United States Patent

Martelee

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[54] GRIPPER FOR HANDLING HEAVY PRODUCTS AND SPECIFICALLY HORIZONTAL-AXIS COILS

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[52] **U.S. Cl.** ..... **294/67 R,** 294/67 BB, 294/88

[51] **Int. Cl.** **B66c 1/66**

[58] **Field of Search** 294/67, 88, 81, 86, 85

[56] **References Cited**

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[57] **ABSTRACT**

In a handling gripper for rigid products and specially coils there is provided a framework in the form of a rigid casing pivotally suspended from a vertical suspension pivot attached to a lifting hook. The casing houses horizontal telescopic arms operated by a horizontal ram and from which are suspended hollow vertical telescopic grasping arms each housing a vertical hydraulic ram connected to a compressed oil accumulator which supplies oil to said horizontal ram and to a rotating ram about the vertical suspension pivot, according to the position of a remotely controlled electromagnetic valve.

3 Claims, 6 Drawing Figures

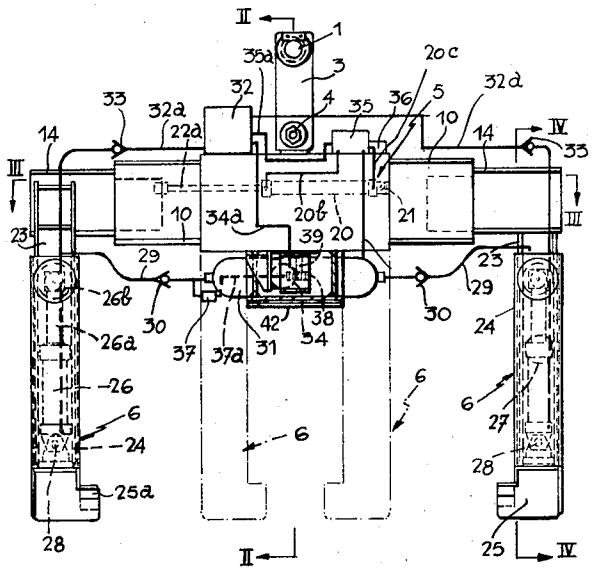

FIG. 1

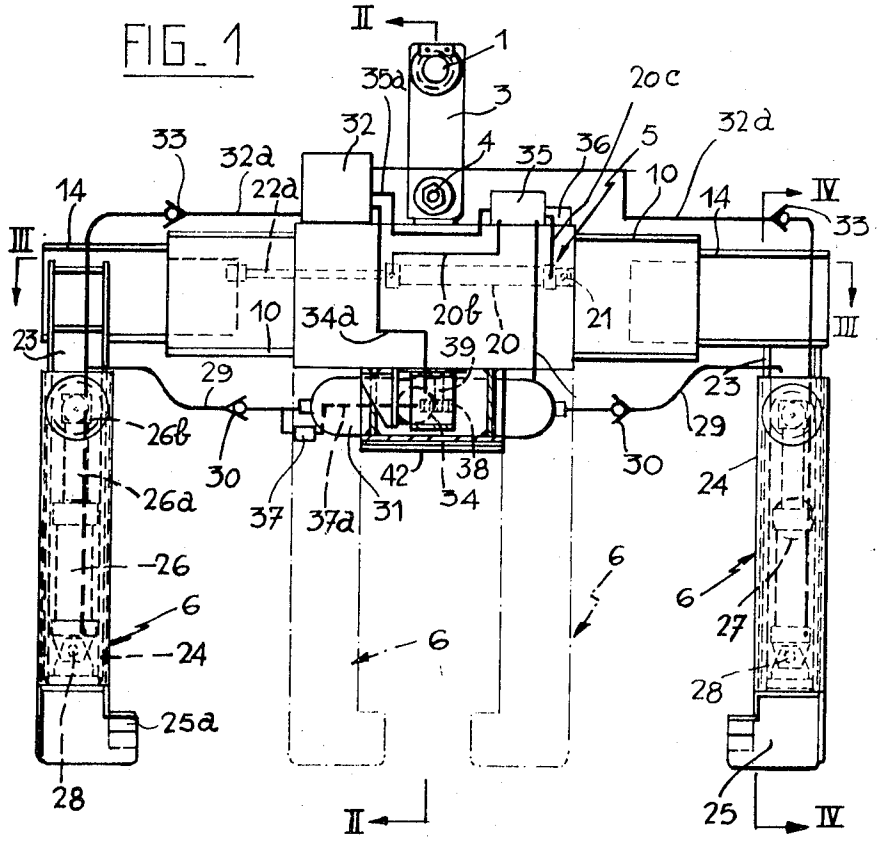

FIG. 3

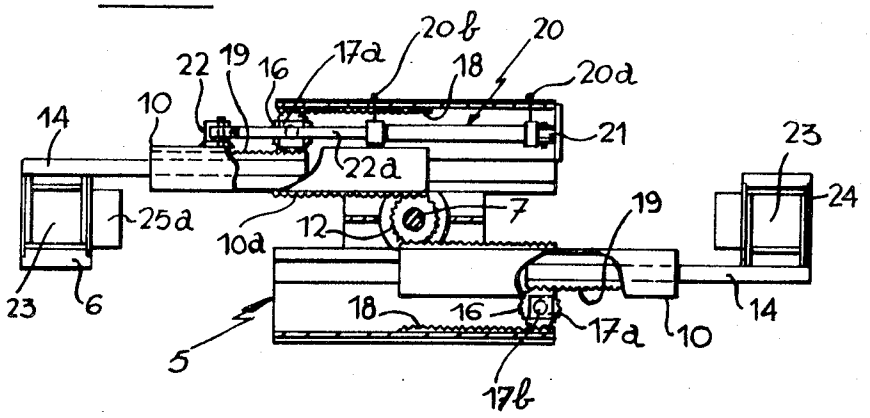

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FIG_2

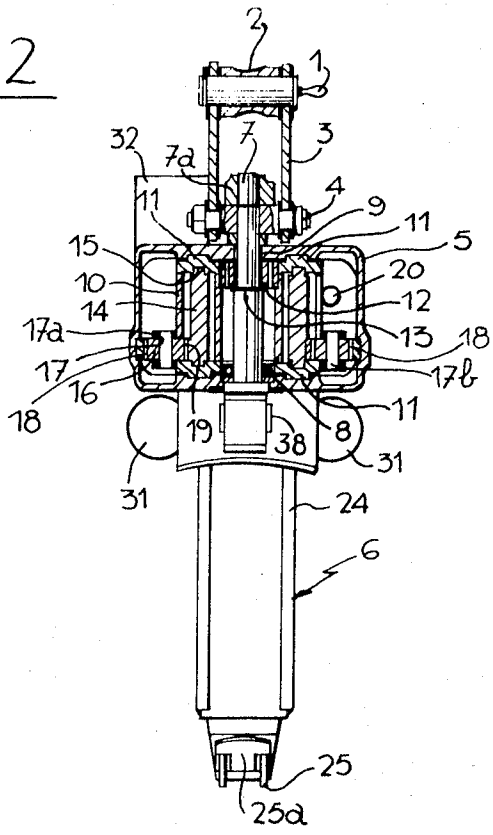


FIG_5

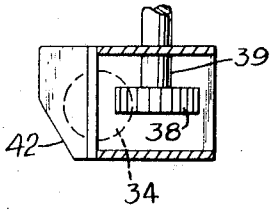


FIG_4

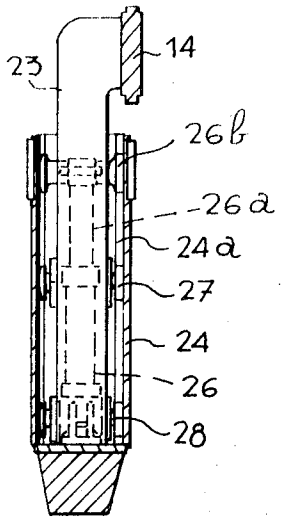
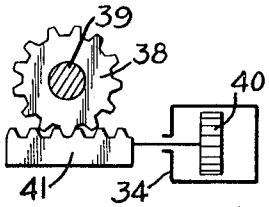


FIG_6



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GRIPPER FOR HANDLING HEAVY PRODUCTS AND SPECIFICALLY HORIZONTAL-AXIS COILS

The present invention relates to a gripper intended for handling packages of metal plates and above all coils of sheet metal having their axis positioned horizontally.

