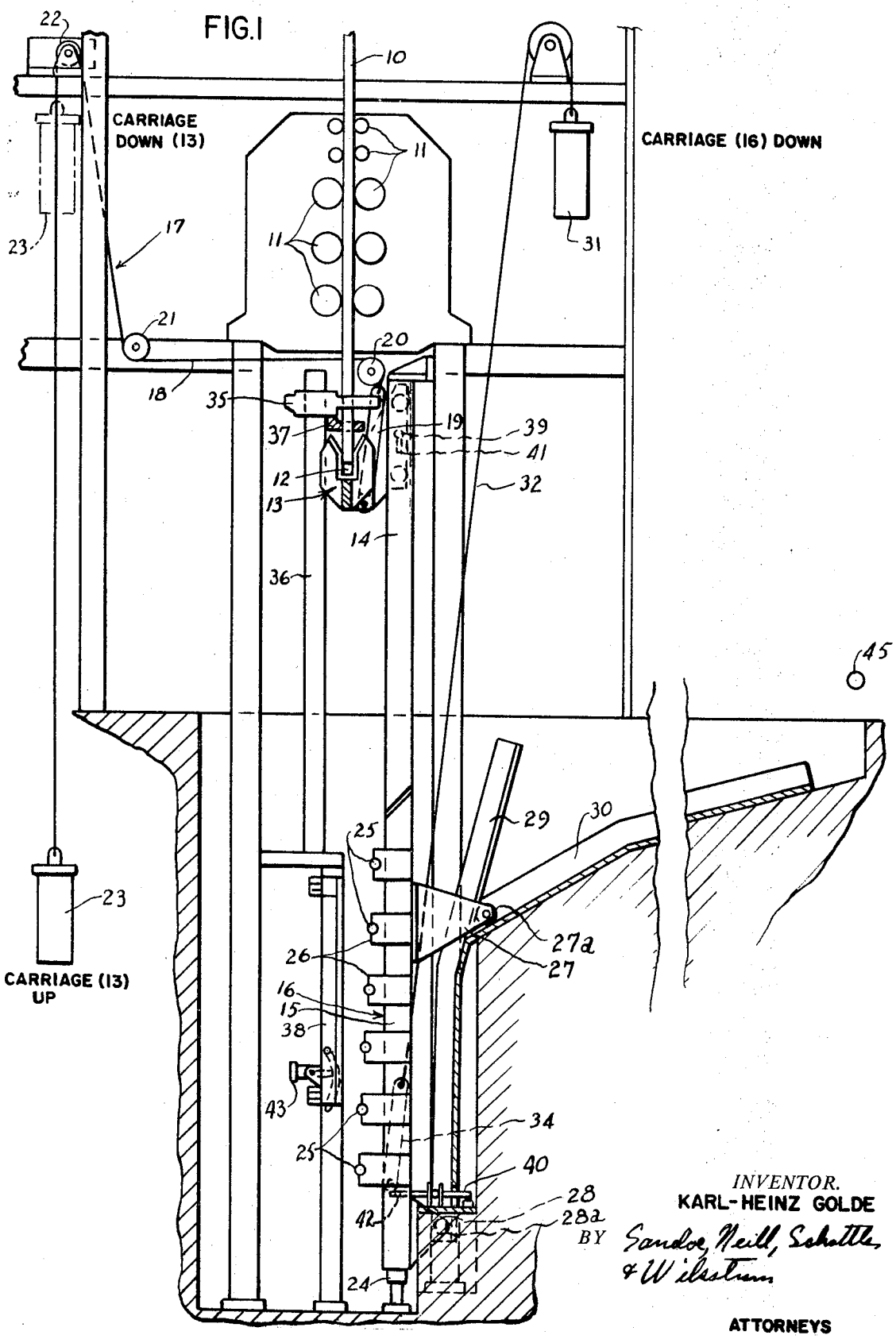
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APPARATUS FOR TRANSFERRING A CASTING FROM VERTICAL TO HORIZONTAL POSITION

