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Description

BACKGROUND OF THE INVENTION

1. Field of the invention:

The invention relates to an apparatus for casting metal strip. More particularly, the invention relates to a nozzle assembly system for mounting a casting nozzle to a crucible reservoir to cast continuous metal strip.

2. Description of the prior art:

In the production of continuous metal strip, molten metal has typically been extruded from a pressurized reservoir through a nozzle on to a high speed, rotating quench surface. Representative apparatus are shown in US—A—4 142 571.

When continuously casting metal strip over extended periods of time, it has been desirable to connect a recplaceable nozzle to a separate crucible capable of holding a large quantity of molten metal. The resultant multipiece assembly has required sealing means to prevent leakage of molten metal between the component parts. A conventional nozzle assembly is representatively shown in US—A—4 154 380 describing the nearest prior art to which the preambles of the independent claims 1 and 10 relate.

The sealing means of the US—A—4 154 380 is comprised of a tapered, frusta-conical surface on the casting nozzle which is adapted to mate with a corresponding tapered surface along the outlet passage from the crucible. The weight of the nozzle plus the metallostatic pressure head holds the mated, tapered surfaces together. These tapered surfaces, however, required precise machining to obtain the required degree of sealing effectiveness. In addition, the closely mated surfaces do not allow for any differences in thermal expansion between the crucible and the nozzle body, particularly where the crucible and nozzle body are constructed from different refractory materials having different coefficients of thermal expansion. As a result, the nozzle can expand more than the crucible outlet passage opening, and very large lateral, side to side, forces developed between the crucible and nozzle have often caused the nozzle to fracture. If the nozzle should fracture severely, the flow of molten metal is no longer restricted by the relatively small nozzle extrusion orifice; large volumes of molten metal may then escape and damage the casting surface and any nearby auxiliary support equipment.

Thus, conventional nozzle assemblies, such as those taught by US—A—4 154 380, have lacked a mechanism for preventing nozzle fracture due to thermal expansion of the nozzle against the crucible and have lacked a safety device to prevent the sudden escape of large volumes of molten metal from a fractured nozzle.

Summary of the Invention

The invention provides an apparatus for casting continuous metal strip comprising:

(a) nozzle means for extruding molten metal, which has a nozzle body, a nozzle inlet opening, a nozzle exit orifice and a nozzle mounting surface located proximate to said nozzle inlet opening,

(b) reservoir means in fluid communication with said nozzle means for containing said molten metal, said, reservoir means having a reservoir outlet opening for flowing said molten metal therethrough and having a reservoir mounting surface located proximate to said reservoir outlet and

(c) sealing means located between said nozzle mounting surface and said reservoir mounting surface for minimizing molten metal leakage therebetween; and is characterized in that

(d) said nozzle mounting surface mates with said reservoir mounting surface allowing a relative, sliding-type movement,

(e) said sealing means are resilient and heat resistant; and

(f) force means are provided for resiliently urging said nozzle mounting surface toward said reservoir mounting surface, while allowing longitudinal movement of the nozzle means relative to the reservoir means.

In accordance with the invention, there is further provided a method for casting continuous metal strip, comprising the steps of:

(a) containing a supply of molten metal in a reservoir means which has a reservoir mounting surface located proximate to a reservoir outlet opening,

(b) extruding said molten metal from a nozzle means which is in fluid communication with said reservoir means and has a nozzle mounting surface located proximate to a nozzle inlet opening, and

(c) mating together said nozzle mounting surface with said reservoir mounting surface, the region between said surfaces being sealed to minimize molten metal leakage therebetween, which is characterized by

(d) providing means to allow a relative, sliding-type movement between said nozzle and reservoir mounting surfaces due to a differing thermal expansion of said nozzle means relative to said reservoir means and

(e) resiliently urging said nozzle mounting surface toward said reservoir mounting surface.

The invention advantageously allows differential thermal expansion between the nozzle body and reservoir. In particular, the lateral clearance avoids lateral contact between the nozzle and reservoir, and the planar mounting surfaces allow an amount of relative movement along the mated, parallel mounting surfaces to avoid the build up of excessive lateral stresses that could fracture the nozzle or crucible. Additionally, the force means, which resiliently urges the nozzle and reservoir means together, allows a lengthwise, longitudinal thermal expansion of the nozzle without a buildup of excessive internal stresses. The safety device prevents a sudden escape of excessive amounts of molten metal if the nozzle should become inadvertently fractured.

Thus, compared to conventional nozzle assemblies without planar mounting surfaces, without a resilient force means or without a safety device, the present inveniton more reliably and more efficiently casts continuous metal strip. The invention minimizes nozzle fracturing due to thermal stresses developed between the nozzle and the reservoir means and minimizes the escape of molten metal from the reservoir if the nozzle should become inadvertently fractured.

Brief Description of the Drawings

The invention will be more fully understood and further advantages will become apparent when reference is made to the following detailed description of the preferred embodiment of the invention and the accompanying drawings in which:

FIG. 1 shows a representative prior art apparatus for casting continuous metal strip;

FIG. 2 shows a representative cross-sectional view of a nozzle mounted internally to a crucible;

FIG. 3 shows a representative cross-sectional view of a nozzle mounted externally to a crucible;

FIG. 4 shows a side elevational view of a nozzle mounted externally to a crucible with a force means comprised of springs;

FIG. 5 shows a side elevational view of a nozzle mounted externally to a crucible with a forced means comprised of a pneumatic actuator;

FIG. 6 shows a bottom plan view of the pneumatic actuator mechanism taken in the direction A—A of FIG. 5; and

FIG. 7 shows a representative cross-sectional view of the apparatus shown in FIG. 5.

Description of the Preferred Embodiments

The present invention is suitable for casting continuous strip of crystalline or amorphous metal. While the preferred embodiments are described with respect to casting amorphous metal alloy strip, it is readily apparent that the invention can be easily adapted to cast crystalline metal strip as well.

For the purposes of the present invention and as used in the specification and claims, a "strip" is a slender body in which the transverse dimensions are much smaller than the length. Thus, a strip includes wire, ribbon and sheet of regular or irregular cross-section.

FIG. 1 shows a typical prior art apparatus for the continuous casting of metal strip to point out the general use of the present invention. Molten alloy contained in crucible 101 is heated with a heating element 4. Pressurization of the crucible with an inert gas extrudes a stream of molten metal from nozzle 102, located at the base of the crucible, onto quench surface 5 of rotating quench wheel 6. The solidified moving strip 8 after its break-away point from the quench wheel is routed onto a winding wheel (not shown).

