United States Patent [19]

Wagner

[11] **3,736,786**

[45] **June 5, 1973**

[54] EXTRUDING APPARATUS AND METHOD

[75] Inventor: **Nicholas A. Wagner,** Chester, Va.

[73] Assignee: **Reynolds Metals Company,** Richmond, Va.

[22] Filed: **July 9, 1971**

[21] Appl. No.: **161,170**

[52] **U.S. Cl.** **72/255**

[51] **Int. Cl.** **B21c 23/00**

[58] **Field of Search** 72/254, 255

[56] **References Cited**

UNITED STATES PATENTS

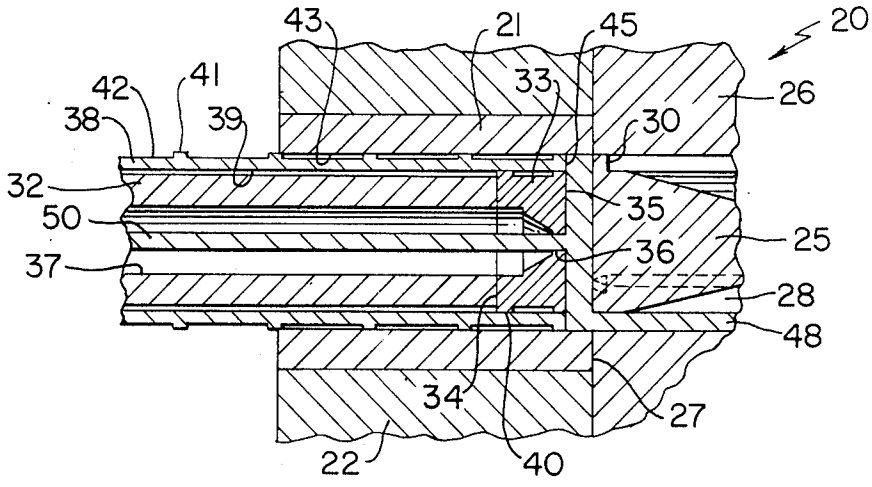
2,738,064	3/1956	Kreidler	72/254
3,577,759	5/1971	Tandler	72/254
3,184,944	5/1965	Sibler	72/272

Primary Examiner—Charles W. Lanham
Assistant Examiner—Robert M. Rogers
Attorney—John F. C. Glenn, Arthur I. Palmer, Jr. and John W. Gibbs, Jr. et al.

[57] **ABSTRACT**

An extruding apparatus having a support for receiving and supporting a metallic billet to be extruded therefrom through a die of the apparatus that is disposed adjacent one end of the billet upon relative movement between the billet and a ram of the apparatus that is operatively associated with the billet. A shearing device is provided for removing the billet skin at the end of the billet that is to be extruded through the die while the billet is supported by the support to produce at least a scalped portion of the billet prior to the extrusion of that scalped portion of the billet through the die upon relative movement between the ram and the billet.