To perform this handling action, grippers are employed which comprise a strong framework supporting vertical grasping arms which may be opened or closed in manner to bring claws tipping these arms to grasp or release the product to be displaced. In the known grippers, the opening and closing of the arms are produced by a variety of devices, commonly by electrical actuation or by means of a motor-reduction gear. Owing to this fact, the actuating means have given speeds imposed a priori, so that impacts occur at some instants, which are difficult to prevent even if the operative works with care and smoothly. The vertical grasping arms thus strike suddenly against the product to be lifted, which is particularly inconvenient in the case of acoil of metal sheets, whereof the edges are easily dented at some points ; the cables for lifting the gripper by means of the travelling crane also incur shocks, which acts deleteriously on their durability; the floor covering on which the product carried by the gripper is placed too roughly, deteriorates quickly. Moreover, another major shortcoming of the known grippers consists in their excessive bulk given their considerable dimensions in height as well as in length. This considerable bulk limits the storage capacity in a store ; in point of fact, in the vertical direction, it is necessary to keep an unobstructed height above a store of coils equal to the height for passage of the travelling or overhead crane plus the height of the gripper ; moreover, the the rows of coils should be spaced apart sufficiently to allow the gripper to come down between two adjacent rows of considerable height to grasp coils situated in a lower row.

The present invention which has the object of eliminating the shortcomings cited, relates to a handling gripper for heavy products and specifically to sheet metal coils having their axes positioned horizontally, comprising a strong framework equipped with horizontal arms, which are displaceable and terminally carry vertical grasping arms, being characterised in that it comprises suspended in rotary manner from a vertical suspension pivot carried by an attachment for fastening to a lifting hook, a frame formed by a rigid case in which are housed horizontally telescopic arms from which are suspended vertical telescopic grasping arms , in each of which is housed a hydraulic ram or jack in communication with a pressurised oil accumulator which, according to the position of remote control electromagnetic valves, feeds a ram for actuation of the horizontal telescopic arms and a ram for rotation of the gripper, the said rams both being connected to a reserve tank containing oil under pressure, connected to the rams of the vertical grasping arms in such manner as to accumulate a part of the potential energy of the load handled to induce operation of the gripper independently of any source of energy external to the gripper-load aggregate.

According to one feature, the rigid case is a hollow element of double T-shape in plan view whereof the branches contain the horizontal telescopic arms whereas the stem is secured in rotary manner to the vertical suspension pivot.

According to another feature, the horizontal telescopic arms are each formed by two elements, an internal element remaining close to the suspension spindle and an external one spaced apart from the said spindle in the extended position, and installed telescopically with respect to each other and to the rigid case.

According to another feature, the internal telescopic elements of each arm each carry, at one side, a rack meshing with a pinion arranged loose on the vertical pivot and, at the other side, a pinion meshing on the one hand with a rack arranged on the rigid case, and on the other hand with a rack arranged on the external telescopic elements.

Other features of the invention will become more clearly apparent from the following description of the accompanying drawings which relate to an example of embodiment given by way of illustration only.

In these drawings :

FIG. 1 is a diagrammatical view in lateral elevation of a gripper wrought according to the invention.

FIG. 2 is a view in axial section along II—II of FIG. 1.

FIG. 3 is a view in section along III—III of FIG. 1.

FIG. 4 is a view in section along IV—IV of FIG. 1.

FIGS. 5 and 6 are respectively fragmentary side cross-sectional and plan views of the rotation ram structure according to the present invention.

These figures show only the elements useful in grasping the invention, the others having been omitted deliberately.

