June 17, 1952 H. L. HORN 2,600,772

DIE OR MOLD AND COOLING ASSEMBLY THEREFOR

Filed April 14, 1948 2 SHEETS—SHEET 1

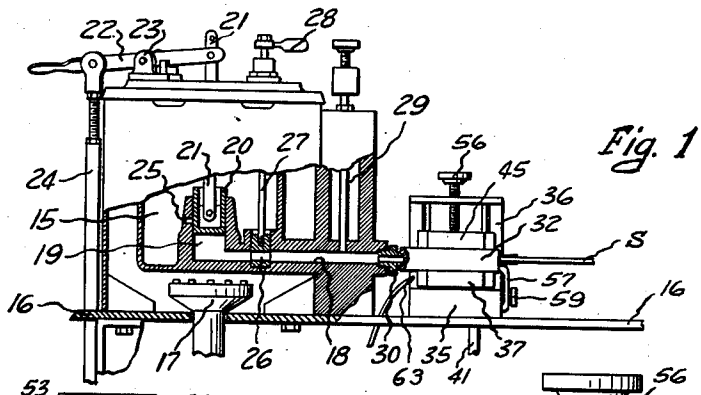


Fig. 1

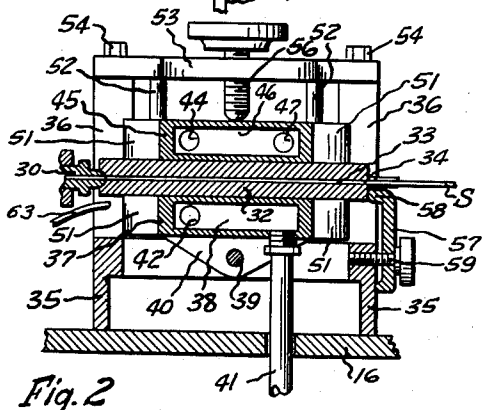


Fig. 2

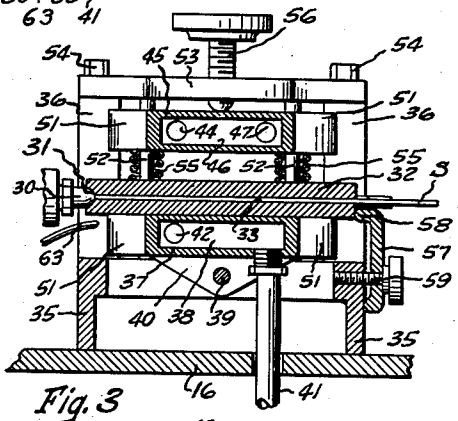


Fig. 3

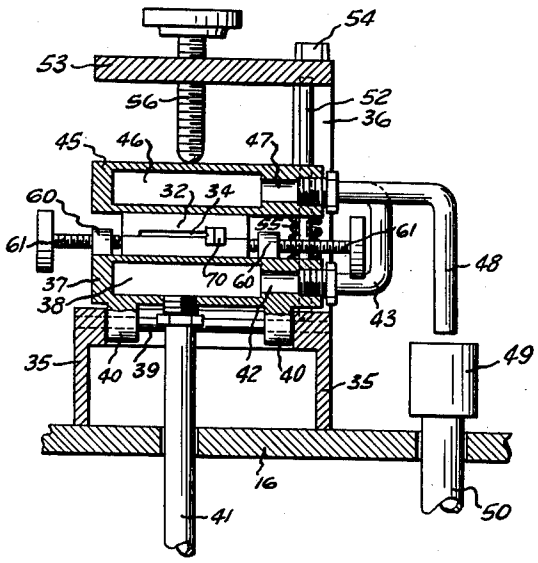


Fig. 4

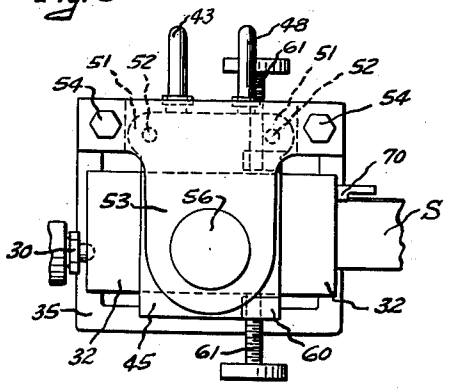


Fig. 5

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Filed April 14, 1948 2 SHEETS—SHEET 2