20 Claims, 10 Drawing Figures



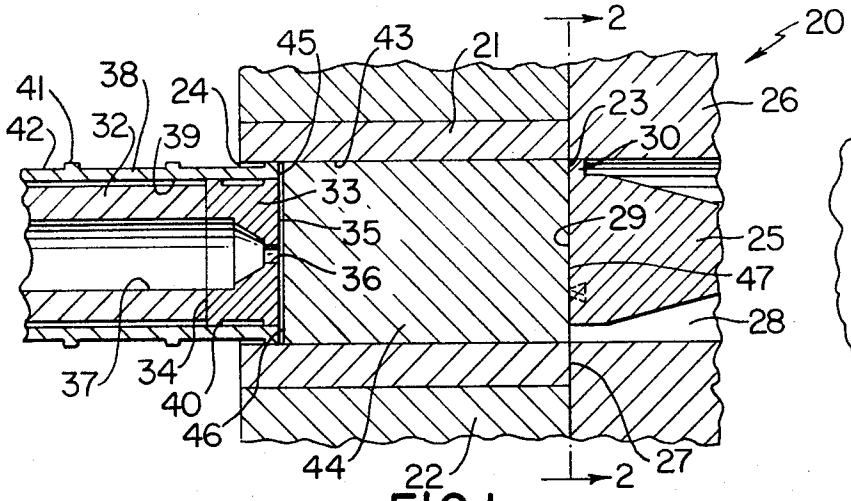


FIG. 1

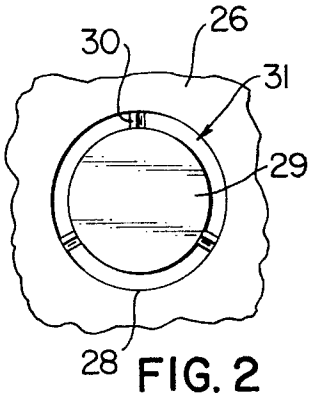


FIG. 2

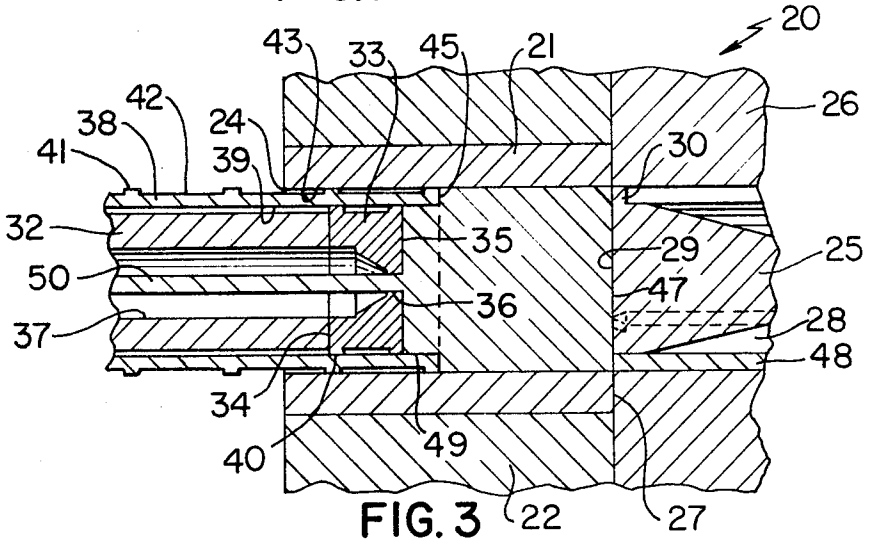


FIG. 3

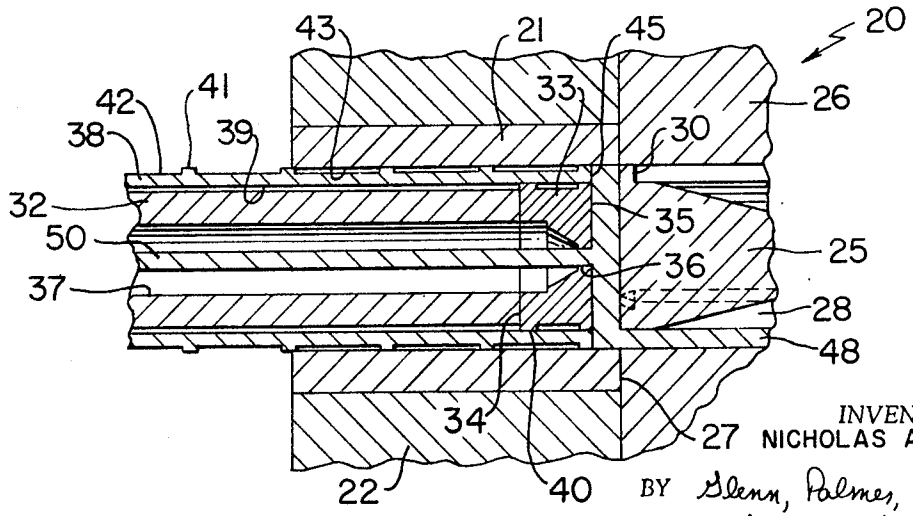


FIG. 4

INVENTOR.
NICHOLAS A. WAGNER

