Nov. 19, 1963 R. T. FAGG 3,110,941

CONTINUOUS METAL CASTING MACHINE

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FIG. 1

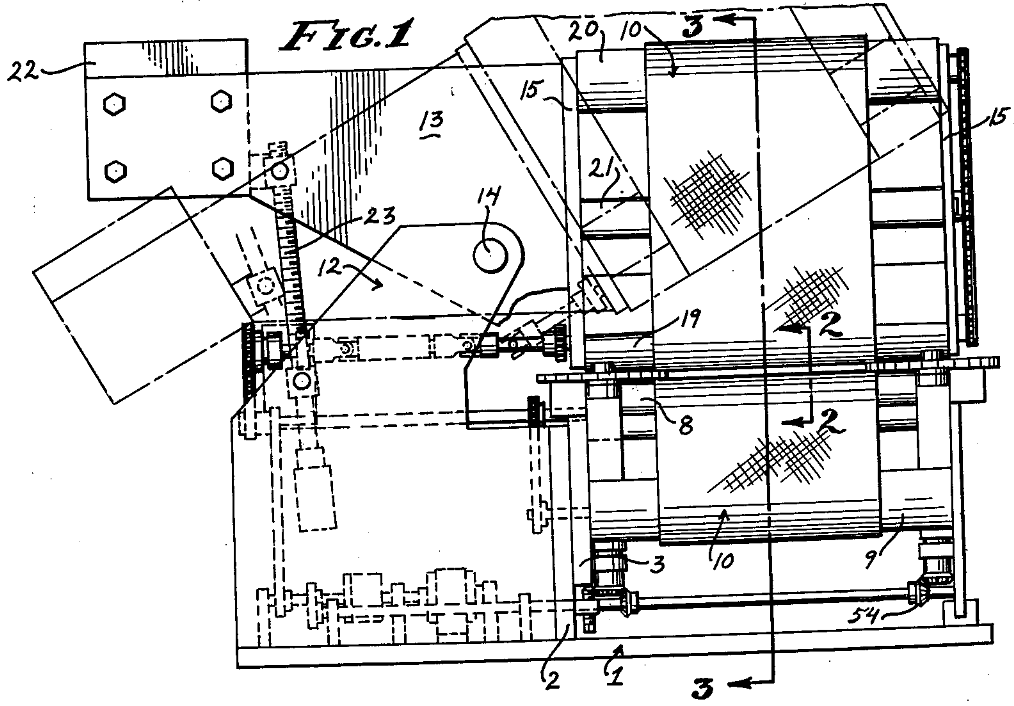
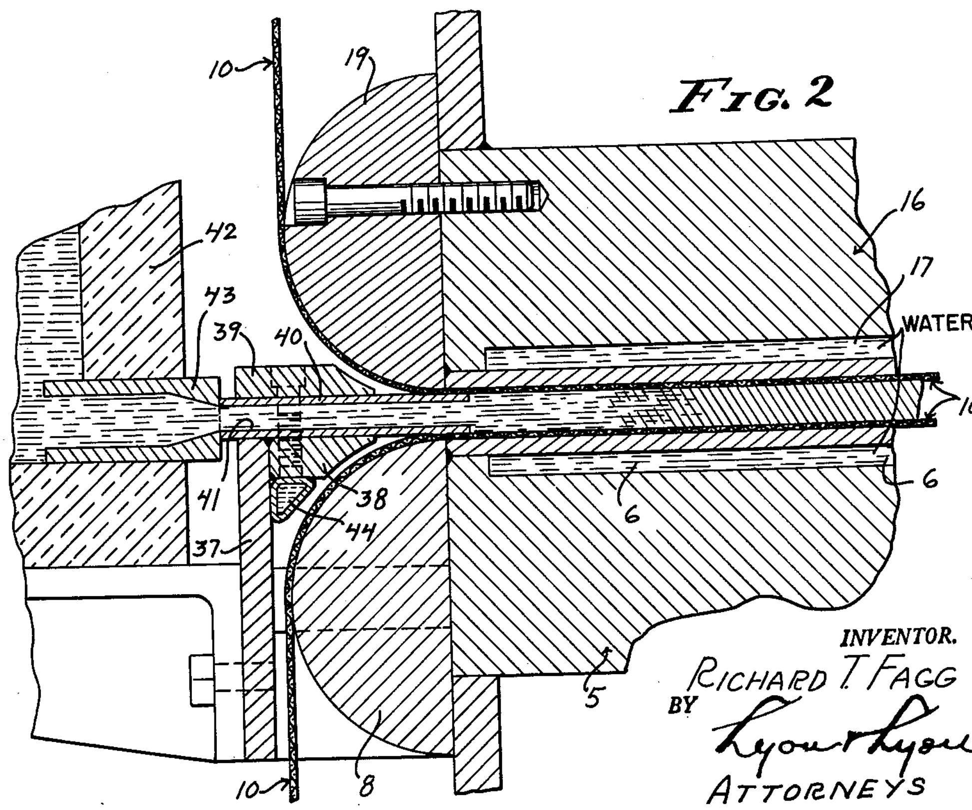


FIG. 2



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CONTINUOUS METAL CASTING MACHINE

