March 13, 1956 D. A. EDGECOMBE 2,738,062

GLASS MAT CUTTER FOR STEEL EXTRUSION PROCESS

Filed March 31, 1953 3 Sheets-Sheet 1

Fig. 1.

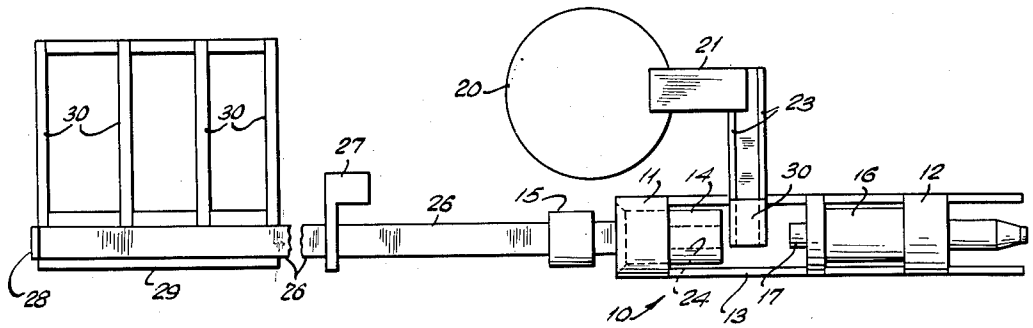


Fig. 2.

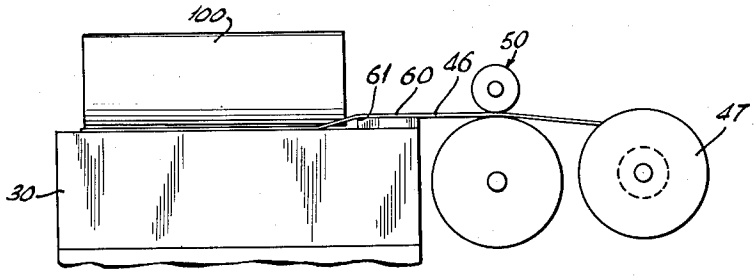


Fig. 3.

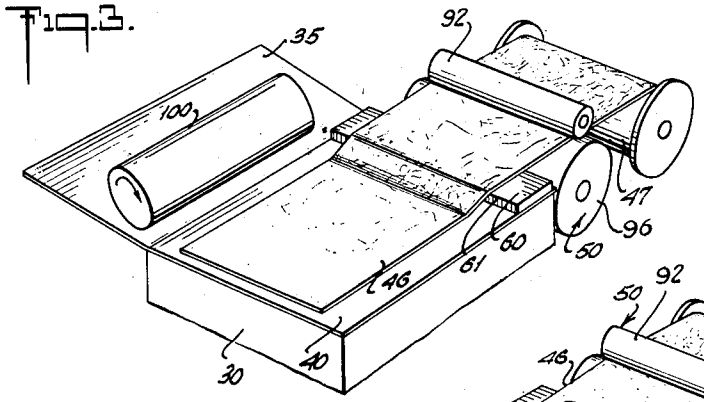
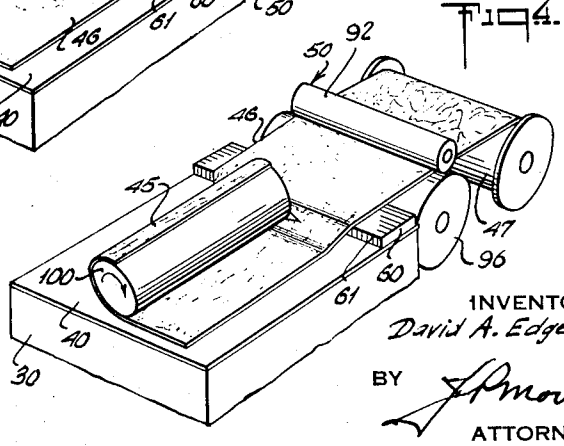


Fig. 4.



INVENTOR
David A. Edgecombe
BY J. P. Moran
ATTORNEY

March 13, 1956 D. A. EDGECOMBE 2,738,062

GLASS MAT CUTTER FOR STEEL EXTRUSION PROCESS

Filed March 31, 1953 3 Sheets-Sheet 2

Fig. 5.

