The invention relates generally to the art of can making and resides in the provision of a novel can closure and method of forming the same, while the invention is applicable to the manufacture of cans wherein the bodies are of seamless, drawn type, it preferably is applied in the manufacture of cans including bodies of steel, aluminum or aluminum alloys having very thin walls, say of 0.004 to 0.011 inch, for example, and including welded side seams wherein the thickness of the metal at the weld corresponds generally to the thickness of the metal elsewhere in the body.

In the manufacture of cans, it is common practice to secure metal closures on the metal bodies by the well known double rolled seaming action, edge portions of each can body and its closure being rolled together in the formation of the double seam. In this conventional practice each can body is provided with outwardly turned flanges at its end extremities, and each closure includes a central countersink presenting a chulk wall which is insertable into an end of the can body, and an outwardly extending portion for overlying a body flange and adapted to be rolled with the body flange into the seaming seam structure. The bodies commonly have lock and lap side seams the lock portions of which are composed of interlocked body hooks, thus presenting four thicknesses of metal, and the lock portions of which are disposed at the ends of the side seam and present two thicknesses of metal which are rolled into the seaming seam structure.

Conventional side seam structures of the character stated usually are solder bonded, and since the flanging of the bodies is accomplished after the solder bonding, the flanging operation often results in a rupturing of the bond in the lap seam portions intended to be rolled into the closure seam structure, and leaky cans are thus formed. It sometimes happens also that by reason of the turning of non-uniform lengths of the body metal in the flanging operation, or in the chucking of the bodies incidental to the formation of closure seams, cans of non-uniform height will be provided. Also, when attempts have been made to form flanged can bodies from thin stock, such as double rolled tin plate, difficulties such as rupturing and leakage have been encountered because this stock cannot be flanged satisfactorily, the flanges having what is known in the industry as H-grain and circumferential brittleness.

A primary object of the present invention is to avoid the problems above referred to and provide a novel can closure wherein interlocking side seams and the rolling together of closure and body edge portions is entirely eliminated, thus providing for a marked saving of metal as a result of the elimination of body flanges and interlocked side seams, without sacrifice in the objective of providing wholly practical closure seals, even against ingress of relatively high pressures from within the sealed cans.

Another object of the invention is to provide a novel closure of the character stated wherein the closure seal may embody a sealing compound, or optionally, a metal-to-metal adhesive bond, providing not only for the desired sealing purpose but also adding to the structural strength in the finished seam.

A further object of the invention is to provide a novel closure of the character stated wherein provision is made for adding rigidity to the seam, providing a greater strength against relatively high sealed-in pressures, and also facilitating application of the closure piercing types of can openers, by reason of the inclusion in the closure of an opener engaging ledge of practical dimension and strength.

Another object of the invention is to provide a closure of the character stated in which the can body is devoid of an outwardly turned flange and has a generally cylindrical end extremity over which the closure channel of an end closure is receivable and which merges downwardly into an inwardly turned bead presenting a horizontal seat or shoulder merging inwardly and downwardly into an outwardly and downwardly flared and curving wall portion finally merging into the main upright body wall of the can body.

Still another object of the invention is to provide a can body of the character stated wherein the body structure is the same at each of its ends, is not only devoid of outwardly turned end flanges but also is either seamless or provided with a side seam which does not depart substantially from the thickness of the metal of the body wall stock, and wherein the main body between its curving end portion flares is circumferentially corrugated uniformly throughout its height for providing firm and internal pressure retaining rigidity.

A further object of the invention is to provide a novel closure of the character stated wherein the can body is formed in the manner hereinabove stressed and in which the can end closure includes a central closure portion surrounded by an upstanding downwardly opening channel defined by an inner chuck wall connected with the central closure portion through a chuck radius and an outer skirt or seaming wall which is longer than the generally cylindrical end extremity of the body and which is connected with the chuck wall through a channel radius, said central closure portion firmly resting on the horizontal shoulder of the body about an annulus joining with the chuck wall through said chuck radius, and the seaming wall portion remote from the channel radius being turned snugly under and locked against the body at said shoulder with the generally cylindrical end extremity tightly embraced between the chuck wall and the seaming wall and conforming in shape thereto and with the channel radius firmly engaged over the end edge extremity of said generally cylindrical body end extremity.

