Feb. 18, 1969 T. A. CUSCINO 3,428,112

VERTICAL CONTINUOUS CASTING ASSEMBLY HAVING A TORCH CUT-OFF APPARATUS

Filed Sept. 21, 1965 Sheet 1 of 5

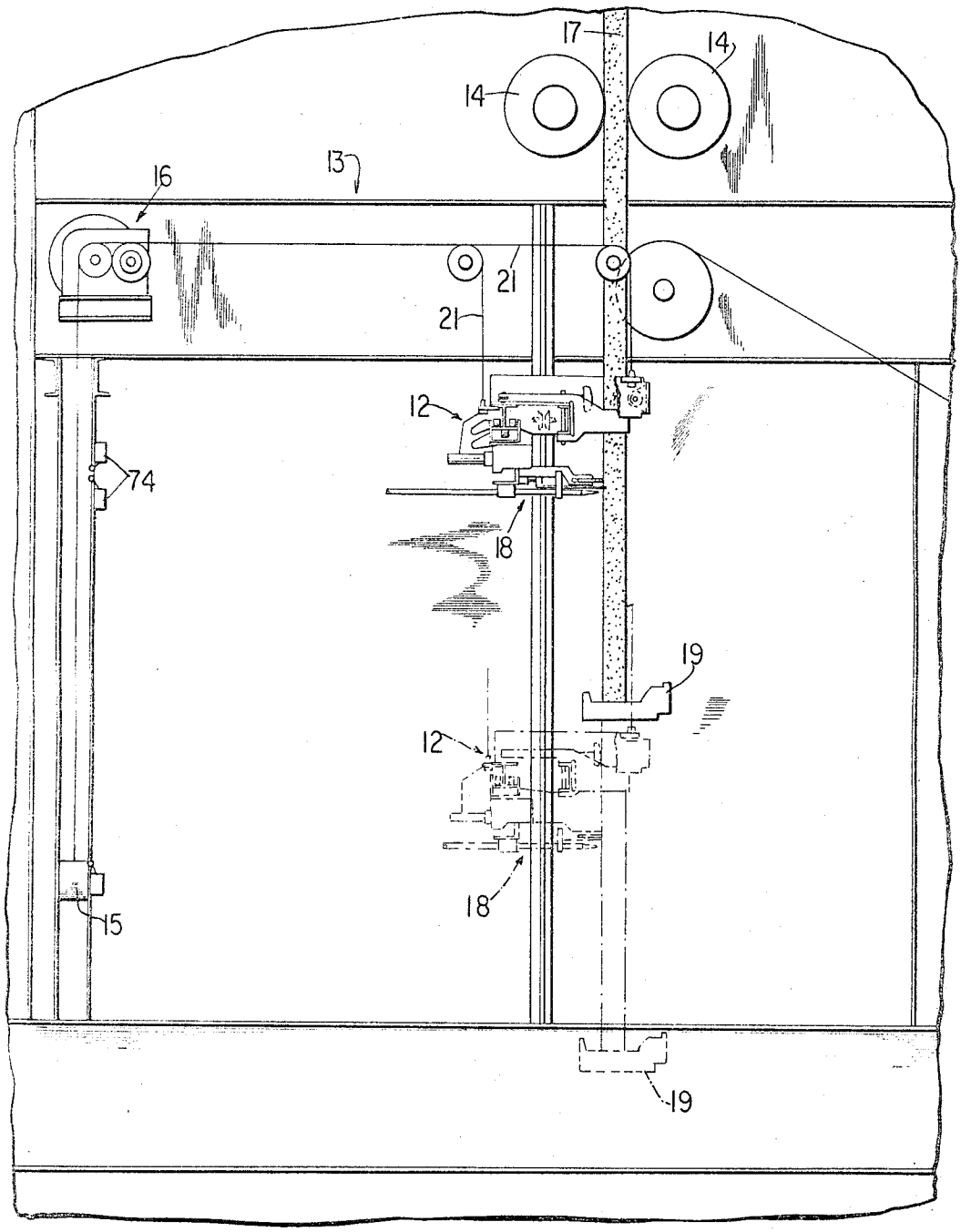

FIG. 1

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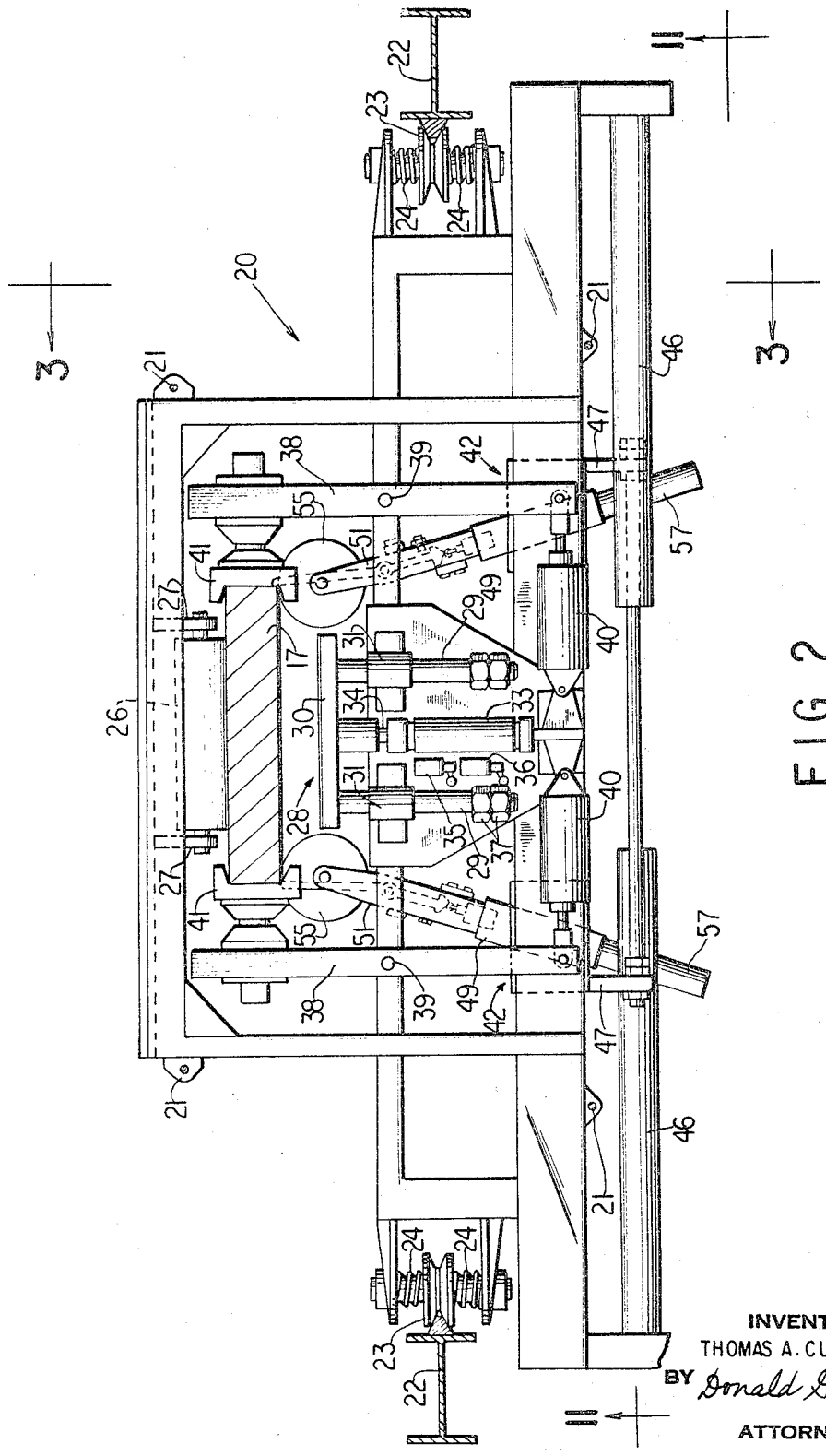

