March 31, 1970 G. A. JEAN-MARIE MARTELEE 3,503,528

TILTING DEVICE FOR INGOTS

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FIG.1

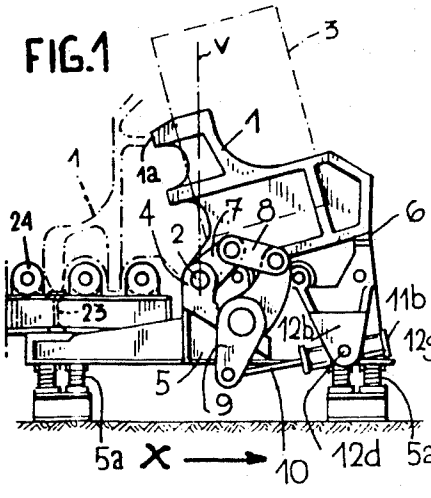


FIG.2

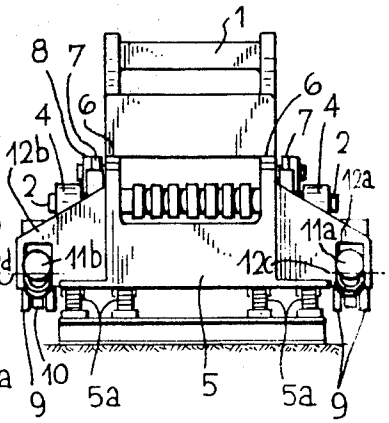
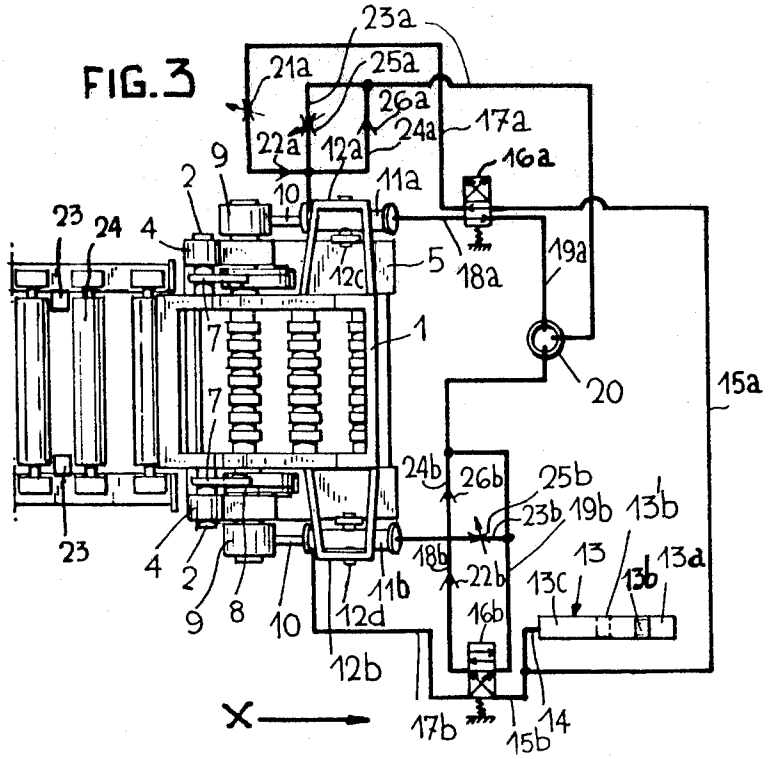


FIG.3



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TILTING DEVICE FOR INGOTS

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Claims priority, application Belgium, June 16, 1966, 40,986

Int. Cl. B25g *3/00;* B66c *23/18*

U.S. Cl. 214—1 3 Claims

ABSTRACT OF THE DISCLOSURE

In a tilting device for ingots, a basket loaded with an ingot is rocked about a horizontal axis and compresses gas in a chamber so as to recuperate the gravity energy of the descent of the loaded basket which after unloading of the ingot is returned to its initial position by expansion of said compressed gas.

This application is a division of copending application Ser. No. 646,301, filed June 15, 1967.

This invention relates to tilting devices for ingots.