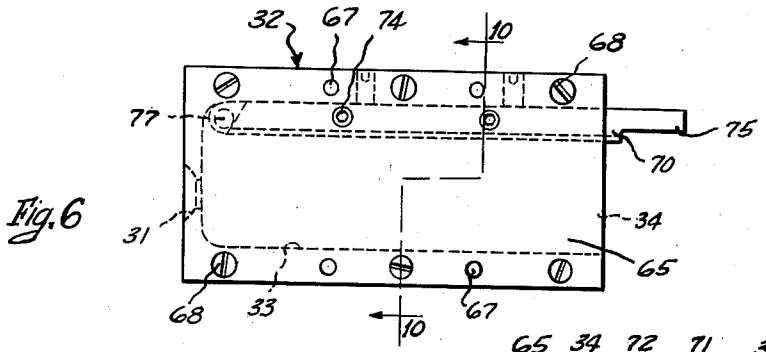


Fig. 6

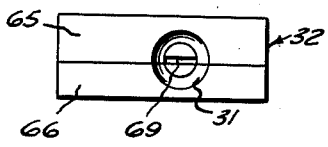


Fig. 7

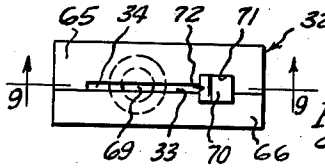


Fig. 8

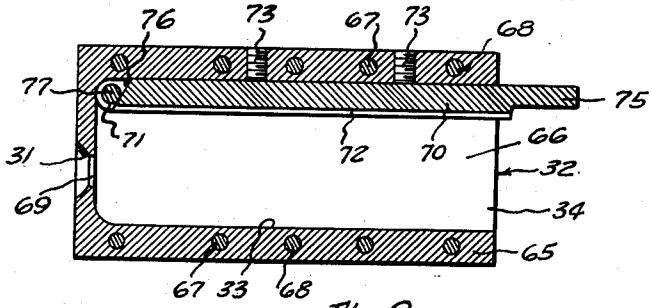


Fig. 9

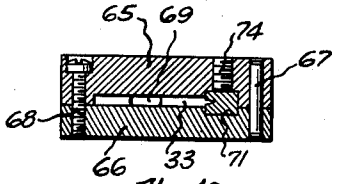


Fig. 10

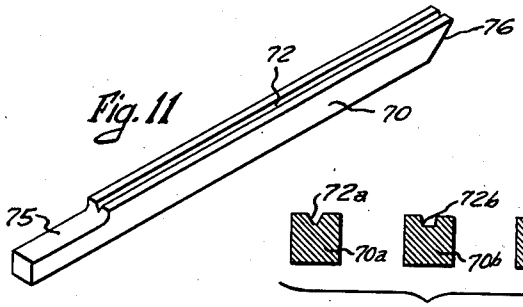


Fig. 11

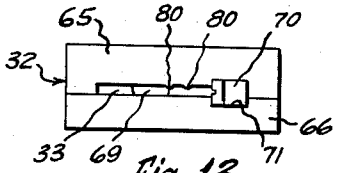


Fig. 13

Fig. 12

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UNITED STATES PATENT OFFICE

2,600,772

DIE OR MOLD AND COOLING ASSEMBLY THEREFOR

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Application April 14, 1948, Serial No. 20,855

7 Claims. (Cl. 22—57.2)

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This invention relates to new and useful improvements in dies or molds and cooling assemblies therefor, for use in machines for making printers' leads, slugs and rules, and more particularly for use in machines of the general type shown in the United States Letters Patent No. 1,438,951, granted to Benjamin S. Elrod on December 19, 1922, and No. 1,800,938, granted to Arthur H. Hedly on April 14, 1931, such machines being constructed and arranged to form a continuous strip of type metal which is then cut into sections of desired lengths. The improvement is directed more particularly to the die or mold used in forming and shaping the strip of type metal and to the cooling assembly for cooling and solidifying the type metal as it passses through such die or mold.

The invention relates broadly, therefore, to the arts of die-expressing and drawing or metal, and more particularly to the forming of continuous bars of metal from a molten body thereof. The machines used for practicing the foregoing method or art are adapted to form a continuous metal bar by drawing the same from the bottom or from below the surface of a molten body of the metal, the metal being drawn through the shaped channel of a suitable die and cooled while passing through said channel, so that the metal enters one end of the channel as a fluid and emerges from the other end thereof as a solid bar, the movement of the bar being effected by pulling upon the solidified portion thereof protruding from the die, the molten metal being subjected merely to sufficient pressure to cause it to follow through the die channel rather than to a pressure great enough to directly expel or extrude the metal through the die channel.