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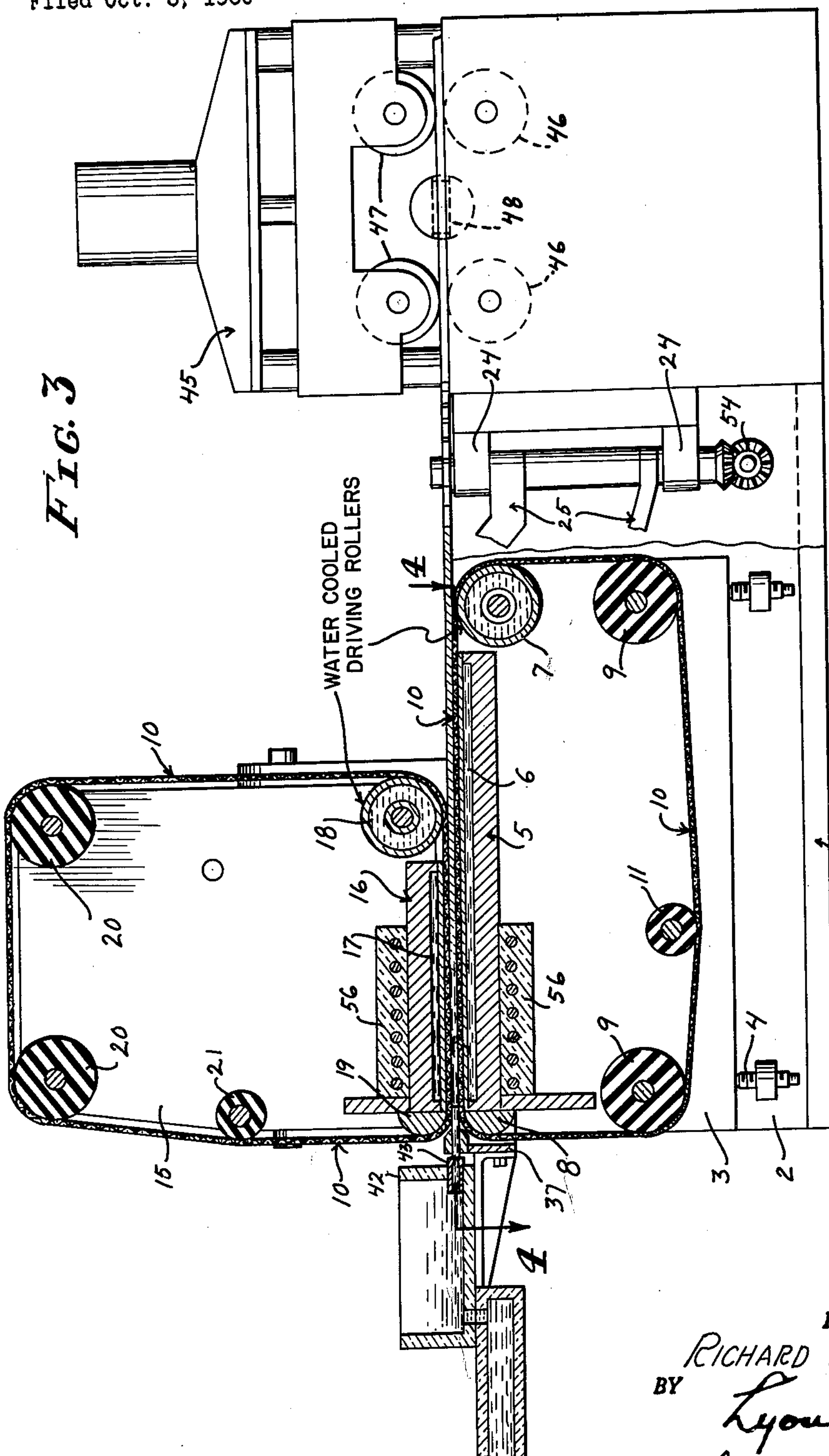
FIG. 3



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CONTINUOUS METAL CASTING MACHINE