A still further object of the invention is to provide a novel can closure of the character stated wherein the closure seam is sealed by a sealing medium in the closure channel and engaging between the opposing faces of the generally cylindrical body end extremity, the chuck wall and the seaming wall.

Still another object of the invention is to provide a novel can closure of the character stated wherein the closure seam is sealed by a seam bonding adhesive in the closure channel and engaging between the opposing faces of the generally cylindrical body end extremity, the chuck wall and the seaming wall.

A further object of the invention is to provide a novel can closure of the character stated wherein the end closure seaming wall portion remote from the channel radius carries an outwardly turned reinforcing hem which is engaged in shape conforming closure locking contact under the horizontal shoulder on the body.

Still another object of the invention is to provide a novel can closure of the character stated wherein the closure seaming wall portion remote from the channel radius carries an inwardly turned reinforcing hem which is engaged in shape conforming closure locking contact under the horizontal shoulder on the body.
A further object of the invention is to provide a novel method of forming an end closure for a metal can having a body devoid of a flange at its end extremity, said extremity terminating in a generally cylindrical portion merging inwardly into an inwardly turned bead presenting a horizontal shoulder merging inwardly and downwardly into an outwardly flared portion, with a closure having a central closure portion surrounded by an upstanding downwardly opening channel defined by an inner chuck wall connected with the central closure portion, a chuck radius and an outer sealing wall connected with the chuck wall through a channel radius; said method comprising placing the closure over the body end extremity with the chuck wall closely telescoped within said end extremity and the central closure portion firmly seated on the horizontal shoulder, and the reshaping of the inwardly directed reinforcing hem thereof. FIGURE 5 is a fragmentary sectional view of a plurality of can end closures of the form shown in FIGURES 2 through 5, said closures being shown in nested, stacked relation.

FIGURE 7 is a fragmentary sectional view corresponding to the initial closure mounting illustrated in FIGURE 2 and showing a novel form of closure including an outwardly and upwardly directed edge curl. FIGURE 8 is a fragmentary sectional view similar to FIGURE 3 and illustrating the seam configuration between the chuck and the sealing roll and the initial reshaping of the cover edge curl into an open, outwardly directed hem.

FIGURE 9 is a fragmentary sectional view similar to FIGURE 4 and illustrating the completion of the locking-on of the cover and the reshaping of the outwardly directed reinforcing hem thereof. FIGURE 10 is a fragmentary sectional view similar to FIGURE 6 and illustrating can ends of the form shown in FIGURES 7, 8 and 9 in nested, stacked relation.

In the example of embodiment of the invention herein disclosed, the improved closures are provided on an improved can body best shown in FIGURES 2. Each can body generally designated 5, as shown in FIGURE 1, has top and bottom end closures respectively designated 6 and 7 applied thereof. At each body end extremity, there is provided a generally cylindrical portion 8 merging through an inwardly turned bead 10 with a horizontal seat or locking shoulder 11, and each such horizontal seat or shoulder merges through an inwardly, downwardly and then outwardly turned portion 12 into an outwardly curved body flare 13 which in turn merges at 14 into the main body portion of the can body generally designated 5. Between the outwardly curving flares 13, the main body is uniformly and circumferentially corrugated to give to the very thin wall structure of 0.004" to 0.011" thickness the desired rigidity and strength for retaining sealed-in pressures for which the can is designed.