In the aforementioned patent to Elrod, the die channel is bolted to an outlet neck formed on the pot or crucible containing the molten type metal, and the cooling mechanism for the die is incorporated as an integral part of the die assembly. In the patent to Hedly, supra, the die or mold is set in an outlet throat opening from the pot or crucible containing the molten metal and is held in place therein by means of a portion of the metal contained in the pot or crucible throat which has been permitted to harden or set around the die between the die and the wall of the throat, and the cooling mechanism forms an integral part of the outlet throat of the pot or crucible. Furthermore, in both of the patented devices, the configuration of the metal strip formed by the die is fixed and unchangeable, it being necessary to replace the die with another having the desired configuration when it is desired to change the shape of the strip or the printing face thereon. Furthermore, the cooling mechanism of both of the previous devices forms an integral part of either the die or the throat of the crucible in

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which the die is set, and such cooling mechanism cannot be repaired, adjusted or replaced without completely shutting down the entire machine for long periods of time, and completely replacing the cooling mechanism and frequently rebuilding both the crucible and cooling mechanism. Also, the position of the die in the foregoing devices is positively fixed and cannot be changed to correct bowing or other misalignment of the strip of type metal formed by the die.

It is, therefore, one object of this invention to provide an improved die or mold and an improved cooling system for such die or mold, for use in machines for making printers' leads, slugs and rules, and the like.

An important object of the invention is to provide, for a machine of the character described, a die or mold which may be readily and easily installed, removed, altered, replaced, or adjusted in position.

A further important object of the invention is to provide an improved means for mounting the die or mold in communication with the molten metal contained in the pot or crucible of the machine, whereby exchange or replacement of dies is facilitated and may be accomplished without shutting down the entire machine for long periods of time.

Another object of the invention is to provide in a die of the character described means providing for the formation of printing faces of different shapes on slugs or leads formed by the die, said means being in the form of inserts which are interchangeable or replaceable as desired.

A still further object of the invention is to provide a die of the character described wherein the same die body may be used for forming strips of type metal of the same thickness, and wherein the die body is provided with a removable and interchangeable type face forming liner or slide insert which forms the desired printing face on the strip of type metal, whereby the same mold body may be used for various styles of printing face merely by changing the insert forming the printing face, so that the same mold may be used for forming various different styles of printing faces, thus reducing the cost of molds and providing for quick interchangeability thereof.

Still another object of the invention is to provide in a machine of the character described improved means for installing and securing the die in position for forming the strip of type metal.

A further object of the invention is to provide a die of the character described which has provided therein means for forming marking indicia on the sides of the strip of type metal for identifying the size, the type face, etc. of the particular strip.

It is a particularly important object of the invention to provide an improved cooling system for

a machine of the character described, wherein said cooling system is spaced from and independent of the pot or crucible containing the molten metal and likewise independent of and separable from the die for forming the strip of type metal.

Another important object of the invention is to provide a cooling system of the character described having adjustable cooling jacket elements, whereby said elements may be adjusted to fit dies of different thicknesses, sizes and shapes.

It is also a particular object of the invention to provide a cooling system of the character described wherein the jackets are each independently and separately removable and replaceable if desired or necessary, thus facilitating and expediting repairs or replacement of parts of the cooling system and reducing the costs thereof.

A further object of the invention is to provide a cooling system of the character described wherein the cooling jackets are readily movable into and out of contact with the strip forming die to permit quick interchange of dies.

A still further object of the invention is to provide in a cooling system and die holding mechanism of the character described means for adjusting the position of the die in the cooling system to provide for the elimination of bowing of the metal strip formed by the die.

Additional objects and advantages of the invention will readily be apparent from the reading of the following description of devices constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

Figure 1 is a view, partly in elevation and partly in section, of a portion of a machine for making printers' leads, slugs, rules, and the like, and showing a die and cooling system constructed in accordance with the invention incorporated therein,

Figure 2 is an enlarged, longitudinal, vertical sectional view of the cooling mechanism and die, showing the die secured in place in the cooling mechanism,

Figure 3 is a view similar to Figure 2, but showing the cooling mechanism in a released position permitting the removal of the die therefrom,

Figure 4 is a transverse, vertical sectional view through the die and cooling mechanism,

Figure 5 is a plan view of the die and cooling mechanism,

Figure 6 is an enlarged plan view of the die of the invention,

Figure 7 is a view, in elevation, of the entrant or front end of the die,

Figure 8 is a view in elevation of the exit or rear end of the die,

Figure 9 is a transverse, longitudinal sectional view of the die taken on the line 9—9 of Figure 8,

Figure 10 is a transverse, vertical sectional view of the die taken on the line 10—10 of Figure 6,

Figure 11 is an isometric view of one of the removable type face forming inserts for the die,

Figure 12 is a series of transverse cross-sectional views through several of the type face forming inserts, illustrating type faces of different styles which may be incorporated in such insert, and

Figure 13 is a view in elevation of the outlet end of a modified form of the die, showing means for forming identifying indicia on the cast strip.