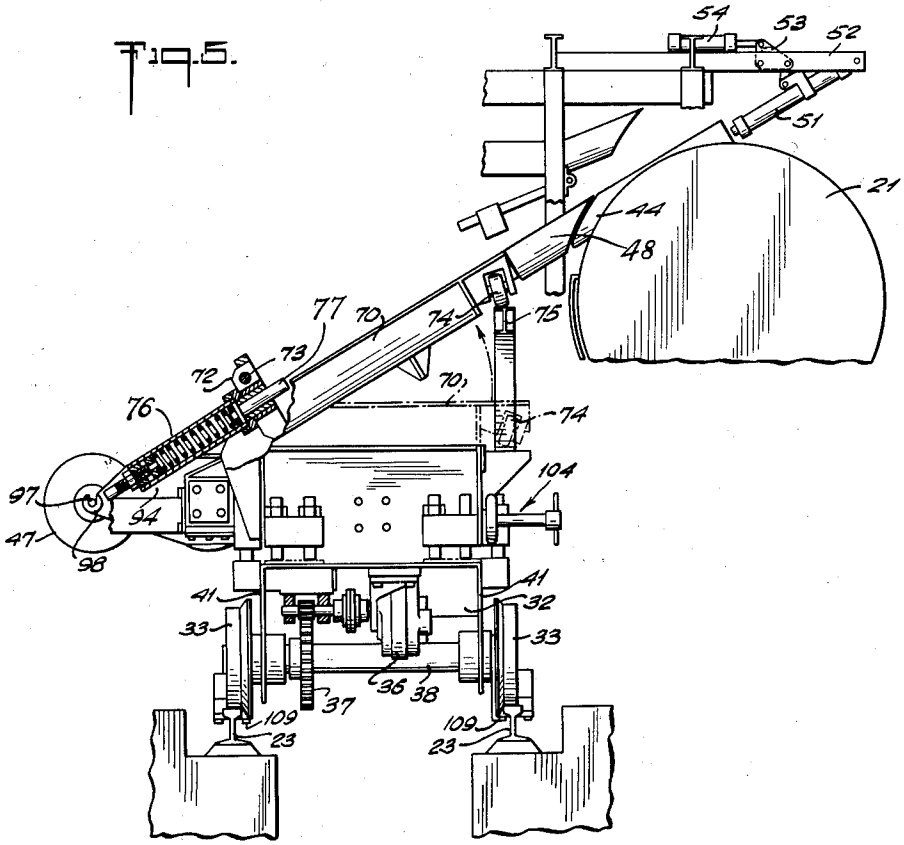
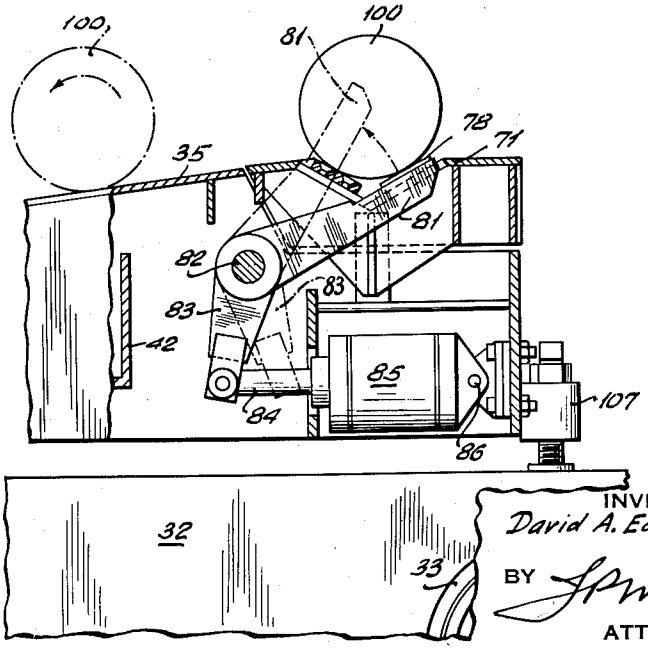


Fig. 6.