BY Glenn, Palmer, Lyne, Gibbs & Thompson

HIS ATTORNEYS

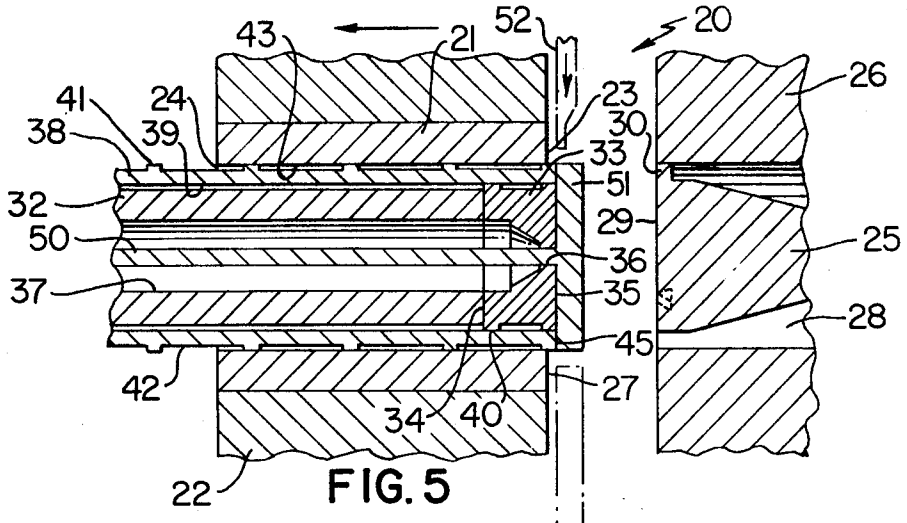


FIG. 5

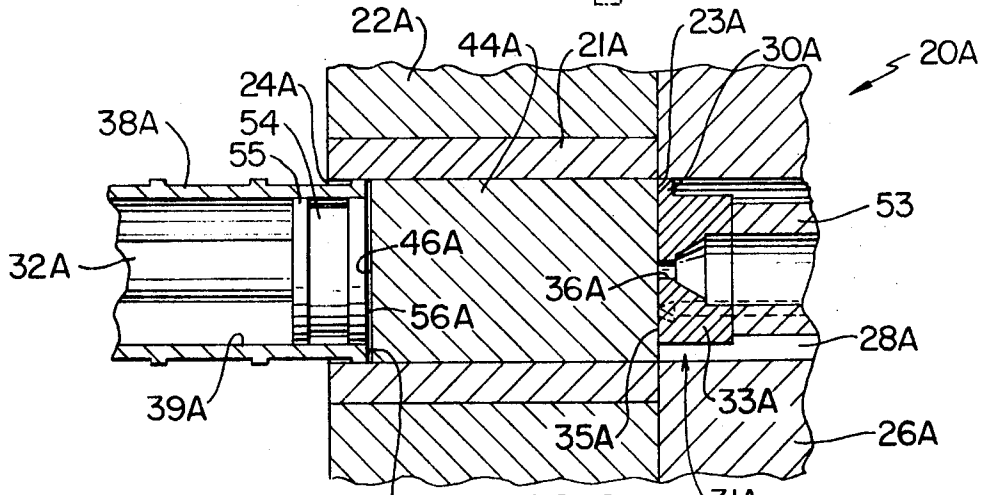


FIG. 6

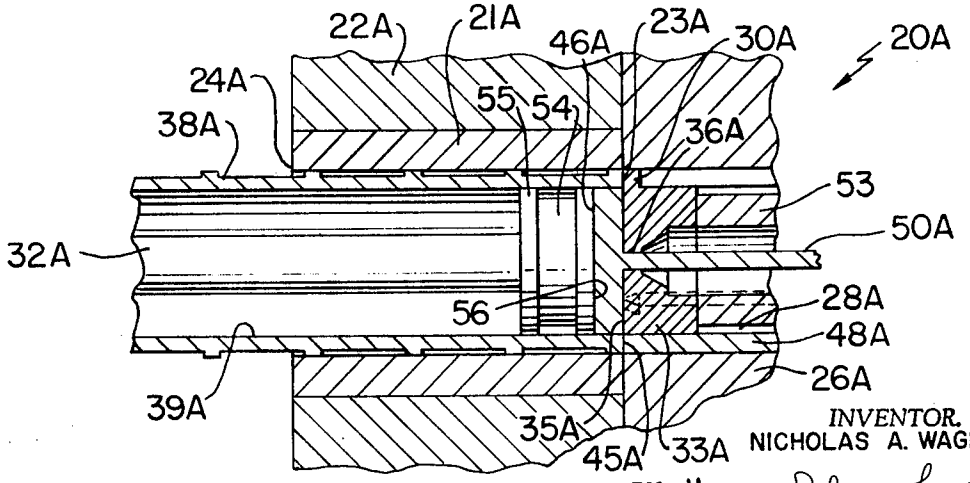


FIG. 7

INVENTOR.
NICHOLAS A. WAGNER
BY Glenn, Palmer, Lyne, Gibbs & Thompson
HIS ATTORNEYS

