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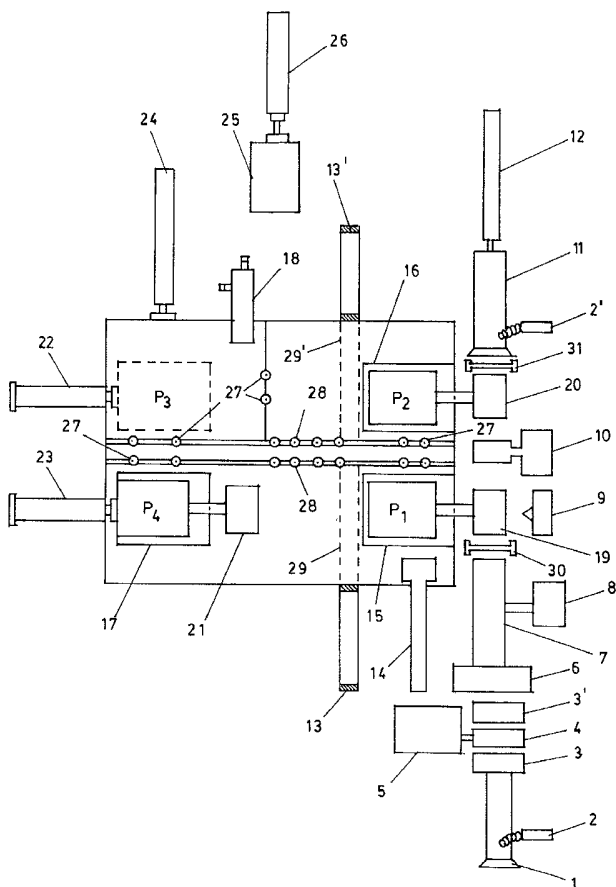
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(54) Title: A MACHINE FOR WINDING THIN METAL RIBBON CONTINUOUSLY ON SPOOLS



(57) Abstract: A machine for winding thin metal ribbon continuously on spools comprising a fixed entry chute (1) to receive the ribbon, a pair of support rollers (3, 3') with a dancing roller (4) between them to support and guide the ribbon delivered through said fixed entry chute (1). A thickness measuring gauge (6) is provided in the path of the ribbon for continuously monitoring the thickness of the ribbon, a snubber roller assembly (30) is provided for pressing the ribbon and a brush assembly (31) is provided for catching the ribbon. A detachable entry chute (7) and a spool changing platform having a first position (P₁), a second position (P₂), a third position (P₃), and a fourth position (P₄) are provided in which the first position (P₁) is a ribbon attaching station (15) with an empty spool on a winding mandril (19), a second position (P₂) is a ribbon winding station (16) with the winding spool on a winding mandril (20), the third position (P₃) is a station for unloading the wound spool and loading an empty spool, and the fourth position (P₄) is a stand-by station (17) with an empty spool on a winding mandril (21). A hitting rod mechanism (9) is located close to the ribbon attaching station (15) to attach the ribbon to the empty spool on the mandril (19). A ribbon support roller (10) is located between the winding spool at the ribbon attaching station (15) and the winding spool at the ribbon winding station (16) for supporting the ribbon and a delivery chute (11) is provided for removing cut piece of ribbon after attaching the ribbon on the spool.

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A MACHINE FOR WINDING THIN METAL RIBBON CONTINUOUSLY ON SPOOLS

FIELD OF INVENTION

The invention relates to a machine for winding thin metal ribbon continuously on a spool. Thin metal foil made by continuous casting of metal requires collection of the foil by winding on spools continuously. The machine according to the invention is used with a continuous casting machine for producing metal foil in the form of a ribbon. The continuous casting machine with a machine for winding thin metal ribbon is developed for collecting amorphous magnetic cast material in the form of ribbon on spools.