INVENTOR
David A. Edgecombe
BY J. P. Moran
ATTORNEY

March 13, 1956 D. A. EDGECOMBE 2,738,062

GLASS MAT CUTTER FOR STEEL EXTRUSION PROCESS

Filed March 31, 1953 3 Sheets-Sheet 3

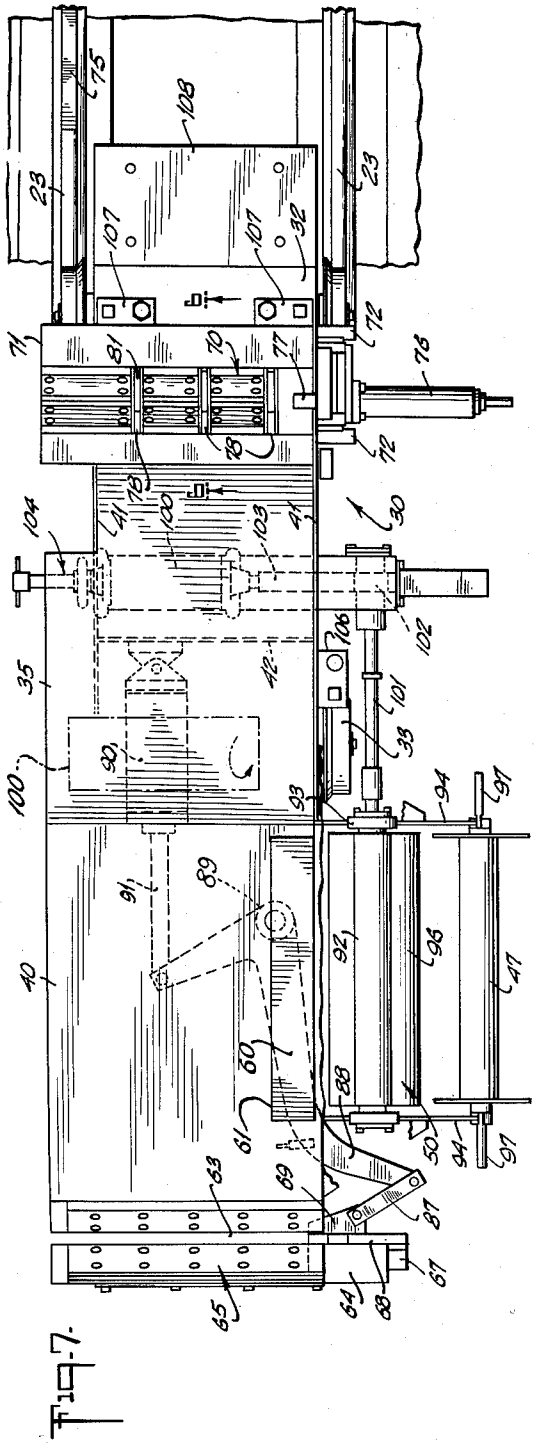


Fig. 7.

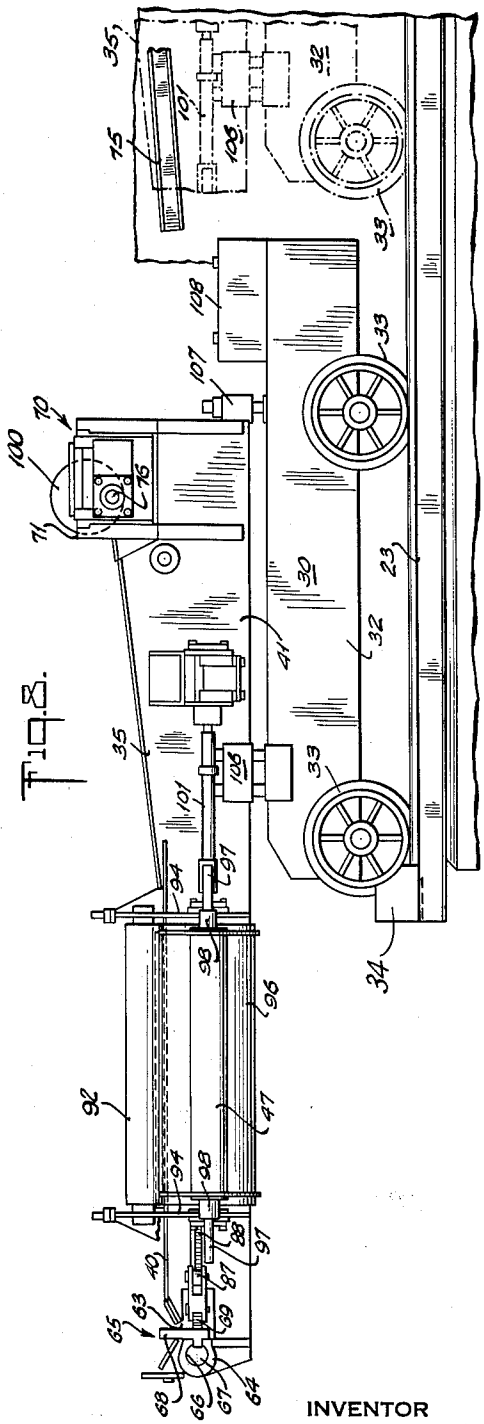


Fig. 8.

