Jan. 6, 1959 C. G. A. SWANSON 2,867,321

CONTAINER FOR AN EXTRUSION PRESS

Filed June 3, 1955 2 Sheets-Sheet 1

Fig. 1.

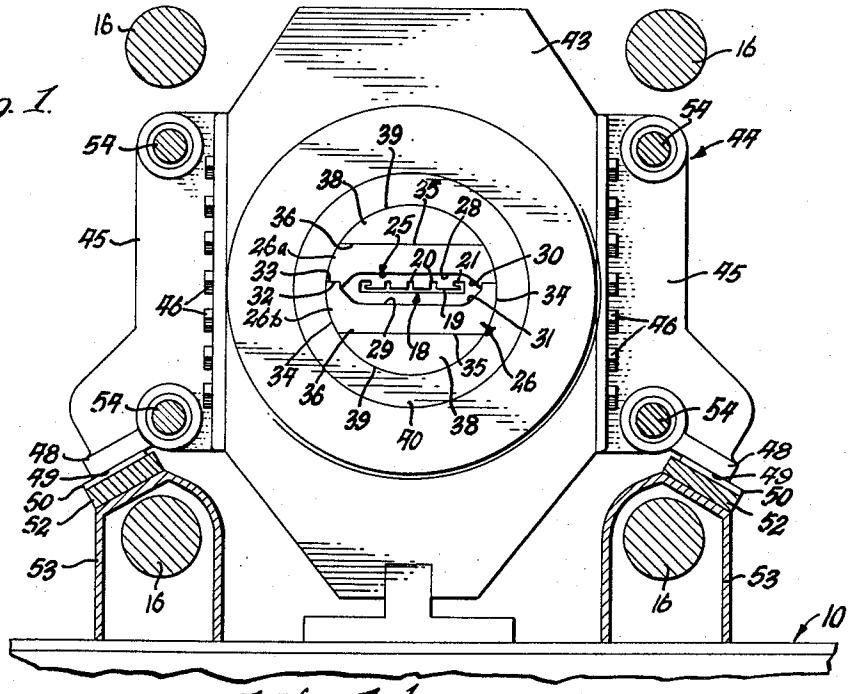


Fig. 2.

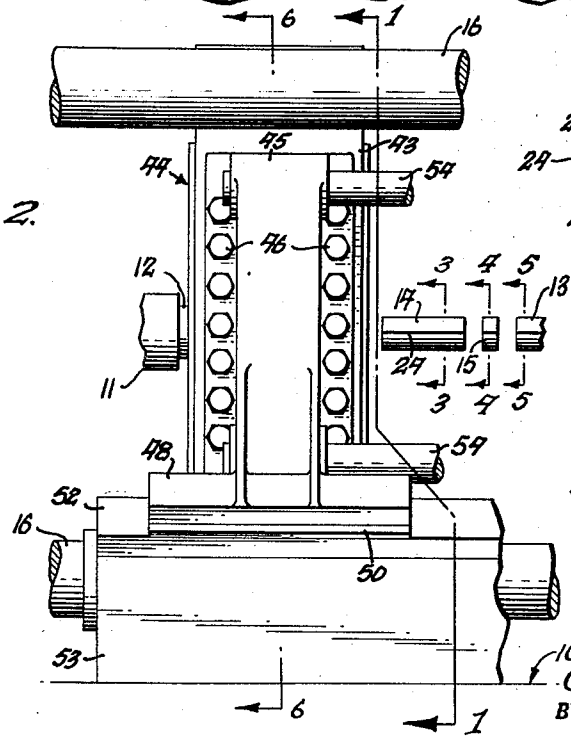


Fig. 3.

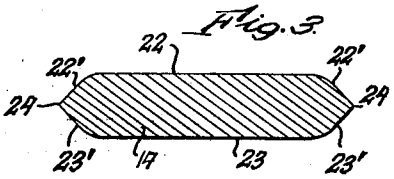


Fig. 4.

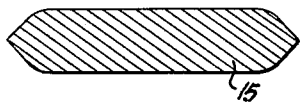
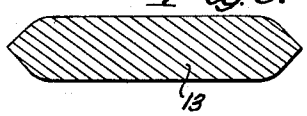


Fig. 5.



