July 26, 1949. F. H. WUETIG 2,477,030

CENTRIFUGAL STRIP CASTING MACHINE

Filed July 24, 1947 2 Sheets-Sheet 1

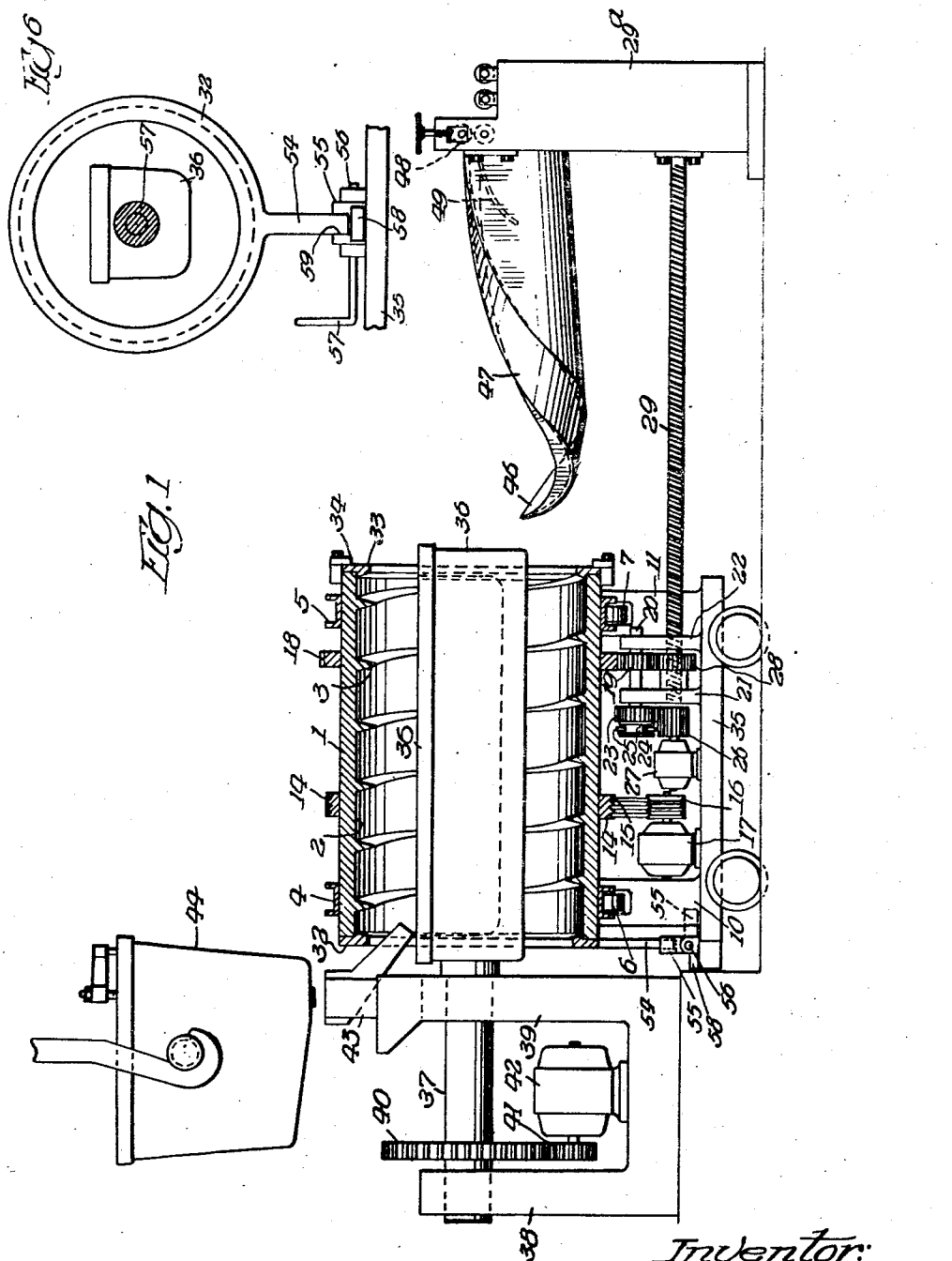


FIG. 1

FIG. 6

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July 26, 1949. F. H. WUETIG 2,477,030