When casting a strip of amorphous, glassy metal or when casting a strip of certain crystalline metal alloys, the extruded metal is quenched at an extremely rapid rate of at least about 10^4°C/sec, and the solidified strip moves rapidly off the quench wheel at a speed ranging from about 400—2200 m/min. The cast strip is quite thin, typically about 25—100 microns thick, but considerable selectivity may be exercised with respect to the width and cross-section.

FIG. 2 shows a representative nozzle assembly for casting continuous metal strip in which a nozzle means for extruding molten metal is shown generally at 2. The nozzle has a nozzle body 12, a nozzle inlet opening shown generally at 14, a nozzle exit orifice 16 and a nozzle mounting surface, such as substantially planar surface 24. A reservoir means, comprised of crucible 1, contains molten metal and includes a reservoir outlet opening, shown generally at 10, for flowing the molten metal therethrough. A reservoir mounting surface, such as substantially planar surface 22, is located on the reservoir means proximate to the reservoir outlet. Reservoir surface 22 is adapted to mate with nozzle surface 24 and allow a relative, sliding-type movement therebetween due to a differing thermal expansion of nozzle 2 relative to crucible 1. In addition, the reservoir crucible is adapted to provide a lateral clearance distance 3 between nozzle 2 and crucible 1. The lateral clearance prevents lateral contact caused by a differing thermal expansion of nozzle 2 relative to crucible 1. A safety device is comprised of a cover member 26 having a constricted passage 28 therethrough. Cover 26 has a peripheral, outwardly extending cover flange 29 adapted to mount at the inlet portion 14 of nozzle 2 to limit the flow of molten metal from crucible 1 into the nozzle. A resilient, heat resistant sealing means, such as a boron nitride paste adhesive 21, is interposed between nozzle mounting surface 24 and crucible mounting surface 22 to minimize molten metal leakage therebetween. Force means 30 resiliently urges the nozzle mounting surface toward the crucible mounting surface to mate the nozzle and crucible together.

The apparatus of the invention advantageously minimizes any stresses caused by differing amounts of thermal expansion between nozzle 2 and crucible 1. In particular, lateral clearance 3 avoids lateral contact between the nozzle and crucible, and the planar mounting surfaces 22 and 24, disposed substantially parallel to each other, allows relatively free, sliding-type movement between the nozzle and the crucible. Surface shear stresses are present, but bulk stresses that could crack and break the nozzle are minimized. In addition, the resilient force means allows longitudinal thermal expansion while mating and holding together nozzle 2 and crucible 1 with a force sufficient to prevent molten metal leakage therebetween.

The nozzle assembly illustrated in FIG. 2 is an internally mounted nozzle. Thus, the reservoir mounting surface is an inwardly facing surface 22 of crucible 1, and the nozzle mounting surface is a nozzle body surface 24 facing in the direction of the intended flow of molten metal. Preferably, nozzle mounting surface 24 is located on a surface of a nozzle flange 15 which extends radially outward along a peripheral edge of nozzle body 12. While force means 30 can be comprised of a distinct mechanical mechanism, the force means in this embodiment is preferably provided by the weight of nozzle 2 and cover 26 along with the metallostatic pressure head of any molten metal contained in crucible 1.

FIG. 3 shows an externally mounted nozzle which compared to the internally mounted nozzle is more easily removed and serviced, particularly when there is molten metal in crucible 1. A stopper rod 66 can be employed to block passage 28 while the nozzle is being preheated or serviced. In this embodiment, the reservoir mounting surface is an outwardly facing surface 25 of crucible 1, and the nozzle mounting surface is a nozzle body surface 20 facing opposite to the direction of the intended flow of molten metal. Preferably, nozzle mounting surface 20 facing opposite to the direction of the intended flow of molten metal. Preferably, nozzle mounting surface 20 is located on a surface of nozzle flange 15 to increase the mated surface area between the nozzle and crucible. The sealing means 23 for the externally mounted nozzle is preferably comprised of a gasket composed of a ceramic fiber, such as alumina silica. Such a gasket is easier to handle than a paste material and still allows the needed amount of movement between planar surfaces 20 and 25. The externally mounted nozzle advantageously eliminates the need for a separate cover for the safety device. With this embodiment, the cover member of the safety device is comprised of the bottom wall 64 of crucible 1, and constricted outlet passage 28 which communicates through bottom wall 64 limits the flow of molten metal from crucible 1. The externally mounted nozzle, however, does require a force means 30 comprised of a distinct mechanical mechanism 33 to hold the nozzle and crucible together and maintain alignment therebetween.

FIG. 4 shows an embodiment of the invention which employs an optional nozzle heater means 18 disposed about nozzle 2 to preheat the nozzle and maintain the temperature of the molten metal as it passes therethrough. FIG. 4 further shows a force means comprised of springs.

In this embodiment of the invention, a support member, such as frame 32, is configured to be substantially immobile with respect to crucible 1. A displacement member, such as plate 34, is spaced a distance away from support frame 32 and is movable relative to the frame. Spring means, such as compressible springs 36, are operably connected to plate 34 and support frame 32. Springs 36 provide a selected force which is adapted to move plate 34 toward nozzle 2 and resiliently urge the nozzle mounting surface 23 toward crucible mounting surface 25. Adjustment means, comprised of threaded studs 38, nuts 42 and washers 40, adjust springs 36 to provide a selected spring force.

As shown by FIG. 4, threaded studs 38 are attached to frame 32 by suitable attachment means, such as welding. The studs extend through holes in plate 34 and are adapted to slide freely through those holes. Additionally, frame 32 has openings which allow nozzle 2 and heater 18 to extend therethrough without interference from the frame. There is sufficient clearance between nozzle 2 and frame 32 to eliminate any lateral, side to side contact therebetween due to thermal expansion of the nozzle. Plate 34 is adapted to operably contact nozzle heater 18 and move nozzle 2 toward crucible 1. Plate 34 also has an opening 61 therethrough which is configured to allow extrusion of molten metal from nozzle 2 onto a suitable quench surface. A spring 36 and a washer 40 are assembled about each stud 38. Each spring is interposed between a washer 40 and the frame 32, and a nut 42 is then threaded onto each stud 38. Thus, by selectively turning nuts 42 up onto stud 38 to compress springs 36, plate 34 is drawn up against heater 18, which contacts nozzle 2 to urge the nozzle mating surface 23 toward crucible surface 25 and hold the nozzle and crucible together. By adjusting the amount of compression imparted to springs 36, the amount of mating force can be adjusted to a selected magnitude. The resilience of the springs also allows longitudinal movement of plate 32 along studs 38 in response to the thermal expansion of nozzle 2 and heater 18, and prevents the buildup of excessive stresses within the nozzle.