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Fig. 6.

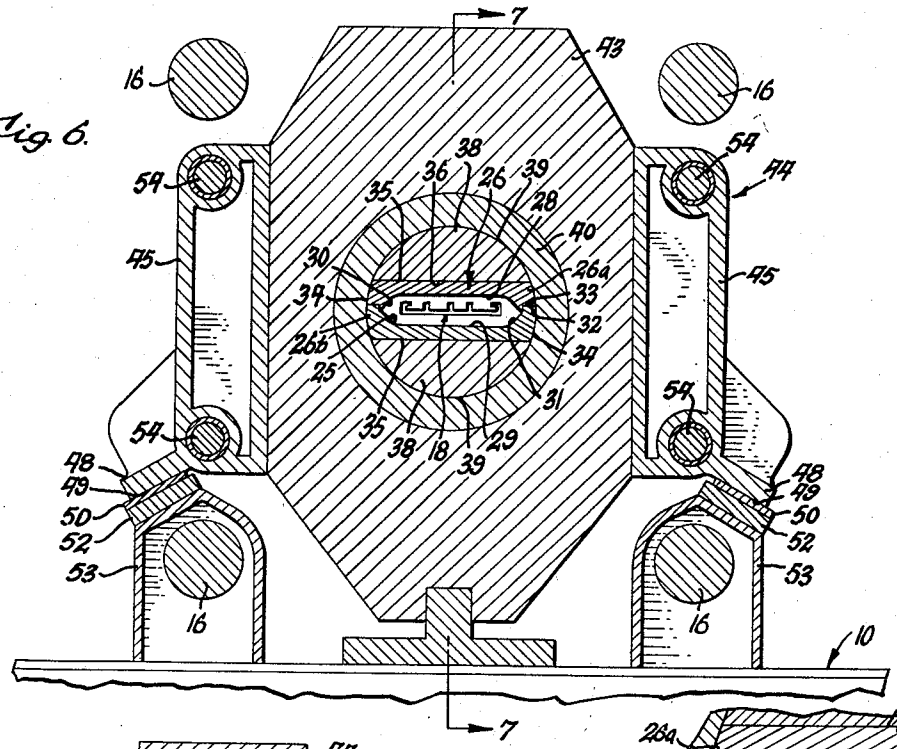


Fig. 7.

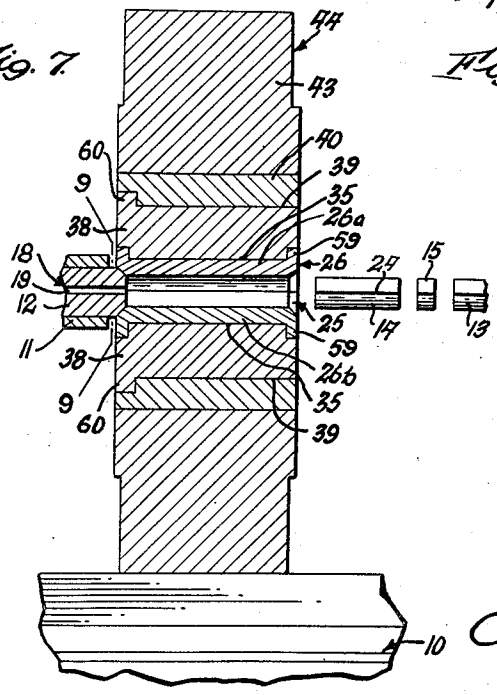
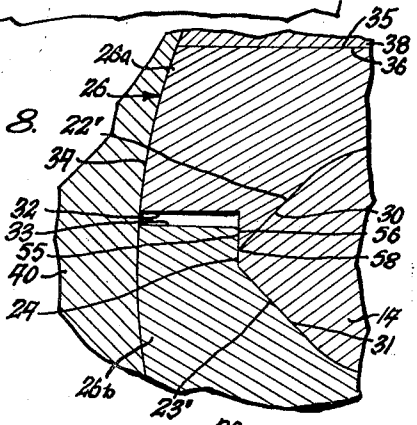


Fig. 8.



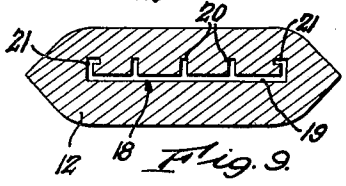


Fig. 9.