In the drawings, the numeral 15 designates a melting pot or crucible, substantially cylindrical in form, which is mounted on a bench or table top 16 of a strip casting machine used for forming continuous bars of metal from a molten body thereof in the form of printers' leads, slugs, rules, and the like. Beneath the crucible is mounted a gas burner or other heating element 17 to which fuel is supplied for heating the crucible for melting the type metal, lead, or similar soft metal alloys capable of fusion at moderate temperatures and having a fair degree of tensile strength when cold, which metals are used in forming the strips.

The crucible is provided with an outlet passage or spout 18 communicating with the lower portion of the crucible and extending laterally therefrom. The inner end of the passage communicates with the lower end of a pump cylinder 19 which is disposed in the body of the crucible and forms an integral part of the lower portion or bottom thereof. A piston or plunger 20 is slidable within the cylinder and is actuated by means of a connecting rod 21 extending upwardly from the piston and connected to one end of a lever 22 which is fulcrumed between lugs 23 formed on the upper end of the crucible body. The lever 22 is actuated by means of a push rod 24 which is connected with the outer end thereof and extends downwardly below the table top to a suitable crank or cam mechanism (not shown) which causes reciprocating movement of the push rod and thus likewise causes reciprocating movement of the piston 20 in the cylinder 19. Such reciprocating movement of the piston 21 lifts the piston until it is positioned above a lateral opening 25 in the side wall of the cylinder, whereby molten metal may enter through said opening into the bore of the cylinder, whereupon downward movement of the piston will force the metal outwardly along the passage of the spout 18 in the usual manner.

A rotatable ported cylindrical plug valve 26 is mounted in the spout passage 18 for controlling flow of molten metal through the passage of said spout. A valve stem 27 extends upwardly from the valve plug to a point above the upper end of the crucible and is provided with a handle 28 for manipulation by the user of the device.

Also communicating with the passage of the lateral spout 18 from the crucible is an oil feeding mechanism 29, which may be of any desired suitable type, for feeding oil to the inner surface of the passage and of the die or mold which forms the metal strip, for reducing the resistance to the drawing of the formed strip from the die, as will hereinafter be more fully explained. The details of structure of the oil feeding mechanism are not essential to this invention, but such mechanism comprises an oil reservoir and valve means adjustable from externally of the device for controlling the amount of oil permitted to enter the flow passage through the spout 18.

A nozzle or tip member 30 is screwthreaded into the outer end of the outlet spout 18 from the crucible and has an axial flow passage therethrough for permitting the molten metal to flow outwardly through the nozzle. The extreme outer portion or tip of the nozzle is preferably substantially hemispherical in configuration, as clearly shown in Figures 2 and 3, and this hemispherical tip end of the nozzle is arranged to engage in a concave or frusto-conical opening 31 formed in the entrant end of a die or mold 32 which determines the form of the strip or type metal to be produced by the machine. The structure of the die 32 will be hereinafter more

fully described, but includes an elongate longitudinal channel 33 into which the molten type metal flows and wherein such type metal is cooled and caused to set, and is shaped, as it passes from the exit end opening 34 of the die to form the strip S of type metal. A suitable clutch and pulling mechanism (not shown) of any desired suitable type, is mounted on the table top 16 near the exit end of the die for the positively drawing the strip of type metal from the die in the usual manner. The strip so drawn from the die may subsequently be cut into sections of any predetermined desired length by a cutting mechanism (not shown) in any desired suitable or usual manner.

In the forming of the strip S, the metal supplied to the die 32 enters the die in molten form and is caused to solidify or set adjacent the outlet or exit end 34 of the die channel 33, such solidification or setting being effected by cooling means, in heat exchanging relationship with the die, through which cooling water is circulated for reducing the temperature of the type metal to cause the same to set or solidify.

The cooling assembly includes a base which is in the form of substantially a rectangular cubical housing 35 having its upper end open, and the base is provided with a pair of spaced upright posts 36 formed integral with and extending upwardly from the two rear corners of the housing. A lower water jacket 37, preferably substantially rectangular in configuration and having a central hollow or water chamber 38 formed therein, is pivotally mounted on the upper end of the housing 35 by means of a cross hinge pin 39 which extends transversely of the central portion of the upper end of the housing and through a pair of spaced depending wings or lugs 40 formed integral with the under side of the lower water jacket. A flexible water conduit 41 is screwthreaded into an opening in the under side of the lower water jacket for conducting water to the chamber 38. From the chamber 38 of the lower water jacket the cooling water passes outwardly through an opening 42 and through a flexible conduit 43 threadedly connected therewith to the inlet opening 44 of an upper water jacket 45 to which the conduit is also threadedly connected. The upper water jacket is substantially identical in configuration to the lower water jacket and has a hollow or water chamber 46 formed therein for receiving the coolant water. From the chamber 46 the water passes through an exit opening 47 to an L-shaped discharge pipe or conduit 48, which is threaded into the opening 47 and extends downwardly to a point just above a waste pot or vessel 49 having a waste pipe 50 communicating with a suitable point of disposal for the waste coolant water.