INVENTOR
David A. Edgecombe
BY
J. P. Moran
ATTORNEY

United States Patent Office 2,738,062 Patented Mar. 13, 1956

2,738,062

GLASS MAT CUTTER FOR STEEL EXTRUSION PROCESS

David A. Edgecombe, Beaver Falls, Pa., assignor to The Babcock & Wilcox Company, New York, N. Y., a corporation of New Jersey

Application March 31, 1953, Serial No. 346,010

5 Claims. (Cl. 207—1)

This invention relates to means for automatically wrapping, around a highly heated metal billet being fed to an extrusion press, a refractory lubricating material in sheet form, such as a sheet of fiberglas, and cutting the material, as it is so wrapped, into a length substantially equal to the billet length.

In the formation of metal shapes by extrusion, a block or billet of metal at an elevated temperature is forced under high pressure to flow through a die having an opening corresponding to the desired cross-sectional shape of the extrusion to be produced. The temperature of the metal may be 2300° F. in the case of steel, by way of example.

In a typical extrusion press, a front and rear platen are held in accurately spaced relation with each other. Between the platens is mounted a billet container for movement toward and away from the forward platen. The rear platen supports a ram arranged to project into the container and force a billet therein to flow through the die. The latter is mounted in a die holder releasably engaged in a die carrier aligned with the container passage. This carrier is mounted for movement into and out of the forward platen to move the die into and out of operative relation with the exit or downstream end of the container.

When an extrusion is to be made, the container is moved forwardly to seat against the rear face of the forward platen. A die holder and die assembly is meanwhile mounted on the rear face of the carrier and the latter is moved rearwardly into the forward platen to engage the die in a recess in the forward end of the container and coaxial with the container passage. The carrier is then locked to the forward platen. After a heated billet has been loaded into the container, the ram, carrying a dummy block on its outer end, is moved forwardly under very high pressure to force the billet outwardly through the die. The extrusion is then severed and conveyed away from the press.

The formation of metal shapes by extrusion has been successfully applied to non-ferrous metals for some time. However, it is only recently that plain and alloy steels have been extruded using glass as a lubricant. This has been due to the relative difficulties and problems involved in the extrusion of steels and alloys as compared to the difficulties and problems of extruding non-ferrous metals such as aluminum, brass, and copper. For example, the use of lubricants having a carbon base for the extrusion of some alloy steels may require an excessive amount of refinishing of the extruded shape due to the carbon pickup in the hot metal. These extra finishing operations have prevented the extrusion process from attaining a competitive position with respect to other metal working processes.

This picture has been changed radically by the introduction of a new steel extrusion process in which relatively refractory materials, such as glass, have been used as lubricants. These refractory materials have the advantage that they do not contain any significant amounts of carbon as a constituent element, coupled with a further advantage that the glass has the property of melting in succesive layers or films as it is contacted by the hot metal. Thus, only the surface or contacting layer of the glass is initially melted as the billet moves therealong, and as this film is destroyed, successive underlying layers or films are melted sequentially, thus providing a continuous lubricant film between the extrusion and the die through which the extrusion is being forced under very high pressures.

In the aforementioned typical extrusion press, plugs of glass fibre or similar material are placed in the container passage before the billet is loaded into the container. Charging of the billet into the container pushes these plugs up against the upstream or entry surface of the die. In addition, the billet itself is wrapped in a sheet or mat of glass fibre as it is being fed into the extrusion press. Thus, all surfaces of the hot billet which would normally contact either the container passage surface or the die are separated or spaced from such surface and the die by glass.

In a specific example, the highly heated billet, as it is removed from a heating means, is discharged onto a transfer car movable laterally across the longitudinal extent of the extrusion press. This car carries the billet to a position where the billet is axially aligned with the container passage, and an ejector on the car then moves the billet into the passage, after which the car is retracted from the path of movement of the press parts during an extrusion.

The transfer car has, at its end remote from the press, a billet receiving section which slopes upwardly away from the press. The billet is discharged onto this sloping section so that it rolls downwardly therealong toward a substantially level section or platform on the car and thence into the ejector, or container charging, means.