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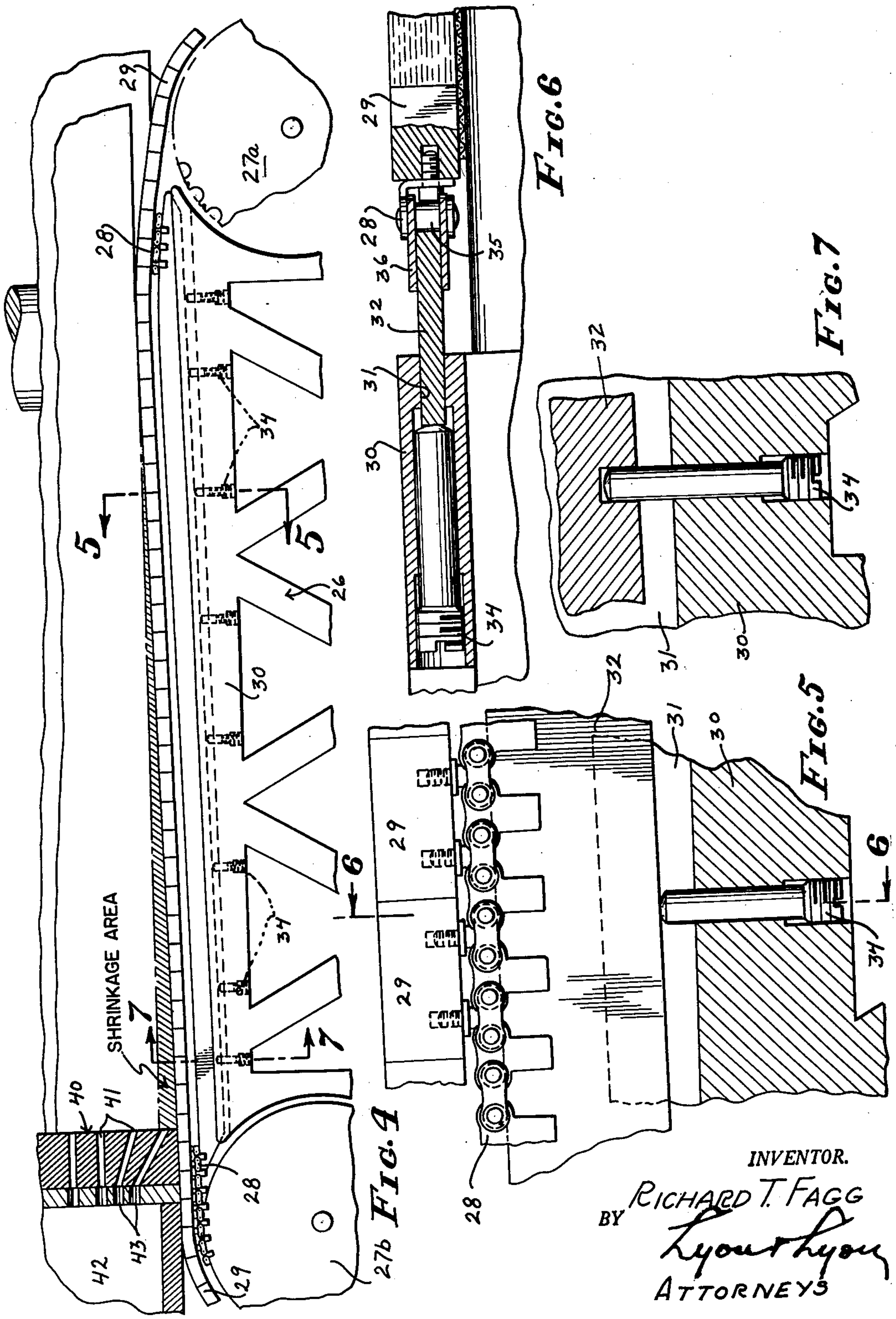

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FIG. 8

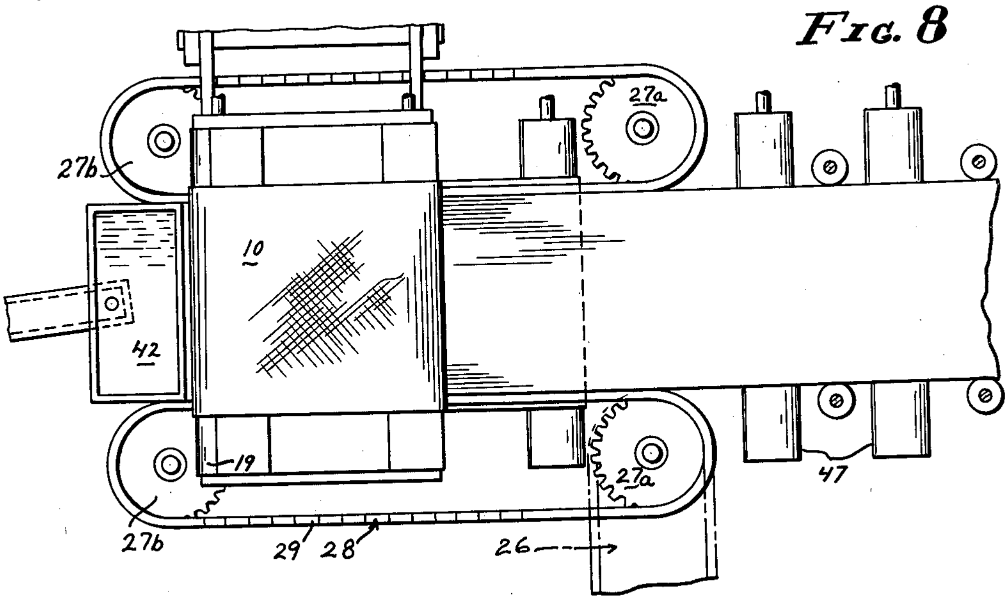
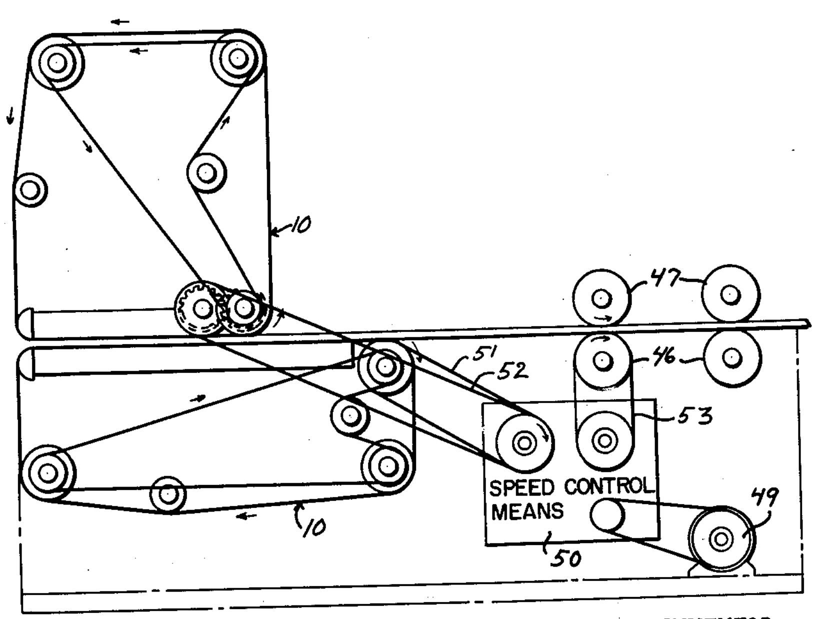