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FIG. 1



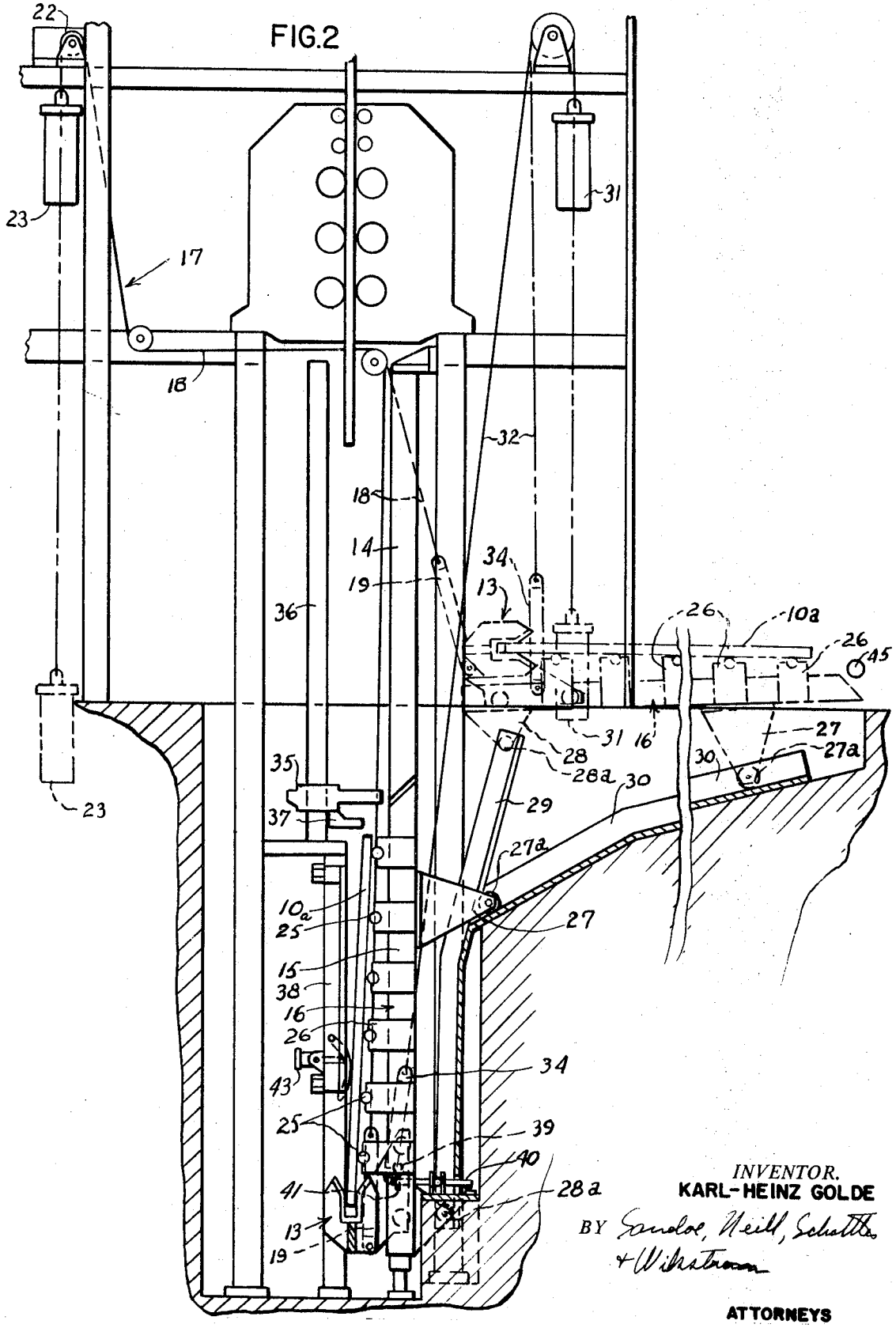
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FIG.2



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APPARATUS FOR TRANSFERRING A CASTING FROM VERTICAL TO HORIZONTAL POSITION

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Int. Cl. B22d 11/12
U.S. Cl. 164—263 9 Claims