CENTRIFUGAL STRIP CASTING MACHINE

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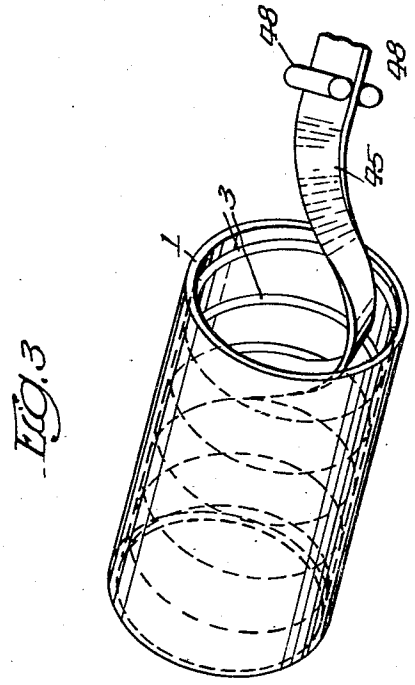


FIG. 3



FIG. 5



FIG. 4

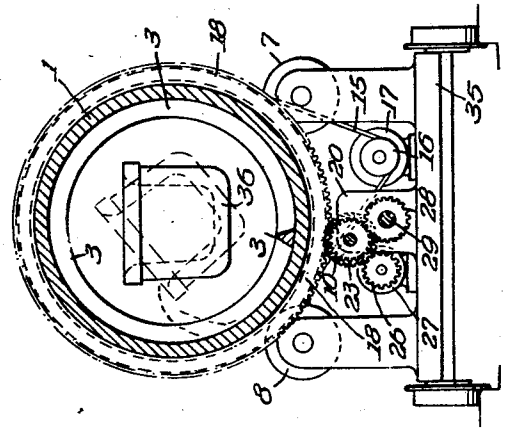


FIG. 2

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL STRIP CASTING MACHINE

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6 Claims. (Cl. 22—65)

1

This invention relates to improvements in machines for centrifugally casting, for various purposes, a continuous strip or bar of metal, preferably spirally inside of a rotatable cylindrical mold, and subsequently stripping the solidified casting from the inside of the mold, whereby a strip, which is of a length greater than the longitudinal dimension of the mold, may be obtained, and by a method which is of considerably less expense than has heretofore been possible.

The prior and usually adopted method of producing the strips by centrifugal action, has been to provide a tubular casing into which the molten metal is fed, in a suitable manner. The casing is then rotated, and centrifugal action throws the metal outwardly so as to form a pipe within the casing. After the pipe is withdrawn or removed from the casing, it is cut into lengths transversely of the longitudinal dimension of the pipe, to provide a number of sections. These sections are then compressed laterally, after which they are rolled into strips of the desired thickness. This is a somewhat expensive as well as time consuming operation, and the length of the finished strip is limited by the amount of material in each section, the original length of the section and the thickness of the finished strip. Furthermore there are a number of slips in the operation which necessitate a considerable handling of the material before the final product is produced, the length of the strips being also of a somewhat limited length.

It is one of the objects of the present invention to improve and simplify the method of producing such metal strips, and to overcome the objections and difficulties in the prior machines.

A further object is to provide an improved centrifugal machine of this character in which there is provided a continuous strip or bar, which in the first instance is of approximately the desired width and thickness, the strip being shaped in a rotatable cylinder by centrifugal force, the strip being preferably formed in the shape of a spiral, the convolutions of which are spaced from each other.

A further object is to provide improved means for removing the spirally formed strip from the cylinder.

A further object is to provide an improved machine of this character in which the strip is formed in a rotatable cylinder by centrifugal force, the material being supplied to the cylinder by means of a ladle that projects into, and is of substantially the same length as the cylinder, and improved means for relatively shifting the

2

cylinder and ladle, one with respect to the other, whereby the ladle will be both withdrawn from and inserted into the cylinder.

A further object is to provide improved means for forming the continuous strip or bar within the cylinder.

A further object is to provide improved means for rotating and for bodily shifting the cylinder with respect to the ladle, into and out of operative position with relation thereto.

A further object is to provide an improved form of stripper for removing the spiral strip from the cylinder, and for causing the strip to ultimately leave the cylinder in a substantially flat position.