Both the upper end the lower water jackets have laterally extending ears or lugs 51 formed at each side of the rear corners thereof, and a pair of spaced vertically extending guide rods 52 extend through openings formed in these ears. The lower ends of the guide rods are fixed in recesses formed in the upper edge of the housing 35, while the upper ends are fixed in similar openings formed in the underside of a cover plate 53 which is secured by means of bolts 54 to the upper ends of the upright posts 36 carried by the rear corners of the housing. A helical coil spring 55 surrounds each guide rod and is confined between the upper and lower jackets, whereby the springs exert their force to urge the upper water jacket upwardly away from the lower water jacket, such movement being guided by the rods 52.

An elongate clamping screw 56 is threaded through the cover plate 53 and engages the upper side of the upper water jacket for controlling the movement and positioning of such water jacket, whereby said upper water jacket may be pressed firmly downwardly against the upper surface of the die or mold 32 to securely clamp the mold or die between the upper and lower water jackets in cooling or heat exchanging contact therewith, so that water circulated through such water jackets will cool and cause the molten type metal passing through the channel 33 of the die to solidify and become set in the outlet portion thereof. It will be seen, therefore, that the adjusting screw 56 may be turned to force the upper water jacket 45 downwardly toward the lower water jacket to securely clamp the die 32 in heat exchanging relationship with the upper and lower water jackets; and, likewise, the screw may be adjusted upwardly to permit the upper water jacket 45 to be raised away from the die by the springs 55, whereby the die may be readily adjusted or removed from between the two cooling water jackets.

The entrant opening of the die 32 is maintained in positive leak proof engagement with the tip or nipple of the nozzle 30 by means of a clamping arm 57, which has an inturned finger 58 at its upper end, and which is adjustable by means of an adjusting screw 59 which extends through an opening in said arm and is threaded into the upper portion of the side wall of the housing 35 at a position substantially centrally of the outlet or exit end of the die, as clearly shown in Figures 2 and 3. When the screw 59 is tightened, the arm 57 is swung to cause the finger 58 to engage against the lower portion of the outlet end of the die to press the die firmly toward the nozzle 30 in such a manner that the concave recess 31 in the inlet end of the die engages and seals against the hemispherical tip of the nozzle. The hemispherical nozzle tip permits slight misalignment of the die without breaking the seal therebetween. Also, the hinge cross pin 39 upon which the lower water jacket is mounted permits the lower water jacket to tilt to accommodate slight variations of position or misalignment of the die when it is clamped against the nozzle tip as aforesaid, and the loose fit of the upper water jacket on the guide rods 52 permits such upper jacket to tilt to similarly accommodate such variations of position or misalignment of the die.

It sometimes happens that the die 32 is not positioned in proper alignment with the pulling mechanism (not shown) by means of which the strip S is pulled from the outlet opening of the die. In such event, the strip of metal which is pulled from the die will be formed with a bow or in substantially a crescent shape. Or, the strip may be caused to bow for other reasons, such as uneven cooling in the die, etc. In order to prevent the formation of the strip with such a bow or curvature in the strip, the die must be adjusted in position or to proper alignment with the pulling mechanism to deliver a straight strip. To provide for such adjustment or alignment of the die, the lower water jacket 37 has upstanding lugs 60 on its front and rear corners on the side of the jacket nearest the outlet end of the die, and adjusting screws 61 are threaded through these lugs and engage against the front and rear sides of the outlet end portion of the die, where-

by such outlet end of the die may be adjusted laterally to correct alignment with the pulling mechanism or to proper position to eliminate the formation of any bow or curvature in the strip S pulled from the die.

In the usual strip casting machine, the strip of type metal S is pulled from the die in intermittent movements. A short section of strip is pulled from the die, then the pulling mechanism moves forward for a new grip to pull another section from the die. In order that the strip be formed of a continuous uniform length, the molten metal must be caused to flow into the die channel **33** of the die in sufficient volume to maintain the same completely filled at all times, this being accomplished by means of the pump piston **20** which forces additional molten metal into the entrant or inlet end of the die each time the formed strip portion is pulled from the exit or outlet end of the die. As the strip is pulled from the die, there is a tendency of the metal which is in a mushy state between the solidified portion in the outlet end portion of the die and the molten or fluid state at the entrant end portion of the die to be reduced in size. Where a printing face is being formed on the strip, this reduction in size of the mushy part of the strip sometimes causes a gap to be formed in such printing face, even though the molten metal usually flows into the die in sufficient quantity to completely fill the same. To prevent such gaps or irregularities in the printing face of the strip, a small supplementary burner **63** is positioned near the inlet end of the die for heating the inlet portion of the die along the side on which the printing face is formed, whereby the type metal will be somewhat more molten and will more readily flow to fill the space created when the solidified strip is withdrawn from the outlet or exit end of the die. This auxiliary burner has been found to very satisfactorily cause the metal to flow into the printing face forming portion of the die to provide a uniform full smooth printing face on the strip.