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CONTAINER FOR AN EXTRUSION PRESS

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Application June 3, 1955, Serial No. 512,999

1 Claim. (Cl. 207—15)

This invention relates to an extrusion press and more particularly to a heavy duty press for producing an extrusion having a major cross sectional dimension greatly exceeding any of its transverse cross sectional dimensions from an elongated hot billet of substantially uniform shape in cross section and which has a minor cross sectional dimension and a major cross sectional dimension.

The invention relates to that type of extrusion press having a holder for a die provided with a die opening conforming to the cross sectional shape of the extrusion, the press also having a cross head movable toward and from the die in a direction in line with the die opening and the cross head including a billet container having a through opening in line with the die. The extrusion press also has a main plunger in line with the die and movable longitudinally through the billet container opening toward engagement with the die so as to force the metal from the hot billet through the die opening and thereby produce the extrusion.

In the extrusion of shapes having cross sectional dimensions which do not differ greatly from one another, the container is provided with a cylindrical through bore and a cylindrical billet is loaded into this bore. With sufficient pressure applied by the main plunger, substantially all the metal of the billet is readily forced through the die opening to produce the extrusion. However, where the die opening is of large size and has a major cross sectional dimension substantially exceeding in size any of its transverse cross sectional dimensions, it is impracticable to use a cylindrical billet, both because the billet would have to be of excessively large diameter in order to encompass the major dimension of the die opening and also because excessive pressure would be required to displace the metal at the periphery of such a large cylindrical billet transversely of the major dimension of the die opening.

Accordingly, in the production of such extrusions having a major cross sectional dimension substantially exceeding any of its transverse cross sectional dimensions, it is the practice to provide a pair of liners in the container which jointly provide a billet receiving bore which bore is out-of-round in cross section and has a major and a minor cross sectional dimension alining, respectively, with the major and minor cross sectional dimensions of the die opening. A hot billet, of substantially the same cross sectional shape as this bore provided by these liners, is inserted into this bore and the metals extruded by a plunger having substantially the same cross sectional shape as the billet. With such an out-of-round billet receiving bore, the outward pressures of the metal of the billet against the internal surface of the bore are, of course, unequal, the pressures in the direction of the major cross sectional dimension of the bore being very substantially less than the pressures in the direction of the minor cross sectional dimension of the bore. By making the liner in two counterpart halves, they are able to move slightly away from each other and adapt themselves to such heavy and concentrated pressures and, at the same time, are under compressive forces only. In so expanding away from each other, the pressure of the billet is transmitted through the liner sections to the billet container which is made sufficiently strong to withstand such pressures.

However, with the liner being in the form of two counterpart sections, difficulty has been experienced in preventing the escape of metal from the billet through the parting line or joints between the two counterpart liner sections.

It is the principal object of the present invention to provide an extrusion press having such counterpart liners jointly providing an out-of-round bore adapted to receive a hot billet in which the counterpart liners are so formed as to prevent the escape of metal through the joints or parting lines between the two liner sections and, at the same time, permit the liner sections to separate under extrusion pressures.

It is another object of the present invention to provide such liner sections in which the cross sectional shape of the billet container bore provided by these sections is not substantially altered by such separation of these liner sections under extrusion pressures.

It is another object of the present invention to provide a billet container structure having such liner sections which adequately resist the forces being transmitted through the liner sections by the metal being extruded.

Another object is to provide such counterpart liner sections which are of simple and inexpensive construction and which can be produced at little cost.

Other objects and advantages of the invention will be apparent from the following description and drawings in which:

Fig. 1 is a vertical transverse section through an extrusion press taken generally on line 1—1, Fig. 2 and showing, in elevation, the cross head carrying a billet container carrying a bushing lined with liner sections embodying the present invention.

Fig. 2 is a fragmentary side elevation of the press and showing the die, die holder, billet container cross head, billet, dummy block and main plunger in elevation.

Figs. 3, 4 and 5 are enlarged vertical transverse sections through the billet, dummy block and main plunger, respectively, these cross sections being substantially identical.

Fig. 6 is a vertical transverse section taken generally on line 6—6, Fig. 2.