During the rolling of the billet along the transfer car, the billet is wrapped with a mat of glass fibre. This is effected by feeding a sheet or blanket of glass fibre, from a roll thereof, transversely across the substantially level platform of the car and the path of travel of the billet along the car. As the billet rolls across the glass fibre blanket lying on the platform, it picks up a glass fibre mat and wraps it around itself.

Severing of the mat section from the blanket of glass fibre is designed to be effected by the billet itself, the theory being that the highly heated billet will automatically melt or cut the glass fibre blanket along the line representing the line of movement of one end of the billet.

In practice, this arrangement for severing the glass fibre mat has not proved practically reliable. The present invention is accordingly directed to novel and simple means for effectively assuring severing of the glass fibre mat from the fed glass fibre sheet or blanket substantially at the end of the billet and as the billet rolls over the sheet. To this end, a metal bar or "knife" is mounted on the transfer car platform parallel to the line of movement of the billet and spaced slightly from an end of the billet as the latter rolls along the platform. This bar extends a short distance above the surface of the platform, and the glass fibre sheet or blanket is fed over the bar. Thereby, as the relatively heavy billet rolls over the glass fibre sheet, with its end close to or substantially engaging the bar, the sheet is effectively severed along the line of travel of the billet end nearest the bar.

For an understanding of the invention principles reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a schematic plan view of an extrusion press and associated billet and extrusion handling and processing components;

Fig. 2 is a somewhat diagrammatic front elevation view of a portion of the transfer car illustrating the invention "knife";

Figs. 3 and 4 are diagrammatic perspective views of a part of the transfer car, illustrating the operation of the invention "knife";

Fig. 5 is a rear elevation view, particularly in section, of the transfer car and the means for moving the billet onto the car;

Fig. 6 is a longitudinal sectional view through the rear, or billet receiving, end of the transfer car;

Fig. 7 is a plan view of the transfer car, showing the invention "knife"; and

Fig. 8 is a side elevation view of the transfer car.

Referring to Fig. 1, an extrusion press **10** is illustrated as including a front platen **11**, a rear platen **12** rigidly tied to platen **11** by tie rods such as **13**, a container **14** having limited longitudinal movement relative to the platens, a die carrier **15** movable into and out of front platen **11**, and a ram assembly **16** having a ram **17** projectable into container **14**. The billets to be extruded are heated to a high temperature, such as 2300° F. in the case of steel, in a preferably rotary heating means **20**. The billets are charged into a heating means **20** and extracted therefrom by a suitable billet handling device **21**. This device deposits the heated billets onto a transfer car **30**, operating on tracks **23**, which carries the billets into alignment with passage **24** of container **14** and ejects them into this passage.

Ram **17** is then projected into passage **24** to engage the billet and force it, under high pressure, through a die mounted on the rear face of carrier **15** and held thereby against the exit end of container passage **24**, carrier **15** being locked into forward platen **11** and thus held against movement relative to the two platens **11** and **12**. Following the extrusion movement of the ram, the latter is withdrawn and container **14** moved rearwardly a short distance away from front platen **11**. The extrusion is then severed between the container and front platen, after which container **14** is moved forwardly and the extrusion withdrawn by runout table and conveyor **26**. Ram **17** is then moved into container **14** to eject the severed end, or discard, of the extrusion, this discard moving into platen **11** and falling into a suitable receptacle.

Meanwhile, conveyor **26** moves the extrusion forwardly beneath a saw **27**. The latter severs the extrusion into the required handling lengths and the cut sections are moved forwardly against a stop **28**. At this point, a pusher **29** moves the sections laterally from conveyor **26** onto skids **31** for storage or further handling.

Before the billet, such as **100**, is moved by the ejector mechanism on car **30** into the passage **24** of container **14**, one or more cylindrical plugs of glass fibre are placed in the passage **24** so that loading of the billet thereinto will result in the plugs being interposed between the billet and the upstream face of the die assembly. The die assembly is shown and described more particularly in my copending application Serial Number 334,211, filed January 30, 1953, for "Die Charging Arrangement for Metal Working Apparatus." Also, and as has been briefly mentioned heretofore, the billet is wrapped in a mat of glass fibre as it is being transported on car **30** from device **21** into position for charging into passage **24** of container **14**. The automatic wrapping arrangement will be described with initial reference to Figs. 2, 3 and 4, followed by more detailed description of car **30** with reference to Figs. 5–8.