SUMMARY OF THE INVENTION

The invention provides a machine for winding thin metal ribbon continuously on spools comprising a fixed entry chute to receive the ribbon, a pair of support rollers

with a dancing roller between them to support and guide the ribbon delivered through said fixed entry chute, a thickness measuring gauge in the path of the ribbon for continuously monitoring the thickness of the ribbon, a snubber roller assembly for pressing the ribbon, a brush assembly for catching the ribbon and providing better tension control, a detachable entry chute, a spool changing platform having a first position (P_1), a second position (P_2), a third position (P_3), and a fourth position (P_4), the first position (P_1) being a ribbon attaching station with an empty spool on a winding mandril, the second position (P_2) being a ribbon winding station with the winding spool on a winding mandril, the third position (P_3) being a station for unloading the wound spool and loading an empty spool, and the fourth position (P_4) being a stand-by station with an empty spool on a winding mandril, a hitting rod mechanism located close to the ribbon attaching station to attach the ribbon to the empty spool on the mandril, a ribbon support roller located between the winding spool at the ribbon attaching station and the winding spool at the ribbon winding station for supporting

the ribbon, a delivery chute for removing cut piece of ribbon after attaching the ribbon on the spool, a mechanism for wound spool unloading and empty spool loading located at the third position, said spools on mandrils being movable between the four positions on the spool changing platform on a guided path so that an empty spool on the mandril is located at the ribbon attaching station, a winding spool on the winding mandril is located at the ribbon winding station and an empty spool on the winding mandril is located at the stand by station when the winding is in progress.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 shows a schematic diagram of the machine for winding thin metal ribbon continuously.

Figures 2 and 3 show the details of the mechanism for spool unloading and empty spool loading.

Figures 4 and 5 show the details of the hitting rod mechanism.

Figure 6 shows the details of the snubber roller assembly.

Figure 7 shows the details of the brush assembly.

DETAIL DESCRIPTION

The cast metal ribbon enters through a fixed entry chute (1). The ribbon is dragged through the chute with the help of a suction provided in the chute by means of a blower (2). The ribbon is passed through a pair of support rollers (3, 3') and a dancing roller (4) located between the support rollers (3, 3').

A thickness measuring gauge (6) is located in the path of the metal ribbon for monitoring the thickness of the ribbon. A snubber roller assembly (30) is provided for pressing the ribbon till it touches the spool. A brush

assembly (31) is provided to catch the ribbon and maintain a required tension in the ribbon. A detachable entry chute (7) is provided through which the metal ribbon is passed to a ribbon attaching station (15) at a first position (P_1) provided with an empty spool on a winding mandril (19). A hitting rod mechanism (9) is provided aligned to the ribbon attaching station (15) to hit on the ribbon against the empty spool on the winding mandril (19) so that the ribbon gets attached to the spool and the extended portion of the ribbon is cut out from the spool. Preferably the surface of spool is provided with an adhesive tape so that the ribbon is properly stuck to the spool when the hitting rod mechanism hit on the ribbon against the spool. After the hitting action the winding mandril start rotating and the rotation of the spool is synchronized with the linear speed at which the ribbon is advanced. Necessary loop correction is achieved with the dancing roller (4) by means of a pneumatic cylinder (5) to keep the ribbon at appropriate tension. Then the mandril with the ribbon attached to the winding spool is moved to the winding station (16) at the second position (P_2) and the empty spool on a winding

mandril (21) is moved to the first position (P_1). Support roller (10) is located between the first position (P_1) and second position (P_2) to support the ribbon. The cut portion from the ribbon after the operation of the hitting mechanism is sucked out through a delivery chute (11) provided with a suction created by a blower (2). The delivery chute (11) is provided with a pneumatic cylinder (12) for its operation and the cut pieces are collected and may be recycled.

When the winding spool is fully wound with metal ribbon it is moved to the third position (P_3) where a mechanism (18, 25) for wound spool unloading and empty spool loading is provided for removing the wound spool and loading an empty spool on the mandril.

The mechanism for wound spool unloading and empty spool loading comprises a pusher plate (18.1) with a hydraulic pushing cylinder (18.3) to push the wound spool from the mandril to a turn style (25) with operating means (26) for receiving the wound spool, a hydraulic lifting

cylinder (18.2) for lifting the pusher plate and a base stand (18.4). Hydraulic cylinders (14, 22, 23, 24) are provided on the spool changing platform for moving the spool on the winding mandrils from the first position (P_1) to second position (P_2), then to the third position (P_3) and to the fourth positions (P_4). The empty spool at the first position (P_1) is moved to the second position (P_2) after the ribbon is attached to the spool. The ribbon is wound on the spool at the second position (P_2) and moved to the third position (P_3).