During certain casting operations, however, the ambient high temperatures, which can exceed 1,000°C, can cause a relaxation of the force exerted by springs 36. The force between nozzle 2 and crucible 1 may become too low to maintain an adequate seal therebetween, and leakage of molten metal may occur.

To minimize this problem, the force means is preferably comprised of a pneumatic actuator mechanism as shown in Figures 5 and 6. By employing a pneumatic actuator 46 operated by a pressurized fluid, such as compressed gas, one can advantageously monitor and continuously adjust the gas pressure in the actuator to provide a substantially constant force that operates to hold nozzle 2 and crucible 1 together and maintains an adequate seal therebetween.

As shown in FIG. 5, support frame 32 is substantially immobile with respect to crucible 1 and has openings configured to accommodate placement of nozzle 2 and heater 18 therethrough without interference from the frame. A displacement member is comprised of lever arms 54, a cross member 52 connected between two end portions of the lever arms and a pivot plate 35. The displacement member is movable relative to frame 32. In particular, pivot means, comprised of pivot brackets 52 and pivot bearings 56, connect to support frame 32 and are adapted to pivot the displacement means thereabout. Pivot brackets 52 are rigidly connected to support frame 32 by suitable fasteners or by welding and are adapted to support pivot bearings 56. Pivot bearings 56 pivotably connect each lever arm 54 to its respective pivot bracket 52. A pneumatic actuator means, such as a dual action pneumatic actuator 46, is adapted to pivot the displacement member about the pivot means to move a portion of the displacement member, particularly plate 35, toward nozzle 2. Actuator 46 further provides a selected force that resiliently urges the nozzle mounting surface 23 toward mounting surface 25 of the crucible reservoir to mate and hold the nozzle and crucible together. As illustrated in FIG. 5, actuator brackets 50 are rigidly connected to frame 32 and adapted to support actuator 46. Actuator 46 operably connects to cross member 62 and when operated, provides a force that moves cross member 62 downwards to pivot lever arms 54 about pivot pins 56. As the lever arms rotate, they move plate 35 upward against nozzle heater 18 which in turn, contacts nozzle 2. The preselected force provided by actuator 46 urges surface 23 toward surface 25 to mate the nozzle and crucible together.

Pressure regulator means 48 controls the gas pressure supplied to actuator 46 to adjust the force directed against heater 18 and nozzle 2. Advantageously, the regulated gas pressure in actuator 46 provides a resiliency which allows thermal expansion of nozzle 2 and downward movement of plate 35 while still maintaining a constant, stable force between nozzle 2 and crucible 1 that is sufficient to preserve the liquid seal therebetween. As a result, leakage is minimized and excessive thermal stresses that could fracture the nozzle are avoided.

Claims

1. An apparatus for casting continuous metal strip comprising:

(a) nozzle means (2) for extruding molten metal, which has a nozzle body (12), a nozzle inlet opening (14), a nozzle exit orifice (16) and a nozzle mounting surface (20, 24) located proximate to said nozzle inlet opening,

(b) reservoir means (1) in fluid communication with said nozzle means for containing said molten metal, said reservoir means having a reservoir outlet opening (10) for flowing said molten metal therethrough and having a reservoir mounting surface (22, 25) located proximate to said reservoir outlet and

(c) sealing means (21, 23) located between said nozzle mounting surface and said reservoir mounting surface for minimizing molten metal leakage therebetween; characterized in that

(d) said nozzle mounting surface (20, 24) mates with said reservoir mounting surface (22, 25) allowing a relative, sliding-type movement,

(e) said sealing means (21, 23) are resilient and heat resistant; and

(f) force means (30) are provided for resiliently urging said nozzle mounting surface toward said reservoir mounting surface, while allowing longitudinal movement of the nozzle means (2) relative to the reservoir means (1).

2. An apparatus as recited in claim 1, wherein said nozzle mounting surface (20, 24) and said reservoir mounting surface (22, 25) are substantially planar.

3. An apparatus as recited in claim 1, further comprising a safety device comprised of a cover member (26) having a constricted passage (28) therethrough.

4. An apparatus as recited in claim 1, wherein said reservoir mounting surface is an inwardly facing surface (22) of said reservoir means (1) and said nozzle mounting surface is a nozzle body surface (24) facing in the direction of the intended flow of molten metal into said nozzle.

5. An apparatus as recited in claim 1, wherein said reservoir mounting surface is an outwardly facing surface (25) of said reservoir means (1) and said nozzle mounting surface (20) is a nozzle body surface facing opposite to the direction of the intended flow of molten metal into said nozzle.

6. An apparatus as recited in claim 1, wherein said force means comprises:

(a) a support member (32) which is substantially immobile with respect to said reservoir means;

(b) a displacement member (34) which is spaced a distance away from said support member and movable relative thereto;

(c) spring means (36) operably connected to said displacement member and said support member for providing a selected force which is adapted to move said displacement member toward said nozzle means and urge said nozzle mounting surface toward said reservoir mounting surface; and

(d) adjustment means (38, 40, 42) for adjusting said spring means to provide said selected force.

7. An apparatus as recited in claim 1, wherein said force means comprises:

(a) a support member (32) which is substantially immobile with respect to said reservoir means;

(b) a displacement member (35) which is movable relative to said support member;

(c) pneumatic actuator means (46) for moving said displacement member toward said nozzle body and for providing a selected force that urges said nozzle mounting surface toward said reservoir mounting surface; and

(d) pressure regulator means (48) for controlling a fluid pressure supplied to said pneumatic actuator to adjust said force.