Referring first to Figs. 2, 3 and 4, the car **30**, which is reciprocable along rails **23** extending normal to the line of movement of ram **17**, is provided adjacent its end remote from the extrusion press with a sloping ramp, or the like, **35** leading to a substantially level elongated platform **40**. Billet **100** is delivered by device **21** to suitable receiving means at the upper end of ram **35** and, during movement of car **30** toward the extrusion press, the billet is caused to be moved onto ram **35** so that it will roll downwardly therealong, across platform **40**, and into a container charging device at the forward end of platform **40** shown and described more fully hereinafter.

During its travel along platform **40**, the highly heated billet is caused to wrap around itself a mat **45** of glass fibre. For this purpose, a blanket or sheet **46** of glass fibre is fed transversely of the path of movement of billet **100** along surface **40** by feeding means generally indicated at **50**, the sheet **46** being withdrawn by the feeding means from a replaceably mounted supply roll **47** at one side of car **30**. As the hot billet rolls over blanket **46**, the glass fibre adheres to the billet surface so that the mat **45** is wrapped around the billet, the mat tearing away from blanket **46** along a line parallel to one longitudinal edge of the path of movement of billet **100** over surface **40**, as shown in Figs. 2, 3 and 4.

When the blanket **46** is merely fed across the flat surface **40**, it has been found that the cutting or tearing action due to the weight and high temperature of the billet is not dependably effective to sever mat **45** from blanket **46** along a straight line close to the end of billet **100**. The present invention is directed to cutting means or a cutting knife for assuring completely effective severing of mat **45** from blanket **46** each time a billet rolls across the blanket.

To this end, a flat metal bar **60** is placed along the edge of platform **40** in such a position that its inner edge **61** is at or closely adjacent, and parallel to the line of movement of the right end of billet **100** as the latter rolls across the platform. This bar **60** preferably has a height above platform **40** of the order of ¾". The bar may be secured to the platform **40** or, if the bar is sufficiently massive, it may merely be placed on the platform and be held in position by its own weight.

With the bar **60** thus placed along the platform, the bar elevates the blanket **46** along a line which is closely adjacent and parallel to the edge of the billet path. The blanket **46** is fed over bar **60** onto platform **40** so that, as billet **100** rolls over the blanket, the elevated portion of the blanket is forced downwardly by the billet, effecting severing of mat **45** from the blanket along a line parallel to and substantially at the edge **61**. Due to this severing of the mat from the blanket by the downwardly directed force of the billet acting on the sheet portion elevated above surface **40** by bar **60**, the mat is always severed from the blanket at the desired length substantially equal to the length of billet **100** and each time a billet rolls across the blanket. The feeding mechanism **50** is operated, during the return movement of the car, to feed a fresh length of blanket **46** across platform **40**. This feeding means, as well as the billet handling components on car **30** will be more particularly described with reference to Figs. 5–8.

Car **30** comprises an undercarriage **32** mounted on flanged wheels **33** traveling over rails **23**. Suitable chocks **34** are secured to rails **33** at the forward and rear limits of movement of car **30**. Travel of the car along rails **23** is effected by a driving motor **36** which, through suitable reduction gearing **37**, rotates the rear axle **38** to which the rear pair of wheels **33** are keyed or otherwise secured.

The elongated level platform **40** and the sloping ramp **35** are supported through suitable side frame members **41** and braces, such as **42**, on the under frame **32**. The arrangement is such that the platform **40** projects a substantial distance forwardly from the front end of car **30** so that only this platform, the means **47** and **50**, and the billet charging device **65** project into the line of movement of the press parts when car **30** is at its forward limit of movement. This enables the rails **23** to be terminated short of the line of movement of the press parts so as not to offer any interference therewith.

The billets **100** are delivered to car **30** by a billet handling device **21** which may be of the type shown and described in the copending application of Sidley O. Evans, Serial Number 328,688, filed December 3, 1952, for

"Charge-Discharge Mechanism for Billet Heating Means." As described more particularly in such Evans application, device **21** is a drum shaped elevator carrying on its periphery a trough **44** arranged to receive a metal "basket" in which is a highly heated billet. In the position of device **43** shown in Fig. 5, this trough **44** is aligned with a short trough **48** which extends between trough **44** and the billet receiving means **70** of car **30** when the car is in its rearmost position. At this time, the billet is moved from trough **44** along trough **48** and into means **70** by an air-operated ejector **51** pivotally mounted on a framework **52** and movable into and out of billet ejecting position by linkage **53** operated by a piston and cylinder arrangement **54** on the framework **52**.