ABSTRACT OF THE DISCLOSURE

A vertically movable first carriage is adapted to receive and support the lower end of a continuous casting that moves down in vertical alignment. A second carriage having an elongated bed to support a section severed from the casting is movable from a first position, in which its bed is adjacent and approximately parallel to the vertical path of movement of the first carriage, to a second position, in which its bed is approximately horizontal. A severing device is arranged to sever a lower end section from the casting which is supported on the first carriage, and means is provided to support the severed end section on the first carriage as the first carriage moves down to a position adjacent the lower end of the second carriage when the latter is in its first position. A tilting device is then operable to tip several sections so that its upper portion leans on the bed of the second carriage. When the first carriage is adjacent the lower end of the second carriage and the latter is in its first position, a lever is operable to slide a latch pin on the first carriage for latching, or unlatching, the first carriage to the second. The first carriage is moved up and down by a driven chain or cable hoist connected in such a way as to be operable also to move the second carriage when the carriages are latched together and the hoist is operated to lift the first carriage. Each carriage is also counterbalanced by its own counterweight, the counterweights for the respective carriages being arranged to act in concert when the two carriages are latched together.

The present invention is apparatus for transferring a length of casting, which has been severed from a vertically aligned continuous casting, from vertical alignment to a substantially horizontal position from which it is moved onto a conveyor mechanism for transporting the severed length in a horizontal direction.

In known continuous-casting plants, in which the casting emerges from the bottom of the casting mold as a straight, vertically aligned strand, the casting is cut into suitable lengths for further handling and processing by severing successive lengths from its lower end. The severed sections of the casting are then shifted to a horizontal position in which they are more easily conveyed to subsequent work stations. In a known arrangement the lower end of the continuous casting extends down into a pit below shop-floor level. The lower end section, which is severed, is received and supported by a first, or receiving, carriage which is moved up and down by a suitable driven hoist. The receiving carriage, which rides on rails, guides the lower end of the casting down to its lowest point, at which the severed section is transferred to a second, or transfer, carriage. The first carriage is then moved up to engage the new lower end of the continuous casting to guide that end down and the second carriage is drawn up out of the pivot by a second hoist. The second carriage also moves on rails and transports the severed section to a position in which it is moved onto conveyor mechanism, which transports the severed section in a horizontal path.

This known receiving and transferring apparatus requires two separate drive connections, one for the first, or receiving, carriage and another for the second, or transfer, carriage. Moreover, the means for transferring the severed casting section from the first to the second carriage is such that it is possible for the section to stick on the first carriage and drop between the two carriages as the second is moved up out of the pit.

It is an object of the present invention to provide improved apparatus for receiving the lower end of a vertically aligned continuous casting, which is severed, and transferring the severed section up into horizontal position in line to be moved onto conveyor mechanism, such as a roller table.

Another object is to provide apparatus for this purpose in which the receiving and transferring carriages are both operated through the same drive connection, and in which there is no chance of the severed section dropping between the carriages which accomplish the reeciving and transferring.

In accordance with the invention, a first car, which is vertically movable up and down by a driven chain or hoist, is adapted to receive and support the lower end of a continuous casting and guide the lower end of the casting downward. A second carriage, which has an elongated bed to support a severed section of the casting, is movable from a first position in which the bed is adjacent and approximately parallel to the lower end portion of the vertical path of movement of the first carriage, up to a second position, in which the bed is in substantially horizontal alignment with the support surface of a conveyor for a severed section of casting. The first carriage is adapted to ride on a fixed vertical track. The second carriage also has a track for the first carriage along its bed surface and is mounted so that when the second carriage is in its first position its track is vertically aligned with the fixed vertical track. Thus, the first carriage is adapted, while supporting the lower end of a downwardly moving casting, to move down on track to the lower end of the second carriage, when the latter is in its first position. A severing device mounted to move parallel to the casting for severing the casting has a releasable clamp associated with it to clamp the casting below the point at which the casting is severed to hold the severing device in a fixed position on the casting so as to be able to sever the casting while the casting is moving. The clamp also serves to support the severed section in vertical alignment on the first carriage as the first carriage moves down to its lowermost position at the bottom end of the second carriage.

A slidable latch pin on the first carriage is adapted to attach the first carriage to the second carriage when the first carriage is at the lower end of the second. Actuating mechanism is provided for moving the latch pin to latching or unlatching position when the second carriage is in its first position and the first carriage is at the lower end of the second carriage.

When the first carriage, supporting a severed end section of casting, is at the lower end of the second carriage, which is in its first position, and the clamp on the severing device has been released, a tilting device is operated to tilt the severed section to lean against the bed of the second carriage. Then, when the two carriages are latched together by the latch pin, the two will move as a unit, with the severed section supported thereon, when the second carriage is moved to its second position.