Fig. 7 is a fragmentary vertical longitudinal section taken generally on line 7—7, Fig. 6.

Fig. 8 is a greatly enlarged fragmentary view similar to Fig. 6, but showing the billet under extrusion pressure and also showing the manner in which the contacting surfaces of the two counterpart liner sections are sealed to prevent the escape of metal into the joints between these liner sections. This view shows an exaggeration of the separation of these liner sections under extrusion pressures.

Fig. 9 is an enlarged section through the die, this section being taken on line 9—9, Fig. 7.

The present invention is essentially concerned with the liner sections for a billet container for an extrusion press and details of the extrusion press not directly associated with the billet container are not illustrated in detail. Thus the extrusion press forming the subject of the present invention is mounted on a bed 10 and the main section of the press comprises a stationary die platen (not shown) which carries the holder 11 for a die 12 and a cylinder platen (not shown) which carries the usual main plunger 13 which is movable axially toward the die 12 so as to extrude a billet 14 of hot metal through the die. The usual dummy block 15 is interposed between the metal billet 14 and main plunger 13 during extrusion and the

die and cylinder platens are securely held together at the four corners thereof by the usual four large horizontal columns **16**.

The present invention is directed to the production of an extrusion having a major cross sectional dimension substantially exceeding any of its transverse cross sectional dimensions. Thus, as illustrated, the extrusion has the form of the opening **18** through the die **12**, this opening being shown as being in the form of a wide horizontal slot **19**, forming the major cross sectional dimension of the extrusion, and from the center of which slot **19** a plurality of small ribs **20** rise and from the ends of which slot **19** small L-shaped ribs **21** rise in opposing relation to each other. The die opening **18**, and hence the extrusion, therefore has a major cross sectional dimension (horizontal) substantial exceeding any of its transverse (vertical) cross sectional dimensions. Of course, this particular shape of the opening **18** in the die **12** is not critical and is merely an example of a type of a die opening which could not be extruded from a cylindrical billet. This is because a cylindrical billet would have to be of excessive size to encompass the major (horizontal) cross sectional dimension of the die opening **18** and also because the metal from the upper and lower parts of such an oversize cylindrical billet could not be forced through the relatively small horizontally elongated die opening.

Accordingly, the billet **14**, illustrated in Fig. 3, follows the general overall cross sectional form of the die opening **18** and hence is shown as being of horizontally flattened form having an upper flat face **22** and a lower flat face **23** arranged in relatively closely spaced relation to each other and terminating in angular side faces **22'** and **23'**, respectively, which side faces meet in more or less pointed edges **24**. It will particularly be observed that each of the faces **22'** and **23'** are inclined at an acute angle or curve to the major (horizontal) cross sectional dimension of the billet, this being an important feature. Such a billet is of the required low and broad form in cross section to be readily forced through the die opening **18** which is also generally of low and broad form in cross section, but with the billet being of such out-of-round form in cross section it is also necessary that the bore **25** through the split billet container liner **26** generally conform to the cross sectional shape of the billet **14**. Accordingly, as best shown in Figs. 1, 6 and 8, the through bore **25** in the billet container liner **26** has a flat surface or wall **28** in closely spaced relation to a parallel flat lower face or wall **29** and these two faces merge into inclined end faces or part walls **30** and **31**, respectively, which converge or slope toward each other and toward a separating line of the liner sections to generally conform to the inclined faces **22'** and **23'**, respectively, which meet to form the relatively sharp or pointed edges **24, 24** of the billet **14**.

The dummy block **15** and main plunger **13** are of generally the same cross sectional shape and size as the billet **14**, as best illustrated in Figs. 4 and 5.

With the bore **25** in the billet container liner **26**, being of such flattened form having inclined end faces as is illustrated, it is also obvious that there is a distinct variation in the internal distribution of the pressure of the billet **14** against the walls of the through bore **25**. Thus, with the form of bore **25** shown the vertical pressures of the billet being extruded against the horizontal surfaces **28, 29** of the bore **25** greatly exceed the horizontal pressures of the billet against the inclined end faces **30, 31** thereof.