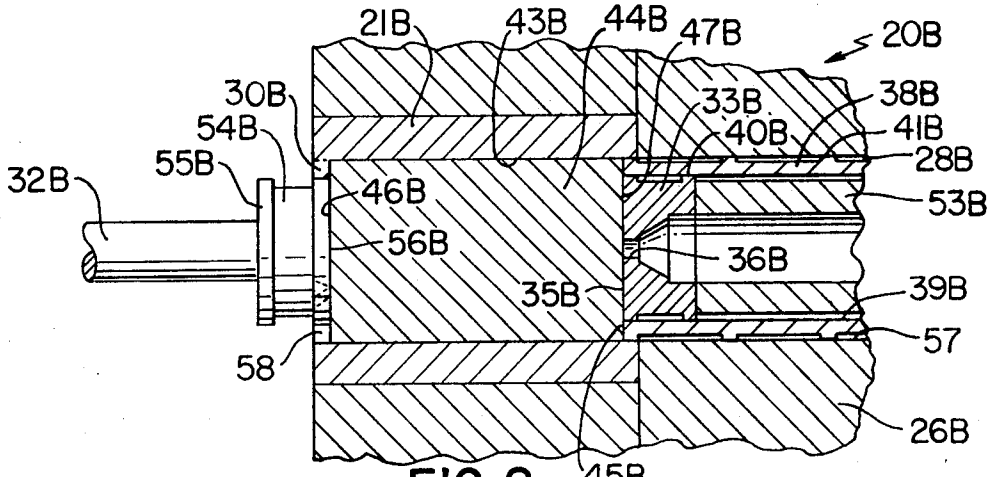


FIG. 8

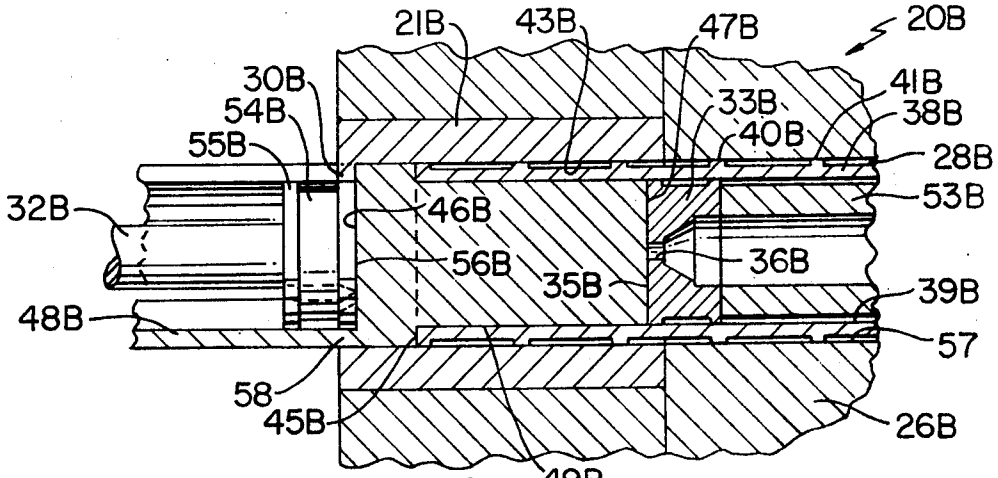


FIG. 9

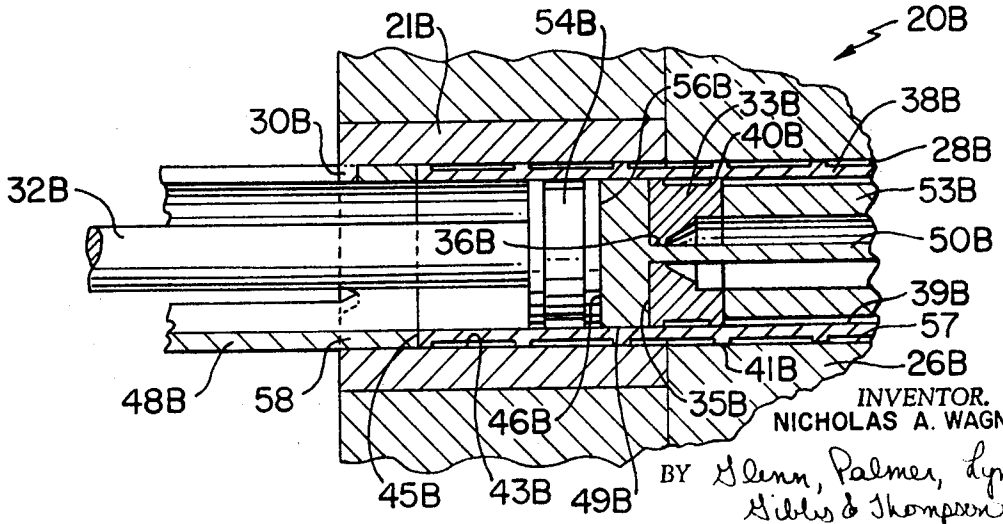


FIG. 10

INVENTOR.
NICHOLAS A. WAGNER
BY Glenn, Palmer, Lyne, Gibbs & Thompson
HIS ATTORNEYS

EXTRUDING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

When metallic billets are utilized in extruding apparatus, such billets have an outer peripheral skin which if extruded in an uncontrolled manner through an extrusion die will provide a defective extruded part because of the different metallic characteristics of the billet skin from the characteristics of the rest of the billet material. For example, when such metallic billets are formed from aluminum containing metallic material, a heavy oxide billet skin is provided on such billets.

