

United States Patent

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**[54] METHOD AND APPARATUS FOR REMOVING
ABORTED CASTINGS FROM A CONTINUOUS-
CASTING MACHINE
6 Claims, 3 Drawing Figs.**

[52] **U.S. Cl.**..... 164/70,
164/263, 164/269
[51] **Int. Cl.**..... B22d 11/12
[50] **Field of Search**..... 164/52, 69,
70, 82, 252, 263, 269, 282, 270; 13/16, 15

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ABSTRACT: In operating a continuous-casting machine sometimes there is left in the machine a length of casting too short to be handled by the driven rolls of the machine. Such castings are referred to as "aborted." The invention is an apparatus for gripping an aborted casting below the pinch rolls of the casting machine. The casting is severed with a torch, after which the apparatus swings the severed length out of the way. The steps are repeated until the entire casting is removed.

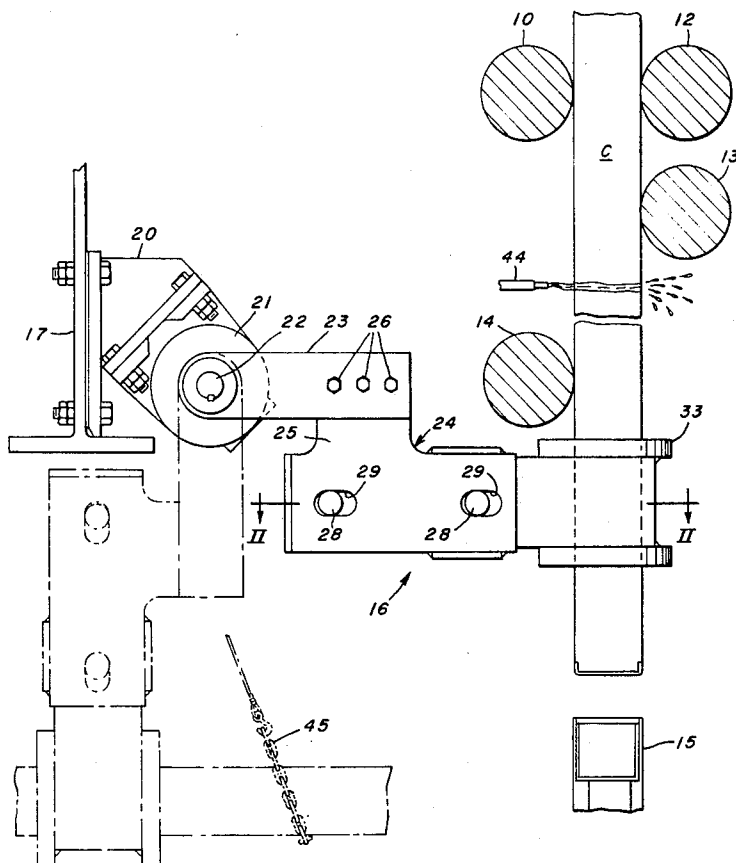
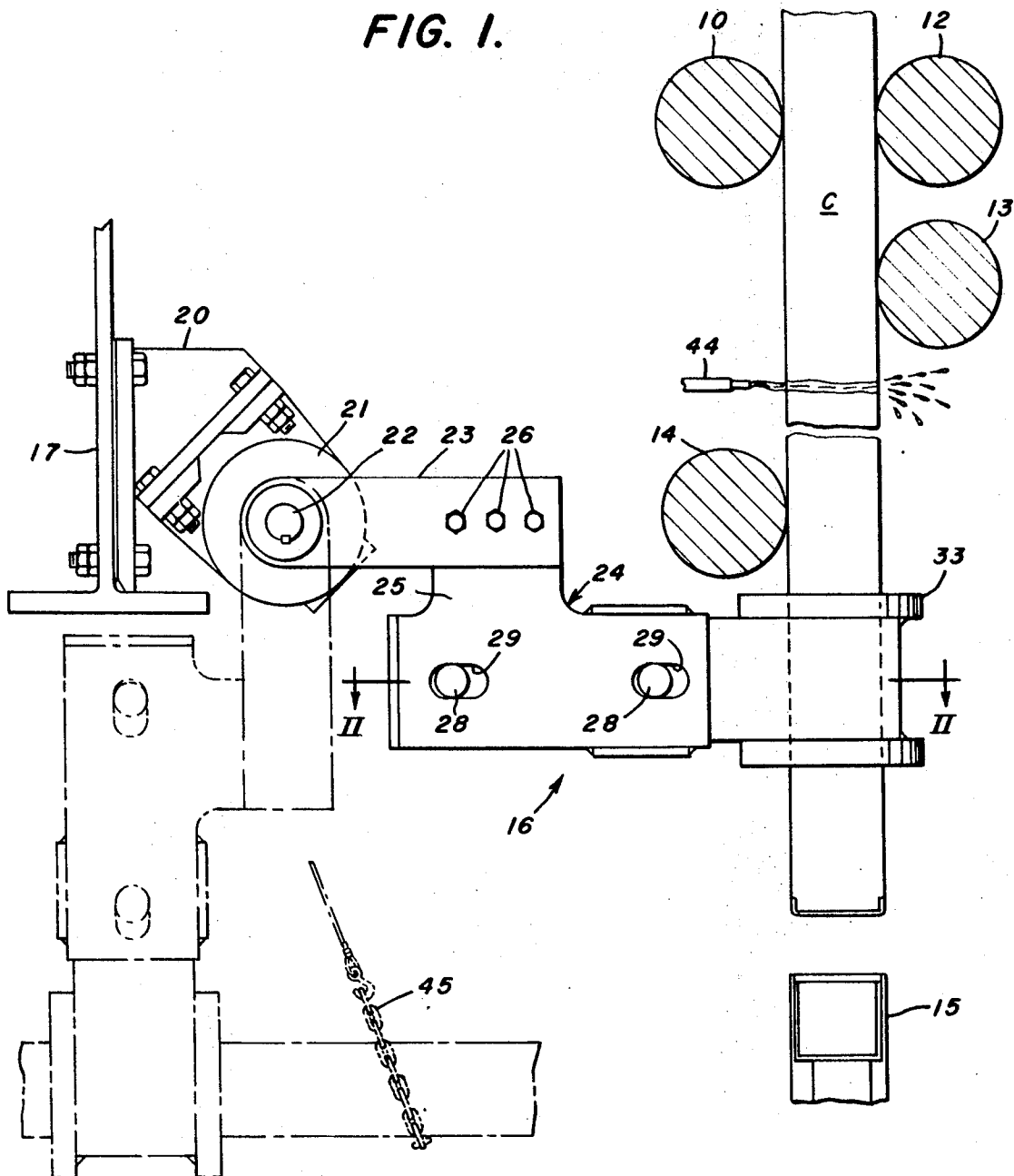