FIG. 2

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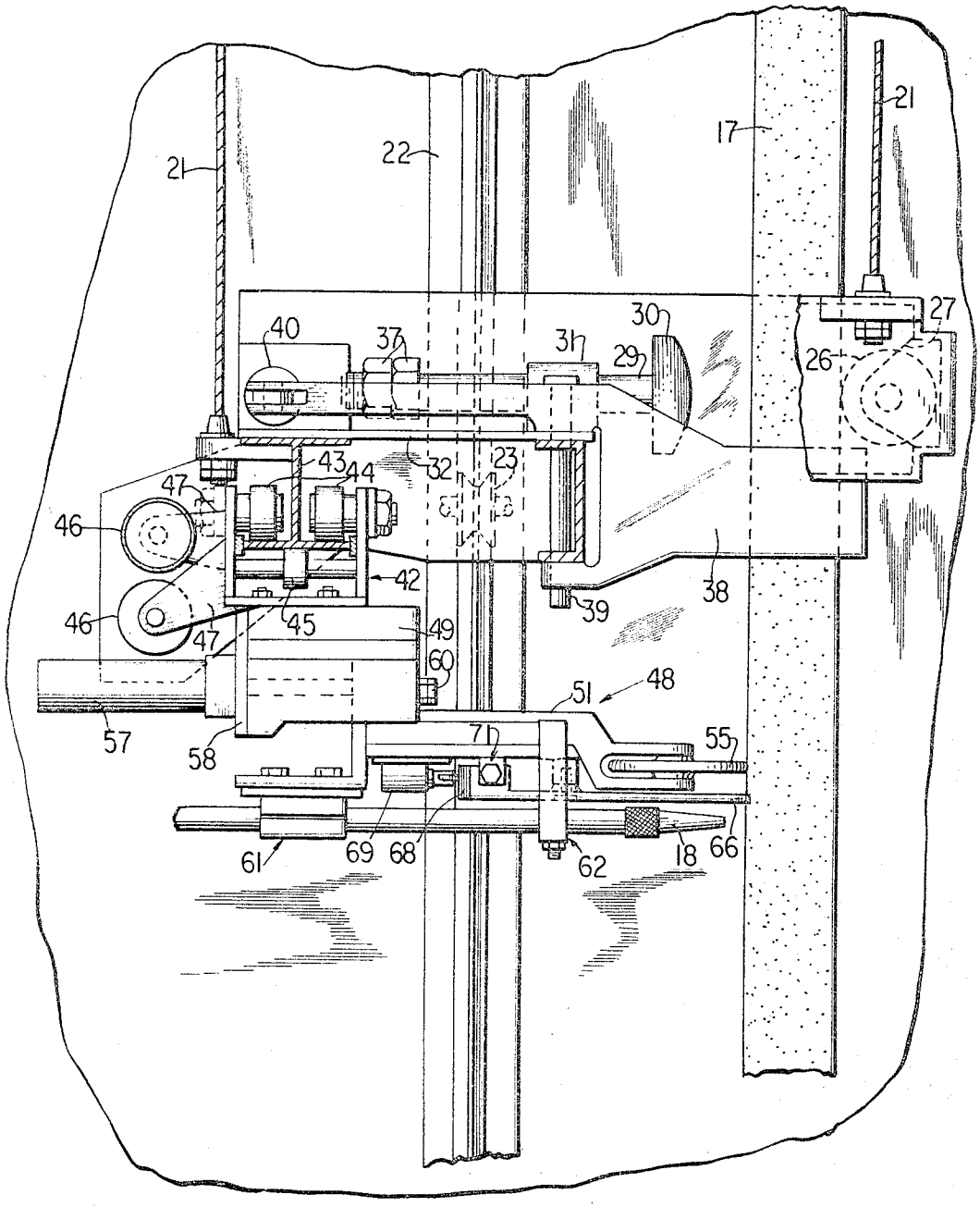

FIG. 3

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VERTICAL CONTINUOUS CASTING ASSEMBLY HAVING A TORCH CUT-OFF APPARATUS