It is also preferable that the channel **33** through the die be tapered outwardly or relieved slightly from the inlet end toward the outlet end of the die on at least two sides other than the printing face forming side, the outlet opening **34** of the die thus being slightly larger than the exact dimension to which it is desired to form the strip S. This permits the type metal in the solidified or set state to be withdrawn from the die without deformation caused by stretching as it is pulled from the die. The taper of the walls of the channel **33** of the die will preferably amount to approximately three thousandths (.003) of an inch on each tapered face.

While any suitable die having a concave or frusto-conical recess at its entrant end opening may be used for forming the strip S, it is preferable that a die of the character illustrated in Figures 6 through 12 be utilized. It will be noted that the preferred form of the die is so constructed and arranged that the strip formed thereby is positioned on one side, so that the printing face does not drag against or touch any part of the machine after such strip leaves the die.

As will clearly be seen in the drawings, the die **32** is preferably substantially of elongate rectangular configuration and is formed with an upper plate **65** and a lower plate **66** which are properly positioned with respect to each other by means of dowel pins **67** extending through openings formed in both the upper and lower plates, said plates being held securely together by means of screws **68** extending through the upper plate and threaded into the lower plate, as clearly shown in Figure 10. The channel **33** in the die is substantially rectangular in configuration, as clearly shown in Figures 9 and 10, the concave or frusto-conical recess **31** at the entrant end of the die communicating with such channel through an aperture **69**. The channel **33** is provided in the die by forming a longitudinally extending recess in the upper plate of a depth sufficient to provide a strip of the desired thickness, such as two point, four point, six point, or the like. The bottom of the channel is formed by the flat upper surface of the lower plate **66**, as will clearly be seen in Figure 10. The width of the recess formed in the upper plate will determine the height of the slug or strip formed by the die or mold.

For forming the printing face on the strip, a face forming insert **70**, illustrated in Figure 11, is mounted in an elongate longitudinally extending rectangular groove or recess **71** formed in both the upper and lower plates of the die along one side of the channel **33** therein and of a thickness greater than said channel. The elongate rectangular recess **71** extends from the outlet opening end of the die completely along the channel **33** to the closed end thereof near the entrant end of the die. The face forming insert **70** is an elongate substantially rectangular member having a longitudinally extending groove **72** formed in one surface thereof and so positioned as to form the desired printing face on the strip formed by the die.

The insert fits closely within the elongate recess **71** and is positively secured in position therein by means of set screws **73** which press the insert inwardly in the recess toward the channel **33** until the face forming surface of the insert engages against the shoulder between the channel **33** and the recess **71**, thus positively dimensioning the strip formed by the die. Clamping set screws **74** are threaded through the upper plate **65** and engage against the sides of the insert to positively prevent the same from being displaced outwardly from the recess in the die as the metal is pulled from the outlet end **34** of the channel in the die. The extreme inner end of the insert is tapered as illustrated at **76** and engages against a button **77** positioned at the extreme inner end of the recess **71**, whereby the inner end of the insert is firmly and securely pressed inwardly toward the shoulder between the channel and the recess. The button **77** likewise serves as a stop to limit inward movement of the insert in the recess. A finger grip extension **75** is formed on the outer end of the insert and is so dimensioned that the printing edge of the strip will not contact such grip, the material from which the insert is formed being relieved along the surface of the insert in which the groove **72** is formed.

Manifestly, the groove provided in the surface of the insert, which forms the printing face on the strip, may be varied from the substantially triangular shaped groove **72** illustrated in Figure 11. Several different styles of printing faces may be formed as illustrated, by the grooves **72*a***, **72*b***, and **72*c*** formed in the inserts **70*a***, **70*b***, and **70*c*** respectively, of Figure 12 of the drawings.

Furthermore, each of the inserts **70**, **70*a***, **70*b***, **70*c***, and any other insert having a groove of a configuration other than those illustrated, may be inserted in the recess **71** to form a printing

face on the strip of type metal formed by the die. Or, if desired, the grooves may be omitted from the insert 70 and a rectangular strip thus formed by the die and insert.

It will be seen, therefore, that the same die may be used with a number of different inserts having grooves of different shapes formed therein, or with an insert without a groove formed therein, to mold or shape strips of type metal having various printing faces. Thus, only a single die having a number of interchangeable inserts is required to form strips of a given thickness having a variety of printing faces, and the printing faces formed on the strips may be varied by changing the insert in the die. It is, of course, necessary that a different die be used if a strip of a different thickness is to be formed. However, the number of dies otherwise required to form many various printing faces on strips of the same thickness is reduced to one die with the desired number of inserts. This reduces substantially the cost of dies for the strip casting machine.