It is known that the manipulation, transport or change of place or position of commercial and industrial products is undertaken with the help of various devices or apparatuses actuated by driving means of different types, particularly motors, whose power depends on the operations to be carried out and on the weight of the products to be manipulated.

Particularly for certain metallurgical operations, such as rolling, the ingots must be disposed in the longitudinal direction while they are drawn vertically from the reheating furnaces; in order to put them into this horizontal position, there have been conceived tilting devices for ingots, which are apparatus essentially composed of an ingot support basket mounted on pivots and rockable around a horizontal axis situated below the center of gravity of the whole of the basket and ingot, and outside of the vertical passing through the center of gravity; this placing is necessitated by the bank of transport rollers at the rolling mill in conventional installations. The known tilting devices are driven in their pivoting by a continuous motor of very high power, taking into account the weight of the tilted ingots; in these tilting devices, in particular the starting efforts are very considerable and the motor requires a feed whose current peaks are very high and which, resulting from this fact, must be made by Ward-Leonard groups or by rectifiers. The result of this is that the known tilting devices are costly, not only to install but also in functioning.

The problem at the basis of the invention is to do away with the external feed of the driving means of a handling apparatus, making a product to pass from a higher level to a lower level and to make the said apparatus function only by the energy recuperated during the descent.

The invention concerns a plant for tilting ingots comprising a tilting device with a basket rocking about a horizontal axis, placed below the center of gravity but outside the vertical of the said center of gravity, being characterized in that the driving means for the basket comprises a highly compressed gas lodged in a first tight chamber of an accumulator cylinder separated by a movable piston from a second chamber filled with oil and connected by means of pipes provided with valves for changing the directions with one or the other face of two hydraulic jacks, whose respective piston rods act by a set of rods on the arms fixed at the ends of the basket pivots, in such a way as to pivot the basket loaded with the ingot from the start position until beyond the vertical, passing through the pivoting axis by the expansion of the said compressed gas, then to recuperate the gravity energy due to the descent of the loaded basket to the position of unloading, compressing the gas and finally to bring back the unloaded basket to the initial position where it receives another ingot, by a partial expansion and compression of the said gas, in such a way that the operations can be repeated indefinitely without any other supply of energy.

In accordance with one feature of the invention, the compressible fluid, which is preferably an inert gas such as nitrogen, is previously introduced under very high pressure into the first tight chamber in order to place all the hydraulic system under pressure; in accordance with a modification, the pressurization of the inert gas is brought about by the descent of the first ingot, the operations of raising the empty basket and descent of the loaded basket being repeated then indefinitely.

The invention will now be described in greater detail by way of example with reference to the accompanying drawing, in which:

FIGURES 1, 2 and 3 are diagrammatic views showing an elevation of a lateral face, an elevation of the rear face, and a plan respectively of a tilting installation embodying the invention.

The installation as shown comprises a basket **1** provided with two lateral pivots **2**, disposed in accordance with a horizontal axis which comprises the axis of pivoting of the basket; this axis is situated at a level lower than the center of gravity of the basket **1** loaded with an ingot **3** and moved towards the front of the vertical passing through the center of gravity with relation to the direction of pivoting. The pivots **2** turn in bearings **4**, supported by a rigid frame **5**, resiliently mounted on helicoidal springs **5***a*. At the beginning, the basket **1** loaded with the ingot **3** rests on stops **6** at the rear of the frame **5**.

On the end of the two lateral pivots **2** are fixed arms **7**, to which are articulated links **8** which in turn are articulated to pivoting levers **9** which in turn are articulated to the ends of rods **10** of the pistons of hydraulic jacks **11***a* and **11***b* pivotably mounted at **12***c* and **12***d* respectively between clamps **12***a* and **12***b* and the frame **5** on one side and the other of the latter.

The rocking of the basket is effected by a hydraulic system which will now be described.

A cylindrical accumulator **13** contains in a first closed chamber **13***a* an inert gas, such as nitrogen, previously compressed to a very high pressure which can be 150 to 200 kg./cm.^{2}. A movable piston **13***b* separates this first

chamber from a second closed chamber **13***c* which is filled with oil.

The chamber **13***c* is attached to a pipe **14** having two pipes **15***a* and **15***b* coming from it.