In the past, the attempt to control the billet skin feed-in when extruding metallic billets by the indirect method has been provided by a tool called a die ring which has given various degrees of feed-in control but is believed not to have eliminated the adverse billet skin problems, particularly on longer billet lengths where the billet skin is extruded through the die and forms a defective extruded part. Extruding by the direct process, skin feed-in is controlled by varying the butt length in relation to the configuration of the extruded product.

SUMMARY

This invention provides an improved apparatus and method for extruding metallic billets wherein the aforementioned adverse billet skin problem is substantially eliminated.

One embodiment of this invention comprises an extruding apparatus having a support for receiving and supporting the metallic billet to be extruded therefrom through a die of the apparatus that is disposed adjacent one end of the billet upon relative movement between the billet and a ram of the apparatus that is operatively associated with the billet. This invention provides means for removing the billet skin at the one end of the billet while the billet is supported in the support to produce at least a completely scalped portion of the billet prior to the extrusion of that scalped portion of the billet through the die upon relative movement between the ram and the billet so that at no time will the billet skin actually be extruded through the die along with the remainder of the material of the billet.

Other details, uses and advantages of the invention will become apparent as the following description of the present preferred embodiments thereof in the accompanying drawings proceeds.

DESCRIPTION OF THE DRAWINGS

The accompanying drawings show the present preferred embodiments of the invention, in which:

FIG. 1 is a fragmentary, cross-sectional view illustrating an indirect extrusion apparatus of this invention before the billet therein has been extruded.

FIG. 2 is a fragmentary, cross-sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is a view similar to FIG. 1 and illustrates the extruding apparatus during the extruding operation thereof.

FIG. 4 is a view similar to FIG. 3 and illustrates the extruding apparatus after the same has completed the extruding operation thereof.

FIG. 5 is a view similar to FIG. 3 and illustrates the extrusion apparatus having the unextruded billet butt being removed therefrom.

FIG. 6 is a view similar to FIG. 1 and illustrates a direct extruding apparatus of this invention before the billet therein has been extruded.

FIG. 7 is a view similar to FIG. 6 and illustrates the extruding apparatus of FIG. 6 during the extruding operation thereof.

FIG. 8 is a view similar to FIG. 1 and illustrates another direct extrusion apparatus of this invention before the billet therein has been extruded.

FIG. 9 is a view similar to FIG. 8 and illustrates the billet skin removing operation of the apparatus of FIG. 8.

FIG. 10 is a view similar to FIG. 8 and illustrates the extrusion of the scalped portion of the billet in the apparatus of FIG. 8.

DESCRIPTION OF ILLUSTRATED EMBODIMENTS

Referring now to FIG. 1, one improved method and apparatus of this invention is generally indicated by the reference numeral 20 and comprises a billet receiving container liner 21 suitably supported in the apparatus 20 by a container 22 and having opposed open ends 23 and 24. The open end 23 of the container 21 is adapted to be substantially closed by a billet plate 25 carried by a container back-up member 26 abutting against the end surface 27 of the container 21 and having an opening 28 passing therethrough and aligned with the open end 23 of the container 21. The billet back-up plate or stop 25 has a front flat surface 29 adapted to be coplanar with the open end 23 of the container 21 when the billet back-up member 26 is disposed against the container 21 in the manner illustrated in FIG. 1.

The billet back-up member 25 is centrally located within the passage 28 passing through the back-up member 26 and has a plurality of outwardly directed radiating shear members 30 spanning the annular area 31 between the back-up member 25 at the surface 29 thereof and the billet back-up member 26 in the manner illustrated in FIG. 2 so that the annular area 31 is divided into a plurality of segments for a purpose hereinafter described.

A ram 32 is carried by the apparatus 20 and is adapted to be movable toward and away from the container 21 in a conventional manner. The ram 32 carries a die 33 at the end 34 thereof with the die 33 having a front surface 35 interrupted by a central extruding opening 36 that passes through the die 33 and is alignable with an opening 37 passing through the ram 32 and through which the extrusion from the die 33 can pass in a manner hereinafter described.

A shell piercer or shear ram 38 is carried by the apparatus 20 and is movable toward and away from the open end 24 of the container 21 in such a manner that the same has an interior peripheral surface 39 surrounding the main ram 32 and being disposed in sliding and sealing engagement with outer peripheral annular guide members 40 of the die 33. The shear ram 38 in turn has outwardly directed annular guide members 41 provided on the outer peripheral surface 42 thereof for sliding and sealing engagement against the internal peripheral surface 43 of the container 21 for a purpose now to be described.