The ends or covers for use in the form of the invention shown in FIGURES 2 through 5 are illustrated in nested, stacked relation in FIGURE 6. Each such end or closure includes a central closure portion 11 and a surrounding upstanding and downwardly opening channel generally designated 17. The channel comprises a chuck wall 18 merging through the inner chuck radius 19 with the central closure portion 16, and through the channel radius 20 with the sealing wall or skirt 21. The sealing wall or skirt 21 is longer than the chuck wall and is provided at its extension beyond the chuck wall depth with an inwardly turned hem 22. It will also be apparent by reference to FIGURES 2 and 6 that each can end channel also is equipped with a sealing compound or bonding adhesive as indicated at 23.

The manner of forming the closure of FIGURES 2 through 5 is progressively illustrated in said figures. It will be apparent by reference to FIGURE 2 that the lower end extremity of the can body 5 is supported and confined at 24 on the bed plate 25, and in said figure, the can end or cover is shown as having been dropped onto the upper end extremity of the body and resting on the horizontal shoulder 11, as at 26. Relative movement between the bed plate 25 and a chuck roll 27 is then brought about to place the chuck roll base 28 against the central closure portion 16 of the can body and the chuck wall 29 of the roll within the chuck wall 18 of the can end, as shown in FIGURE 3. With the chuck roll thus placed, a sealing roll 30 interlocked at 31 with the chuck roll 27 in the well known manner is moved into contact with the sealing wall or skirt 21 of the can end, said sealing roll including the usual seam pressing
and conforming wall 32 and a can end seaming wall re-
shaping and locking portion 33. The cooperation or mov-
ing together of the seaming roll and the chuck roll serves
to tightly conform the can end walls 18 and 21 and the
can body wall portion 8 embraced between them in the
manner clearly illustrated in FIGURE 3. The seaming wall re-
shaping and locking portion 33 of the seaming roll is so formed as to be effective during the rolling of the
seam by the seaming roll as to first bring the hem 22 into
engagement with the head 10 as at 34 and turn the hem
inwardly as at 35, and then to reshape the hem pro-
gressively to conform and lock the same under the hori-
zontal shoulder 9 as illustrated in FIGURE 4. In the
process of reshaping and locking the cover skirt rein-
forcing hem in the manner described, and as shown pro-
gressively in FIGURES 3 and 4, the cover channel is drawn
downwardly to firmly seat the inner chuck radius 19 on
the horizontal shoulder, pulling the seaming wall or skirt
21 downwardly and putting the same and holding the
same previously described end extremity 9 of the can body
wall portion 8, as shown at 51 in FIGURE 3.

It will be observed by reference to FIGURE 4 that not
only is the can end or cover reinforcing hem 22 con-
formed to and securely locked under the head 10 and the
horizontal locking shoulder 9 thereof, but the raw metal
dge of the hem is so enclosed within the seat structure as
to avoid exposure thereof to the atmosphere. In the pro-
cess of forming the seam as herein described, the sealing
compound or bonding agent 23 is distributed in the seat
in the manner illustrated in FIGURES 3 and 4, serving
to efficiently seal the seat when sealing compounds are
employed, and to both seal and provide for an efficient
bonding of the seat and its components when a bonding
adhesive is employed.

In the form of the invention illustrated in FIGURES 7
through 10, can ends or covers of the form illustrated in
FIGURE 10 are employed. These can ends are similar to
the covers previously described except for the fact that
they are equipped at the downwardly and outwardly
flaring extremities of the downwardly opening channel
with an outwardly and upwardly turned curl 37, rather
than the inwardly turned hem structure shown in FIG-
URE 6. In other words, each of these modified can ends
includes a central closure portion 38 surrounded by an up-
standing and downwardly opening channel 39, said chan-
nel comprising a chuck wall 40 merging into an inner
chuck radius 41 with the central closure portion 38, and
through a channel radius 42 with a seaming wall or skirt
43, which as in the previous form, is longer than the chan-
nel wall and is provided at its extremity or extension
beyond the channel wall, with the aforedescribed
curl 37. A sealing compound or bonding adhesive, there-
preferably is applied in the can end channel as illustrated
in FIGURE 7.