A further object is to provide improved means for shifting the cylinder and the stripper one with respect to the other.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts, hereinafter more fully described and claimed, and shown in the accompanying drawings exemplifying this invention, and in which drawings:

Figure 1 is a view partly in side elevation, and partly in section of a machine of this character constructed in accordance with the principles of this invention.

Figure 2 is an end view partly in vertical section of Figure 1, with parts omitted.

Figure 3 is an isometric view of the casting or strip being removed or stripped from the cylinder or mold.

Figures 4 and 5 are detail longitudinal sections through the mold or casting cylinder of different forms of various strips that could be cast.

Figure 6 is a detail transverse, sectional view of a means for indexing or stopping rotating mold in the proper position for stripping.

Referring more particularly to the drawings and in the form of the invention shown, the casting mold 1, is cylindrical, of any desired diameter and length, and constructed of any suitable material. If desired, it may be cooled in any suitable manner by means of a water jacket, water spray or any cooling means (not shown) well known in this art.

Disposed within the mold is a continuous spiral groove 2, formed in any suitable manner by a continuous spiral ridge or rib 3. This rib may be of any desired or suitable shape in cross sec-

tion, but is preferably tapered or of an inverted V shape, the ribs being spaced from each other in directions lengthwise of the axis of the mold, according to the width of strip or bar it is desired to produce. They are also of a height suitable of producing strips or bars of the desired thickness.

The mold is supported to rotate upon a substantially horizontal axis in any suitable manner, such as by means of grooved rings 4 and 5, which ride upon rollers 6 and 7, mounted upon suitable supports 10 and 11, any number of which rollers may be provided and suitably positioned.

Mounted externally and fixed to the mold 1, is a ring pulley 14 driven by means of suitable belts 15, from a driving pulley 16, that is operatively connected with a motor 17.

Also mounted externally of the mold 1, is a ring gear 18, which meshes with an intermediate gear 19, that is affixed to a shaft 20, that is journaled in bearings in supports 21 and 22. Fixed to the shaft 20, is a gear 23, and a grooved collar 24, that is engaged by a shifting fork or lever 25, the latter being provided with a conventional shifting or operating device (not shown).

The gear 23, meshes with a gear 26, that is operatively connected to a motor 27.

When the fork 25, is shifted laterally, the intermediate gear 19, will move into and out of meshing engagement with the ring gear 18, and also a lead nut gear 28, which latter is threaded upon a lead screw 29, and the nut gear 28, is mounted between the supports 20, and 21, so that when the nut gear 28, is rotated upon the screw 29, the gear will be maintained against traveling movement with respect to the length of the mold, and the mold will be advanced or retracted bodily, according to the direction of rotation of the nut gear 23, as will be later explained.

Both ends of the mold 1, are open, and retainer rings or annular members 32, and 33, are provided to prevent the molten metal from running out of the mold. The ring 33, is preferably removably secured in position by means of suitable fastening lugs 34.

The mold with its supporting structure is rotatably mounted upon a movable carriage 35, whereby the mold may be bodily moved in opposite directions.

In the casting position, a casting ladle 36, projects thereinto and is preferably centered with respect thereto, extending for substantially the entire length of the mold, the ladle being mounted on the end of a horizontal shaft 37, journaled in suitable bearings 38 and 39. Attached to the shaft 37, is a gear 40, which meshes with a pinion 41, of a motor 42, or of any other suitable driving mechanism or device, to obtain a slow rotation of the casting ladle 36, and the rotation of the ladle may be controlled in any suitable and well known manner (not shown).

The casting ladle is filled in any suitable manner, such as by means of a pouring spout 43, slidably mounted upon a pedestal of the bearing 39, so that it may be moved back and out of the way after the casting ladle is filled, thus allowing the casting ladle to rotate freely. The molten metal is poured from some suitable standard pouring ladle 44, suitably mounted and operated.

Arranged at any suitable distance beyond one end of the mold 1, is a stationary support 29a to which the screw 29 is fastened by one end, in a manner to prevent rotation of the screw. Carried by the support and in a position to be projected into the mold 1, from one end of the latter is a stripper 46, provided with a curved guide housing 47, at the end of which housing may be arranged pinch rolls 48, between which the strip or bar 45, passes when removed from the mold, and from these rolls the strip may enter equalizing or reheating furnaces (not shown) or conveyed to any other point for further operation thereupon, if desired.