In the operation of the apparatus 20, the shear ram 38 and main ram 32 are moved to the left in FIG. 1 so that a metallic billet 44 can be disposed within the container 21 in the manner illustrated in FIG. 1 and the

shear ram 38 and main ram 32 are then moved into the open end 24 of the container 21 in such a manner that the front surface 35 of the die 33 and the front surface 45 of the shear ram 38 will substantially simultaneously compact against the end 46 of the billet 44 so that the other end 47 of the billet 44 will compact against the surface 29 of the billet back-up member 25 as illustrated in FIG. 1. With the surfaces 35 and 45 of the die 33 and shear ram 38 compacting against the end 46 of the billet 44, the billet 44 is slightly crushed within the container 21 and, thereafter, the die member 33 is held stationary against the end 46 of the billet 44 by the ram 32 remaining stationary and the shear ram 38 is advanced from left to right beyond the surface 35 of the die 33 to shear an outer annular billet skin member 48, FIG. 3, from the billet 44 and advance such billet skin member 48 in an extruding manner beyond the right end 47 of the billet 44 into the annular area 31 between the billet back-up member 25 and the container back-up member 26 as illustrated in FIG. 3. However, such sheared annular billet member 48 extrudes against the splitting members 30 in the annular area 31 so that the billet skin member 48 is continuously extruded into a plurality of segments into the opening 28 of the container back-up member 26 for subsequent scrap or recycling thereof.

Nevertheless, it can be seen that by advancing the shear ram 38 beyond the surface 35 of the die 33, a scalped billet portion 49 is now provided adjacent the opening 36 of the die 33 whereby subsequent movement of the ram 32 to the right in FIG. 3 causes the die 33 to move in unison therewith and indirectly extrude the scalped portion 49 of the billet 44 through the opening 36 thereof in such a manner that no billet skin will be extruded through the opening 36 to adversely affect the extruded product 50 now being extruded through the opening 36 of the die 33 into the opening 37 of the ram 32 as illustrated in FIG. 3.

If desired, the shear ram 38 can be driven completely along the entire length of the billet 44 to shear the annular skin member 48 completely from the same before any of the scalped portion 49 of the billet 44 is extruded through the die 33. Alternately, the shear ram 38 can merely proceed slightly in advance of the die 33 along the container 21 so that at all times will a recently scalped portion 49 of the billet 44 be extruded through the die 33.

By scalping the skin area of the billet 44 prior to each portion thereof that is being extruded into the die 33 of the apparatus 20, no skin area or material of the billet 44 will ever pass through the extrusion die 33 to cause defective extrusions in the manner provided by other extruding apparatus where the billet skin is not removed and is attempting to be controlled by the aforementioned die ring structure and the like.

Referring now to FIG. 5, after the desired amount of the billet 44 has been extruded from the apparatus 20, the remaining billet butt 51 can be removed therefrom by merely backing off the container 22 and container liner 21 from the back-up member 26 and billet back-up member 25 in the manner illustrated in FIG. 5 and advancing the billet butt 51 beyond the end 23 of the container 21 by the ram 32 so that the billet butt removing member 52 can shear the billet butt 51 from the die 33 in a conventional manner whereby the apparatus 20 can be utilized to extrude another metallic billet 44 in the manner previously described.

Referring now to FIGS. 6 and 7, another extruding apparatus and method of this invention is generally indicated by the reference numeral 20A and parts thereof similar to the apparatus 20 previously described are indicated by like reference numerals followed by the reference letter "A". However, the apparatus 20A of this invention is for direct extrusion of the billet 44A through the opening 36A of the die 33A whereas the apparatus 20 previously described provided an indirect extrusion operation.

The die 33A of the apparatus 20A is carried on a die back-up member 53 carried within the opening 28A of the container back-up member 26A so as to position the surface 35A of the die 33A coplanar with the open end 23A of the container 21A as illustrated in FIG. 6. The annular space 31A between the die 33A and the container back-up member 26A is spanned by a plurality of radially disposed shear members 30A carried by the die 33A to shear the billet skin in a manner similar to the shear members 30 previously described and in a manner hereinafter described. Of course, the shear members 30A could be carried by the container back-up member 26A, if desired.

The ram 32A for the apparatus 20A includes an enlarged dummy block 54 having outer annular slide members 55 thereon for being disposed in sliding and sealing engagement with the internal peripheral surface 39A of the shear ram 38A whereby the front flat surface 56A of the dummy block 54 is adapted to engage against the end 46A of the billet 44A to cause the billet 44A to directly extrude through the die opening 36A of die 33A in a manner now to be described.