8. An apparatus as recited in claim 1, wherein said force means comprises:

(a) support member (32) which is substantially immobile with respect to said reservoir means;

(b) a displacement member (35) which is movable relative to said support member;

(c) pivot means (52, 56) connected to said support member for pivoting said displacement member (35) thereabout;

(d) pneumatic actuator means (46) for pivoting said displacement member (35) about said pivot means to move a portion of said displacement member toward said nozzle body and provide a selected force that resiliently urges said nozzle mounting surface toward said reservoir mounting surface to mate said nozzle and said reservoir means together; and

(e) pressure regulator means (48) for controlling a gas pressure supplied to said pneumatic actuator to adjust said force.

9. An apparatus as recited in claim 1, further comprising heater means (18) disposed about said nozzle for heating molten metal contained therein.

10. A method for casting continuous metal strip comprising the steps of:

(a) containing a supply of molten metal in a reservoir means (1) which has a reservoir mounting surface (22, 25) located proximate to a reservoir outlet opening (10),

(b) extruding said molten metal from a nozzle means (2) which is in fluid communication with said reservoir means (1) and has a nozzle mounting surface (20, 24) located proximate to a nozzle inlet opening (14), and

(c) mating together said nozzle mounting surface with said reservoir mounting surface the region between said surface being sealed to minimize molten metal leakage therebetween, characterized by

(d) providing means to allow a relative, sliding-type movement between said nozzle and reservoir mounting surface due to a differing thermal expansion of said nozzle means relative to said reservoir means and

(e) resiliently urging said nozzle mounting surface toward said reservoir mounting surface.

Patentansprüche

1. Vorrichtung zum Gießen von kontinuierlichen Metallstreifen mit

a) einer Düseneinrichtung (2) zum Extrudieren von geschmolzenem Metall, die einen Düsenkörper (12), eine Düseneinlaßöffnung (14), eine Düsenausgangsöffnung (16) und eine Düsenhalterungsfläche (20, 24), die in unmittelbarer Nähe der Düseneinlaßöffnung angeordnet ist, hat,

b) einer Vorratsbehältereinrichtung (1) in Fließmittelverbindung mit der Düseneinrichtung, um das geschmolzene Metall zu enthalten, wobei die Vorratsbehältereinrichtung eine Vorratsbehälterauslaßöffnung (10) zum Hindurchfließen des geschmolzenen Metalles und eine Vorratsbehälterungsfläche (22, 25), die in unmittelbarer Nähe zu dem Vorratsbehälterauslaß angeordnet ist, hat, und

c) Dichtungseinrichtungen (21, 23), die zwischen der Düsenhalterungsfläche und der Vorratsbehälterungsfläche zum Minimieren einer Leckage von geschmolzenem Metall zwischen ihnen angeordnet sind, dadurch gekennzeichnet, daß

d) die Düsenhalterungsfläche (20, 24) mit der Vorratsbehälterhalterungsfläche (22, 25) derart zusammenpaßt, daß sie eine Relativegleitbewegung gestatten,

e) die Dichtungseinrichtungen (21, 23) elastisch und hitzebeständig sind und

f) Anpreßeinrichtungen (30) für ein elastisches Pressen der Düsenhalterungsfläche gegen die Vorratsbehälterhalterungsfläche vorgesehen sind, während eine Längsbewegung der Düseneinrichtung (2) relativ zu der Vorratsbehältereinrichtung (1) gestattet ist.

2. Vorrichtung nach Anspruch 1, bei der die Düsenhalterungsfläche (20, 24) und die Vorratsbehältgerhalterungsfläche (22, 25) im wesentlichen eben sind.

3. Vorrichtung nach Anspruch 1, zusätzlich mit einer Schutzeinrichtung, die aus einem Abdeckteil (26) mit einem eingeschnürten Durchgang (28) durch es hindurch besteht.

4. Vorrichtung nach Anspruch 1, bei der die Vorratsbehälterhalterungsfläche eine nach innen gerichtete Oberfläche (22) der Vorratsbehältereinrichtung (1) ist und die Düsenhalterungsfläche eine Düsenkörperoberfläche (24) ist, die in die Richtung des beabsichtigeten Stromes von geschmolzenem Metall in die Düse blickt.

5. Vorrichtung nach Anspruch 1, bei der die Vorratsbehälterhalterungsfläche eine nach außen gerichtete Oberfläche (25) der Vorratsbehältereinrichtung (1) ist und die Düsenhalterungsfläche (20) eine Düsenkörperoberfläche ist, die entgegengesetzt zur Richtung des beabsichtigten Stromes von geschmolzenem Metall in die Düse blickt.

6. Vorrichtung nach Anspruch 1, bei der die Anpreßeinrichtungen

a) ein Stützteil, das im wesentlichen unbeweglich bezüglich der Vorratsbehältereinrichtung ist,

b) ein Verschiebeteil (34), das in einem Abstand von dem Stützteil entfernt und in Bezug auf dieses bewegbar angeordnet ist,

c) Federeinrichtungen (36), die betriebsmäßig mit dem Verschiebeteil und dem Stützteil verbunden sind, um eine ausgewählte Kraft zu liefern, die so ausgebildet ist, daß das Verschiebeteil zu der Düseneinrichtung hin bewegt wird und die Düsenhalterungsfläche zu der Vorratsbehälterhalterungsfläche hin gedrückt wird, und

d) Einstelleinrichtungen (38, 40, 42) zur Einstellung der Federeinrichtung, um die ausgewählte Kraft zu ergeben, umfassen.

7. Vorrichtung nach Anspruch 1, bei der die Anpreßeinrichtungen

a) ein Stützteil (32), das bezüglich der Vorratsbehältereinrichtung im wesentlichen unbeweglich ist,

b) ein Verschiebeteil (35), das bezüglich des Stützteiles beweglich ist,

c) pneumatische Betätigungseinrichtungen (46) zum Bewegen des Verschiebeteils zu dem Düsenkörper hin und zur Lieferung einer ausgewählten Kraft, die die Düsenhalterungsfläche zu der Vorratsbehälterhalterungsfläche hin drückt, und

d) Drucksteuereinrichtungen (48) zur Steuerung eines Fließmitteldruckes, der auf die pneumatische Betätigungseinrichtung ausgeübt wird, um die Kraft einzustellen, umfassen.

