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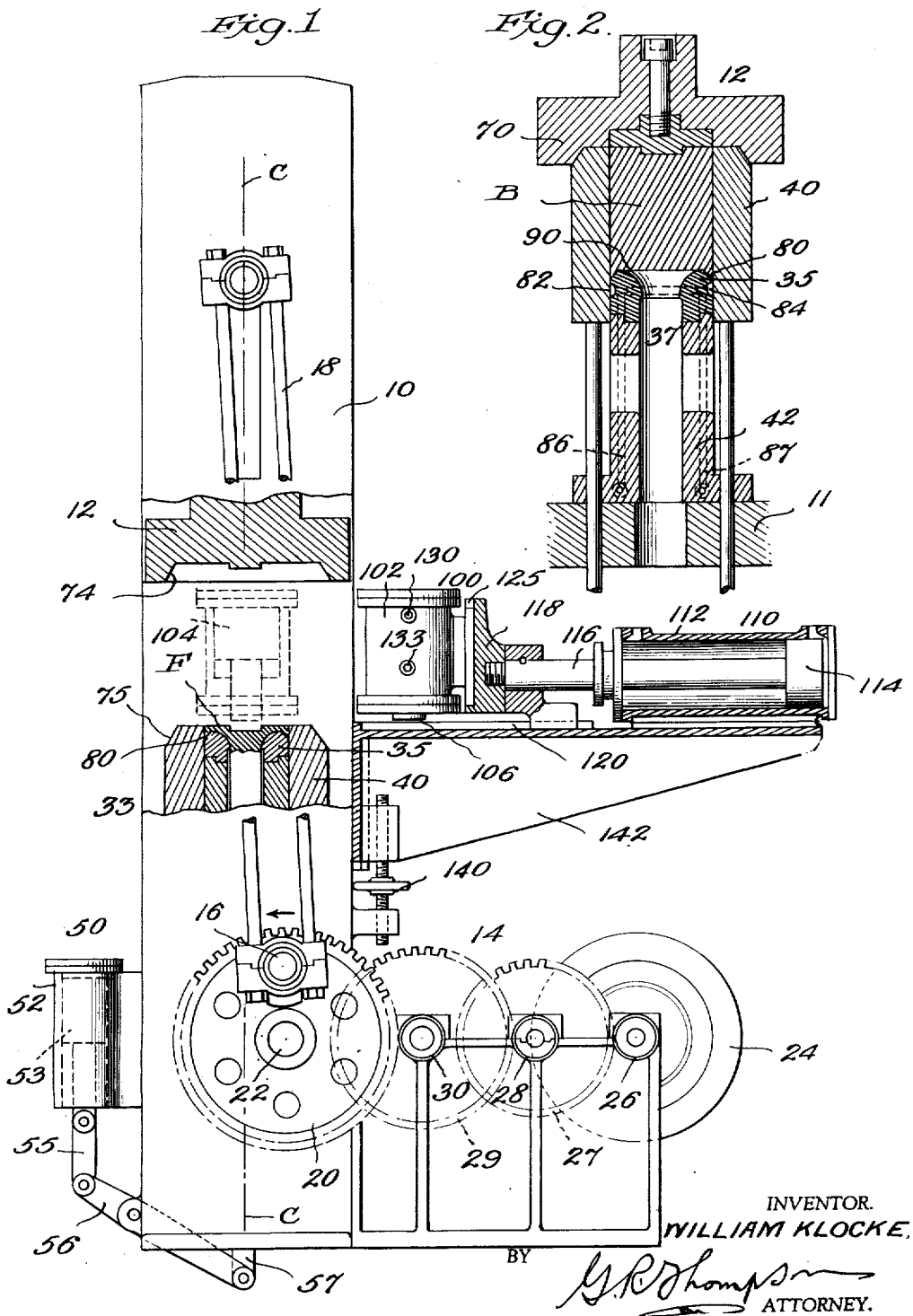
W. KLOCKE

2,167,845

EXTRUSION PROCESS AND APPARATUS

Filed April 14, 1937

2 Sheets-Sheet 1



Aug. 1, 1939.