These modified forms of can ends or covers are ap-
plied over can bodies which are identical in structure to
those previously described, each including a generally
cylindrical wall portion 45 and an end extremity and pre-
senting an edge extremity 46, and each said generally
cylindrical portion 45 merges through an interwound head
47 with a horizontal seat or body shoulder 48, and each
said shoulder 48 merges through an inwardly, downwardly
and then outwardly turned portion 49 with the respective
outwardly curved flare 50 which in turn merges into the
main corrugated body portion, as previously described.

In FIGURES 7 to 9, progressive steps in the forma-
tion of the seat are shown, and it is to be understood
that the lower extremity of the can body will be supported
and confined in the manner previously described, and as
shown in FIGURE 2.

In FIGURE 7, the can end is shown as having been
dropped onto the upper end of the can body and resting
on the seat or horizontal shoulder as indicated at 51.
The chuck roll 52 is now brought into contact in the
manner previously described to present its base 53 against
the can end central portion or countersink 38, as shown
in FIGURE 8, and the chuck wall 54 of the roll within the
can end chuck wall 40. The cooperating and inter-
locking seaming roll 55 includes a shaping wall portion
56 which is modified as necessary to provide for the
progressive reshaping of the can end seaming wall and
its extremity and its curl 37, as will be apparent by
reference to FIGURES 8 and 9. The initial reshaping of
the curl is shown at 57 in FIGURE 8, and the com-
pIete reshaping of the curl in the form of an outwardly
turned reinforcing hem and the reshaping and locking of
the seam under the horizontal head shoulder 48 is shown
at 58 in FIGURE 9.

It is understood that in both of the herein disclosed
forms of the invention, namely that illustrated in FIG-
URES 2 through 5, and that illustrated in FIGURES 7
to 9, the reshaping and locking of the reinforcing hem
under the horizontal shoulder 9 or 48 serves to draw the
can end channel downwardly to firmly seat the
chuck wall radius 19 or 41 against the horizontal shoulder
and the channel radius 29 or 42 firmly against the end
extremity of the can body, with the seaming wall 21 or
43 of the closure seam held in tension by the firm locking
of the reinforcing hem under the horizontal shoulder of
the head in the manner stated.

The novel can both a closure and method of forming
the same disclosed herein have provided very considerable advantages, some of which are herein enumerated.

The employment of the flangeless body structure, also
devoid of interlocked side seaming serves to provide
great savings in metal.

The particular form of the body with its flangeless
and generally cylindrical end portion 8 or 45 and
the inwardly directed head 12 or 49 serves to facilitate intro-
duction of fill, and also to prevent rolling of fill portions
into the seam structure with the result of the provision
of flat seam. The smoothly rolled bead serves to facili-
tate entry of the fill, and the raw metal edge at the end
extremity of the body will serve to cut through fill tending to hang over the edge in position for inter-
fering with the closure application.

The particular form of the seam structure provides
for secure sealing and seam strength without the necessity
of the interrolling of flanges. It will be apparent by
reference to FIGURE 1 that the seam structure are so
formed and positioned as to provide no projection outward beyond the mean body diameter. This arrange-
ment provides for more compact storage and casing, and
thus damping of the can ends by engagement of end seam
against end seam.

The particular hem reinforced seam structures also
provide secure shoulder means against which to anchor
opening devices, either of the rotary type, or the ful-
crimping, end piercing type.

The ends or closures of the type shown in FIGURES
7 to 10 can be produced by a single operation employing
present standard end presses, by simply designing the
die to produce the end closures in the forming illustrated
in FIGURES 7 and 10.

In the making of the closures of the form shown in
FIGURES 2 and 6 there would be a first stamping out of
the end closure, and in a second operation the bending
over of the closure to form the internally hemmed edge
thereon.