FIG. 1.



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FIG. 2.

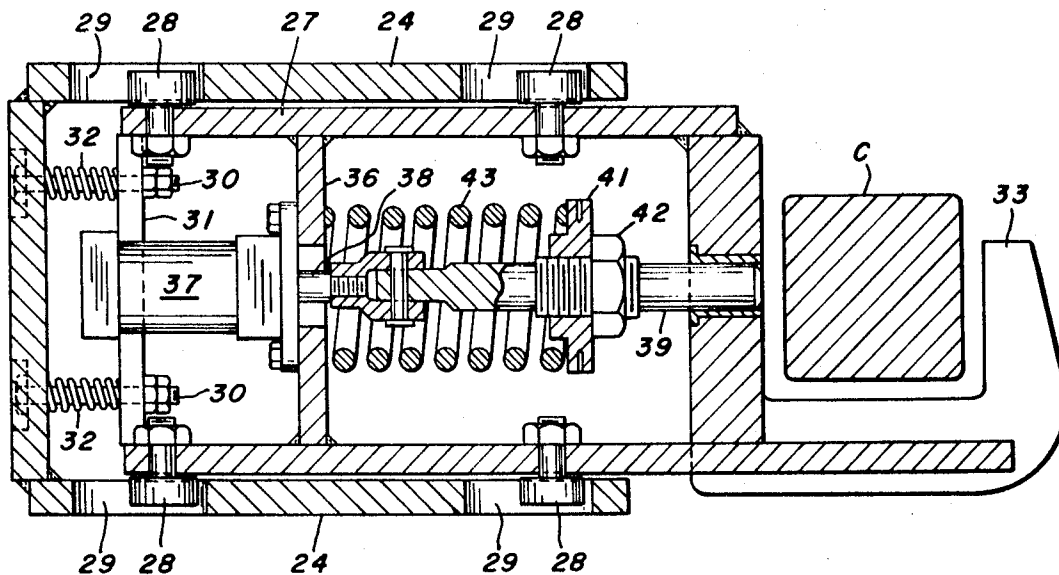
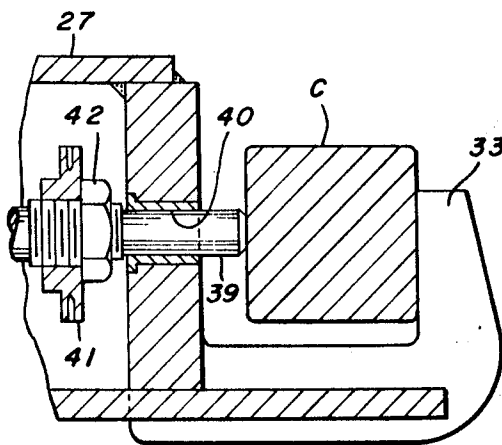


FIG. 3.