FIG. 9



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CONTINUOUS METAL CASTING MACHINE

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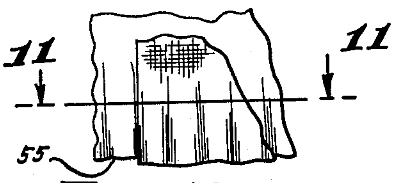

FIG. 10

FIG. 11

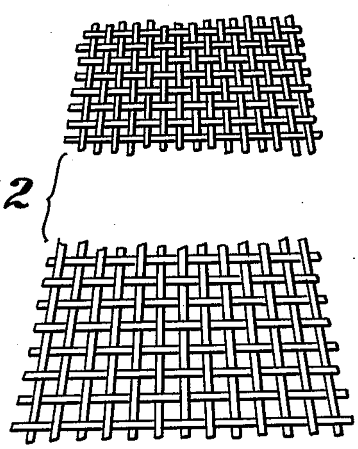

FIG. 12

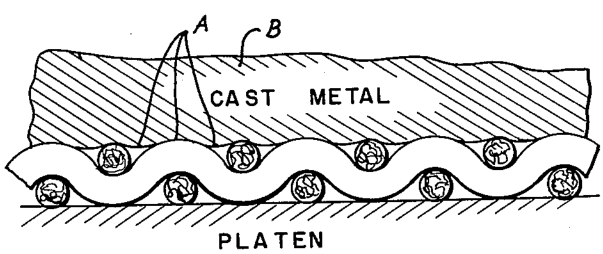

FIG. 13

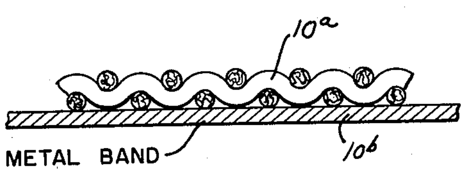

FIG. 14

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United States Patent Office

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Patented Nov. 19, 1963

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CONTINUOUS METAL CASTING MACHINE

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Filed Oct. 3, 1960, Ser. No. 59,953
7 Claims. (Cl. 22—57.4)

This invention relates to continuous metal casting machines, more particularly to machines wherein the metal is cast in a continuously moving mold chamber formed of top and bottom bands and closed by side bands.

One of the major problems inherent in a conventional metal casting machine utilizing casting bands is apparently due in part to localized buckling of the metal band due to contact with the hot metal. When cold sheet metal, such as a water-cooled band, is brought into contact with the molten metal, the surface of the sheet next to the hot metal becomes hotter than the surface exposed to the cold water. Expansion of the hot sides results in a bowing or buckling of the band in the direction of the hot metal. Simultaneously, the molten metal starts to solidify from its surfaces inward; but because of the buckling of the metal band, heat transfer from the metal to the band is not uniform. This results in an irregular grain growth of the solidifying core of the metal. The nonuniform cooling develops porous spots and a nonuniform density of the cast strip. This is particularly serious if the cast strip is to be fabricated or rolled, as further working cannot be successful.

The problem is compounded by the fact that the metal being cast undergoes substantial shrinkage as it changes from its liquid to its solid state. If the metal being cast is aluminum, it passes through what is termed a "hot short" state in which maximum shrinkage occurs, and the metal has virtually no tensional strength. This is particularly true of many high strength aluminum alloys. The frictional contact between the metal casting and the metal is such as to subject the metal being cast to tensional loads sufficient to cause cracking of the product.

The objects of this invention seek to overcome the difficulties outlined, and include:

First, to provide a continuous metal casting machine wherein the upper and lower moving bands are capable of contracting as the metal cools. More particularly, these bands are formed of woven material so that as the metal shrinks in passing from its liquid phase it is not required to slide relative to the casting bands; instead, the casting bands likewise shrink, thus avoiding, or at least minimizing, tension loads on the metal, especially during its "hot short" period.

Second, to provide a continuous metal casting machine which utilizes for the casting bands woven fiberglass backed by a chilling platen, the weave of the fiberglass being superficially interlocked mechanically with the surface of the metal so that the woven fabric "gathers" uniformly as the metal shrinks, without developing wrinkles.

Third, to provide a continuous metal casting machine wherein the woven fiberglass casting belts functions as a heat barrier to control heat transfer from the molten metal to the platen, to minimize thermal shock on the cooling platen and eliminate thermal fatigue of the surface of the cooling platen; and furthermore controlling the rate of heat extraction from the solidifying metal thereby producing a more uniform grain structure in the cast product.

Fourth, to provide a continuous metal casting machine which incorporates novel edge casting bands or dams which move inward between the top and bottom casting bands to compensate for lateral shrinkage of the metal being cast.