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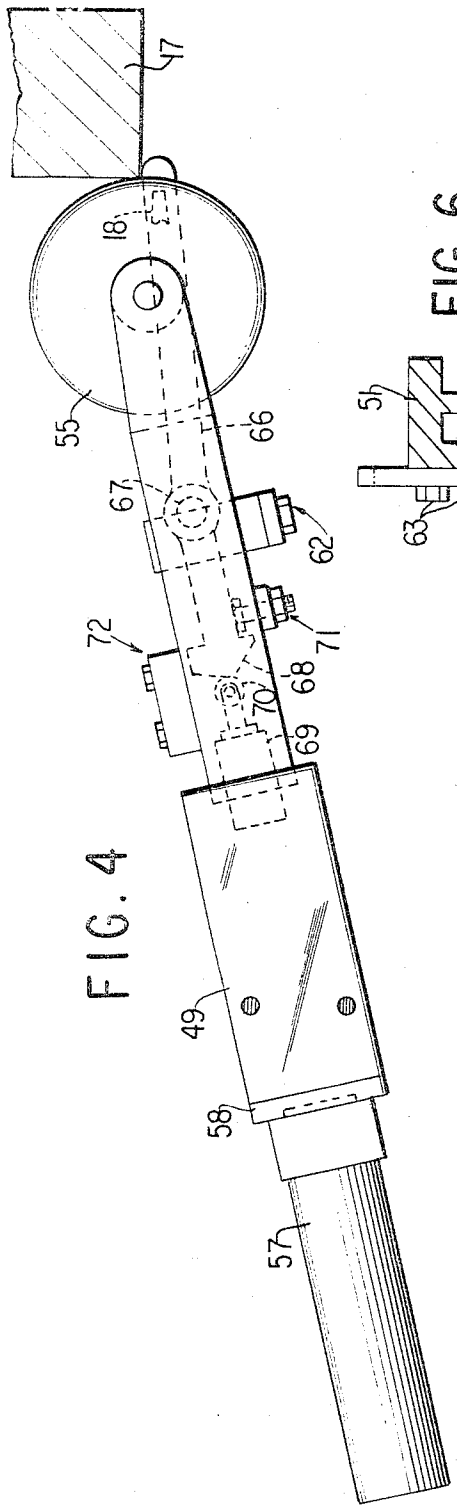

FIG. 4

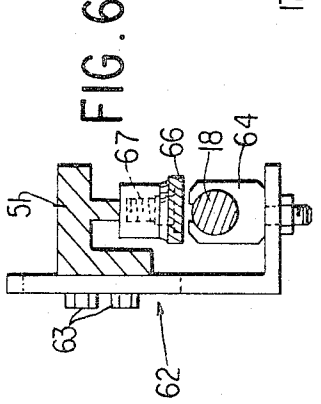

FIG. 6

FIG. 5

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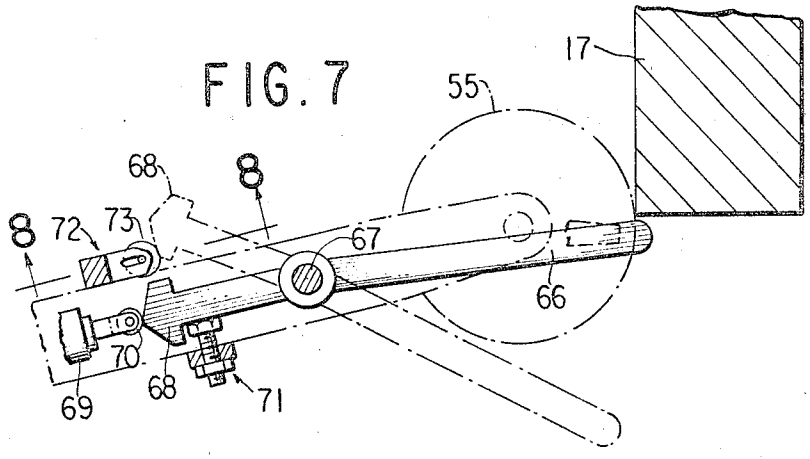
FIG. 7