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METHOD AND APPARATUS FOR REMOVING ABORTED CASTINGS FROM A CONTINUOUS-CASTING MACHINE

This invention relates to a method and apparatus for removing aborted castings from a continuous-casting machine.

The form of continuous-casting machine with which my invention is most useful includes a water-cooled mold open at both ends, trains of vertically spaced guide rolls below the mold, a set of power-driven pinch rolls below the guide rolls, and a curved casting guide below the pinch rolls. Before a casting operation begins, a starter bar is inserted upwardly through the pinch rolls and guide rolls to the mold. A stream of molten metal is poured through the mold into contact with the top of the starter bar, which descends through the guide rolls and pinch rolls ahead of the casting. As the casting passes the guide rolls, water sprays are applied to its surface to aid in solidifying it. Initially the leading end of the casting attaches itself to the top of the starter bar, but the starter bar is disconnected as the casting passes through the pinch rolls. At first the pinch rolls restrain descent of the starter bar, but after the casting is part way through the guide rolls, the pinch rolls propel the starter bar and casting. After the starter bar is disconnected, bending rolls within the casting guide bend the casting 90° so that it travels horizontally from there on for further processing. Reference can be made to Foldessy U.S. Pat. No. 3,338,297 for a more complete showing of such a machine, although my invention is not limited to use with this particular machine.

When something goes wrong with the casting operation, a defective casting too short to be handled in the usual manner may be left in the guide rolls and pinch rolls. Such castings commonly are referred to as "aborted" and may result, for example, when metal freezes in the nozzle which feeds the mold or when there is a breakout. Heretofore an aborted casting has been cleared from the casting machine by lowering the casting through the pinch rolls, bypassing the bending rolls, and passing the casting through a special set of emergency pinch rolls. After the starter bar is disconnected, the emergency pinch rolls lower the aborted casting and carry it to a tilter, which finally removes it.

An object of my invention is to provide an improved and simplified method and apparatus for removing aborted castings and avoiding need for emergency pinch rolls and other parts.

A further object is to provide an improved apparatus for removing aborted castings, which apparatus includes means for gripping the casting below the pinch rolls and swinging it out of the way. In the drawing:

FIG. 1 is a partially diagrammatic side elevational view of a portion of a continuous-casting machine equipped with my apparatus for removing aborted castings;

FIG. 2 is a horizontal section on line II—II of FIG. 1 showing the position of parts before the apparatus grips an aborted casting; and

FIG. 3 is a fragmentary view similar to FIG. 2, but showing the apparatus gripping the casting.

FIG. 1 shows diagrammatically power-driven pinch rolls 10 and 12, the first two bending rolls 13 and 14, and a portion of a starter bar 15 of a continuous-casting machine, which may be of the type hereinbefore described. An aborted casting C is supported within the pinch rolls 10 and 12. My apparatus for removing the casting is indicated at 16 and is supported on a structural member 17 of casting tower.

The casting-removal apparatus 16 includes a bracket 20 bolted to the structural member 17, a journal-bearing-type torque actuator 21 bolted to the bracket and having a double-ended output shaft 22, and respective arms 23 keyed to the two ends of this shaft. I have not described the actuator 21 in detail, since per se it is a known mechanism. One example of a suitable actuator which is available commercially is the "Model HN/ROTAC" of the Ex-Cell-O Corporation, Detroit, Michigan. My casting-removal apparatus includes a housing 24 which has side members 25 of inverted T-shape fixed between the arms 23 with bolts 26. I mount a carriage 27 within the housing 24. The carriage has rollers 28 which are

journalled to its sidewalls and ride in slots 29 in the side members 25 of the housing. A plurality of bolts 30 extend between the backwall of the housing and transverse bars 31 at the back end of the carriage. Compression springs 32 encircle bolts 30 and urge the carriage outwardly with respect to the housing. A jaw 33 is fixed to the outer end of the carriage.

The carriage 27 has a transverse partition 36 on the back face of which I mount a hydraulic cylinder 37. The cylinder has the usual connections (not shown) for admitting and discharging hydraulic fluid, and it contains a reciprocable piston and piston rod 38. The end of the piston rod carries a plunger 39 which projects through an opening 40 in jaw 33. The plunger has a threaded portion or which I mount a collar 41 and a nut 42. A compression spring 43 encircles the plunger and piston rod and bears at its ends against the partition 36 and collar 41, thus urging the plunger outwardly into the jaw. I turn nut 42 to adjust the force on spring 43.