Fifth, to provide on the whole a continuous metal cast-

ing machine which produces a particularly uniform, high strength product ideally suitable for further working.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings in which:

FIGURE 1 is an end view of the continuous metal casting machine, showing the metal-receiving end thereof with the metal supply nozzle and reservoir removed, and indicating by broken lines the manner in which the upper part of the machine is tilted;

FIGURE 2 is an enlarged, fragmentary, sectional view, showing the entrance end of the machine, with the metal reservoir and nozzle also shown fragmentarily;

FIGURE 3 is a longitudinal, sectional view of the machine taken substantially through 3—3 of FIGURE 1;

FIGURE 4 is an enlarged, fragmentary sectional view taken substantially through 4—4 of FIGURE 3, showing one of the edge casting assemblies;

FIGURE 5 is a further enlarged, fragmentary, sectional view through 5—5 of FIGURE 4;

FIGURE 6 is a fragmentary, sectional view through 6—6 of FIGURE 5;

FIGURE 7 is a fragmentary, sectional view through 7—7 of FIGURE 4;

FIGURE 8 is a substantially diagrammatical plan view of the machine;

FIGURE 9 is a substantially diagrammatical side view thereof;

FIGURE 10 is a greatly enlarged, fragmentary, front view of one of the guide bars, indicating the ribs therein which tend to spread the casting band;

FIGURE 11 is a still further enlarged, fragmentary, sectional view thereof, taken through 11—11 of FIGURE 10;

FIGURE 12 is an enlarged, fragmentary, diagrammatical, plan view of one of the woven casting belts to indicate the manner in which the fabric shrinks longitudinally and transversely with the metal as the metal cools;

FIGURE 13 is a greatly exaggerated, fragmentary, sectional view, showing the relationship of a platen, fabric belt, and the metal cast;

FIGURE 14 is another fragmentary, sectional view, similar to FIGURE 13 but at a reduced scale, showing a modified fabric belt with an underlying metal band.

The continuous metal casting machine rests on a base frame **1** which includes a pair of spaced vertical plates **2**. Inwardly of the vertical plates **2** is a pair of adjustable vertical plates **3**, the position of which is determined by adjustment screws **4**. The adjustable vertical plates **3** support between their upper ends a bottom platen **5** in which is incorporated suitable ducts or a chamber **6** for the circulating of a coolant, such as water.

Rearwardly of the platen **5** is a water-cooled drive roller **7**. At the forward end of the platen **5** is a semicircular guide bar **8**. Below the drive roller **7** and guide bar **8** are guide rollers **9** which, with the drive roller **7** and guide bar **8**, define a rectangle around which is wrapped a casting band **10**. The casting band is formed of woven material and will be described in more detail hereinafter. Between the guide rollers **9** is a skewing roller **11** which may be positioned slightly out of parallel with the guide rollers **9** so as to effect lateral adjustment of the casting band **10**.

At one side of the vertical plates **2** is a mounting bracket structure **12** which pivotally supports a frame structure **13** on a pivot shaft **14**. The frame structure **13** includes spaced side plates **15**, which are connected at their lower ends by a top platen **16** similar to the bottom platen **5** except that it is somewhat shorter. Suitable cooling ducts or a cooling chamber **17** are provided within the top platen **16**.

Rearwardly of the top platen **16** is a water-cooled drive roller 18, and forwardly of the top platen is a semicylindrical guide bar 19 corresponding to the guide bar 8. Above the guide bar and drive roller, to define therewith the corner of a rectangle, is a pair of guide rollers 20, and between the guide bar 19 and one of the guide rollers 20 is a skewing roller 21 corresponding to the roller 11. A casting band 10, identical to the casting band which passes over the bottom platen 5, is wrapped about the drive roller, guide rollers, and guide bar. By reason of the fact that the upper platen 16 is shorter than the lower platen 5, the guide rollers 20 are spaced a further distance from the upper platen 16 than the guide rollers 9 with respect to the bottom platen 5, so that identical casting bands 10 may be used.

The frame structure 13 may be provided with a counterweight 22 and a suitable tilting screw 23 for the purpose of moving the upper platen 16 and its associated assembly between the solid and broken line positions shown in FIGURE 1.

Suitably supported by brackets 24 rearwardly of the bottom platen 5 and associated assembly is a pair of frame structures 25, indicated fragmentarily in FIGURE 3, which supports a pair of edge casting assemblies 26 adapted to be pivoted between the solid and broken line positions indicated diagrammatically in FIGURE 8. More particularly, as shown best in FIGURES 4, 5, 6, and 7, each edge casting assembly 26 includes a sprocket wheel 27*a* and guide wheel 27*b* around which passes a chain 28.

The sprocket and guide wheels 27*a* and 27*b* have vertical axes, and the axis of the rear or sprocket wheel 27*a* may coincide with the axis of rotation of the frame structure 25 on the corresponding mounting bracket 24. The forward wheel 27*b* of each edge casting assembly 26 is located slightly forward of the bottom platen 5. The plane defined by the wheels 27*a* and 27*b* and chain 28 of each assembly lies between the lower and upper casting bands.

Each chain 28 is provided with a series of edge casting segments 29 so connected to the links of the chain that when the chain is straight the ends of the segments are in contiguous relation with each other. One of the reaches of each chain is so positioned that the segments 29 carried thereon may pass between the upper and lower casting bands.

Extending between the wheels 27*a* and 27*b* of each assembly 26 is a bridging frame 30 having a retainer channel 31 adapted to receive a track bar 32, which bears against the backside of the corresponding chain 28 to guide the edge casting segments 29 between the casting bands 10. The edge bar is backed by set screws 34, and its surface confronting the chain is contoured so that with proper adjustment of the set screws the edge casting segments 29 may be moved inwardly so as to pass between the forward and rearward wheels 27*a* and 27*b* to compensate for lateral shrinkage of the metal cast therebetween.