The chain or cable hoist for moving the first carriage and the path of movement of the second carriage are arranged so that the hoist, being operated to apply lifting pressure on the first carriage when the two carriages

are latched together, operates to move the two carriages as a unit to the second position of the second carriage. Thus, a single drive connection is effective to move both carriages for the receiving and transferring operation of the apparatus. In addition, the amount of power required to drive the carriages in this manner, is minimized by connecting separate counterweights respectively to the two carriages in such a way that they counterbalance the movements of the respective carriages when the carriages are separate, but act in concert to counterbalance the movement of the unit formed by latching the carriages together.

An illustrative embodiment of the receiving and transferring apparatus of this invention is described below with reference to accompanying drawings in which:

FIG. 1 is a schematic side elevation of apparatus embodying the invention, showing the parts in one position in full lines and showing some of the same parts in dash lines indicating a successive operative position of these parts; and

FIG. 2 is another schematic side elevation of the same apparatus shown in FIG. 1, illustrating additional successive operative positions of some of the parts.

Referring to the drawings a continuous casting **10** of metal from a continuous-casting mold (not shown) is guided vertically downward by pinch rolls **11** and its lower end is received and supported in the well **12** of a first, or receiving, carriage **13**.

The first carriage **13** is movable up and down on a fixed vertical track **14**, and on track **15**, which is on a second, or transfer, carriage **16** and which is in vertical alignment below the lower end of fixed track **14** when the second carriage is in its first position, indicated in full lines in FIG. 1. A chain or cable hoist **17** is connected to move the first carriage **13** up and down and consists of a chain or cable **18** attached at one end to the first carriage **13** through a shock absorber **19**. From the first carriage **13**, the chain or cable **18** passes over an idler pulley **20**, under an idler pulley **21**, and then over a driven pulley **22** to a counterweight **23** that is attached to its other end to counterbalance the weight of the first carriage **13**. The driven pulley **22** is connected to be reversibly driven by reversible drive means (not shown).

The second carriage **16**, carrying tracks **15**, has a row of rollers **25** on supports **26**, which project above the tracks **15**, to form a bed for a section **10***a* severed from the casting **10**. Projections **27** and **28** from the underside of the second carriage **16** have rollers **27***a* and **28***a* thereon mounting the ends of the second carriage **16** respectively on tracks **29** and **30** for moving the second carriage **16** from a first position to a second position. In the first position of the second carriage **16**, shown in full lines in FIG. 1, its bottom end rests on a shock absorber **24**; its track **15** is vertically aligned with the lower end of the fixed vertical track **14** and its bed, defined by rollers **25**, is adjacent and approximately parallel to (but spaced from) the vertical path of movement of a casting **10** supported on the first carriage **13**. In the second position of second carriage **16**, shown in dash lines in FIG. 2, its bed is substantially horizontal, and, as indicated, a casting section **10***a* carried on it is in line to be dragged off and directly onto a horizontal conveyer, which is indicated by the first roller **45** of a conventional roller table (not shown). The section **10***a* may be dragged from the bed of the second carriage by a winch, tractor or other suitable conventional means.

For moving the second carriage **16** between its first and second positions the rollers **28***a* on projections **28** at its lower end ride on the track **29** which extends up and slightly to the right from a vertical line while the rollers **27***a* on projections **27** at its upper end move along the gently upwardly sloping track **30**.

The movement of the second carriage **16** is assisted by a counterweight **31**. The counterweight is adapted to partially counterbalance the weight of the second carriage and is attached to one end of a cable **32**, which passes over an idler pulley **33** with its other end attached to the second carriage through a shock absorber **34**.

As the casting **10** moves downward with its lower end supported in the first carriage **13**, the lower end section **10***a* is severed by a flame cutting device **35** which moves down with the casting. For this purpose, the flame cutting device **35** is vertically movable on a track **36** parallel to the vertical alignment of the casting **10** and has a releasable clamp **37** mounted below it to clamp the flame device to the casting **10** at the point at which it is desired to sever the casting. The clamp **37** also serves to hold the severed end section **10***a* in vertical alignment after the severing is complete.