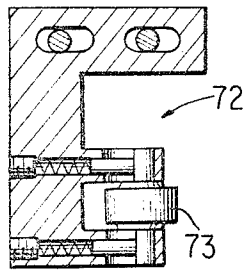


FIG. 8

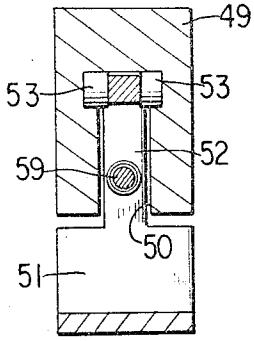


FIG. 9

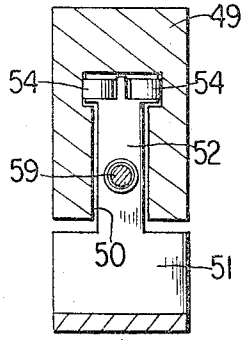


FIG. 10

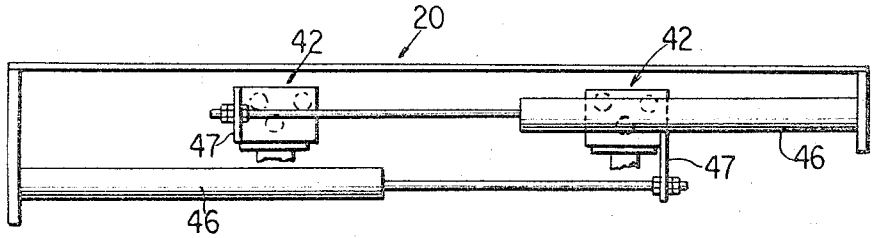


FIG. 11

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3,428,112

VERTICAL CONTINUOUS CASTING ASSEMBLY HAVING A TORCH CUT-OFF APPARATUS

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U.S. Cl. 164—154 2 Claims
Int. Cl. B22d *31/00*; B23k *1/20*

ABSTRACT OF THE DISCLOSURE

Apparatus for cutting a continuously cast slab into lengths comprises a frame through which the slab descends, mounted to travel with it during cutting. Clamp means on the frame engage the slab faces and edges. Torch-mounting carriages travel on the frame across the slab width. A gaging wheel retractably mounted on each carriage rolls on the slab face and positions the torch tip relative thereto. A "feeler" arm pivoted on each carriage engages the slab edge before the torch comes into line therewith and starts a preheating flame which is subsequently altered to a cutting flame as alinement of the torch with the slab edge occurs.

This invention relates to a vertical torch cut-off apparatus for cutting a steel casting, e.g., a slab produced by a continuous casting process.

It has been customary to provide for this operation a pair of cut-off torches mounted on a traveling frame through which the casting passes downwardly. However, because the casting has an irregular movement in a lower temperature range, i.e., 1400° F., resulting from bulging and bending, an accurate positioning of the cut-off torches with respect to the casting has not been achieved, resulting in a missed cut and consequently a stoppage of casting.

This invention provides a torch cut-off apparatus with means clamping it to a vertically moving steel casting during the cutting operation and an accurate torch positioning means including an adjustable mounting for the torch carriage of the cut-off apparatus and a cooperating adjustable casting locating means which permits the torch carriage to come and go with the casting depending upon the bend thereof. In addition, the torch positioning means includes a spring biased tracer means which rides against the casting so as to follow the surface contour thereof and is mounted with respect to the tip end of the torch so as to maintain an accurate position of the torch relative to the casting.