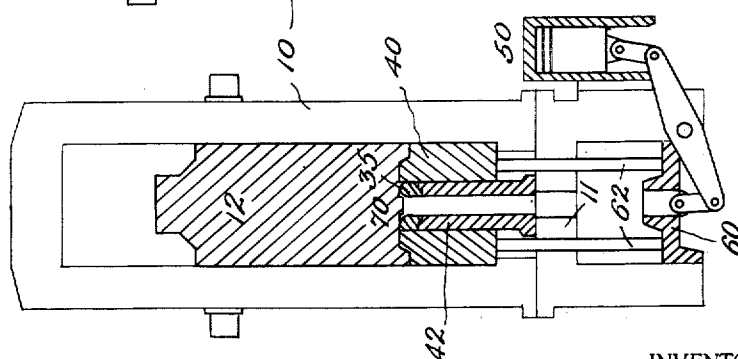
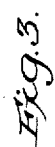
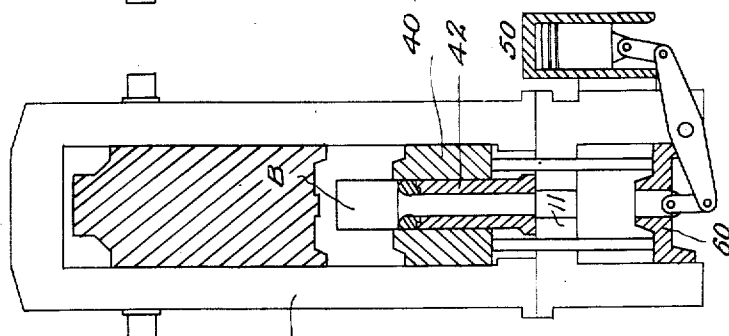
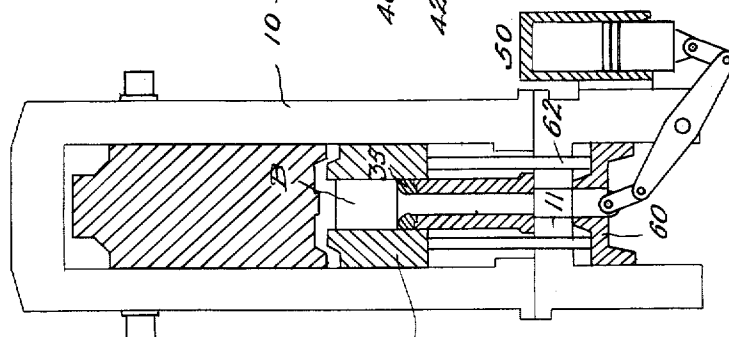
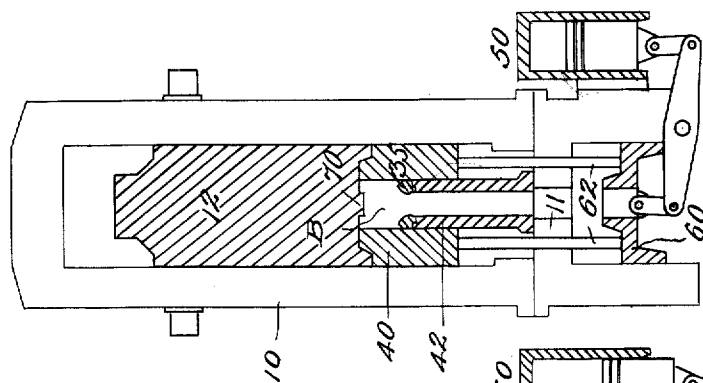
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,167,845

EXTRUSION PROCESS AND APPARATUS

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Application April 14, 1937, Serial No. 136,764

18 Claims. (Cl. 207—2)

This invention relates to extrusion processes and apparatus and provides improvements therein.