The pipe **15***a* arrives at a sliding electro-valve for changing the directions **16***a* at which terminates also pipes **17***a*, **18***a* and **19***a* respectively attached to the front chamber and to the rear chamber of the jack **11***a* and to an oil reservoir **20**; on the pipe **17***a* are placed a diaphragm **21***a*, an anti-compressor flap valve **22***a* from which come two pipes **23***a* and **24***a* provided one with a diaphragm **25***a* and the other with an anti-compressor flap valve **26***a*; these two pipes **23***a* and **24***a* also end in the reservoir **20**.

The pipe **15***b* arrives at a sliding electro-valve for changing the direction of flow **16***b* at which terminate also pipes **17***b*, **18***b* and **19***b* attached to the front chamber and to the rear chamber of the jack **11***b* and to the reservoir **20** respectively; the pipe **18***b* being provided with an anti-compressor flap valve **22***b* and is also attached to the reservoir **20** by a pipe **24***b* on which there is an anti-compressor flap valve **26***b*; a diaphragm **25***b* is placed on a pipe **23***b* joining the pipe **18***b* to the pipe **19***b*.

After assembling of the installation, there is effected the filling of the hydraulic system, from which air is expelled by purging and nitrogen is introduced under a very high pressure in chamber **13***a* of the accumulator, the spring-return electro-valves **16***a* and **16***b* being at rest in the positions shown in FIG. 3.

The pressure of the oil coming from the accumulator **13** is without any effect on the jack **11***a* because the pressure of the oil in the chamber **13***c* passing by the pipes **15***a* and **17***a* is stopped by the anti-compressor flap valve **22***a* and also on the jack **11***b* because the oil pressure in the chamber **13***c* passing by the pipe **16***b* is stopped by the anti-compressor flap valve **22***b*.

At the start of an operation, the basket **1** rests on the stops **6**; an ingot **3** is disposed in the basket **1** by means of a rolling bridge. By the activation of a push button (not shown) in an electric circuit (not shown), the electro-valve **16***b* is excited and moved towards the base against the action of its return springs; due to this, through the pipes **14**, **15***b* the electro-valve **16***b* and the pipe **17***b*, the pressure of the oil in the chamber **13***c* acts on the front chamber of the jack **11***b* whose piston is pushed back following the direction of the arrow X. In this way by the set of rods **7**, **8**, **9** and **10**, the jack **11***b* makes the loaded basket **1** pivot in a counterclockwise direction. The loaded basket **1** leaves the stops **6** and pivots progressively until the center of gravity of the whole, basket and ingot, is slightly beyond or outside the vertical V passing through the axis of pivoting; at this moment a contact breaker (not shown) automatically cuts the current to the electro-valve **16***b* which is maintained excited by the action of the press button (not shown) and as soon as the current is cut, the electro-valve returns to its position of rest by the action of its return spring.