It is impractical to make a one-piece container liner having a bore of such cross sectional form as the bore **25** illustrated and it is heretofore been proposed to make the container liner of two pieces or counterpart sections **26*a*** and **26*b***. However, up to the advent of the present invention no adequate sealing means has been provided for preventing escape of the metal of the billet being extruded into the joints between the two parts or sections of the billet container liner.

In accordance with the present invention the counterpart liner sections **26*a*, 26*b*** of the billet container separate adjacent the convergent extremities of the faces **30, 31** thereof and have parallel parting faces or surfaces **32, 33**. These parting faces or surfaces **32, 33** are adapted to contact each other and at each side of the liner **26** terminate in an external cylindroidal face **34**, the faces **34** being concentric with each other. The upper and lower external faces **35** of the liner **26** are flat and parallel and each mates with the flat face **36** of a corresponding semicylindrical spacer **38**. The other face **39** of each semicylindrical spacer is cylindroidal and is concentric and forms a continuation of the cylindroidal faces **34** of the two-part liner **26**.

The counterpart sections **26*a*** and **26*b*** of the liner **26** as well as the semicylindrical spacers **38** are held in assembled relation with one another by a cylindrical bushing **40** the cylindroidal faces **34, 39** of the liner **26** and spacers **38** fitting in the bore of this bushing. This cylindrical bushing is, in turn, shrunk into the central part **43** of a cross head **44**.

The cylindrical bushing **40** is mounted in the central part **43** of a cross head **44** which is movable longitudinally of the main plunger **13** into and out of engagement between the die **12** and the sections **26*a*** and **26*b*** of the liner. This cross head **44** is also shown as including opposite side parts **45** secured, as by screws **46**, to the opposite sides of the central part **43** of the cross head **44**. Each side part **45** is formed at its lower end to provide a shoe **48** the bottom face **49** of which is parallel with the main plunger **13** but inclines downwardly and outwardly.

Each of these underfaces is provided with a wear strip **50** which slides along a rail **52** mounted on a curb **53** which extends along the bed **10** of the press parallel with and partly housing the corresponding bottom horizontal columns **16** of the press. The cross head **44** is moved along the rails **52** parallel with the main plunger **13** by four piston rods **54** which are actuated by pistons (not shown) carried by the stationary cylinder platen (also not shown).

As best shown in Fig. 8, the parallel parting faces **32, 33** of the two sections **26*a*** and **26*b*** of the liner extend from the cylindroidal external faces **34** toward but short of the through bore **25** in the liner **26** in the general direction of the major (horizontal) transverse dimension of this bore **25** and of the billet **14**. These parting faces or surfaces **32, 33** are, however, out of line with the edges **24** of the billet **14**, being well above these edges as illustrated in Fig. 8. The counterpart liner sections **26*a*** and **26*b*** also have their parting surfaces **32, 33** terminating in opposite pairs of parallel engaging faces **55, 56** each of which extends in the direction of the minor (vertical) transverse dimension of the billet **14** and bore **25**. These parallel engaging faces **55, 56** extend from the inner extremities of the parting faces **32, 33**, respectively, to the through bore **25** at the corresponding edge **24** of the billet **14** in this bore. Each face **30** forms with its companion face **55** a wedge-shaped ridge on the liner section **26*a*** which terminates in a sharp pointed edge **58**.

To prevent displacement of the liner sections **26*a*** and **26*b*** in either direction they are preferably provided with the end flanges **59** which are set into the semicircular spacers **38** and these spacers are also preferably each provided with an arcuate end flange **60** which is set into the bushing **40** as illustrated in Fig. 7.

In the operation of the press forming the subject of the present invention, an elongated hot metal billet, having the cross sectional shape shown in Fig. 3, is loaded into the through bore **25** provided by the liner sections **26*a*** and **26*b*** of the liner **26**. This through bore has substantially the same size and cross sectional dimensions as the

billet **14** and it will be noted that the major (horizontal) transverse dimension of the bore **25** is in register with the major transverse dimension of the die opening **18** and that the minor (vertical) dimension of this through bore **25** registers with the minor dimensions of the die opening **18**. With the billet **14** and bore **25** of such form, it will be seen that the metal from the billet can readily be forced through the die opening **18** even though the major transverse cross sectional (horizontal) dimension of this die opening very greatly exceeds its minor (vertical) cross sectional dimensions. It will further be seen that it would be impracticable to extrude metal through the die opening **18** from a cylindrical billet since the diameter of the billet would have to be greater than the major transverse (horizontal) dimension of the die opening **18**. Not only would excessive pressure be required to effectively act against a cylindrical billet of such large cross sectional diameter, but also would be difficult to displace the metal from the top and bottom of the billet through the die opening **18** having its major transverse dimension horizontally disposed, as indicated.