In order to facilitate the use of the track bar 32, the chains 28 are of the type having rollers 35 which ride on the edge of the track bar. In addition, the chains may be provided with lugs 36 which overlie and underlie the track bar, as shown best in FIGURE 6. One or more of the set screws 34 may project into mating sockets in the track bar 32 so as to restrain the track bar against longitudinal displacement.

Forwardly of the guide bar 8 is a cross bar 37 to which is welded a lower nozzle block clamp 38 adapted to cooperate with an upper nozzle block clamp 39 to secure a nozzle block 40 therebetween. The ends of the clamps 38 and 39 confronting the lower and upper guide bars 8 and 19 are beveled to clear the casting bands 10. The nozzle block 40 is formed of suitable heat-resistant material, such as a ceramic material, and is adapted to extend between the casting bands 10 at the region in which the casting bands move onto their respective platens and are in parallel relation.

The nozzle block 40 is approximately equal in thickness to the thickness of the band of metal to be cast, and is provided with a series of axially extending passages 41. The passages near the lateral ends of the nozzle block 40 may diverge so that molten metal may be distributed uniformly across the casting bands. The nozzle block is located slightly rearward of the forward wheels 27*b* of the edge casting assemblies 26, as indicated in FIGURE 4.

Forwardly of the nozzle block 40 is a reservoir 42 having a suitable nozzle 43 which may be brought into registry with the nozzle block 40, as indicated in FIGURE 2. Molten metal is supplied in any conventional manner to the reservoir 42 and discharged through the nozzle 43 and nozzle block 40 into the space between the casting bands 10 and the edge casting segments 29. If desired, a coolant tube 44 may be provided under the lower clamp 38 to minimize warping of the lower clamp, as shown in FIGURE 2.

Located rearwardly of the mounting brackets 24, that is rearwardly of the drive roller 7, is a feed control unit 45. The feed control unit includes framework which supports a set of lower rolls 46 and a set of upper rolls 47. These rolls are so adjusted as to grip opposite surfaces of the cast metal and withdraw the solid metal as it emerges from between the casting bands. Edge rolls 48 are provided to effect lateral adjustment of the solid cast metal passing between the rolls 46 and 47.

The lower and upper casting units include respectively the bottom platen 5, top platen 16, edge casting assembly 26, and feed control unit 45 and are synchronized in their operations by suitable drive means, indicated in part in FIGURE 1, and may be located at one side of the base frame 1. For purposes of illustration, however, reference is made to the diagrammatical view shown in FIGURE 9.

The drive means includes a motor 49 which supplies power to a speed control means 50 having suitable output drives 51, 52, and 53 leading respectively to the feed control unit 45, lower drive roller 9, and upper drive roller 18. In addition, an output drive, which includes the bevel gears 54 shown in FIGURE 3, operates the rear sprocket wheels of the edge casting assemblies 26. The speeds of the various drives are so coordinated by conventional means that the casting belts and edge casting segments move at essentially the same speed, and the feed control unit 45 is adjusted to remove the cast material at the proper rate to minimize tensile or compression loads on the material as it is being cast.

It is essential to the operation of the machine that the casting bands 10 be formed of woven material capable of contracting, both longitudinally and transversely, in correspondence with the shrinkage of the metal as it cools from its molten state to its fully solid state.

It has been found that, for the purposes of casting aluminum, glass cloth may be used as the material comprising the casting bands. This is true even though the glass cloth would soften or weaken if heated to the temperature of the molten aluminum. In practice this does not occur because of the contact between the glass cloth and the cooled platen.

In other words, although the glass cloth has insulation properties, nevertheless it is capable of conducting heat at a sufficient rate to prevent destruction of the surface in contact with the molten metal. In practice, a single glass cloth belt may last for a continuous run of several days duration without replacement. The glass cloth is inherently sufficiently inexpensive to warrant its replacement at the end of each normal run.

The insulation properties of the glass cloth diffuse the heat from the molten metal to the chilled platen to the extent that the platen is protected from excessive temperature shock, and consequently the life of the platen is greatly extended. The fixed platens reach a stable and constant state of temperature gradient during the casting run, and are not subject to alternate heating and cooling as in the case of the casting bands.

The woven fabric offers a particular advantage over a solid or sheet metal band, platen, or roll shell. When such metal band, or the like, is heated on one side and cooled on the other, or a temperature differential is set up, the hot side expands relative to the cool side, and because of its rigid nature the band will raise or buckle away from the cool side. This does not happen with a flexible woven fabric.

Furthermore, if the metal band is restrained against buckling, or if the member is a heavily reinforced platen or roll, the surface still expands and the surface is put into compression. If the surface is repeatedly heated and cooled, thermal fatigue and surface cracking or "crazing" results. This does not happen with the use of a flexible woven fabric.

A still further important feature resulting from the use of a woven fabric is, that it is free to contract or shrink in precise correlation with the shrinkage of the metal as it passes from the molten to its fully solid state. The metal, which does not wet the woven material, bridges over the interstices and, apparently, effects a superficial mechanical interlocking with the surface, so that as each unit of metal corresponding to the distance between adjacent strands of the woven material shrinks, the strands readily move closer together without imparting tensile loads on the metal being cast. This is particularly important during the critical stage wherein the metal is essentially in a semisolid state and almost devoid of tensile strength. At this critical stage, any resistance to shrinkage of the metal will result in improper bonding of the crystals of the metal. In fact, to obtain this unrestrained shrinkage of the metal has been one of the major problems encountered in the use of the conventional casting machine.