While preferred example disclosures of the closure,
body and seam structures and the method of forming the
closure have been described in detail herein it is to be
understood that variations in said structures and the
steps in said method may be made and practiced without
departing from the invention as defined in the appended
claims.

What is claimed is:
1. In a metal container, a generally cylindrical body
having a generally cylindrical end portion terminating
endwise in a raw metal edge, said generally cylindrical portion merging into an inwardly turned bead presenting a horizontal shoulder in turn merging inwardly and in a direction generally axially away from said raw metal edge and into an outwardly and longitudinally flared and curving wall portion finally merging into the main generally cylindrical body, a closure having a central closure portion and a surrounding upstanding downwardly opening channel defined by an inner chuck wall connected with the central closure portion through a chuck radius and an outer sealing wall which is axially longer than the chuck wall and the generally cylindrical end portion and which is connected with the chuck wall through a channel radius, said central closure portion firmly resting on said shoulder about an annulus joining with the chuck wall through said chuck radius, with the seaming wall portion remote from the channel radius turned snugly under and locked against the body shoulder in a manner holding said seaming wall in tension and the closure firmly against said raw metal edge and on said shoulder with the generally cylindrical body end portions tightly embraced between the chuck wall and seaming wall and conforming in shape thereto and with the channel radius firmly engaged over the raw metal edge.

2. A closure structure as defined in claim 1 wherein the seaming wall portion remote from the channel radius carries a reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder.

3. A closure structure as defined in claim 1 wherein the seaming wall portion remote from the channel radius carries an inwardly turned reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder.

4. A closure structure as defined in claim 1 wherein the seaming wall portion remote from the channel radius carries an outwardly turned reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder.

5. A closure structure as defined in claim 1 wherein the seaming wall portion remote from the channel radius carries a reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder and there also being included a seam sealing medium in the closure channel and engaging between the opposing faces of the generally cylindrical body portion the chuck wall and the seaming wall.

6. A closure structure as defined in claim 1 wherein the seaming wall portion remote from the channel radius carries a reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder and there also being included a seam sealing and bonding adhesive in the closure channel and providing a metal to metal bond between the generally cylindrical body portion and the chuck and seaming walls between which it is embraced.

7. In a metal container, a generally cylindrical body having at each end thereof a generally cylindrical end portion terminating endwise in a raw metal edge, each said generally cylindrical portion merging into an inwardly turned bead presenting a horizontal shoulder in turn merging inwardly and in a direction generally axially away from the respective raw metal edge into an outwardly and longitudinally flared and curving wall portion finally merging into the main generally cylindrical body, a closure at one end of the container body and having a central closure portion and a surrounding upstanding downwardly opening channel defined by an inner chuck wall connected with the central closure portion through a chuck radius and an outer sealing wall which is axially longer than the chuck wall and the generally cylindrical end portion and which is connected with the chuck wall through a channel radius, said central closure portion firmly resting on said shoulder about an annulus joining with the chuck wall through said chuck radius, with the seaming wall portion remote from the channel radius turned snugly under and locked against the body shoulder in a manner holding said seaming wall in tension and the closure firmly against said raw metal edge and on said shoulder with the generally cylindrical body end portion tightly embraced between the chuck wall and seaming wall and conforming in shape thereto and with the channel radius firmly engaged over the raw metal edge.

8. Container structure as defined in claim 7 wherein the seaming wall portion remote from the channel radius carries a reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder.

9. Container structure as defined in claim 7 wherein the seaming wall portion remote from the channel radius carries an inwardly turned reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder.

10. Container structure as defined in claim 7 wherein the seaming wall portion remote from the channel radius carries a reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder.

11. Container structure as defined in claim 9, there also being included a seam sealing medium in the closure channel and engaging between the opposing faces of the generally cylindrical body portion the chuck wall and the seaming wall.