The billet receiving means **70** comprises a trough formed in the upper surface of a tiltable table **71** having, at its end remote from trough **48**, trunnions **72** engaging a shaft **73** mounted longitudinally of car **30**. By this means the table or platform **71** is vertically swingable between the full line and broken line positions of Fig. 5. Such tilting of the receiving means **70** is effected by a roller **74** journalled in the free end of platform **71** and traveling along a sloping elevated rail **75**. Rail **75** is so located and so inclined that, when the car **30** is at its rearmost position, trough **70** will have been swung up into substantial alignment with trough **48**. As the car moves toward the extrusion press, roller **74** travels downwardly along rail **75** so that, before the car reaches the full line position of Figs. 7 and 8, the platform **71** will be in a substantially horizontal position.

Extending from the hinged end of platform **71** is a shock absorber means **76** having a plunger **77** extending into trough **70** in substantial central alignment therewith. As the billet is ejected through trough **48** into trough **70**, the plunger **77** acts as a cushioning means for the billet.

By reference to Fig. 7, it will be noted that trough **70** is formed with transverse slots **78**. As the trough reaches its horizontal position, fingers **81**, secured to a transverse shaft **82**, enter slots **78** to lie slightly beneath the billet supporting surface of the trough **70**. A crank arm **83**, secured to shaft **82**, is connected to a piston rod **84** of a pressure fluid actuator **85** pivotally connected at **86** to the framework of car **30**. With the trough in the horizontal position, which it attains during movement of car **30** toward the press, actuator **85** is operated to cause fingers **81** to be swung counterclockwise moving billet **100** out of the trough to roll down the ramp **35**.

After the billet has rolled along platform **40** to wrap mat **45** around itself and to sever the mat from blanket **46** along edge **61** of the bar **60**, as previously described, the billet rolls into the container charge device or billet ejector **65** at the end of surface **40** nearest the extrusion press. Referring to Figs. 7 and 8, this ejector comprises a V-shaped trough having a slot **63** along its apex. The outer wall of trough **65** carries a guide **64** having a key-shaped slot **66** receiving a correspondingly shaped rib **67** formed on an ejector bar **68**. Ejector bar **68** is thus guided to move along slot **63**.

On its opposite surface, bar **68** has projecting therefrom an ear **69** connected by a link **87** to one end of a crank **88** pivoted on an axis **89** to swing parallel to surface **40**. The other end of crank **88** is connected to the piston **91** of a pressure fluid actuator **90** pivoted to a cross brace **42** of the car framework. Actuator **90** is operated, when the car **30** reaches its forward limit of movement with trough **63** aligned with container passage **24**, to swing crank **88** to move bar **68** along slot **63** in trough **75** to charge the billet into the container passage.

As the car **30** is moved toward its rearward limit of movement, following charging of the billet, the feeding means **50** is operated to advance a predetermined length of sheet or blanket **46** across bar **60** and platform **40**. This feeding means comprises a relatively large diameter driven roller **96** cooperable with a smaller diameter pressure roller **92**. Rollers **96** and **92** are mounted in suitable bearings **93** in longitudinally spaced plate brackets **94** projecting laterally from one side of car **30**. The supply roller **47** has projecting axles **97**, **97** which rest in upwardly opening bearings **98** in the outer ends of brackets **94**. Thereby, an empty roller **47** can be readily lifted from bearings **98** and a fresh roll **47** mounted in the bearings.

The feeding roller **96** is driven by a shaft **101** to which is secured a pinion **102** engaged by a rack **103** reciprocated transversely of the car **30** by a pressure fluid actuator **100**, the connections including a one-way clutch arrangement so that pinion **102** is rotated by the rack only in a sheet feeding direction. To pre-set the length of the blanket or sheet **46** fed across the car during each feed stroke, adjustment means, generally indicated at **104**, are provided to limit the stroke of rack **103** to the proper value for the length of blanket feed desired.

It will be noted, from Figs. 5–8, that the platform **40**, ramp **35**, and associated elements are supported on underframe **32** by adjustable supports such as **106** and **107**. Also, the rear surface of underframe **32** projects substantially beyond rear wheels **33** and carries a massive counter-weight **108** to balance the portions of the car projecting beyond the forward end of the underframe. Tilting of the car is also prevented by hooks **109** (Fig. 5) riding beneath the heads of rails **23**.