8. Vorrichtung nach Anspruch 1, bei der die Anpreßeinrichtungen

a) ein Stützteil (32), das bezüglich der Vorratsbehältereinrichtung im wesentlichen unbeweglich ist,

b) ein Verschiebeteil (35), das bezüglich des Stützteils beweglich ist,

c) Schwenkeinrichtungen (52, 56), die mit dem Stützteil verbunden sind, um das Verschiebeteil (35) um sie zu verschwenken,

d) pneumatische Betätigungseinrichtungen (46) zum Verschwenken des Verschiebeteils (35) um die Schwenkeinrichtungen, um einen Teil des Verschiebeteils zu dem Düsenkörper hin zu bewegen und um eine ausgewählte Kraft zu liefern, um die Düsenhalterungsfläche elastisch zu der Vorratsbehälterhalterungsfläche zu drücken, damit die Düse und die Vorratsbehältereinrichtung zusammenpassen, und

e) Drucksteuereinrichtungen (48) zur Steuerung eines Gasdruckes, der auf die pneumatische Betätigungseinrichtung ausgeübt wird, um die Kraft einzustellen, umfassen.

9. Vorrichtung nach Anspruch 1, zusätzlich mit einer Heizeinrichtung (18), die um die Düse herum angeordnet ist, um darin enthaltenes geschmolzenes Metall zu erhitzen.

10. Verfahren zum Gießen kontinuierlicher Metallstreifen mit den Stufen, bei denen

a) ein Vorrat von geschmolzenem Metall in einer Vorratsbehältereinrichtung (1) enthalten ist, die eine Voratsbehälterhalterungsfläche (22, 25) in unmittelbarer Nähe zu einer Vorratsbehälterauslaßöffnung (10) hat,

b) das geschmolzene Metall aus einer Düseneinrichtung (2) extrudiert wird, die in Fließmittelverbindung mit der Vorratsbehältereinrichtung (1) steht und eine Düsenhalterungsfläche (20, 24) in unmittelbarer Nähe zu einer Düseneinlaßöffnung (14) hat, und

c) die Düsenhalterungsfläche mit der Vorratsbehälterhalterungsfläche zusammenpaßt, wobei der Bereich zwischen diesen Flächen so abgedichtet ist, daß eine Leckage an geschmolzenem Metall dazwischen auf ein Minimum herabgesetzt ist, dadurch gekennzeichnet, daß

d) Einrichtung vorgesehen sind, die eine Relativgleitbewegung zwischen der Düsen- und der Vorratsbehälterhalterungsfläche infolge unterschiedlicher Wärmeausdehnung der Düseneinrichtung gegenüber der Vorratsbehältereinrichtung gestatten und

e) die Düsenhalterungsfläche elastisch zu der Vorratsbehälterhalterungsfläche gepreßt wird.

Revendications

1. Un appareil pour couler une bande de métal continue, comprenant:

(a) un système de busette (2) pour l'expulsion du métal fondu, qui présente un corps de busette (12), un orifice d'entrée de la busette (14), un orifice de sortie de la busette (16) et une surface (20, 24) de montage de la busette située à proximité dudit orifice d'entrée de la busette,

(b) un système de réservoir (1) en communication fluide avec ledit système de busette pour contenir ledit métal fondu, ledit système de réservoir présentant un orifice de sortie de réservoir (10) pour l'écoulement dudit métal fondu par cet orifice et présentant une surface (22, 25) de montage du réservoir située à proximité de ladite sortie du réservoir et

(c) un système d'étanchéité (21, 23) situé entre ladite surface de montage de la busette et ladite surface de montage du réservoir pour réduire toute fuite de métal fondu entre celles-ci, caractérisé en ce que

(d) ladite surface (20, 24) de montage de la busette se conjugue à ladite surface (22, 25) de montage du réservoir tout en permettant un mouvement relatif de type coulissant;

(e) ledit système d'étanchéité (21, 23) est élastique et résistant à la chaleur; et

(f) un système d'application (30) est prévu pour presser élastiquement ladite surface de montage de la busette contre ladite surface de montage du réservoir, tout en permettant un mouvement longitudinal du système de busette (2) par rapport au système de réservoir (1).

2. Un appareil tel qu'il est exposé dans la revendication 1, dans lequel ladite surface (20, 24) de montage de la busette et ladite surface (22, 25) de montage du réservoir sont substantiellement planes.

3. Un appareil tel qu'il est exposé dans la revendication 1, comprenant en outre un dispositif de sécurité composé d'une pièce de recouvrement (26) percée d'un passage étroit (28).

4. Un appareil tel qu'il est exposé dans la revendication 1, dans lequel ladite surface de montage du réservoir est une surface intérieure (22) dudit système de réservoir (1) et ladite surface de montage de la busette est une surface du corps de la busette (24) tournée vers le flux désiré de métal fondu dans ladite busette.

5. Un appareil tel qu'il est exposé dans la revendication 1, dans lequel ladite surface de montage du réservoir est une surface extérieure (25) dudit système de réservoir (1) et ladite surface (20) de montage de la busette est une surface du corps de la busette tournée vers le flux désiré de métal fondu dans ladite busette.

6. Un appareil tel qu'il est exposé dans la revendication 1, dans lequel ledit système d'application comprend:

(a) une pièce de support (32) qui est substantiellement immobile par rapport audit système de réservoir;

(b) une pièce de déplacement (34) qui est disposée quelque peu à distance de ladite pièce de support et qui se déplace par rapport à cette dernière;

(c) un système de ressort (s) (36) relié à ladite pièce de déplacement et à ladite pièce de support pour produire une force choisie qui est capable d'actionner ladite pièce de déplacement vers ledit système de busette et presser ladite surface de montage de la busette contre ladite surface de montage du réservoir; et

(d) un système d'ajustage (38, 40, 42) pour ajuster ledit système de ressort (s) afin de produire ladite force choisie.

7. Un appareil tel qu'il est exposé dans la revendication 1, dans lequel ledit système d'application comprend:

(a) une pièce de support (32) qui est substantiellement immobile par rapport audit système de réservoir;

(b) une pièce de déplacement (35) qui se déplace par rapport à ladite pièce de support;

(c) un système d'actionnement pneumatique (46) pour metre en mouvement ladite pièce de déplacement vers ledit corps de la busette et pour produire une force choisie qui presse ladite surface de montage de la busette contre ladite surface de montage du réservoir; et

(d) un système régulateur de pression (48) pour contrôler une pression de fluide fournie audit système d'actionnement pneumatique pour ajuster ladite force.