The wound spool at the third position (P_3) is unloaded from the mandril and an empty spool is loaded on the mandril and moved to the fourth position (P_4) where it remains till the spool in the second position (P_2) is fully wound and the hitting rod mechanism (9) is operated to cut the ribbon from the spool in the second position (P_2) and to attach ribbon to the spool in the first position (P_1). The mandril with wound spool in the second position (P_2) is moved to the third position (P_3) and the mandril with the empty spool and attached to the ribbon is moved to the

second position (P₂). The mandril with the empty spool in the fourth position (P₄) is now moved to the first position (P₁) till the spool in the second position is fully wound. Meanwhile the mandril with the wound spool in the third position (P₃) is unloaded, an empty spool is loaded on the mandril and moved to the fourth position (P₄) as a stand by mandril with spool. The tips of the mandrils (19, 20, 21) are preferably collapsible in order to make loading and unloading of spools easy.

The hitting rod mechanism (9) comprises a hitting rod operating lever (9.1), a lever actuating rod (9.2) and an electromagnet (9.3) for operating the lever actuating rod (9.2). Movable guides (27) and fixed guides (28) are provided on the spool changing platform for smooth movement of the winding mandrils with spools, along the prescribed paths.

The movable guides (29, 29') are operated by hydraulic cylinders (13, 13') and the spooling mechanism is provided with a hydraulic cylinder (14) for moving the

mandril (19) to the second position (P_2) after catching the ribbon at first position (P_1). The pneumatic cylinder with ribbon support roller (10) brings the ribbon down for attaching the ribbon, when the winding is completed at the second position (P_2). The sequential operation of the motion of the winding mandrils with spools and operation of the hitting mechanism are controlled by a programmed processor. The timings of the operation of the pneumatic cylinders and hydraulic cylinders are decided by the program.

The machine according to the invention can be used for coiling ribbon material of any type wherein the ribbon is produced continuously and is required to be made in the form of coil. The machine has been effectively tried in the production of coils of amorphous magnetic ribbon used in making electrical transformers and rotating machinery.

CLAIMS

1. A machine for winding thin metal ribbon continuously on spools comprising a fixed entry chute (1) to receive the ribbon, a pair of support rollers (3, 3') with a dancing roller (4) between them to support and guide the ribbon delivered through said fixed entry chute (1), a thickness measuring gauge (6) in the path of the ribbon for continuously monitoring the thickness of the ribbon, a snubber roller assembly (30) for pressing the ribbon, a brush assembly (31) for catching the ribbon and providing better tension control, a detachable entry chute (7), a spool changing platform having a first position (P₁), a second position (P₂), a third position (P₃), and a fourth position (P₄), the first position (P₁) being a ribbon attaching station (15) with an empty spool on a winding mandril (19), a second position (P₂) being a ribbon winding station (16) with the winding spool on a winding mandril (20), the third position (P₃) being a station for unloading the wound spool and

loading an empty spool, and the fourth position (P₄) being a stand-by station (17) with an empty spool on a winding mandril (21), a hitting rod mechanism (9) located close to the ribbon attaching station (15) to attach the ribbon to the empty spool on the mandril (19), a ribbon support roller (10) located between the winding spool at the ribbon attaching station (15) and the winding spool at the ribbon winding station (16) for supporting the ribbon, a delivery chute (11) for removing cut piece of ribbon after attaching the ribbon on the spool, a mechanism (18, 25) for wound spool unloading and empty spool loading located at the third position (P₃), said spools on mandrils (19, 20, 21) being movable between the four positions (P₁, P₂, P₃, P₄) on the spool changing platform on a guided path so that an empty spool on the mandril (19) is located at the ribbon attaching station (15), a winding spool on the winding mandril (20) is located at the ribbon winding station (16) and an empty spool on the mandril (21) is located at the stand by station (17) when the winding is in progress.

2. The machine as claimed in claim 1, wherein said hitting rod mechanism (9) comprises a hitting rod operating lever (9.1), an actuating rod (9.2) for actuating said hitting rod actuating lever (9.1) and an electro-magnet (9.3) for applying force for hitting.
3. The machine as claimed in claims 1, wherein said spool unloading and spool loading mechanism (18) comprises a base stand (18.4), a pusher plate (18.1) provided with a pushing hydraulic cylinder (18.3), a lifting hydraulic cylinder (18.2) and a platform (18.5).
4. The machine as claimed in any one of the claim 1, wherein said spool changing platform is provided with movable guides (27) and fixed guides (28) for guiding the motion of the winding mandrils with spools and hydraulic cylinders (14, 22, 23, 24) for pulling and pushing the mandrils to the desired positions (P_1 to P_4).