The details and advantages of the invention will be more apparent from the following detailed description of an embodiment thereof when taken in conjunction with the accompanying drawings in which:

FIG. 1 is an elevational view of the mechanism of the vertical torch cut-off apparatus of this invention in conjunction with a continuously formed casting to be severed;

FIG. 2 is a plan view of the vertical torch cut-off apparatus of the invention;

FIG. 3 is a view taken at line 3—3 of FIG. 2;

FIG. 4 is a plan view of the sensing means in cooperation with a steel casting;

FIG. 5 is a side view of the sensing means of FIG. 4;

FIG. 6 is a view taken at line 6—6 of FIG. 5;

FIG. 7 is a view taken at line 7—7 of FIG. 5;

FIG. 8 is a view taken at line 8—8 of FIG. 7;

FIG. 9 is a view taken at line 9—9 of FIG. 5;

FIG. 10 is a view taken at line 10—10 of FIG. 5; and

FIG. 11 is a view taken at line 11—11 of FIG. 2.

Referring initially to FIG. 1, a vertical torch cut-off

apparatus 12 is incorporated into a continuous casting frame assembly 13 near the lower level, i.e., in the cut-off chamber. The vertical torch cut-off apparatus is initially held in its upper position as shown in solid lines below the pinch rolls 14 by the counterweight 15 and hoist brake 16. After the desired length to be severed from the steel casting 17 has passed in front of the torches 18, the cut-off apparatus 12 is clamped to the casting 17 and the hoist brake 16 is released so that the cut-off apparatus 12 moves with the casting 17 to the position shown in phantom. At this position the cutting torches 18 will have severed a length from the casting 17 and the severed length of casting will drop into a receiving basket 19 for delivery out of the frame structure 13. In addition, the cut-off apparatus 12 will be disengaged from the casting 17 and the apparatus 12 will return by way of a hoist clutch to its upper position where the hoist brake is again engaged. The cut-off apparatus is then in place to begin the next cut.

Referring to FIGS. 2 and 3, the vertical torch cut-off apparatus 12 includes a carriage frame 20 which is supported by suitable hoist chains 21 and surrounds the casting 17. The carriage frame 20 moves vertically on suitable guideways 22 and has a pair of wheels 23, each of which is spring mounted in a transverse horizontal direction so to allow the frame 20 to move horizontally with respect to the guideways 22. The springs 24 which allow the movement of the frame 20 are designed with less pressure than usual to permit limited movement, for example, two and one-half inches in either transverse direction. In addition, where necessary, the flanges of the frame 20 are cut out to allow the limited movement.

The frame 20 mounts an adjustable casting locating means including a rotatable back-up roll 26 which is suitably mounted by brackets 27 on the frame 20 and a locating cylinder means 28, comprising a pair of shafts 29 which mount a bumper head 30 for reciprocal movement toward and away from the back-up roll 26. The shafts 29 are guided in suitable members, such as pillow blocks 31, secured to a support plate 32 in the carriage frame 20. The shafts 29 and bumper head 30 are actuated through a hydraulic cylinder 33 having its piston rod 34 secured to head 30. A pair of limit switches 35, 36 cooperate with nuts 37 on one of the shafts 29 to control the limits of movement of the locating cylinder means 28 by activating or deactivating the cylinder 33.

In operation, the bumper head 30 is initially in the position shown in FIG. 2; however, when the casting 17 is in the cut-off position, the bumper head 30 is moved towards the back-up roll 26 so as to position the casting 17 therebetween. It is noted that, depending on the transverse bend and position of the casting 17, the carriage frame may also move transversely through springs 24 with respect to the casting 17. After positioning of the casting relative to the carriage frame is effected, a pair of clamps 38 are brought into engagement with the edges of the casting 17.

The clamps 38 are pivotally mounted on the carriage frame 20 on suitable pins 39 and are actuated by hydraulic cylinders 40 which are also mounted on the frame 20. Each clamp 38 has a shoe 41 mounted at its free end which is adapted to abut against the sides of the casting 17. The shoes 41 can be of any length to accommodate the size of the casting so as to maintain a secure clamping force. Initially, the shoes 41 are spaced a suitable distance, for example, 3 inches, from the ends of the casting 17. Thus, depending on the longitudinal bend in the casting 17, the casting will always be positioned between the shoes 41 of the clamps 38.

