively reducing the pressure applied externally of the cans during the cooling treatment at such rate as to prevent overstraining of the can seals by differences between the pressures internally and externally of the cans.

26. In a method of processing hermetically sealed canned goods wherein the cans are subjected to heat treatment under externally applied pressure above atmospheric, thereby generating pressure internally of said cans, the steps of thereafter subjecting said cans to a cooling treatment under externally applied pressure above atmospheric, and progressively reducing the pressure applied externally of the cans during the cooling treatment in such relation to the reduction of pressure internally of the cans as to prevent overstraining of the can seals by differences between the pressures internally and externally of the cans.

27. In a method of processing hermetically sealed canned goods wherein the cans are subjected to heat treatment under externally applied pressure above atmospheric, the steps of thereafter transferring said cans while under...
such external pressure into a cooling liquid at a point sufficiently below the surface thereof so that the pressure applied to the cans by such liquid is sufficient to prevent overstraining of the can seals by differences between the pressures internally and externally of the cans, and progressively elevating the cans through said cooling liquid during cooling of the cans thereby to reduce the pressure applied to the cans by said liquid at such rate as to prevent overstraining of the can seals by differences between the pressures internally and externally of the cans.

ALBERT R. THOMPSON.