12. Container structure as defined in claim 7 wherein the seaming wall portion remote from the channel radius carries a reinforcing hem which is engaged in shape conforming closure locking contact under the body shoulder, and there also being included a seam sealing and bonding adhesive in the closure channel and providing a metal to metal bond between the generally cylindrical body portion and the chuck and seaming walls between which it is embraced.

13. A metal closure for use on a metal container body devoid of an end flange, said closure comprising a central closure portion and a surrounding upstanding downwardly opening V-shaped channel defined by an inner chuck wall connected with the central closure portion through a chuck radius and an outer sealing wall connected with the chuck wall through a channel radius dimensioned for receiving the flangeless end extremity of a can body, said seaming wall being axially longer than the chuck wall and provided at its free edge extremity with an inwardly turned reinforcing hem serving also as means for holding closures in spaced relation when they are nest stacked.

14. A metal closure for use on a metal container body devoid of an end flange, said closure comprising a central closure portion and a surrounding upstanding downwardly opening V-shaped channel defined by an inner chuck wall connected with the central closure portion through a chuck radius and an outer sealing wall connected with the chuck wall through a channel radius dimensioned for receiving the flangeless end extremity of a can body, said seaming wall being axially longer than the chuck wall and provided at its free edge extremity with an inwardly turned reinforcing hem, and said channel being provided with a sealing medium in and adjacent the channel radius in position for being out of contact with a like closure nested in the closure with its seaming wall within and in contact with the inwardly turned hem of the closure.

15. In a metal container, a generally cylindrical body having a generally cylindrical end portion terminating endwise in a raw metal edge, said generally cylindrical portion merging into an inwardly turned bead presenting a horizontal shoulder in turn merging inwardly and in a direction generally axially away from said raw metal edge and into an outwardly and longitudinally flared and curving wall portion finally merging into the main generally cylindrical body, a closure having a central closure portion and a surrounding upstanding downwardly opening channel defined by an inner chuck wall connected
with the central closure portion through a chuck radius and an outer seaming wall which is axially longer than the chuck wall and the generally cylindrical end portion and which is connected with the chuck wall through a channel radius, said central closure portion firmly resting on said shoulder about an annulus joining with the chuck wall through said chuck radius, with the seaming wall portion remote from the channel radius turned snugly under and locked against the body shoulder in a manner holding said seaming wall in tension and the closure firmly against said raw metal edge and on said shoulder with the generally cylindrical body end portions tightly embraced between the chuck wall and seaming wall and conforming in shape thereto and with the channel radius firmly engaged over the raw metal edge, said container body being formed of metal having a thickness of 0.004 to 0.011 inch and of uniform thickness throughout the full circumference of its cross section, and the body portion intermediate the flares being uniformly and circumferentially corrugated.

16. In a metal container, a generally cylindrical body having at each end thereof a generally cylindrical end portion terminating endwise in a raw metal edge, each said generally cylindrical portion merging into an inwardly turned bead presenting a horizontal shoulder in turn merging inwardly and in a direction generally axially away from the respective raw metal edge into an outwardly and longitudinally flared and curving wall portion finally merging into the main generally cylindrical body, a closure at one end of the container body and having a central closure portion and a surrounding upstanding downwardly opening channel defined by an inner chuck wall connected with the central closure portion through a chuck radius and an outer seaming wall which is axially longer than the chuck wall and the generally cylindrical end portion and which is connected with the chuck wall through a channel radius, said central closure portion firmly resting on said shoulder about an annulus joining with the chuck wall through said chuck radius, with the seaming wall portion remote from the channel radius turned snugly under and locked against the body shoulder in a manner holding said seaming wall in tension and the closure firmly against said raw metal edge and on said shoulder with the generally cylindrical body end portions tightly embraced between the chuck wall and seaming wall and conforming in shape thereto and with the channel radius firmly engaged over the raw metal edge, said container body being formed of metal having a uniform thickness of 0.004 to 0.011 inch and being of uniform thickness throughout the full circumference of its cross section, the body portion intermediate the flares being uniformly and circumferentially corrugated.

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