It will particularly be noted that the billet **14**, the dummy block **15**, which is inserted behind the billet, and the plunger **13** each has its major cross sectional dimension terminating in the edges corresponding to the edges **24** of the billet, each of these edges is formed by at least one face of the billet, dummy block and plunger being arranged at an acute angle to the major transverse cross sectional dimension. It will further be noted that the parting faces **32, 33** of the counterpart liner sections **26*a*** and **26*b*** extend toward, but short of, the through bore **25** in the general direction of the major transverse dimension of the billet in the through bore but that each of these parting faces **32, 33** is out of line with the corresponding edge **24** of the billet. It will also be noted that the counterpart sections **26*a*** and **26*b*** of the liner also have opposing pairs of parallel faces **55, 56** which engage each other and which extend in the direction of the minor (vertical) dimension of the billet **14** from the inner extremities of the parting faces **32, 33** toward the corresponding edge **24** of the billet.

Accordingly, when the main plunger **13** is moved to apply extrusion pressure against the dummy block **15** and billet **14**, the vertical pressure of the metal forming the billet **14** against the liner sections **26*a*** and **26*b*** causes these liner sections to move vertically apart from each other. This movement is very slight, the amount of movement illustrated in Fig. 8, which shows the billet under extrusion pressures, being very much exaggerated for the purpose of illustration. It will be seen that in such movement, the cross section shape of the billet receiving bore **25** is not greatly altered, this bore being enlarged slightly in response to the high extrusion pressure.

It will further be seen that in such movement, the faces **55** and **56** of the liner sections **26*a*** and **26*b*** merely slide along each other and that there is no opening up of any space between these faces so that, in this movement of the liner sections, no enlarging crack is formed which would permit the escape of metal. It will also be seen that since the faces **30** and **55** of the section **26*a*** provide tapered or wedge-shaped edges **58** at the lines of sealing, the pressure of the extrusion metal horizontally against these edges tends to displace them outwardly and increase their sealing effect against the faces **56** of the liner section **26*b***.

It will be noted that during the extrusion operation, the counterpart liner sections **26*a*** and **26*b*** are essentially under compressive force, this force being transmitted principally through the semicylindrical spacers **38** to the central part **43** of the cross head **44**.

After the extrusion is completed, the plunger **13** and dummy block **15** are withdrawn, the cross head **44** is moved to the right as viewed in Fig. 2 to permit severing of the discard left at the end of the extrusion, the die **12** is cleaned and the operation is completed.

From the foregoing, it will be seen that the present invention provides an adequate seal between the parting lines of the counterpart liner sections for an extrusion press in which these sections provide a bore which is out-of-round in cross section, and which seal insures against the escape of extrusion metal through the necessarily enlarged crevices between such counterpart liner sections. It will further be seen that the sealing means forming the principal feature of the present invention can be provided in such liner sections at low cost.

I claim:

A billet container for producing an extrusion having a major cross-sectional dimension and a minor cross-sectional dimension comprising, a pair of counterpart liner sections jointly forming a through bore into contact with the walls of which a billet is expanded by pressure applied from one end of said bore to force the metal from said billet as said extrusion from the opposite end of said bore, said bore having a minor cross-sectional dimension and a major cross-sectional dimension, each of said counterpart liner sections including a wall of said major dimension and having a part wall of said minor dimension at each end thereof creating parting surfaces internally forming a separating line along said bore at opposite sides thereof, at least one face of each section that forms the minor dimension of said bore sloping to said separating line, the parting surfaces of said liner sections transversely extending in separated relation from the exterior thereof toward said bore, and terminating in parallel engaging faces extending in the direction of the minor dimension of said bore to the line of separation of said bore whereby said counterpart liner sections allow expansion of said bore under extrusion pressures in the direction of said minor dimension and resist said expansion in the direction of said major dimension.

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