If desired, the recess formed in the upper plate 65 of the die may have one or more marking ridges 80 formed thereon and projecting into the recess for forming longitudinally extending indentations or depressions in the side surface of the strip formed by the die. The indentations formed in the strip may be used for identifying the various printing faces formed on the strip, or the size of the strip, etc., such identification being effected by the user feeling of the indentations or looking and counting the number thereof or the arrangement thereof. Since the marks or indicia are formed in the strip as indentations, it will be seen that such markings do not interfere with the utility of the strip as a spacer or the like.

It is believed manifest that the die 32 illustrated in Figures 6 through 12 may readily be used in strip casting machines of the type illustrated in the patents to Elrod and Hedly aforementioned, the die being of substantially the same shape and configuration as the dies presently used in such machines.

Furthermore, the provision of the insert 70 in the die for forming the desired printing face on the strip of type metal may be made in dies suitable for use with other machines, and it is to be understood that a die having an insert of the character just described may be so constructed, with any required inlet opening arrangement as may be necessary for use in machines other than those of the character described herein.

From the foregoing, it will be seen that an improved die or mold and an improved cooling system for such die or mold has been provided for use in machines for casting strips of metal, such as printers' leads, slugs, rules, and the like; and that the die or mold may be readily and easily removed from the cooling system and altered, replaced or adjusted in position. It will particularly be noted that an improved means for mounting the die or mold in communication with the molten metal outlet from the melting pot or crucible of the strip casting machine has been provided, whereby exchange or replacement of dies is expedited and facilitated and may be accomplished without shutting down the entire machine for long periods of time. Furthermore, it will particularly be noted that a die has been described having a removable insert providing for the formation of printing faces of different shapes on the slugs or leads formed by the die, such insert being interchangeable or replaceable as desired, whereby the same mold body may be used for various styles of printing face merely by changing the insert forming the printing face, thus reducing the cost of molds for the machine and providing for quick interchangeability thereof. It will further be seen that improved means has been provided for installing and securing the die in position for forming the strip of type metal. Also, means has been described and illustrated for forming marking indicia on the sides of the strip of type metal for identifying the sizes, type face, etc., of the particular strip.

It will particularly be noted that an improved cooling system has been provided for use in strip casting machines, said cooling system being spaced from and independent of the melting pot or crucible containing the molten metal and likewise independent of and separable from the die used for forming the strip of type metal. Furthermore, the cooling system is provided with adjustable cooling jacket elements, whereby said cooling jacket elements may be adjusted to fit dies of different thicknesses, sizes and shapes; and such cooling jackets are particularly adapted to permit ready installation, removal or replacement of dies secured in the cooling system. It is also important to note that the cooling system permits each of the cooling jackets to be independently and separately removed and replaced, if desired or necessary because of becoming stopped with lime or other foreign matter or because of leaks or the like, thus expediting and facilitating repairs or replacements of parts of the cooling system and reducing the costs thereof. It will also be seen that means has been provided for adjusting the position of the die in the cooling system to provide for the elimination of bowing of the metal strip formed by the die. Also, means has been provided for substantially eliminating roughness or incomplete formation of the printing face on the metal strip formed by the die, such means being the auxiliary heating burner positoned at the entrant end portion of the die near the printing face forming insert.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. In a strip casting machine having a melting pot with an outlet therefrom, a die having a strip forming channel extending therethrough and having a pivotal sealing connection at one end with the outlet from the melting pot for receiving molten metal therefrom, a pair of cooling jackets, a support for said cooling jackets disposed to position the cooling jackets on opposite sides of the die, an adjustable clamp on the support for moving one of the cooling jackets toward and away from the other cooling jacket independently of the die whereby the cooling jackets may be releasably secured in heat-exchanging relationship with opposite sides of the die, and opposed adjustable members carried by the support on opposite sides of the die remote from the pivotal connection of the die with the melting pot outlet for moving the outer end of the die between the cooling jackets about the pivotal connection of the die with the melting pot outlet.