In operation, my casting-removal apparatus 16 normally occupies an idle position in which its arms 23 and housing 24 extend downwardly, as shown in dot-dash lines in FIG. 1. When I wish to remove an aborted casting from the casting machine, I first disconnect the starter bar 15 from the casting while the pinch rolls 10 and 12 are holding the casting just above its lower end. I lower the starter bar out of the way, and operate the actuator 21 to raise the arms and housing to a horizontal position in which the jaw 33 is spaced below the pinch rolls and vertically aligned with the casting. I operate cylinder 37 to retract plunger 39, whereby the jaw is open to receive the casting. Next I operate the pinch rolls 10 and 12 to lower the casting within the jaw, as FIG. 2 shows, and operate cylinder 37 to release the piston rod 38 and plunger 39. Spring 43 forces the plunger into engagement with the casting and then forces the carriage 27 rearwardly of the housing 24 against the action of the weaker springs 32. Thus the spring 43 also closes jaw 33 into gripping engagement with the casting, as FIG. 3 shows.

I sever the casting C below the pinch rolls 10 and 12 with a cutting torch 44, as FIG. 1 shows. My removal apparatus 16 now grips and supports the severed length of the casting. I operate the actuator 21 to swing my removal apparatus back to its original position. The severed length of casting now extends horizontally, and may be engaged by a chain sling 45 or the like. I operate cylinder 37 to retract plunger 39 to release the casting, after which it can be carried away for scrap. I repeat the foregoing steps until I have cleared the entire aborted casting from the machine.

From the foregoing description, it is seen that my invention affords a simple method and apparatus for removing aborted castings from a continuous-casting machine. The invention utilizes only a single added piece of equipment, and enables the casting to be removed without dismantling any parts of the casting machine.

I claim:

1. An apparatus for removing aborted castings from a continuous-casting machine, said apparatus comprising:

a housing having slots in its sidewalls;

gripping means including a carriage supported within said housing and having rollers riding in said slots to enable the carriage to move lengthwise of the housing, a jaw mounted on the end of said carriage, and a reciprocable plunger cooperable with said jaw;

operating means for opening and closing said gripping means and including a hydraulic cylinder mounted within said carriage, a reciprocable piston and piston rod in said cylinder, said plunger being connected to said piston rod, a collar fixed to said plunger, and a compression spring encircling said piston rod and plunger and bearing against said collar to urge said plunger toward its closed gripping position;

spring means acting between said housing and said carriage urging said carriage away from said housing; and

means supporting said housing for swinging movement between an idle position and a position in which said

gripping means is aligned with a casting to receive the casting when open and grip and support the casting when closed.

2. The combination with a continuous-casting machine, which includes a set of power-driven pinch rolls and bending rolls below said pinch rolls, of an apparatus for removing aborted castings from said machine, said apparatus comprising:

a housing;

gripping means carried by said housing;

operating means within said housing for opening and closing said gripping means;

power means supporting said housing for swinging movement between an idle position and a position in which said gripping means is spaced below said pinch rolls and aligned with a casting within said pinch rolls to receive the casting when open and to grip the casting when closed;

cutting means located below said pinch rolls, but above said gripping means when said carriage is in its second-named position, for severing a length of the casting gripped by said gripping means; and

sling means cooperable with said gripping means and carriage for receiving the severed length from said gripping means when said carriage is in its idle position.

3. A method of removing an aborted casting from a continuous-casting machine, which includes pinch rolls for supporting and controlling movement of the casting, said method comprising:

lowering a length of the casting below said pinch rolls;

gripping the casting below said pinch rolls with a pivoted gripping means;

severing a length from the casting below said pinch rolls but above the level at which it is gripped;

swinging the severed length of casting away from said machine to a position in which the length extends horizontally;

releasing and lifting the severed length away from the gripping means; driving said gripping means into line with the casting; and

repeating the foregoing steps until the casting is fully removed from the machine.

4. An apparatus as defined in claim 2 in which said gripping means includes a carriage movably mounted in said housing, a jaw mounted on said carriage, and a reciprocable plunger cooperable with said jaw and connected with said operating means.

5. An apparatus as defined in claim 4 in which said operating means includes a hydraulic cylinder mounted within said carriage, a reciprocable piston and piston rod in said cylinder, said plunger being connected to said piston rod, and spring means urging said plunger toward its closed gripping position.

6. An apparatus as defined in claim 2 in which said support means includes a fixed bracket, a torque actuator fixed to said bracket and having a double-ended output shaft, and arms fixed to said shaft, said housing having side plates of inverted T-shape fixed to said arms.

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