In the hot extrusion of shaped articles from metal billets such as rods, rails, strips, tubes and the like, the presses required are usually of great height (or of great length), and are very large and heavy particularly when required to extrude metals such as iron and steel. Moreover the heated billets cause difficulties in the press operation and in the process. The heat causes expansion of the dies and associated parts, interferes with the close guiding of moving parts, increases the friction of moving parts against the hot billet and consequently the force required for accomplishing a given task, and makes it difficult to prevent oozing of the billet-metal at joints between the parts of the structures which confine the billet during the action of the extrusion-force. The separation of the fin or flash which remains in the die after the completion of the extrusion is an awkward operation and takes an amount of time which it is advantageous to minimize.

The present invention provides a process and apparatus by which the successions of extruding operations can proceed with greater speed, increased accuracy of product obtained, diminished wear of the parts in contact with the billet obtained, the force required for a given extrusion operation materially reduced, and the severance and removal of the fin or flash facilitated and time saved.

The invention provides a press comprising a telescoping die-part which exposes the bottom of the die and the fin thereon at the end of the extrusion operation and in which sufficient clearance may be left between the die-parts to prevent binding of the telescoping part, and to take care of unequal expansion when the die parts are heated. It provides means for preventing oozing of the billet metal into the clearance or joint between the die-parts and binding or jamming which would otherwise occur, and a fin formation which would be difficult to remove or clear.

The invention further provides an extrusion press having a crank-driven slide (on which a punch or other tool is mounted) having a minimum or relatively short "throw" or length of stroke; the throw or length of stroke can be only slightly greater than the height of the billet to be used. It provides such a press in which the pull on the slide of the connecting-rods is nearly in a line parallel with the axis of the die or

billet during the time the extrusion force is applied to the billet. There is then less tendency to distort the frame, and more tendency of the slide and extruding tools to run true, and a more accurate product obtained.

By reason of the shorter stroke (shorter length of crank) and lessened friction in the extrusion dies, large economies may be effected in the size and cost of the press for a given task, and in the force required to operate the press.

An embodiment of the extrusion apparatus is illustrated in the accompanying drawings, wherein:

Fig. 1 is a view partly in side elevation, and partly in vertical section, of said embodiment.

Fig. 2 is a vertical sectional view through the extrusion die and punch.

Figs. 3, 4, 5 and 6 are semi-diagrammatic views of the press, illustrating the position of the parts at different stages of its operation.

Referring to said drawings, numeral 10 designates the frame, numeral 11 designates the bed, numeral 12 a reciprocatory slide, and 14 a mechanical means for reciprocating or driving the slide. The mechanical driving means 14 advantageously comprises a crank 16 or mechanical equivalent, located opposite the slide 12 in the lower part of the frame, and connected to the slide 12 through a long connecting rod 18. As here shown, the crank 16 is mounted on a gear wheel 20 on a shaft or axle 22, the gear wheel being driven in suitable manner, as by means of a fly wheel pulley 24 and pinions and gears 26, 27, 28, 29, 30.

The shaft 22 or axis around which the crank 16 turns is advantageously located somewhat to one side of the center line C of the press, in such manner that the pull exerted by the connecting rod 18 during the extrusion operation approximates a straight-line pull in line with said center line C. In this way the frame of the press is subjected to the minimum of distortion.

Numeral 33 designates the extrusion die, which comprises a forming part 35 having an extrusion orifice 37 therein, and a sleeve part 40.

In press use, one or the other of the complementary forming tools (as die and punch) may be mounted on the bed and the other on the slide. Hereinafter for simplicity or description the die is described as mounted on the bed, though the die could be mounted otherwise and such arrangement is not to be considered as excluded from the invention. Moreover, the words "upper", "lower" are used in a similar sense; the press may be arranged horizontally or inverted.