In the course of this operation, the nitrogen is expanded and the piston **13***b* occupies its position **13'***b*; the electro-valve **16***b* being returned into the designated position thus puts the pipe **17***b* into communication with the pipe **19***b* and the pipe **18***b* with the pipe **15***b*. Thus, the front of the jack **11***b* is in contact with a reserve of oil in the reservoir **20** and the rear of the jack **11***b* is connected with the chamber **13***c* by means of the flap valve **22***b* and with the reservoir **20** by the diaphragm **25***b* and the pipes **23***b* and **19***b*. The loaded basket having passed the vertical, descends under the action of the weight and by the arms **7**, the links **8**, and the levers **9**, drives the pistons of the jacks **11***a* and **11***b*, still following the arrow X; the jack **11***b* sucks oil out of the reservoir **20** and propels some towards **18***b* and **15***b*; a small part of this oil is sent to the reservoir **20** by the diaphragm **25***b* and the remainder, driven towards the accumulator **13**, serves to recompress the nitrogen in the chamber **13***a* by repushing the piston **13***b* towards the right. By the descent of the loaded basket **1**, the jack **11***a* is driven like the jack **11***b*; the oil propelled by the jack **11***a* leaves by the pipe **18***a* and by the pipe **19***a* arrives in the reservoir **20** which is at atmospheric pressure. When the pressure of the nitrogen in the chamber **13***a* has become sufficient to equilibrate the action of the loaded basket, the latter lessens in speed a little before the end of the pivoting, the oil propelled by the jack **11***b* continues to pass by the calibrated diaphragm **25***b* and goes to the reservoir **20** by the pipe **19***b*. Thus, due to the rate of leakage, the loaded basket continues to descend very slowly by its weight until it finally comes to rest on the front stops **23**, in such a way that the ingot **3** rests only on the transporting rollers **24**. The cross pieces **1***a* of the basket **1** being completely disengaged, the transport rollers **24** are set into rotation and the ingot is removed. When the basket is empty, it can be returned by exciting the electro-valve **16***a* by a push button (not shown); this electro-valve **16***a* moves towards the base, thus joining pipes **15***a* and **18***a* as well as pipes **19***a* and **17***a*. The pressure of oil of the accumulator **13** acts by the pipes **15***a*, **16***a* and **18***a* and pushes the piston of the jack **11***a* back again in the opposite direction to that of the arrow X; while the oil propelled by the front of the jack **11***a* passes by the pipes **17***a*, **22***a*, **21***a* and enters into the reservoir **20**. The basket **3** is raised by the action of the jack **11***a*; during this operation the two faces on the piston of the jack **11***b* drawn by the movement of the basket are in contact with the reservoir **20** by the pipes **17***b*, **19***b* and electro-valve **16***b*, which is in the designated position; the flap **26***b* is open, since the oil is sucked in out of the reservoir **20** by the back of the jack **11***b*, whose front propels the oil towards the reservoir **20** by passing through pipes **17***b*, **16***b* and **19***b*. The center of gravity of the empty basket approaches the vertical of the axis of pivoting and a circiut breaker (not shown) automatically cuts the excitation of the electro-valve **16***a* which returns to the shown position; the empty basket pivots towards the rear by inertia and by its own weight; the jack **11***a* draws in, through the back, oil from the reservoir **20** by pipes **18***a* and **19***a*, and by the front, it propels some oil which tends to pass through the diaphragm **25***a* to arrive in the reservoir **20**. A part of this oil passes through the anti-compressor flap valve **22***a*, the diaphragm **21***a*, the pipe **17***a*, electro-valve **16***a*, the pipe **15***a* into order to compress the gas in the cahmber **13***a*. The basket is braked in its descent by the increase of pressure of the gas in chamber **13***a* of the accumulator **13**, but it continues to descend, taking into account that the oil passes through the constriction **25a** and enters into the reservoir **20**. The basket thus returns to its starting position where it rests on the stops **6** and the cycle of operations can start again when the basket is loaded with another ingot.

Having described my invention, I claim:

1. A device for tilting ingots comprising a frame, a basket for supporting an ingot, pivots on said basket for having said basket to be rotatably mounted on said frame about a horizontal axis situated outside of the center of gravity of said basket with an ingot, a driving means for rocking said basket with an ingot, an accumulator cylinder and a piston in said cylinder for separating said cylinder into two chambers the first one chamber containing a highly compressed gas and the second chamber containing oil, an arm fixed on the end of each said pivots of said basket, two hydraulic jacks, a piston in each of said two jacks, a rod attached to each of said pistons, a link articulated to each of said arms, a pivoting lever articulated to each of said links and to each rod of said pistons, connecting pipes between said accumulator cylinder and said hydraulic jacks, sliding valves on said connecting pipes for changing the directions of flow of said compressed gas and said oil from and to said accumulator cylinder to and from said hydraulic jacks, in such a way as to pivot the loaded basket by the expansion of the

compressed gas, then to recuperate the gravity energy, due to the descent of the loaded basket, in order to compress the gas and to return the empty basket to the initial position by a partial expansion and compression of the gas.

2. A device as claimed in claim 1 wherein said sliding valves for changing the direction of flow of said compressed gas and said oil from said accumulator cylinder with one or the other end of said two hydraulic jacks are electro-valves having return springs and being excited by action on push buttons.

3. A device as claimed in claim 1 or claim 2, wherein

said two hydraulic jacks are disposed on one side and the other of said frame.

References Cited

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FRANK E. WERNER, Assistant Examiner

U.S. Cl. X.R.

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