8. Un appareil tel qu'il est exposé dans la revendication 1, dans lequel ledite système d'application comprend:

(a) une pièce de support (32) qui est substantiellement immobile par rapport audit système de réservoir;

(b) une pièce de déplacement (35) qui se déplace par rapport à ladite pièce de support;

(c) un système de pivot (52, 56) attaché à ladite pièce de support pour faire pivoter autour de lui ladite pièce de déplacement (35);

(d) un système d'actionnement pneumatique (46) pour faire pivoter ladite pièce de déplacement (35) autour dudit système de pivot pour déplacer une partie de ladite pièce de déplacement vers ledit corps de la busette et produire une force choisie qui presse élastiquement ladite surface de montage de la busette sur ladite surface de montage du réservoir pour conjuguer ledit système de busette et ledit système de réservoir; et

(e) un système régulateur de pression (48) pour contrôler une pression de gaz fournie audit mécanisme d'actionnement pneumatique pour ajuster ladite force.

8. Un appareil tel qu'il est exposé dans la revendication 1, comprenant en outre un système de chauffage (18) disposé autour de ladite busette pour chauffer le métal fondu qui y est contenu.

10. Un procédé pour couler une bande de métal continue, comprenant les étapes suivantes:

(a) contenir une réserve de métal fondu dans un système de réservoir (1) pourvu d'une surface de montage du réservoir (22, 25) située à proximité d'un orifice de sortie du réservoir (10),

(b) expulser ledit métal fondu d'un système de busette (2) qui est en communication fluide avec ledit système de réservoir (1) et qui est pourvu d'une surface (20, 24) de montage de la busette située à proximité d'un orifice d'entrée de la busette (14), et

(c) conjuguer ladite surface de montage de la busette à ladite surface de montage du réservoir tout en rendant étanche l'espace situé entre lesdites surfaces afin de réduire tout risque de fuite de métal fondu entre elles, caractérisé en ce que l'on

(d) prévoit un système qui permet un mouvement relatif de type coulissant entre lesdites surfaces de montage de la busette et du réservoir, dû à une dilatation thermique différente dudit système de busette et dudit système de réservoir, et

(e) on presse élastiquement ladite surface de montage de la busette contre ladite surface de montage du réservoir.