Referring to FIGS. 3, 5 and 11, each of the torches 18 is mounted for horizontal movement longitudinally

of the casting **17** by means of a torch carrier **42**. Each torch carrier **42** travels mounted on the trolley beam **43** of the carrier frame **20** by means of a plurality of upper rollers **44** and lower rollers **45** and is actuated by a hydraulic drive cylinder and piston arrangement **46**, through a connector plate **47** (see FIG. 11). Each hydraulic drive arrangement **46** controls the movement of the respective torch carrier **42** in a manner which permits one torch **18** to cut through the casting to a point within one inch of the centerline and be retracted while the other torch cuts through the centerline to that point. The drive arrangements **46** may also control the movements of the torch carriers so that only one torch is used to cut through the entire casting.

Each torch carrier **42** carries a tracer means **48** which includes a guide block portion **49** having a T-shaped slot **50** therethrough (see FIGS. 9 and 10) and a follower head **51** having a T-shaped portion **52** movably received in the slot **50**. The T-shaped portion **52** is provided with a plurality of anti-friction rollers **53**, **54** mounted at right angles (FIGURE 5) to guide the follower head **51** within the guide block **49**. The gaging head **51** mounts a follower wheel **55** on its end which is adapted to abut and ride across the surface of the casting **17** so as to guide movement of the torch **18** relative to the casting surface contour.

The follower head **51** is biased outwardly by a spring **56** located within the slot **50**. In order to control the movement of the follower head **51**, a hydraulic cylinder means **57** is mounted on a plate **58** secured to the guide block **49** of the tracer means **48**. The cylinder means **57** has a piston rod **59** which passes through the plate **58**, the spring **56** and the T-shaped portion **52** of the follower head **51** and has a pair of nuts **60** threaded on its end. The piston rod **59** has a limited stroke which provides a limit to the spring biased movement of the tracer means. The hydraulic cylinder means **57** is actuated after the cutting operation is completed to retract the piston **59** and thereby compress the spring **56** so as to remove the tracer means from the casting **17**.

The follower head **51** mounts a torch **18** in depending manner axially below the follower wheel **55** by means of suitable brackets **61**, **62**. The tip of the torch is spaced inwardly from the periphery of the wheel **55** a suitable distance for cutting, that is, one-half inch. As shown in FIG. 6, the bracket **62** is secured to the follower head **51** by screws **63** and includes a torch support **64** through which the torch **18** passes. Since the torch **18** is securely held in place by the brackets **61**, **62** it moves with the follower head **51** in response to the movement of the wheel **55** on the surface of the casting. Thus, the torch **18** is accurately positioned with respect to the casting **17** during the cutting operation.

Before the torches **18** can cut the casting **17** it is necessary to preheat the area of the casting where the cut is to be started. Accordingly, the torch carrier **42** also carries a casting sensing means **65** which is adapted to feel the edge of the casting **17** so as to cause the torch **18** to preheat the casting in the usual manner before cutting is begun.

Referring to FIGS. 3, 4, 7 and 8, the casting sensing means **65** is mounted in depending manner from the follower head **51** above the torch **18**. The sensing means **65** includes an arm **66** which is pivotally mounted from the follower head **51** by pin **67** and has an enlarged cam head **68** at one end. The cam head **68** cooperates with a microlimit switch **69** which is adjustably mounted on the follower head **51** and has a roller **70**, to actuate the torch **18** for cutting. The arm **66** projects past the periphery of the wheel **55** so that it can "feel" the edge of casting **17** and thus cause the necessary preheating. A stop **71** is mounted on the follower head **51** to hold the arm **66** in an initial position (FIG. 4) so that it will engage the edge of the casting before the axis of torch **18** comes into line therewith. In addition, a displaceable stop **72** is adjustably mounted on the opposite side of the follower head **51** from the stop **71** to yieldably hold the sensor arm **66** in a position as shown in phantom in FIG. 7 wherein the end of arm **66** is spaced from the surface of the casting, for example, by ⅛ inch. The stop **72** is provided with a displaceable spring-pressed roller **73**.