The forming part 35 of the die is supported on a hollow post 42 which may be mounted on the bed 11 of the press. The sleeve part 40 is movable with relation to the forming part of the die. In one of its positions the sleeve part 40 exposes the fin or flash remaining on the face of the forming part 35 of the die at the end of an extrusion operation. In the other position of the sleeve part 40 it projects beyond or above the face of the forming part 35 in such manner as to receive a billet B, and to confine the sides of the billet during the extrusion operation. The sleeve part 40 of the die is arranged to slide or telescope with relation to the forming part 35 and to the post 42 supporting the latter.

The sleeve-part 40 of the die is moved to its billet-receiving position by suitable means. Advantageously the said means is a fluid-operated means 50 (pneumatic or hydraulic) which acts to exert a yielding resistance to the movement of the sleeve-part 40 of the die under the action of the slide 12, as hereinafter explained. The fluid-operated means 50 may comprise a cylinder 52 and piston 53 acting through suitable links and levers 55, 56, 57, on a reciprocatory slide 60, and force transmitted to the slide 60 may be transmitted to the sleeve-part 40 of the die through posts 62. The preferred arrangement as heretofore described is to support the extrusion die 33 on the bed of the press, in which case, the posts 62 pass through the bed of the press, around the post 42 to contact with the underside of the sleeve-part 40 of the die, and the means 50 for moving said sleeve-part 40 is located at the lower part of the frame 10.

The slide 12 is provided with a part 70 (which may be called a punch) which makes contact with the adjacent or upper side of the billet B, and applies the driving force of the press to the billet for extruding it through the forming-part 35 of the die.

Means are preferably provided for locking the sleeve-part 40 of the die to the slide 12 during the extrusion action. This means is conveniently in the form of beveled shoulders 74, 75 on the adjacent parts of the slide 12 and sleeve-part 40 respectively, the engagement of the shoulders 74 and 75 locking the sleeve-part 40 to the slide, and thereby maintaining the sleeve-part 40 of the die in alignment with the movement of the slide during the extrusion action. The movement of the sleeve-part 40 of the die during the extrusion is thereby maintained true, deviation from the straight line movement practically prevented, and greater accuracy obtained in the shape of the article extruded through the forming-part 35 of the die.

The slide 12 moves the sleeve-part 40 of the die during the extrusion operation against the yielding resistance of the fluid operated means 50 which acts in the opposite direction on the said sleeve-part 40, as heretofore described.

The billets which are placed in the die 33 are hot and cause expansion of the die parts. A tight fit or joint between the sleeve-part 40 of the die and the forming-part 35 of the die, is impracticable. Consequently, there is liability of some of the metal from the billet oozing or being forced into the clearance between the die parts 35 and 40, and thereby form a fin which would cause binding of the die parts 35 and 40. Means are provided for packing the joint between the die parts 35 and 40 to prevent such oozing. The means is an annular packing 80 at the joint between said die parts 35 and 40. The packing 80 is advantageously a part

of the billet metal immediately adjacent said joint, which is cooled or made less plastic than the body of the billet metal, so that it will not flow into the joint or clearance between the die parts 35 and 40. Means 82 may be provided in the press apparatus for cooling a ring of the billet metal immediately adjacent the joint between the die parts 35 and 40. The means 82 may be an annular groove 84 around the die part 40 adjacent the joint between the die parts 35 and 40, connected with ducts 86, 87 for conducting a cooling fluid, such as water, through said groove 84. The upper face of the die part 35 at its periphery, is preferably beveled, as indicated at 90, to form an annular pocket into which the packing ring 80 to be formed from the billet is pressed, upon which packing ring 80 the cooling is concentrated, so as to form, as aforesaid, an annular ring or packing of the billet metal which is less plastic than the remainder of the billet metal.

In some forms of extrusion apparatus, the punch moves within the die, to extrude the metal, in which case the packing 80 would be applied at the joint between the punch and the die, and the cooling means for forming a packing ring 80 from the billet-metal would be applied to the peripheral portion of the punch adjacent its face.