An apron 49 is provided inside of the curved housing 47, to facilitate the entrance of the casting between the pinch rolls 48.

The continuous spiral rib or ridge 3 is of a height greater than the thickness of the metal casting, thereby causing the casting to be separated into a continuous spiral strip, as shown in Figure 3, and the cross section of the cast strip where it bears against the mold may be varied, as illustrated at 50, in Figure 5, and in the form of a groove 52, as shown in Figure 4.

Casting of the molten metal is done while the mold 1, is rotating, and after the metal has solidified the motor 17, is stopped, retaining ring 33 is removed and the end of the casting 45, is bent up, in any suitable manner, such as by means of a bar or hammer, sufficiently to allow the edge of stripper 46, to enter between the mold and casting.

The intermediate gear 19, which during the casting period has been moved out of mesh with the ring gear 18, and lead nut gear 28, is moved back into mesh with the ring gear 18, and lead nut gear 28, and motor 27, is started. Rotation is imparted from motor 27, through pinion gear 26, to rear gear 23 which is fixed to the shaft 20. Intermediate gear 19, is also fixed to shaft 20, and is therefore also rotated. Since the intermediate gear 19, is in mesh with ring gear 18, and lead nut gear 28, they are rotated in opposite directions simultaneously, causing mold 1 to rotate and lead nut gear 28, to travel along lead screw 29.

Any tendency of lead nut gear 28, to travel independently is resisted by the supports or bearings 20, 21, through which lead screw 29, passes, but which restrain lateral movement of lead nut gear 28. Since independent movement of lead nut gear 28, is restricted, travel along lead screw causes the entire carriage 35, to move into stripper 46. By the proper gear ratios in the ring gear 18, and the gear nut 28, and the correct lead on the lead screw 29, the lateral travel of mold 1, will be such as to keep the stripper edge 46, in the spiral groove 2, or between the ribs 3, as the mold rotates. The rigidity of the casting will cause it to follow the curved guide housing 47, and enter between the pinch rolls 48.

With this improved method of casting bars or strips, there is provided a stripper plow like device which has what may be termed a "skewed edge," the leading end of the stripper being larger than the trailing edge. This causes the strip to tilt toward the stripping end of the mold in order to assist its leaving the mold, and also to allow it to flatten out so that it can enter between the pinch rolls, at the end of the stripper. The edge of the stripper is shaped to fit the form of the casting, and the travel of the bar or strip on leaving the mold is guided by the curved guide housing plate in order that it will enter the pinch rolls properly. This guide also supported the blade of the stripper. A lead screw is run from the stripper bar to the mold carriage, and is anchored at the stripper end and threaded through the nut drive gear on the carriage. This

geared nut is so mounted on the mold carriage, that when the gear is turned the nut tends to travel along the lead screw, so as to cause the carriage to travel in the direction of movement of the nut. The gear on the nut is connected through a sliding intermediate gear to a ring gear around the outside of the mold, thereby causing the travel of the mold carriage to be relative to the rotation of the mold.

The operation of the nut gear is controlled by the shifting device **25**.

If desired, and as a means for indexing the mold prior to stripping to insure proper entry of the stripper in the end of the groove in the mold, there may be provided an indexing device which may be of any desired or suitable construction.

A simple and efficient means may embody a lug or projection **54**, on the outside of the mold, and a retractable indexing member **55** of any suitable construction, preferably pivotally mounted on the carriage **35**, as at **56**. This indexing member may be swung about its pivot by means of a suitable operating handle **57** to position the indexing member within the path of movement of the lug **54** so that when it is desired to strip the bar from the mold, the lug **54** may be brought against the indexing member **55** and thus the mold will be in a proper position with relation to the point or end **46** of the strip.

After the material has been stripped from the mold, the indexing member **55** may be swung out of the way of the lug **54**. If desired, and as a means for assisting in holding the indexing member in position there may be provided an arm or projection which engages and rests upon the carriage **35**. This indexing member is preferably provided with a bifurcation **59** into which the end of the lug **54** may project.

While the preferred forms of the invention have been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, within the scope of the claims, without departing from the spirit of this invention.