2. A strip molding die and a cooling mechanism therefor for a strip casting machine having a melting pot with an outlet conduit and includ-

ing, a supporting housing carried by the machine adjacent the outlet conduit from the melting pot, opposed cooling jacket members adjustably carried by said housing, one of said cooling jacket members being movable toward and away from the other jacket member, an adjustable member on the housing engaging the movable cooling jacket member for moving said jacket member toward the other jacket member, a die having a strip forming channel formed therein with an inlet and an outlet at opposite ends and having its inlet positioned in pivotal sealing engagement with the outlet conduit from the melting pot, said die being positioned so as to rest upon one of the cooling jackets and to be clamped between said jacket and the movable cooling jacket by said adjustable member whereby the molten metal in the die is cooled and solidified as it passes through the channel therein, a clamp on the supporting housing engageable with the die for detachably holding the inlet of the die in pivotal sealing engagement with the outlet conduit from the melting pot, and opposed adjustable members carried by one of the cooling jackets on opposite sides of the die and engageable with the die for swinging the outlet end of the die between the cooling jackets about the pivotal engagement of the inner end of the die with the outlet conduit from the melting pot, said movable cooling jacket member being movable away from the die to permit said die to be removed from between the cooling jacket members whereby replacement or interchange of die members is expedited and facilitated.

3. In a strip casting machine having a melting pot, a die having a channel therethrough and pivotally connected at one end to an outlet from said melting pot whereby molten metal from the melting pot will pass into the die channel and the die may be swung about the pivotal connection with the outlet from the melting pot, a lower body having a cooling chamber in heat exchanging relationship with the underside of the die, and an upper body having a cooling chamber in heat exchanging relationship with the upper side of said die whereby the molten metal received in the channel of the die is caused to solidify as it passes through said channel, the die being pivotally movable in a horizontal plane between the upper and lower bodies, the upper body being retractable from heat exchanging contact with the die.

4. In a strip casting machine having a melting pot with an outlet therefrom, an outlet nozzle mounted at the outlet end of the outlet conduit from the melting pot, said nozzle having a convex end substantially hemispherical in shape, a die having a strip forming channel therethrough with an inlet opening and an outlet opening, an adjustable clamp for releasably maintaining said die in a position with the inlet opening of the die body in pivotal sealing engagement with the convex tip of the nozzle at the outlet conduit from the melting pot, and adjustable members on the machine engageable with the sides of the die for moving said die body pivotally about the convex nozzle tip in the plane of the major cross-sectional dimension of the strip formed thereby.

5. In a strip casting machine having a melting pot with an outlet therefrom, a support adjacent said outlet; a first cooling jacket on said support, a die on said first jacket, said die having a strip forming channel extending therethrough and an inlet at one end in pivotal sealing engagement with the outlet of said melting pot; a clamp on said support abutting the end of said die opposite said inlet end for holding said inlet of said die against said outlet of said melting pot; a second cooling jacket on said die; a first member movably mounted on said support for movement toward and away from said second jacket for rigidly holding said second jacket against said die; and a second member movably mounted on said support for movement in a plane perpendicular to the plane of movement of said first member for moving said die pivotally with respect to said inlet in the plane perpendicular to the plane of movement of said first member.

6. A molding die for a strip casting machine including, an elongate body having a longitudinal strip forming channel extending therethrough with an inlet opening at one end and an outlet opening at the opposite end of the body and arranged to receive molten metal and form the same into a solidified strip, said body also having an enlarged recess formed therein at one of the narrow sides of the strip forming channel extending longitudinally inwardly from the outlet end of the die along said side of the channel and opening along its side into said channel, said enlarged recess providing shoulders extending longitudinally along each side of the strip forming channel, an elongate insert slidable longitudinally in the enlarged recess and having a surface engaging the shoulders in said enlarged recess whereby the insert closes such side of the strip forming channel, and securing means carried by the body extending into the enlarged recess and engaging the insert to clamp said insert against the shoulders in said enlarged recess.

7. A molding die of the character set forth in claim 6 wherein said insert is provided with a finger grip extension projecting out of the body whereby the insert may be readily removed and inserted in said recess.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
91,426	Fanning	June 15, 1869
473,579	Illingworth	Apr. 26, 1892
1,139,885	Mellen	May 18, 1915
1,139,887	Mellen	May 18, 1915
1,222,415	Knight	Apr. 10, 1917
1,283,626	Bancroft et al.	Nov. 5, 1918
1,422,532	Breit	July 11, 1922
1,438,951	Elrod	Dec. 19, 1922
1,444,905	Dittman	Feb. 13, 1923
1,476,967	Hedly	Dec. 11, 1923
1,567,363	Elrod et al.	Dec. 29, 1925
1,683,721	Morin	Sept. 11, 1928
1,800,938	Hedly	Apr. 14, 1931
1,811,258	Clark	June 23, 1931
1,895,135	Rohn	Jan. 24, 1933
1,907,130	Summey	May 2, 1933
1,946,488	Dahl	Feb. 13, 1934
2,007,301	Lemieux	July 9, 1935
2,030,726	Strock et al.	Feb. 11, 1936
2,108,080	Schultz et al.	Feb. 15, 1938
2,171,628	Lannert	Sept. 5, 1939
2,186,938	McWane	Jan. 16, 1940