Where the sleeve-part 40 of the die telescopes with relation to the forming-part 35 so as to expose the face of the forming-part 35, the stroke of the slide 12 need be only somewhat greater than the height of the billet B or the length of the designed movement of the sleeve-part 40 of the die above the face of the die-part 35, and the radius of the crank 16 is advantageously such as to give such a stroke to the slide 12, i. e. a stroke somewhat greater than the height of the billet B or the length of the designed movement of the sleeve-part 40 of the die above the face of the die-part 35. For example the slide may have a 20 inch stroke for a 15 or 16 inch billet height. In the raised position of the slide 12 having such a stroke, when the sleeve-part 40 is telescoped on the die-part 35, the billet B may be placed on the face of the die-part 35.

At the same time, great economies and advantages may be obtained in the press construction and operation. The crank is much shorter than otherwise, reducing the weight of the press, the pull (or push) on the slide is throughout closer to the center-line of the slide movement, and the speed with which the extrusion operation may be carried out increased.

The movement of the sleeve-part 40 of the die with the slide 12 during the extrusion action is advantageous, because the resistance within the die is decreased, and thereby economizes in the force required and consequently in the size and weight of the parts of the press; these advantages are further favored by the packing 80 which acts, in the manner already described, to prevent oozing of the billet-metal and binding of the die-parts.

Operation

The press parts at the end of an extrusion operation are illustrated in Fig. 3. The sleeve-part 40 of the die has been forced, against the resistance of the fluid-operated means 50, by the crank operated slide 12 to a position telescoping the die-part 35 and the post 42 supporting the latter. A movement of 90° of the crank 16 moves the slide 12 away from the die to its raised or uppermost position. In its preferred form the press is a vertical press with the die carried on the bed and the punch on the slide, and for sim-

plicity and clarity of description, reference will be made to the positions of the parts as in a press of the type just described.

At the end of the extrusion operation a flash or fin F remains on the face of the die-part 35, and the flash or fin F is removed from the extruded shape or piece in suitable manner, and advantageously by the method and means hereinafter described.

The sleeve-part 40 is maintained in the position shown in Fig. 3 until after the upward movement of the slide 12 has been completed. In this position the flash or fin F on the face of the die 35 is exposed, and its removal facilitated by any means or method of removal which is employed. After the removal of the fin or flash F, the sleeve-part 40 may be moved slightly above or beyond the face of the die-part 35, to provide a shallow recess for receiving the billet B. The press parts would then be in a position shown in Fig. 4. After the billet B has been placed upon the die-part 35, the means 50 is operated to move the die-part 40 to a position to surround the billet. This position of the press parts is illustrated in Fig. 5. The press is now in position to start the extrusion operation.

To extrude the billet, the slide 12 is started on its downward movement. When the slide 12 comes into contact with the sleeve-part 40 the shoulders 74, 75 act to lock the sleeve-part 40 to the slide to assist in guiding the sleeve-part 40 and keep its movement true during the extrusion action. As the movement of the slide 12 continues, it carries with it the die-part 40, moving it against the resistance of the means 50, and when the punch 70 on the slide makes contact with the billet, the driving force of the press is applied thereto, and the billet B being confined by the face of the punch 70, the sides of the die-part 40 and a part of the die-part 35, billet-metal will be extruded through the orifice 37 during the remainder of the downward movement or working stroke of the slide 12. The position of the press parts during the extrusion action is illustrated in Fig. 6, and the position of said parts at the end of the extrusion action is shown in Fig. 3, and it will thus be seen that a description of a cycle of operation has been completed.

When in the beginning of the extrusion operation a portion of the billet-metal is forced in the pocket 90 formed by the beveled periphery on the die-part 35 and the wall of die-part 40, such portion is cooled by the action of the means 82, and a packing ring 80 is formed, which prevents the oozing of the metal into the joint or clearance between the die-parts 35 and 40.

A means 100 is advantageously combined with the press for separating the flash or fin F from the metal which has been extruded through the orifice 37.

The means 100 advantageously comprises a cylinder 102 and a piston 104. The piston 104 has a portion 106 which functions as a cutter. The cutter 106 has a diameter approximating the diameter of the orifice 37, and the severing of the flash F is effected by the co-action of the cutter 106 and the die-part 35.