5. The machine as claimed in claim 1, wherein the said mandrils (19, 20, 21) have collapsible tips for loading and unloading spools easily.
6. The machine as claimed in claim 1, wherein said spool unloading and spool loading mechanism (18) is provided with a turn style (25) having an operating means (26).
7. The machine as claimed in claim 1, wherein the said fixed entry chute (1) and said delivery chute (11) are provided with suction by means of blowers.
8. The machine as claimed in claim 1, wherein said snubber roller assembly (30) for pressing of the ribbon comprises a holding structure (30.1) for holding a snubber roller (30.2) and a hydraulic cylinder (30.3) for applying force while pressing.
9. The machine as claimed in claim 1, wherein said brush assembly (31) for catching the ribbon

comprises a pair of servo motors (31.1) for driving a pair of brushes (31.2) in opposite directions, a pair of hydraulic cylinders (31.3) for the controlled up and down movement of said pair of brushes (31.2) and applying force to said brushes (31.2) while catching the ribbon and a base (31.4) for holding the entire brush assembly.

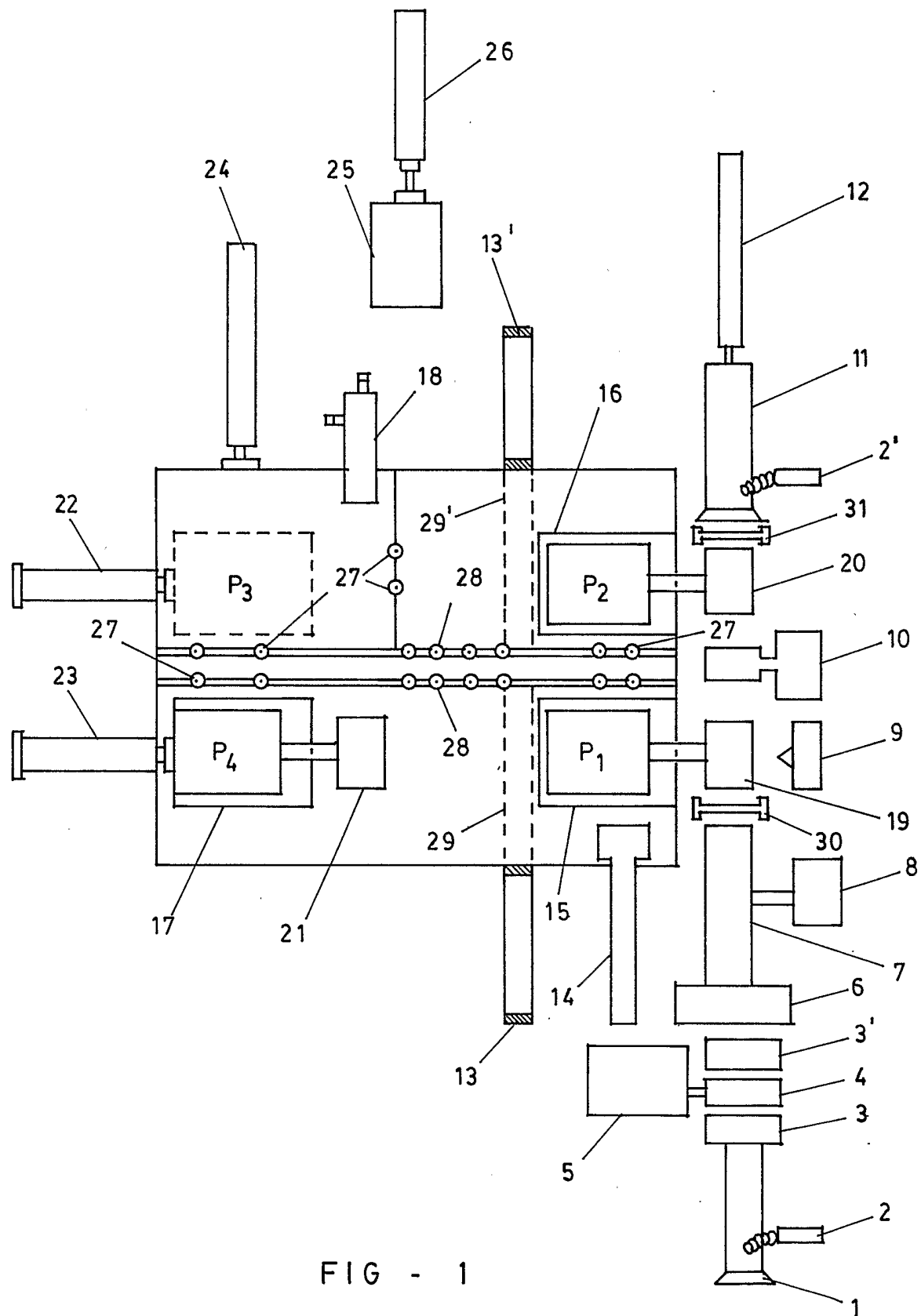


FIG - 1