What is claimed as new is:

1. In a machine for casting strips of metal by centrifugal force having a rotatable mold mounted for rotation about a horizontal axis and a continuous spiral groove on the inner face of the mold having a depth greater than the thickness of the strip to be cast, the combination with said machine of stripping means for removing the strip of metal from the mold including a stripper finger fixed with respect to the axis of the mold at a distance equal to the internal radius of the mold and adapted to be inserted in one end of the mold under the casting, means for rotating the mold and for moving the mold and stripper relative to each other in a rectilinear and coaxial path and in a relation so timed with the rotation of said mold that the end of the stripper finger will follow the spiral groove and remove the casting in a continuous strip.

2. In a machine for casting strips of metal by centrifugal force having a rotatable mold mounted for rotation about a horizontal axis and a continuous spiral groove on the inner face of the mold having a depth greater than the thickness of the strip to be cast, the combination with said machine of stripping means for removing the strip of metal from the mold including a stationary stripper finger fixed with respect to the axis of the mold at a distance equal to the internal radius of the mold and adapted to be inserted in one end of the mold under the casting, and means for simultaneously rotating the mold and moving the mold in a rectilinear path axially in a relation so timed that the end of the stripper finger will follow the spiral groove and remove the casting in a continuous strip.

3. In a machine for casting strips of metal by centrifugal force having a rotatable mold mounted for rotation about a horizontal axis and a continuous spiral groove on the inner face of the mold having a depth greater than the thickness of the strip to be cast, the combination with said machine of stripping means for removing the strip of metal from the mold including a stripper finger adapted to be inserted in one end of the mold under the casting, a support for said finger, an elongated screw secured to said support and parallel with the axis of said mold, means for rotating said mold, said last named means being operatively connected to said screw thereby to move the mold and stripper relative to each other during rotation of the mold in a rectilinear and coaxial path in a relation so timed with the rotation of the mold that the end of the stripper finger will follow the spiral groove and remove the casting in a continuous strip.

4. In a machine for casting strips of metal by centrifugal force having a rotatable mold mounted for rotation about a horizontal axis and a continuous spiral groove on the inner face of the mold having a depth greater than the thickness of the strip to be cast, the combination with said machine of stripping means for removing the strip of metal from the mold including a stripper finger adapted to be inserted in one end of the mold between the mold and the casting, means for rotating the mold and for moving the mold relative to the stripper in a direction parallel to the axis of the mold simultaneously in a relation so that the stripper finger stays in the groove, said last named means including a ring gear around the mold and an elongated screw located parallel with the axis of the mold, said ring gear and said screw being geared together, and the pitch of said screw being such as to cause the mold to advance on the stripper when the mold is rotated in properly timed relation to cause said finger to strip the casting from the mold.

5. In a machine for casting strips of metal by centrifugal force having a rotatable mold mounted for rotation about a horizontal axis and a continuous spiral groove on the inner face of the mold having a depth greater than the thickness of the strip to be cast, the combination with said machine of stripping means for removing the strip of metal from the mold including a stripper finger adapted to be inserted in one end of the mold between the mold and the casting, said stripper finger having a substantially helically curved guiding surface with a helix angle greater than the helix angle of the groove in the mold, a support for said stripper finger, means for simultaneously rotating said mold and for moving the mold axially in a relation so timed as to cause said finger to follow the path of said groove, and said finger having one end thereof terminating in a mitered edge stripping lip thereby to peel the strip internally from the mold.

6. In a machine for casting strips of metal by centrifugal force having a rotatable mold mounted for rotation about a horizontal axis and a continuous spiral groove on the inner face of the mold having a depth greater than the thickness of the strip to be cast, the combination with said machine of stripping means for removing the

strip of metal from the mold including a stripper finger adapted to be inserted in one end of the mold between the mold and the casting, means for rotating the mold and for moving the mold relative to the stripper in a coaxial direction simultaneously in timed relation, said last named means comprising a ring gear around the mold, an elongated screw disposed parallel with the axis of said mold and secured to said stripping means, said ring gear being geared to said screw and said screw pitch being such that the stripper edge will follow the groove in the mold during rotation thereof, and indexing means including a lug on the periphery of the mold and an engaging latch on the mold supporting structure, said latch adapted to engage said lug and to be released therefrom prior to stripping thereby to position the mold for proper entry of the stripper finger in the end of said spiral groove.

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