The height of the cylinder 102 is such as to allow it to be moved between the slide 12 (in its raised position) and the fin or flash F on the face of the die-part 35 to a position where the axis of the cutter coincides with the axis of the orifice 37 and the die-part 35.

Suitable means 110 may be provided for moving

the severing means 100 to and from its position between the slide and die-part 35. The means 110, as here shown, may comprise a cylinder 112, piston 114, stem 116 and a bracket 118 connected to the stem 116. Gibs 120 may be provided for guiding the bracket 118.

The cylinder 102 is advantageously mounted in gibs 125 in the bracket 118, so that the cylinder may have a limited movement toward the slide 112, so as to coact with the slide 112 in the manner about to be explained.

When the severing means 100 is in the dotted line position in Fig. 1, and fluid is admitted to the port 130, the cylinder 102 is forced upward against the slide 112, against which it abuts. At the same time the piston 104 with the cutter 106 is forced against the flash or fin F, and the continued movement of the piston 104, while the cylinder abuts and is held against the slide 12, forces the cutter 106 into the die part, and severs the fin or flash F from the extruded metal. Fluid admitted through the port 133 moves the piston 144 in a direction to lift the cutter 106, the cutter lifting the severed flash F off of the die, and stripping it, so that the flash F is readily removed. At the same time that the cutter 106 moves out of the die, the cylinder 102 descends out of contact with the slide 12, and in such position that the cylinder 102 and the retracted piston are readily removed to a position clearing the slide 12. The retracted position is shown in full lines in Fig. 1.

Adjustments in the level at which the severing means 100 moves to and from its position between the slide 12 and die-part 35 may be effected by means of the double acting screw 140, and a vertically movable carrier 142.

The improvements in the method may be practiced in the apparatus hereinbefore described, though the practice thereof is not limited to any particular construction of apparatus.

In practicing the improved method, a portion or part of the billet-metal adjacent a joint in the parts confining the billet during the extrusion action, is cooled, to such an extent that it will not ooze into the joint under the force applied to the billet to extrude it. The cooled portion or packing is the annular portion 80 shown on the drawings. The cooling is particularly advantageous when the billet is extruded from a die having a forming-part 35 and a sleeve-part 40 which is telescoped on the forming-part 35 at the rate at which the height of the billet is reduced during extrusion, the cooling being practiced on the annular or peripheral portion of the billet B immediately adjacent the joint between the sleeve-part 40 of the die and the forming-part 35.

Moreover my improved method comprises a practice which facilitates the severance of the fin or flash which is left on the face of the die at the end of the extrusion action (see F Fig. 1), and speeds the successive extrusion operations. Such practice comprises the use of a die having a forming-part 35 with an extrusion-orifice 37 therein and a sleeve-part 40 for confining the billet during extrusion, and telescoping the sleeve-part on the forming-part at the rate at which the height of the billet B is reduced, maintaining the sleeve-part 40 in telescoped position following the extrusion action, lifting the slide 12 or other part through which the force for extruding the billet is applied, following the extrusion, and, with the fin or flash F (which is left therein at the end of the extrusion action) exposed on the face of the die-part 35, severing the fin or flash F by a

severing device of any suitable kind acting on the fin or flash while it is supported on the face of the die. In practicing the severing step a severing means may be inserted transversely of the die in the space left clear by the sleeve-part of the die when it is maintained in telescoped position aforesaid, and then forcing the severing means against the slide 12 (which serves as a firm abutment) and the fin or flash F while the latter is resting on the face of the die-part 35, to sever the fin or flash F from the shaped piece which has been extruded.

The invention may have other embodiments than that herein specifically illustrated and described.

What is claimed is:

1. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position.

2. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, said driving means comprising a crank having a throw exceeding but approximating the length of movement of said sleeve-part of the die.

3. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and means on said slide for locking said sleeve-part of the die to the slide during the extrusion operation to keep it in alignment.

4. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and means for packing the joint between the forming-part and the sleeve part of the die to prevent oozing of metal from the billet between said parts of the die during the extrusion operation.

5. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which

the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and means for cooling a part of the billet-metal adjacent the joint between the forming-part and the sleeve-part of the die to prevent oozing of metal between said parts of the die during the extrusion operation.

6. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and means on said slide for locking said sleeve-part of the die to the slide during the extrusion operation to keep it in alignment, and means for packing the joint between the forming-part and the sleeve-part of the die to prevent oozing of metal from the billet between said parts of the die during the extrusion operation.

7. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and means on said slide for locking said sleeve-part of the die to the slide during the extrusion operation to keep it in alignment, and means for cooling a part of the billet-metal adjacent the joint between the forming-part and the sleeve-part of the die to prevent oozing of metal between said parts of the die during the extrusion operation.

8. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, said driving-means comprising a crank having a throw exceeding but approximating the length of movement of said sleeve-part of the die, the axis around which said crank turns being at one side of the line of movement of said slide so that said crank, during the extrusion operation, exerts a pull approximately in line with the line of movement of said slide.

9. An extrusion apparatus according to claim 8, wherein said crank and said slide are on opposite sides of said die, and further comprising a long connecting rod connecting said crank and slide.

10. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion op-

eration is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and a flash-cutter movable to and from a position between the forming-part of the die and said slide, in the above stated position of the die parts, and having a part for contacting with the slide in a raised position of the latter, and means for applying force between the slide and cutter to drive the cutter to separate the flash from the extruded metal.

11. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and a flash-cutter movable to and from a position between the forming-part of the die and said slide, in the above stated position of the die parts, and comprising a cylinder and piston, and means for admitting fluid under pressure to said cylinder to force said cylinder against the slide, in a raised position thereof, and said piston toward the flash on the forming-part of the die to sever the flash from the extruded metal.

12. An extrusion apparatus comprising a die having an extrusion orifice and a part coacting with said die to extrude billet-metal from the die, said die and coacting part having a loose joint between them and a packing at said loose joint to prevent oozing thereat of billet metal between the parts confining the billet during the extrusion.

13. An extrusion apparatus comprising a die having an extrusion orifice and a part coacting with said die to extrude billet-metal from the die said die and coacting part having a loose joint between them, and means for cooling a part of the billet-metal at said loose joint to a substantially flowless condition to form an annular packing to prevent oozing of billet-metal into the loose joint between the parts confining the billet during the extrusion.

14. A method of extruding billets, comprising cooling to a substantially flowless condition a part of the hot extrudable billet-metal adjacent a loose joint in the parts confining the billet during extrusion, to form a packing.

15. A method of extruding billets comprising confining a billet in a die having a forming-part with an extrusion orifice therein and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, and cooling a part of the billet-metal adjacent the joint between the aforesaid die-parts to form a packing to prevent oozing of billet-metal between said die-parts during the extrusion.

16. An extrusion method comprising confining a billet in a die having a forming-part with an extrusion orifice therein, and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, maintaining the sleeve-part in telescoped position following the extrusion action, lifting the slide through which the extrusion force is applied following the extrusion action, and severing against the die the fin or flash left at the end of the extrusion action.

17. An extrusion method comprising confining a billet in a die having a forming-part with an extrusion orifice therein, and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, maintaining the sleeve-part in telescoped position following the extrusion action, lifting the slide through which the extrusion force is applied following the extrusion action, and severing the fin or flash left at the end of the extrusion operation by applying force against the slide and the fin or flash while resting on the face of the die.

18. An extrusion method comprising confining a billet in a die having a forming-part with an extrusion orifice therein, and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, maintaining the sleeve-part in telescoped position following the extrusion action, lifting the slide through which the extrusion force is applied following the extrusion action, inserting severing-means in the space above the forming-part of the die while the sleeve-part of the die is maintained in its telescoped position, and forcing said severing means against the slide and the fin or flash while resting on the face of the die to sever the flash from the shaped piece extruded from the die.