In order to visualize the shrinkage of the woven material which occurs both longitudinally and transversely, reference is made to FIGURE 12. In shrinking, the strands individually do not change in dimension, but the space between the strands decreases. It is not necessary that the material comprising the strands shrink in proportion to the shrinkage of the cast metal, for the reason that the reduction in space between the strands merely increases slightly the corrugations of the individual strands. No appreciable work is required to accomplish this; therefore, no appreciable resistance to shrinkage is transmitted from the woven material to the cast metal. Correlation of the shrinkage of the woven material and the cast metal is probably enhanced by the fact that the metal in bridging between the strands effects a superficial mechanical interlock as represented by the undulations A of the cast metal B shown in FIGURE 13.

While a wide range of glass cloth may be utilized for the casting bands, one commercial grade of cloth used, because it is readily available, is approximately .0067" in average thickness, and has 32 strands per inch in one direction and 42 strands per inch in the transverse direction. Each strand, of course, comprises many fibers of glass.

It should be understood, however, that other weaves of glass cloth may be used. In fact, depending upon the nature of the metal being cast, woven metal fabric may be used. It is essential, of course, that whatever material is used for the fabric it must be unwettable by the material being cast. In the use of metal fabric, the metal may have an oxide coating or may be of such an alloy as to resist wetting.

While it has been found satisfactory to use a casting band **10** solely of woven material, it is possible to use a laminated casting band having an outer layer of woven material and an inner layer of sheet material, as shown in FIGURE 14. In this case, the outer layer **10***a* may be glass cloth or other fabric, whereas the inner layer **10***b* may be formed of sheet metal. The sheet metal in effect becomes a moving platen, and in practice its underside may be in direct contact with a coolant. Inasmuch as thin metal bands are even more subject to thermal shock than a heavy platen, the function of the woven material, particularly if this be a material having insulation qualities such as glass cloth, is highly desirable.

Due to the fact that the metal tends to shrink the casting bands **10** laterally, during the casting operation, it is desirable to utilize a conventional means for effecting lateral stretching of the casting bands. It is a conventional practice to provide, in machinery utilizing fabric conveyor bands, or the like, special rollers which are grooved or otherwise arranged to wipe laterally on the cloth to effect this result.

One means of accomplishing this is illustrated in FIGURES 10 and 11. This means consists essentially in providing rudimentary or shallow grooves **55** on the guide bars **8** and **19**. The grooves are directed helically in a right and left direction from the center of the guide bars so as to exert a lateral wiping force on the casting bands **10** as they pass thereover. It should be noted, however, that glass cloth has inherently a degree of elasticity which in itself tends to function in a manner to effect lateral spreading of the fiber glass cloth, once it is freed from the shrinking effect of the metal.

It is highly desirable that the surfaces of the platens be as flat as possible under operating conditions. Even though water cooled, some warping or bowing of the sides receiving heat from the metal occurs. While this may be, in theory, compensated for by initially hollow-grinding the surfaces, it is difficult to accomplish in practice. Compensation also may be accomplished by placement of strip heaters **56** below and above the platens **5** and **16**, respectively. These heaters expand the remote sides of the platen in correspondence with expansion of the proximal sides thereof. By adjusting the heat supplied and judiciously determining the placement of the strip heaters, satisfactory compensation is achieved so that the cross section of the material being cast may be accurately controlled.

While a particular embodiment of this invention has been shown and described, it is not intended to limit the same to the exact details of the construction set forth, and it embraces such changes, modifications, and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

What is claimed is:

1. A machine for casting metals in the form of a continuous sheet of substantially greater width than thickness, comprising:

a. a horizontal platen having a flat upper surface defining a wide side of a mold cavity;

b. means for cooling said cavity;

c. a woven casting cloth band overlying said platen, said casting cloth being formed of strands that are resistant to damage by the high temperature of the molten metal and non-wettable thereby, and also being limp and flexible, whereby the weight of the molten metal filling the mold cavity presses the casting cloth down into good, heat-conducting contact with said platen;

d. said casting cloth having interstices and surface irregularities that are impressed upon the surface of the metal when the metal solidifies, whereby the casting cloth is frictionally adhered to the surface of the metal and caused to contract with the metal as the metal shrinks transversely during solidification and cooling;

e. and means for advancing said casting cloth at a uniform rate.

2. A machine for casting metals in the form of a continuous sheet of substantially greater width than thickness, comprising:

a. a horizontal platen having a flat upper surface defining a wide side of a mold cavity;
b. means for cooling said cavity;
c. a woven casting cloth band overlying said platen, said casting cloth being formed of strands that are resistant to damage by the high temperature of the molten metal and non-wettable thereby, and also being limp and flexible, whereby the weight of the molten metal filling the mold cavity presses the casting cloth down into good, heat-conducting contact with said platen;
d. said casting cloth having interstices and surface irregularities that are impressed upon the surface of the metal when the metal solidifies, whereby the casting cloth is frictionally adhered to the surface of the metal and caused to contract with the metal as the metal shrinks transversely during solidification and cooling;
e. means for advancing said casting cloth at a uniform rate;
f. and a pair of edge dams disposed inwardly from the opposite side edges of said platen and overlying the side margins of said casting cloth to define the narrow sides of the mold cavity;
g. said edge dams following the edge of the cast metal as the latter shrinks transversely and said casting cloth correspondingly contracts in width.