After the container 21A has been loaded with the billet 44A and the end 23A of the container 21A has been closed off by the die 33A as illustrated in FIG. 6, the shear ram 38A and dummy block 54 are moved into the open end 24A of the container 21A so as to have the front surfaces 56 and 45A thereof respectively engaged against the end 46A of the billet 44A to slightly crush the same within the container 21A. Thereafter, the movement of the ram 32A is stopped and the shear ram 38A is moved from left to right completely along the entire length of the billet 44A so as to completely strip the annular billet skin member 48A therefrom and extrude the same through the opening 28A of the container back-up member 26A where the shear members 30A shear the same into a plurality of parts in the manner previously described. After the entire billet skin has been removed from the billet 44A in the manner illustrated in FIG. 7, the dummy block 54 is advanced to the right by the ram 32A in the manner illustrated in FIG. 7 to directly extrude the scalped billet 44A through the opening 36A of the die 33A to produce the extruded product 50A whereby it can be seen that such extrusion of the biller 44A takes place in such a manner that no billet skin will be extruded through the die 33A because the entire billet skin area has been removed by the shear ram 38A for the reasons previously set forth.

However, it may be desired to provide a direct extruding operation wherein the entire billet skin is not removed prior to any initial direct extruding of the billet in substantially the same manner as provided by the indirect extruding apparatus 20 previously described where the shearing operation merely takes place to scalp a portion of the billet just before that scalped portion is extruded through the extrusion die.

Accordingly, reference is now made to FIGS. 8-10 wherein such a direct extruding apparatus of this invention is generally indicated by the reference numeral 20B and parts thereof similar to the apparatus 20 and 20A previously described are indicated by like reference numerals followed by the reference letter "B".

As illustrated in FIG. 8, the apparatus 20B has the die 33B carried on the ram 53B so as to position the same within the opening 28B of the container back-up member 26B in a manner similar to the apparatus 20A previously described. However, the die 33B does not have the shearing members 30A of the die 33A of FIG. 6 because the shear ram 38B of the apparatus 20B is disposed in the opening 28B of the container back-up member 26B so as to have its internal peripheral surface 39B disposed in sliding and sealing relation with the outwardly directed annular guides 40B of the die member 33B in the same manner as provided by the apparatus 20. The outer annular guide members 41B of the shear ram 38B are adapted to be disposed not only in sliding and sealing relationship with the internal peripheral surface 57 of the opening 28B of the container back-up member 26B, but also in sliding and sealing relationship with the internal peripheral surface 43B of the container 21B in the same manner as the shear ram 38 previously described.

The container 21B has the shear members 30B formed thereon at the left hand end thereof and the dummy block 54B carried by the ram 32B is adapted to be received inside the shear members 30B so that the shear members 30B will be disposed flush with the front surface 56B of the dummy block 54B when the same is positioned within the open end 24B of the container 21B to place the surface 56B of the dummy block 54B against the end 46B of the billet 44B. In this manner, the shear members 30B can be utilized to shear the annular billet skin being extruded by the shear ram 38B into a plurality of parts in the same manner as the shear members 30 and 30A previously described.

In particular, when the container 21B has been loaded with the billet 44B in the manner illustrated in FIG. 8, and the surface 35B of the die 33B and the end surface 45B of the shear ram 38B have been disposed against the end 47B of the billet 44B and the surface 56B of the dummy block 54B has been placed against the surface 46B of the billet 44B so that the billet 44B can be slightly crushed within the container 21B, the shear ram 38B is moved from right to left in the manner illustrated in FIG. 9 to begin to shear the annular billet skin member 48B from the billet 44B and cause the same to be extruded through the annular opening 58 provided between the dummy block 54B and the internal peripheral surface 43B of the container 21B and be sheared by the shear members 30B in the manner previously described. After the shear ram 38B has progressed to the left beyond the surface 35B of the die 33B in the manner illustrated in FIG. 9 a desired distance, the ram 32B can begin to be moved from left to right in the manner illustrated in FIG. 10 to directly extrude the thus scalped portion 49B of the billet 44B through the opening 36B of the die 33B whereby a freshly scalped portion 49B of the billet 44B will always be ready to be extruded through the die 33B so that no billet skin will be extruded into the extruded product 50B now passing to the right out of the opening 36A of the die 33B as illustrated in FIG. 10.

Therefore, it can be seen that in each of the embodiments of this invention, the billet skin is removed from the billet at least just prior to the thus scalped portion of the billet being extruded through the die whether the die is acting as an indirect extrusion die or as a direct extrusion die.