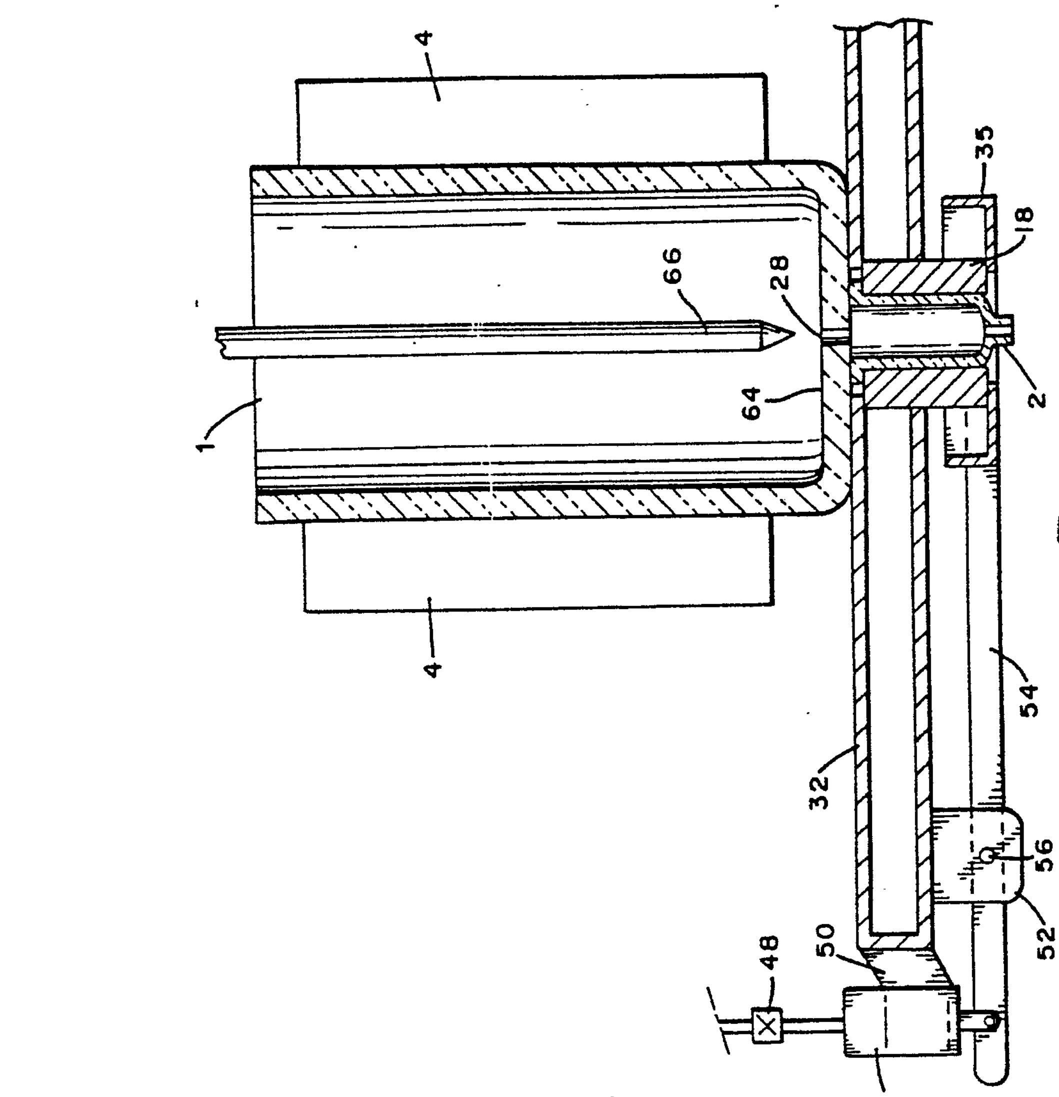


FIG. 7

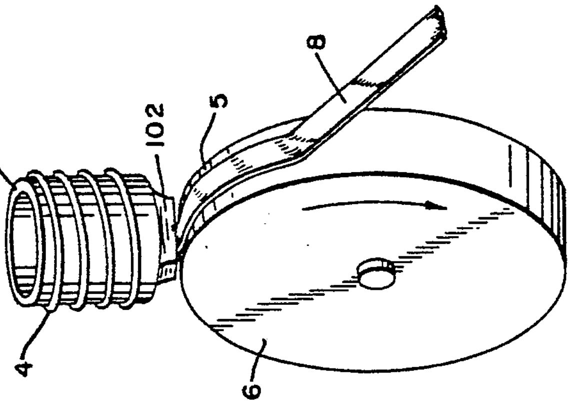


FIG. 1

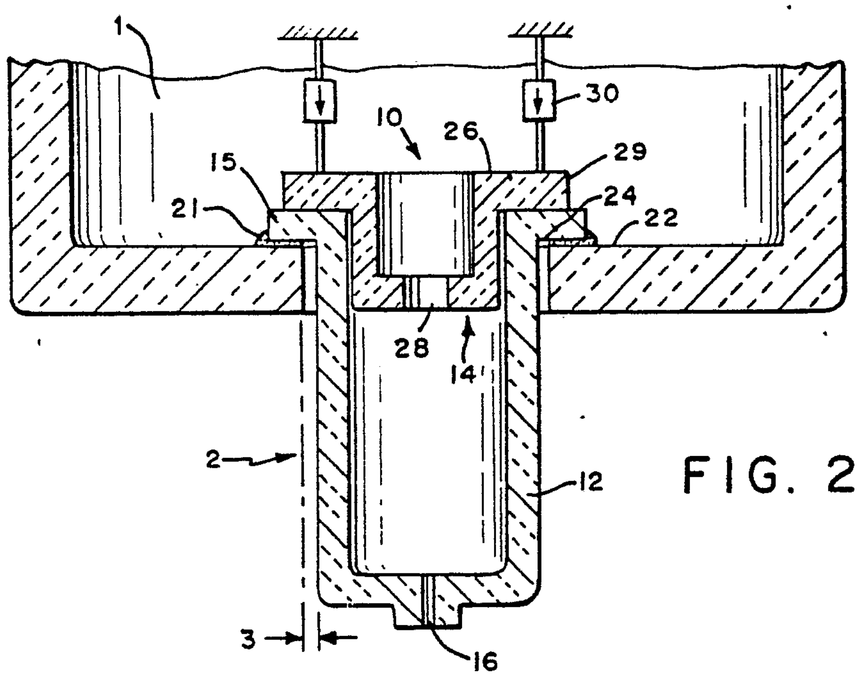
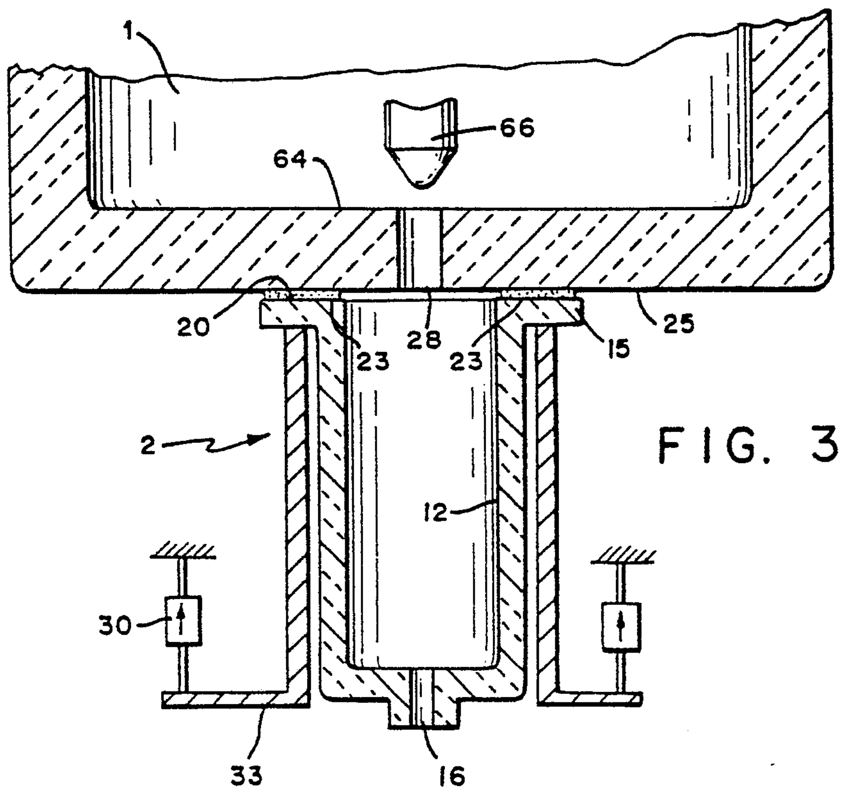

1
30
10
26
29
15
24
21
22
28
14
2
12
3
16

FIG. 2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64
20
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33
16