At the start of an operation of the apparatus the flame cutting device **35** with its clamp **37** in release position are moved up to the top portion of its track **36** (shown in FIG. 1) and held there until thre lower end of the casting **10**, moving down from the first carriage **13**, has moved down far enough so that the length of casting **10** below the flame device is the length desired to be severed. The clamp is then clamped on the casting so that the flame cutting device **35** moves down with the casting and may be operated to sever the lower end section **10***a* as the casting moves down. When the first carriage **13**, supporting the lower end of the section **10***a*, reaches its lowermost position adjacent the lower end of the second carriage **16** shown in full lines in FIG. 2, the flame cutting device **35** will be in the position shown in full lines in FIG. 2. If the severing has been completed, the clamp **37** will hold the severed section **10***a* in vertical alignment until the clamp is released; after release of the clamp the section **10***a* is held in vertical alignment by a vertical support **38** adjacent the lower portion of the vertical path of movement of the first carriage **13**.

The first carriage **13** carries a slidable latch pin **39** for attaching the first carriage **13** to the lower end of the second carriage **16**. When the second carriage is in its first position and the first carriage is at the lower end of its path of movement, adjacent the lower end of the second carriage, the latch pin **39** is in line to be slid to latching or unlatching position, respectively to connect or disconnnect the two carriages, by a lever **40**, which is pivotally mounted in position at the lower end of the paths of movement of the two carriages **13** and **16**. The latch pin **39** is provided with a downwardly projecting stud **41** that is adapted to drop down into a hole **42** in the lever **40** and thus connect the latch pin **39** to the lever **40** to be actuated thereby, when the first carriage is in its lowermost position. The lever **40** may suitably be operated by conventional hydraulic or pneumatic devices.

At the start of an operation of the apparatus the second carriage is in its first position, which is its normal, at rest, position. Thus, as first carriage **13**, supporting the lower end of the casting **10**, moves down it travels down the track **14** and then down to the lower end of the track **15** on the second carriage. During this movement the flame cutting device **35**, attached to the casting **10** by clamp **37**, moves down with the casting and severs casting end sections **10***a*. When the first carriage **13** reaches the lower end of second carriage **16**, or just prior thereto, the clamp **37** is released; the section **10***a* is then held in vertical alignment by the vertical support **38**. The movement of the first carriage **13** down to the lower end of its path of movement causes the stud **41** of the latch pin **39** to engage the lever **40**, which is then actuated to slide the pin **39** and attach the first carriage **13** to the second carriage **16**. A lever device **43** mounted to be adjacent the side of the section **10***a* facing away from second carriage **16** is adapted to swing outward and tilt, or overbalance, the section **10***a* so that the upper portion of the section **10***a* leans against the rollers **25** at the upper portion of the second carriage. The section **10***a* is thus supported on the second carriage **16** by its lower end on the first carriage **13** and its upper end leaning

against the bed of the second carriage defined by rollers **25**.

The driven pulley **22** is then driven in a direction to lift the first carriage **13**, and, since the first and second carriages are now attached, this lifts the two carriages as a unit. As shown, the path of movement of the second carriage **16** and the direction of the lifting pressure thus applied is such that the second carriage **16**, with the first carriage **13** attached, and a casting section **10***a* supported thereon, is raised up to its second position.

The amount of lifting power required for this movement is reduced by the counterweights **23** and **31** which are arranged, as illustrated, to act in concert when the two carriages **13** and **16** are connected.

When the second carriage **16** reaches its second position, the section **10***a* is moved off on to the adjacent conveyor, indicated by roller **29**. The drive for driven pulley **22** is then reversed to let the two carriages **13** and **16** down again to the first position of the first carriage at which the lever **40** is again actuated to slide the latch pin **39** to disconnnect the carriages so that the first carriage can be moved vertically up the tracks **15** and **14** to engage the new lower end of the casting **10**.