WILLIAM KLOCKE,

DISCLAIMER

2,167,845.—*William Klocke*, Woodhaven, N. Y. EXTRUSION PROCESS AND APPARATUS. Patent dated August 1, 1939. Disclaimer filed March 6, 1940, by the patentee.

Hereby enters this disclaimer to claims 1, 2, and 3 of said Letters Patent.
[*Official Gazette April 2, 1940.*]

eration is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and a flash-cutter movable to and from a position between the forming-part of the die and said slide, in the above stated position of the die parts, and having a part for contacting with the slide in a raised position of the latter, and means for applying force between the slide and cutter to drive the cutter to separate the flash from the extruded metal.

11. An extrusion apparatus comprising a die, said die comprising a forming-part having an extrusion orifice therein and a sleeve-part for surrounding a billet, and movable with relation to said forming-part of the die to a position in which the fin or flash remaining on the face of said forming-part at the end of an extrusion operation is exposed, a slide and means for driving said slide to apply pressure to a billet within said die and at the same time move the sleeve-part of the die to said position, and a flash-cutter movable to and from a position between the forming-part of the die and said slide, in the above stated position of the die parts, and comprising a cylinder and piston, and means for admitting fluid under pressure to said cylinder to force said cylinder against the slide, in a raised position thereof, and said piston toward the flash on the forming-part of the die to sever the flash from the extruded metal.

12. An extrusion apparatus comprising a die having an extrusion orifice and a part coacting with said die to extrude billet-metal from the die, said die and coacting part having a loose joint between them and a packing at said loose joint to prevent oozing thereat of billet metal between the parts confining the billet during the extrusion.

13. An extrusion apparatus comprising a die having an extrusion orifice and a part coacting with said die to extrude billet-metal from the die said die and coacting part having a loose joint between them, and means for cooling a part of the billet-metal at said loose joint to a substantially flowless condition to form an annular packing to prevent oozing of billet-metal into the loose joint between the parts confining the billet during the extrusion.

14. A method of extruding billets, comprising cooling to a substantially flowless condition a part of the hot extrudable billet-metal adjacent a loose joint in the parts confining the billet during extrusion, to form a packing.

15. A method of extruding billets comprising confining a billet in a die having a forming-part with an extrusion orifice therein and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, and cooling a part of the billet-metal adjacent the joint between the aforesaid die-parts to form a packing to prevent oozing of billet-metal between said die-parts during the extrusion.

16. An extrusion method comprising confining a billet in a die having a forming-part with an extrusion orifice therein, and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, maintaining the sleeve-part in telescoped position following the extrusion action, lifting the slide through which the extrusion force is applied following the extrusion action, and severing against the die the fin or flash left at the end of the extrusion action.

17. An extrusion method comprising confining a billet in a die having a forming-part with an extrusion orifice therein, and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, maintaining the sleeve-part in telescoped position following the extrusion action, lifting the slide through which the extrusion force is applied following the extrusion action, and severing the fin or flash left at the end of the extrusion operation by applying force against the slide and the fin or flash while resting on the face of the die.

18. An extrusion method comprising confining a billet in a die having a forming-part with an extrusion orifice therein, and a sleeve-part, telescoping the sleeve-part on the forming-part of the die at the rate at which the height of the billet is reduced, maintaining the sleeve-part in telescoped position following the extrusion action, lifting the slide through which the extrusion force is applied following the extrusion action, inserting severing-means in the space above the forming-part of the die while the sleeve-part of the die is maintained in its telescoped position, and forcing said severing means against the slide and the fin or flash while resting on the face of the die to sever the flash from the shaped piece extruded from the die.

WILLIAM KLOCKE,

DISCLAIMER

2,167,845.—*William Klocke*, Woodhaven, N. Y. EXTRUSION PROCESS AND APPARATUS. Patent dated August 1, 1939. Disclaimer filed March 6, 1940, by the patentee.

Hereby enters this disclaimer to claims 1, 2, and 3 of said Letters Patent.
[*Official Gazette April 2, 1940.*]