In operation, a casting **17** descends until its lower end reaches the elevation at which the cut-off apparatus **12** is located. After the desired length of casting has passed by the torches **18**, the bumper head **30** of the casting locating means **25** is actuated to abut the casting and position it against the back-up roller **26** (depending on the bend in the casting **17**, the carriage frame **20** moves horizontally with respect to the casting to accommodate the locating means **25**). The clamps **38** are then swung into engagement with the edges of the casting **17** to secure the carriage frame thereto for downward movement with casting **17**. In the case where the casting has a bend in the direction parallel to the path of travel of the torches **18**, the clamps **38** will engage the casting in an offset relationship with respect to the carriage frame **20**. That is, since each clamp **38** is actuated independently of the other, one clamp shoe **41** will abut the casting before the other. However, there will be no further movement of the first abutting clamp shoe since the casting is sufficiently stiffer to resist lateral movement. As the carriage frame begins to descend the torch carriages are moved toward each other transversely to the casting. The follower wheels **55** abut the surfaces of the casting while the sensor arms **66** abut the edges of the casting. The torches **18** next begin to preheat the casting to the required temperature in the locality when the cut is to be made. After the required temperature is reached, the torch carriages again begin to move toward each other and the torches begin to cut the casting. The tip of each torch is bent with respect to the remainder so as to direct a flame generally perpendicularly to the casting. As the torch carriages proceed, the sensor arms **66** are moved into their respective retracted positions out of contact with the casting. After the cut is effected, the torch carriers are returned to the original positions and the carriage frames are lifted through suitable signals imparted by switches **74** (FIG. 1) to the original positions.

The cut-off apparatus achieves an accurate torch to casting positioning as well as providing for the bends in a casting. Further, it assures a clean, straight line cut through the casting while it descends vertically.

Having thus described an embodiment of the invention, it is not intended to so limit it as changes may be readily made therein without departing from the scope of the invention. Accordingly it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative only and not in a limiting sense.

What is claimed is:

1. In combination with an assembly for continuously casting metals in a vertically descending manner, a torch cut-off apparatus for cutting a continuously vertically formed metal casting comprising a vertically movable carriage frame mounted in said assembly, means mounted on said carriage frame for clamping it to the casting, a torch carrier movably mounted on said carriage frame, spring biased tracer means mounted on said torch carrier adapted to ride on the surface of the casting, and a torch mounted on said tracer means for cutting the casting, the tip of said torch being spaced inwardly of the casting-contacting end of said tracer means whereby said torch is positioned a predetermined distance from the surface of the casting during transverse movement with respect to the casting, said tracer means including a slotted guide block, a follower head reciprocably mounted in said guide block, means for moving said follower head in said guide block, and a gaging wheel mounted at the end of said follower

head adapted to engage the surface of the casting, said torch being mounted on said follower head.

2. The combination as set forth in claim 1 wherein said means for moving said follower head includes a spring biasing said follower head towards the casting and an actuating means for retracting said follower head from the casting after the casting has been cut.

References Cited

UNITED STATES PATENTS

414,841	11/1889	Illingworth	164—263
2,533,605	12/1950	Mueller	228—13 XR
2,782,488	2/1957	Anderson	228—13
3,112,537	12/1963	Hess et al.	164—263
3,237,251	3/1966	Thalmann	164—154 XR
1,887,670	11/1932	Benoit.	
2,472,951	6/1949	Klinke.	
2,474,153	6/1949	Livesay.	
2,571,196	10/1951	Bucknam et al.	
2,574,100	11/1951	Gettys et al.	
2,587,461	2/1952	Gatimel.	
2,886,305	5/1959	Strahan.	
3,291,470	12/1966	Lotz.	
2,865,443	8/1954	Rath.	
3,339,903	9/1967	Reinfeld et al.	164—282 X
3,375,862	4/1968	Boitchenko et al.	164—263

FOREIGN PATENTS

184,308	1/1956	Austria.

OTHER REFERENCES

Continuous and Pressure Casting, A.I.S.E., 1964, pp. 44, 45, 64 and 65.

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U.S. Cl. X.R.

164—263; 266—23; 228—5, 13