FIG. 3

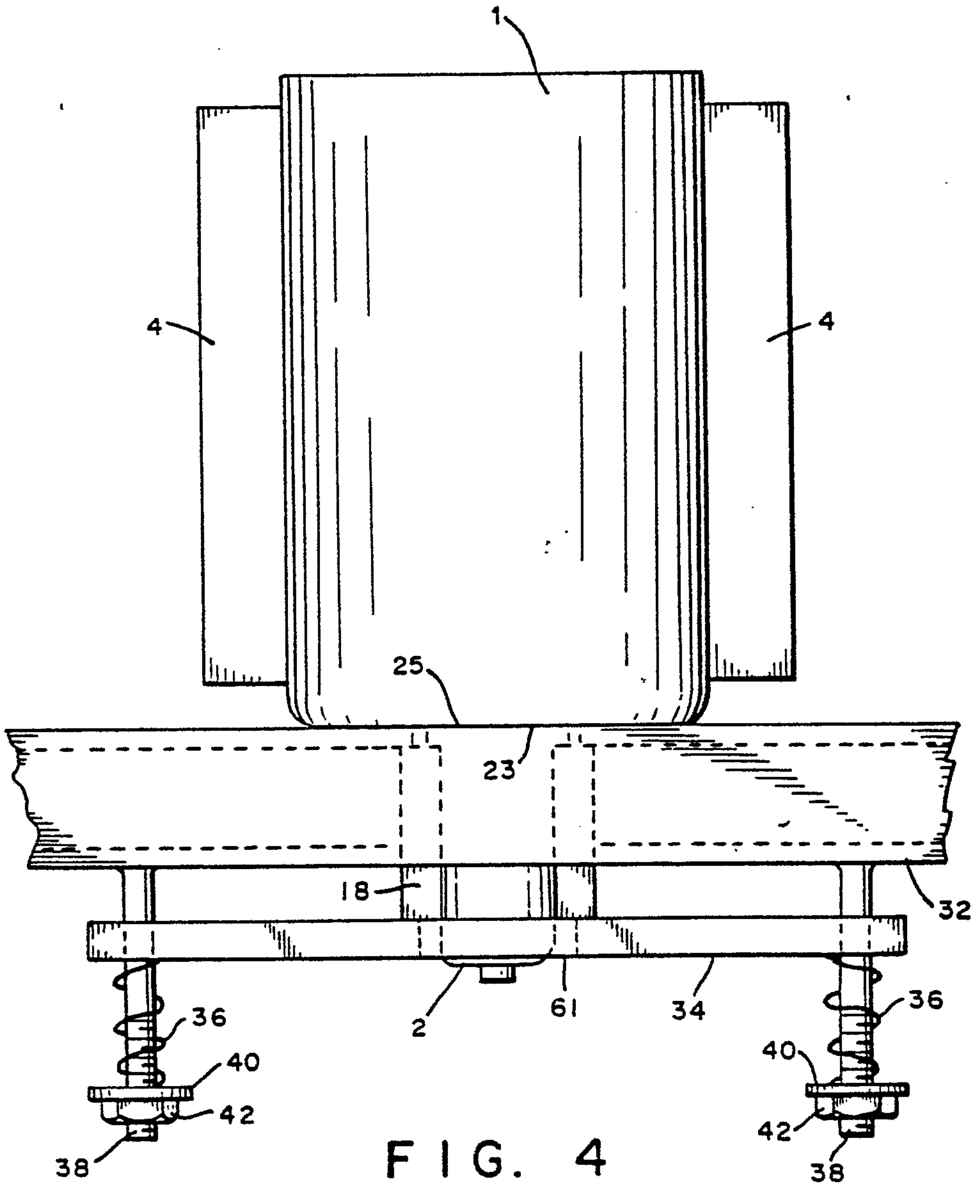
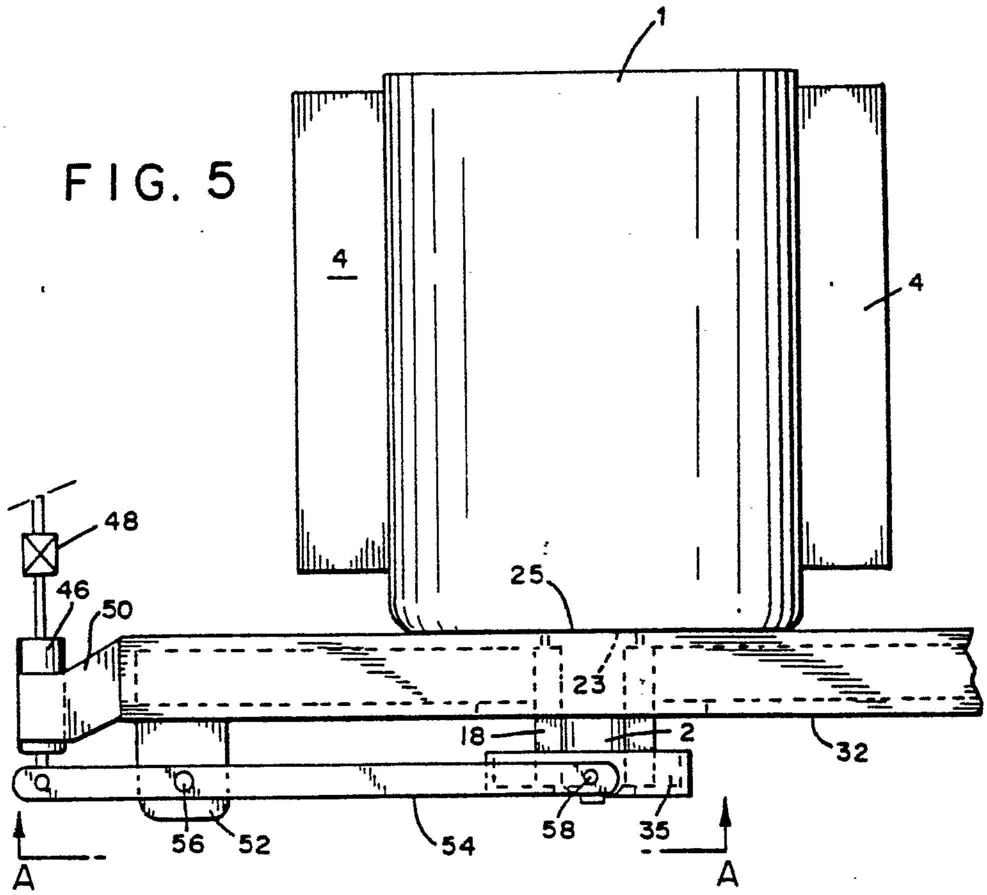


FIG. 4

FIG. 5


1
4
4
48
46
50
25
23
18
2
32
56
52
54
58
35
A
A

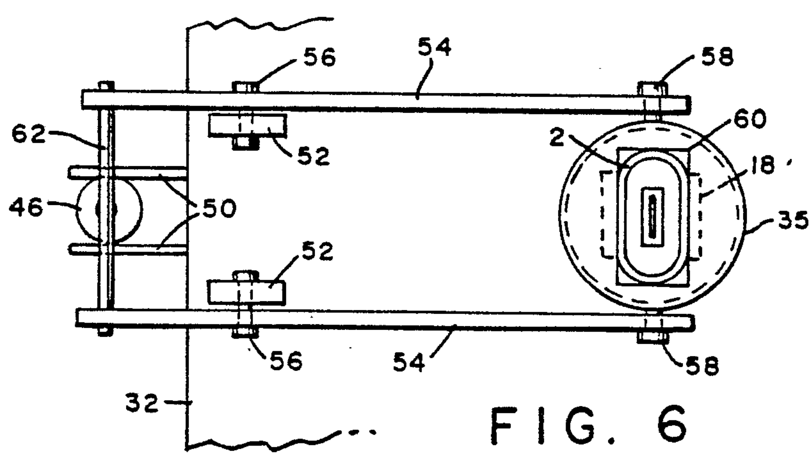

56
54
58
62
52
2
60
18
46
50
35
52
56
54
58
32

FIG. 6