3. A machine for casting metals in the form of a continuous sheet of substantially greater width than thickness, comprising:
a. a horizontal platen having a flat upper surface defining a wide side of a mold cavity;
b. means for cooling said cavity;
c. an endless woven casting cloth band overlying said platen, said casting cloth being formed of strands that are resistant to damage by the high temperature of the molten metal and non-wettable thereby, and also being limp and flexible, whereby the weight of molten metal filling the mold cavity presses the casting cloth down into good, heat-conducting contact with said platen;
d. said casting cloth having interstices and surface irregularities that are impressed upon the surface of the metal when the metal solidifies, whereby the casting cloth is frictionally adhered to the surface of the metal and caused to contract with the metal as the metal shrinks transversely during solidification and cooling;
e. means for advancing said casting cloth at a uniform rate for continuous entry into said mold cavity;
f. a pair of traveling edge dams disposed inwardly from the opposite side edges of said platen and overlying the side margins of said casting cloth to define the narrow sides of the mold cavity;
g. said edge dams advancing with said casting cloth and converging along the line of travel thereof by an amount substanially equal to the contraction in width of the casting cloth;
h. and means for flattening out and smoothing said casting cloth band to its normal uncontracted width before again entering said mold cavity.

4. A machine for casting metals in the form of a continuous sheet of substantially greater width than thickness, comprising:
a. a pair of opposed spaced platens having parallel flat surfaces defining the wide sides of a mold cavity;
b. means for cooling said platens;
c. a pair of endless woven cloth bands overlying said flat surfaces of said platens and slidable relative thereto, said cloth bands being formed of strands that are resistant to damage by the high temperature of the molten metal and non-wettable thereby;
d. said cloth bands having interstices and surface irregularities that are impressed upon the surface of the metal while the metal is still plastic, whereby the cloth is frictionally adhered to the surface of the metal and caused to contract with the metal as the metal shrinks during solidification and cooling;
e. means for advancing said cloth bands at a uniform rate in the same direction for continuous entrance of said cloth bands into said mold cavity;
f. a pair of edge dams disposed between said cloth bands and also between said platens inwardly from the side edges of said cloth bands and platens thereby to define the narrow sides of the mold cavity;
g. the side margins of said cloth bands being free to slide between said edge dams and the adjacent platen surfaces so as to allow the cloth bands to draw inwardly as they are contracted in width by shrinkage of the cooling metal;
h. and means for flattening out and smoothing said cloth bands to their normal uncontracted width before again entering said mold cavity.

5. A machine for casting metals in the form of a continuous sheet of substantially greater width than thickness, comprising:
a. a pair of opposed horizontal fixed platens having flat parallel confronting surfaces defining the wide sides of a horizontal mold cavity;
b. a pair of traveling edge dams disposed along the side margins of said platens to define the narrow sides of said mold cavity;
c. means for cooling said platens;
d. a pair of endless woven cloth bands covering said platens, the side margins of said cloth bands being interposed between and freely slidable with respect to said platens and edge dams to permit free longitudinal travel and transverse contraction of the cloth bands with respect to the surface of the platens;
e. said cloth bands being formed of strands that are resistant to damage by the high temperature of molten metal and non-wettable thereby, and also being limp and flexible, whereby the force exerted by molten metal filling the mold cavity presses the cloth bands into good, heat-conducting contact with said platens, said cloth bands initially forming a temporary skin for the principal surfaces of the molten metal, and readily contractible therewith to prevent establishment of tension stress in the metal during its transition from the molten to the solid state;
f. means for advancing said cloth bands and said traveling edge dams over said platens at a uniform rate and in the same direction;
g. and means for flattening out and smoothing said cloth bands to their normal uncontracted width before again entering said mold cavity.

6. A machine for casting metals in the form of a continuous sheet of substantially greater width than thickness, comprising:
a. a pair of opposed horizontal fixed platens having flat confronting surfaces;
b. means for cooling said platens;
c. a pair of endless woven cloth bands having reaches covering said platens;
d. said cloth bands being formed of strands that are resistant to damage by the high temperature of molten metal and non-wettable thereby, and also being limp and flexible, whereby the force exerted by molten metal filling the mold cavity presses the cloth bands into good, heat-conducting contact with said platens, said cloth bands initially forming a temporary skin for the principal surfaces of the molten metal, and readily contractible therewith to prevent establishment of tension stress in the metal during its transition from the molten to the solid state;
e. a pair of endless edge dams having reaches disposed between the margins of said cloth bands;
f. means for advancing said cloth bands and edge dams in unison;
g. said cloth bands being frictionally adhered to the surface of the metal and caused to contract in width

with the metal as the metal shrinks transversely during solidification and cooling;

h. the side margins of said cloth bands being free to slide between said edge dams and the adjacent platen surfaces so as to allow the cloth bands to draw inwardly as they are contracted in width by shrinkage of the cooling metal;

i. said edge dams converging along the line of travel by an amount substantially equal to the contraction in width of the casting cloth;

j. and means for flattening out and smoothing said cloth bands to their normal uncontracted width before again entering said mold cavity.

7. A machine as set forth in claim 6, wherein:

a. a feed spout extends into the entrance end of said mold cavity between said cloth bands and edge dams, said spout being spaced from said platens to provide clearance for free movement of said cloth bands between said platens and feed spout, and said edge dams contacting opposite sides of said feed spout in sliding engagement therewith.

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