Accordingly, it can be seen that not only does this invention provide an improved extruding apparatus, but also this invention provides an improved method of extruding a metallic billet or the like.

While present preferred embodiments of the invention have been illustrated and described, it will be recognized that the invention may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. In an extruding apparatus having a container for receiving and supporting a billet which has opposed ends and is to be extruded therefrom through a die of the apparatus that is disposed adjacent one end of the billet upon relative movement between said billet and a ram of the apparatus that is operatively associated with said billet, the improvement comprising means for removing the billet skin at said one end of said billet while said billet is supported within said container to produce at least a scalped portion of the billet prior to the extrusion of that scalped portion of the billet through said die upon said relative movement between said ram and said billet.

2. In an extruding apparatus as set forth in claim 1, the further improvement wherein said means continues to remove said billet skin from said billet prior to the thus scalped portion of the billet being extruded through said die whereby only scalped portions of said billet will be extruded through said die.

3. In an extruding apparatus as set forth in claim 1, the further improvement wherein said means completely removes said billet skin from said billet between said ends thereof before said billet is extruded through said die.

4. In an extruding apparatus as set forth in claim 1, the further improvement wherein said means for removing said billet skin comprises a shear ram for engaging against one of the ends of said billet and shearing an outer annular skin from said billet upon relative movement between said shear ram and said billet.

5. In an extruding apparatus as set forth in claim 4, the further improvement wherein said shear ram causes said sheared skin to extrude as an annular skin member beyond the other of said ends of said billet during said relative movement between said shear ram and said billet.

6. In an extruding apparatus as set forth in claim 5, the further improvement wherein said apparatus has a cutter adjacent the skin extruding end of said billet to longitudinally shear said annular skin member into a plurality of parts as said skin member is being extruded beyond that end of said billet.

7. In an extruding apparatus as set forth in claim 6, the further improvement wherein said skin member is being longitudinally sheared at the same end of the billet that will be extruded through said die.

8. In an extruding apparatus as set forth in claim 6, the further improvement wherein said skin member is being longitudinally sheared at the end of the billet opposite to the end thereof that will be extruded through said die.

9. In an extruding apparatus as set forth in claim 1, the further improvement wherein said die and said ram are so constructed and arranged that said billet will be directly extruded through said die upon relative movement between said billet and said ram.

10. In an extruding apparatus as set forth in claim 1, the further improvement wherein said die and said ram are so constructed and arranged that said billet will be indirectly extruded through said die upon relative movement between said billet and said ram.

11. In a method for extruding a billet having opposed ends through a die that is disposed adjacent one end of the billet upon relative movement between said billet and a ram that is operatively associated with said billet, the improvement comprising the step of removing the billet skin at said one end of said billet while said billet is supported within a container to produce at least a scalped portion of the billet prior to the extrusion of that scalped portion of the billet through said die upon said relative movement between said ram and said billet.

12. In a method for extruding as set forth in claim 11, the further improvement wherein said step of removing said billet skin comprises the step of continuing to remove said billet skin from said billet prior to the thus scalped portion of the billet being extruded through said die whereby only scalped portions of said billet will be extruded through said die.

13. In a method for extruding as set forth in claim 11, the further improvement wherein said step of removing said billet skin comprises the step of completely removing said billet skin from said billet between said ends thereof before said billet is extruded through said die.

14. In a method for extruding as set forth in claim 11, the further improvement wherein said step of removing said billet skin comprises the step of engaging a shear ram against one of the ends of said billet and shearing an outer annular skin from said billet by causing relative movement between said shear ram and said billet.

15. In a method of extruding as set forth in claim 14, the further improvement wherein said step of shearing said skin from said billet by said shear ram causes said sheared skin to extrude as an annular skin member beyound the other of said ends of said billet during said relative movement between said shear ram and said billet.

16. In a method of extruding as set forth in claim 15, the further improvement of the step of longitudinally shearing said annular skin member into a plurality of parts as said skin member is being extruded beyond said billet.

17. In a method of extruding as set forth in claim 16, the further improvement wherein said skin shearing step causes said skin member to be longitudinally sheared at the same end of the billet that will be extruded through said die.

18. In a method of extruding as set forth in claim 16, the further improvement wherein said skin shearing step causes said skin member to be longitudinally sheared at the end of the billet opposite to the end thereof that will be extruded through said die.

19. In a method of extruding as set forth in claim 11, the further improvement wherein said die and said ram will directly extrude said billet through said die upon relative movement between said billet and said ram.

20. In a method of extruding as set forth in claim 11, the further improvement wherein said die and said ram will indirectly extrude said billet through said die upon relative movement between said billet and said ram.

* * * * *