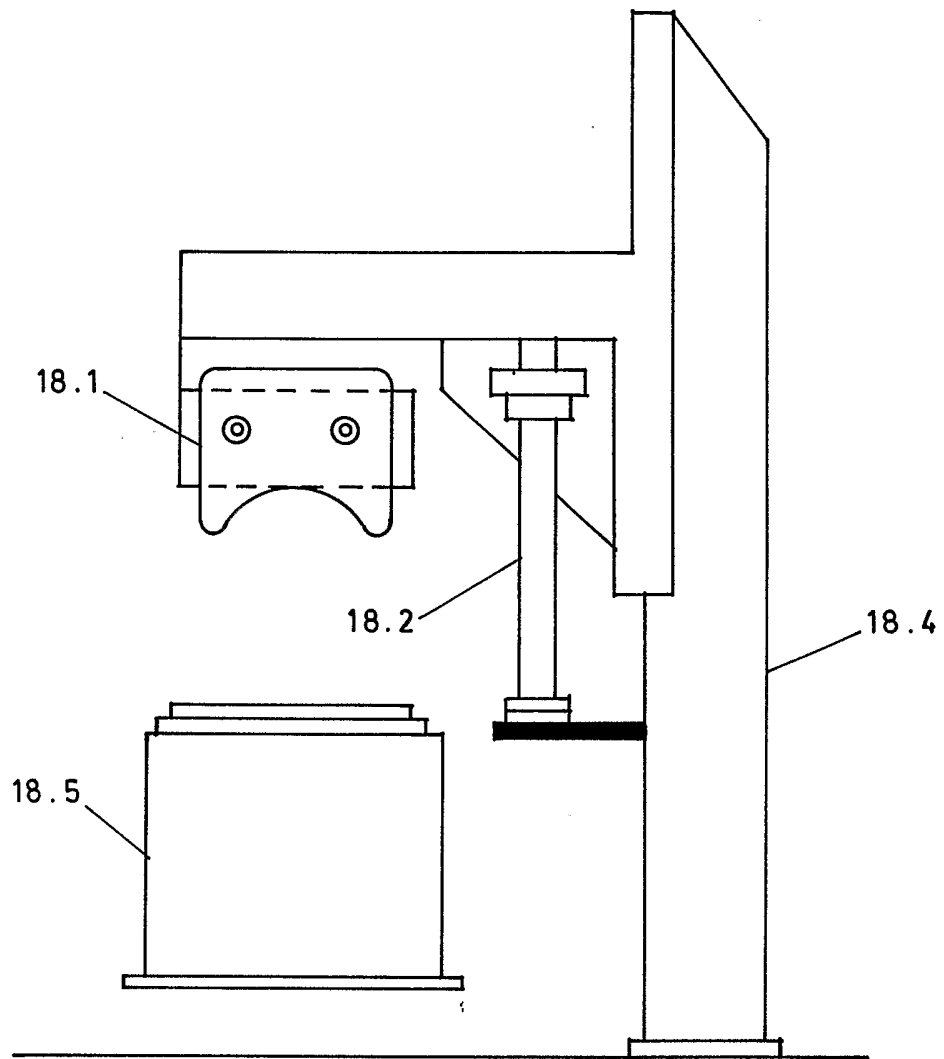


FIG - 2

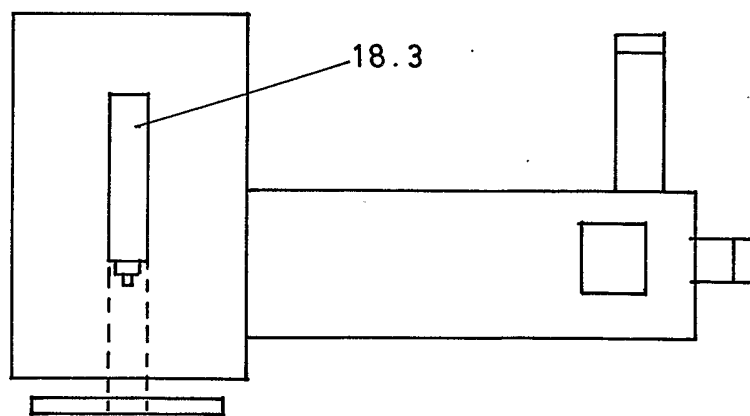


FIG - 3

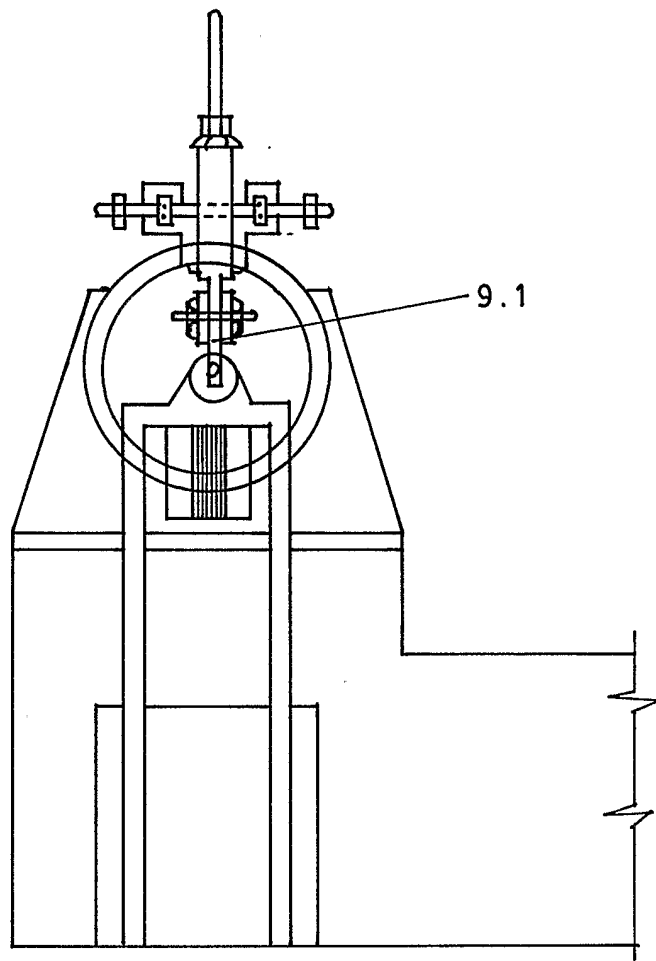


FIG - 4

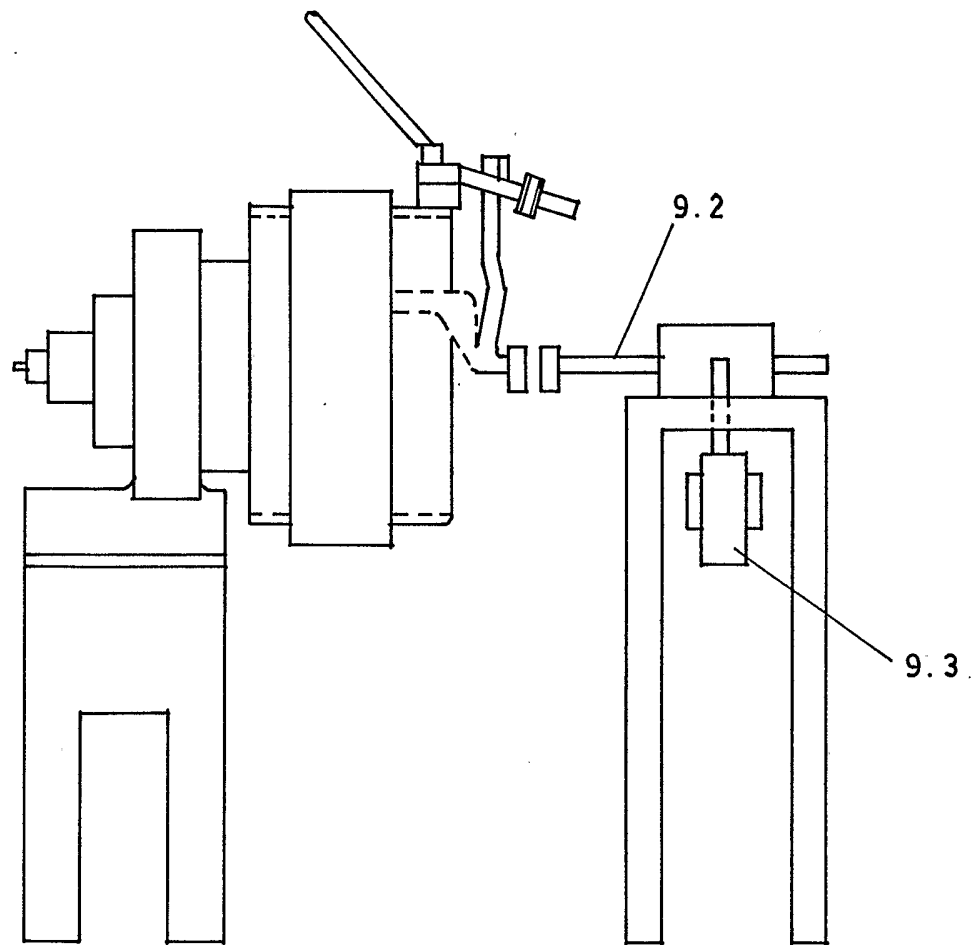


FIG - 5

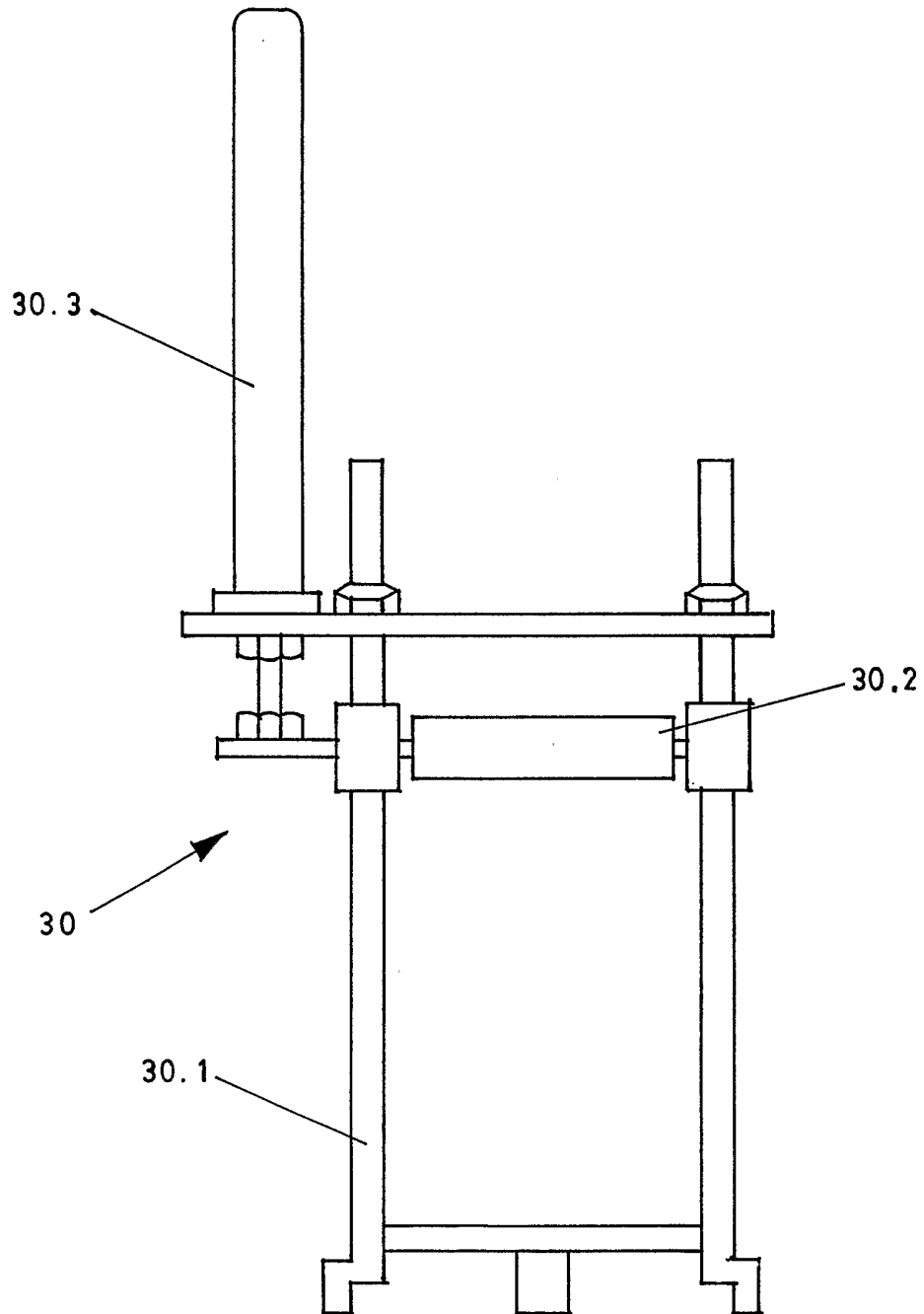


FIG - 6

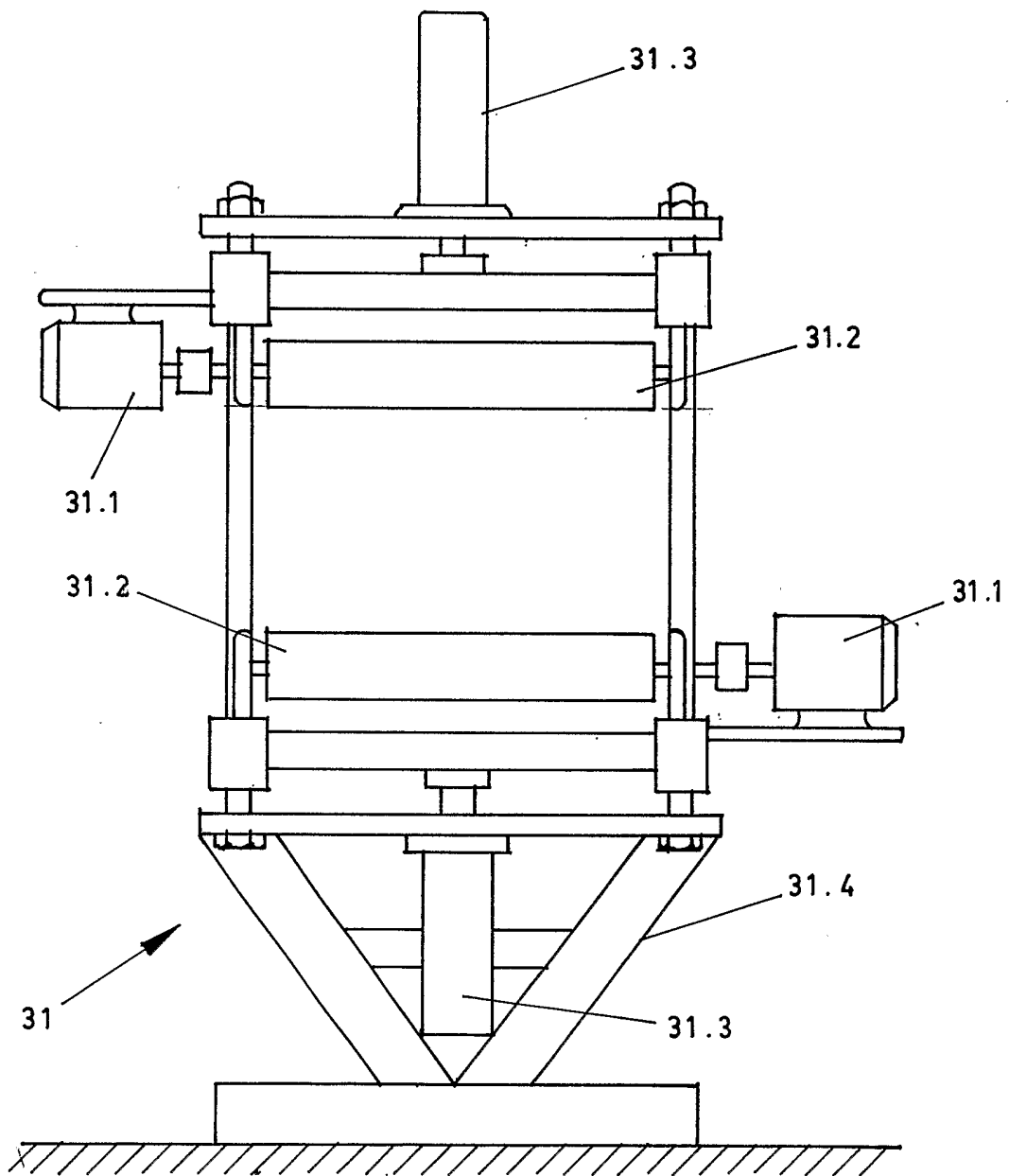


FIG - 7