Suitable limit switch controls (not shown) are mounted along the path of movement of car **30**, for operation thereby at predetermined points during the forward and rearward travel of the car. These limit switch controls cause the fingers **81** to eject billet **100** from trough **70** when the platform **71** reaches a horizontal position during forward movement of the car, and cause ejector **65** to be operated as the car reaches its limit of forward movement. Also, the controls effect operation of actuator **100** during rearward travel of the car to feed sheet **46** across bar **60** and platform **40**.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. Apparatus for applying a wrapping of lubricating material to the surface of a highly heated metal billet as the latter is being delivered to a metal extrusion press, said apparatus comprising, in combination, an elongated surface; means constructed and arranged to roll a highly heated metal billet longitudinally of said surface; an elongated metal bar arranged on said surface along a line parallel to and closely adjacent one longitudinal edge of the path of movement of the billet over the surface; and feeding means operable to feed a sheet of such material transversely across the path of movement of the billet along said surface over said bar, whereby the billet will wrap a mat of the material around itself as it rolls across said sheet; said bar being cooperable with the billet to sever such mat from the sheet as the billet rolls over the sheet.

2. Apparatus for applying a wrapping of lubricating material to the surface of a highly heated metal billet as the latter is being delivered to a metal extrusion press, said apparatus comprising, in combination, an elongated surface; means constructed and arranged to roll a highly heated metal billet longitudinally of said surface; an elongated metal bar arranged on said surface along a line parallel to and closely adjacent one longitudinal edge of the path of movement of the billet over the surface; said bar extending above said surface; and feeding means operable to feed a sheet of such material transversely across the path of movement of the billet along said surface over said bar, whereby the billet will wrap a mat of the material around itself as it rolls across said sheet;

said bar being cooperable with the billet to sever such mat from the sheet as the billet rolls over the sheet.

3. Apparatus for applying a wrapping of lubricating material to the surface of a highly heated metal billet as the latter is being delivered to a metal extrusion press, said apparatus comprising, in combination, an elongated surface; means constructed and arranged to roll a highly heated metal billet longitudinally of said surface; an elongated metal bar arranged on said surface along a line parallel to and closely adjacent one longitudinal edge of the path of movement of the billet over the surface; said bar extending a short distance above said surface; and feeding means operable to feed a sheet of such material transversely across the path of movement of the billet along said surface over said bar, whereby the billet will wrap a mat of the material around itself as it rolls across said sheet; said bar being cooperable with the billet to sever such mat from the sheet as the billet rolls over the sheet.

4. Apparatus for applying a wrapping of lubricating material to the surface of a highly heated metal billet as the latter is being delivered to a metal extrusion press, said apparatus comprising, in combination, an elongated surface; means constructed and arranged to roll a highly heated metal billet longitudinally of said surface; an elongated metal bar arranged on said surface; said bar extending above said surface and having a sharp upper inner edge along a line parallel to and closely adjacent one longitudinal edge of the path of movement of the billet over the surface; and feeding means operable to feed a sheet of such material transversely across the path of movement of the billet along said surface over said bar, whereby the billet will wrap a mat of the material around itself as it rolls across said sheet; said bar being cooperable with the billet to sever such mat from the sheet as the billet rolls over the sheet.

5. Apparatus for applying a wrapping of lubricating material to the surface of a highly heated metal billet as the latter is being delivered to a metal extrusion press, said apparatus comprising, in combination, an elongated surface; means constructed and arranged to roll a highly heated metal billet longitudinally of said surface; an elongated metal bar arranged on said surface; said bar extending a short distance above said surface and having a sharp upper inner edge along a line parallel to and closely adjacent one longitudinal edge of the path of movement of the billet over the surface; and feeding means operable to feed a sheet of such material transversely across the path of movement of the billet along said surface over said bar, whereby the billet will wrap a mat of the material around itself as it rolls across said sheet; said bar being cooperable with the billet to sever such mat from the sheet as the billet rolls over the sheet.

References Cited in the file of this patent

UNITED STATES PATENTS

2,365,569	Larmuth	Dec. 19, 1944
2,538,917	Sejournet et al.	Jan. 23, 1951
2,615,491	Harris et al.	Oct. 28, 1952
2,630,220	Sejournet	Mar. 3, 1953

OTHER REFERENCES

Steel, page 67, March 9, 1953.