What is claimed is:

1. Apparatus for receiving a continuous-casting that is conveyed downward in a vertical direction, and transferring a section severed from the lower end of the casting to a substantially horizontal position, said apparatus comprising: a vertically movable first carriage for receiving and supporting the lower end of a vertically aligned continuous casting; means for moving the first carriage up and down in a vertical direction and being adapted for moving the first carriage downward with the lower end of said casting supported thereon; a second carriage having an elongated bed for supporting a severed section of said casting; said second carriage being movable from a first position, in which its bed is adjacent and approximately parallel to the vertical path of movement of the first carriage, to a second position in which its bed is approximately horizontal; means for severing an end section from the lower end portion of a continuous-casting supported on the first carriage; means for supporting said severed section in approximately vertical alignment as the first carriage, with the severed section supported thereon, moves down to a position adjacent the lower end of the second carriage when the second carriage is in its first position; means for moving a severed section of casting supported on the first carriage to a position in which the severed section leans against the bed of the second carriage, and is supported thereon by gravity, when the first carriage is adjacent the lower end of the second carriage and the latter is in its said first position; and means for releasably attaching the first carriage to the second carriage when the first carriage is adjacent the lower end of the second carriage; the path of movement of the second carriage from its first to its second position being upward and outward in a direction in which the means for moving the first carriage upward is also operative for moving the second carriage from its first to its second position when the first carriage is attached thereto.

2. The apparatus of claim **1** in which the means for moving the first carriage comprises a power driven chain or cable hoist.

3. The apparatus of claim **1** which includes separate counterweights operatively connected respectively to the first and second carriages for counterbalancing the weights of the respective carriages in the directions in which they move, whereby the counterweights operate in concert when the first carriage is attached to the second.

4. The apparatus of claim **1** in which the means for moving the severed section supported on the first carriage to a position in which the section is supported on the bed comprises means for tilting the upper portion of said section to lean against the bed of the second carriage, and in which the movement of the second carriage from its first to its second position is upward and outward in the direction in which said section is tilted.

5. The apparatus of claim **1** in which the means for releasably attaching the first carriage to the second comprises a pin slidably carried on one of the first and second carriages in position to be slidable into latching connection with the other of the first and second carriages when the first carriage is adjacent the lower end of the second carriage, and which includes lever means for sliding said pin between its latching and unlatching positions, said lever means being mounted to be in operative alignment with said pin when the first carriage is adjacent the lower end of the second carriage and the latter is in its first position.

6. Apparatus for receiving a continuous-casting that is conveyed downward in a vertical direction, and transferring a section severed from the lower end of the casting to a substantially horizontal position, said apparatus comprising: a first carriage for receiving and supporting the lower end of the casting; means for moving the first carriage up and down in a vertical direction; a second carriage having elongated track means along which the first carriage is adapted to move, said second carriage being movable to and from a first position in which its track means is in vertical alignment to receive the downwardly moving first carriage and to guide the first carriage down to the lower end of the track means; means for releasably attaching the first carriage to the lower end of the second carriage; means for severing an end section from the lower end portion of the casting when the lower end of the casting is supported on the first carriage; said second carriage having a longitudinal bed portion extending vertically adjacent, but spaced from, the normal vertical position of the axis of a casting, supported on the first carriage which is on the second carriage when the latter is in its first position; said bed portion being of sufficient length to support a severed section of casting when the bed is in a horizontal position; means operative, when the second carriage is in its first position and the first carriage is at the lower end of the track means of the second carriage with a severed casting section supported on the first carriage, for tilting the latter section to cause the upper portion of the latter section to lean against the bed portion of the second carriage while the lower end of the latter section is supported on the first carriage; and means for guiding the second carriage for movement from its first position, upward, and outward in the direction in which a severed section is tilted, to a position in which its bed portion is substantially horizontal, whereby, when the first carriage is attached to the second carriage, the means for moving the first carriage operates to move the second carriage and a severed casting section thereon from the first to the second position of the second carriage.

7. The apparatus of claim **6** including a vertical track for the first carriage, said vertical track being aligned for guiding movement of the first carriage down onto, and up from, the track means of the second carriage when the second carriage is in said first position.

8. The apparatus of claim **6** in combination with conveyor means for a severed casting section, said conveyor means being aligned to receive a severed casting section from the bed portion of the second carriage when the second carriage is in its second position, said bed portion having rollers for supporting a severed casting section thereon and for facilitating removal of the latter casting section onto said conveyor means.

9. The apparatus of claim **6** including a device for severing the casting, said severing device being mounted to move in a vertical path parallel and adjacent to the vertically moving casting, and releasable clamp means mounted below the severing device to be movable therewith for gripping the casting to hold the severing device

at a predetermined position relative to the length of the casting and to support the upper end of the severed lower end portion of the casting in vertical alignment as the casting moves downward.

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