The gripper in question comprises a rigid framework formed by a hollow case **5** having a form of double T-shape in plan view. This hollow case **5** is equipped with a ball thrust bearing **8** traversed by a vertical suspension pivot **7** which is guided in a bushing **9** integral with the said case. The upper part of this vertical pivot **7** passes through a horizontal securing pivot **4** and is equipped with a retaining nut **7***a*. The horizontal pivot **4** forms a lower spacer or cross-member of a fastening attachment which is formed by two flat elements **3** also stayed at the upper part by a removable securing bar, **1** equipped with a removable sleeve or socket **2** "taken" by a lifting hook which is not shown. In this way, the sleeve **2** can be changed, so that the latter can thus be matched to the radius of curvature of the lifting hook, preventing accidental unhooking.

In the branches of the hollow rigid case **5** situated at either side of the vertical pivot **7** are housed horizontal telescopic arms, each formed by an internal telescopic elements **10** of casing form, and by an external telescopic element **14**. The two internal telescopic elements **10** which slide in slideways **11** situated in the case **5** are displaced synchronously by means of a gear **12** meshing with a rack **10***a* on each element **10** ; this gear **12** runs loose in a bushing **13** situated on the vertical pivot **7**. The displacement of the said elements **10** is produced by a single hydraulic actuating ram **20** having a joint **21** for fastening to the case **5** and whereof the end of the rod **22***a* of the piston **22** is jointedly coupled to a lug **22** integral with the adjacent telescopic element **10**.

In the telescopic elements **10** of casing form are arranged slideways **15** in which there slide the external telescopic elements **14** ; however, each of the said elements **10** possesses lugs **17***a* in which are situated bearings **17** of a pivot **17***b* for support of a pinion **16** which meshes on the one hand with a rack **18** secured to the case **5**, and on the other hand with a rack **19** secured to the external horizontal telescopic element **14**. Thus by actuation of the control ram **20**, the displacement is caused of the elements **10** and **14** in one direction or the other, the elements **14** being displaced at twice the speed of that of the elements **10**.

To the free extremity of each of the elements **14** is secured a vertical grasping arm **6**. Each of the two vertical arms **6** consists of a fixed part **23** integral with an element **14** ; on these fixed parts **23** slide sleeves **24** each terminating in a grasping claw **25** which is equipped with a removable bearer element **25***a*. This element is removable to allow of easy replacement in case of wear, or of the application of longer elements penetrating more deeply into the coil, or of pivoting elements reducing the thickness of the sleeves **24** as much as possible.

To the lower extremity of the fixed elements **23** are jointedly coupled at **28** hydraulic rams **26** whereof the piston has a rod **26**a whose upper extremity has a joint **26**b for coupling to the sleeves **24** ; to ensure guiding of these sleeves **24** on the elements **23**, provision is made to equip these latter with ball races **27** which roll in grooves **24***a* machined in the inner face of the sleeves **24**.

On the hollow case **5** are fastened a pressurized oil accumulator **31** and an oleopneumatic tank **32**, in which the oil is subjected beforehand to an air pressure of the order of 6 kgs/cm^2.

When it is intended to lift a coil with the gripper, the latter is brought to the appropriate spot by means of an overhead crane which is not shown, after which a radio-electric signal is applied for operation by means of a battery, of a reception set **36**, an electromagnetic valve **35**, and through a pipe **20***a* starting from the accumulator **31** and by means of the electromag-

netic valve **35**, and through a pipe **20***c* , the ram **20** is supplied to spread the arms **6**, then through a pipe **20***b* to close the said arms **6** and tighten the gripper on the coil. The coil grasped is then raised and the sleeves **24** initially descend relative to the fixed parts **23** of the arms of the gripper, so that the oil of the rams **26** enclosed within the compression chambers between the piston and bottom of each cylinder of the said rams **26** is compressed and expelled under pressure into the oleopneumatic accumulator **31** by passing through pipes **29** in each of which is installed a check valve **30**. Thanks to this valve, the oil in the accumulator **31** is maintained under pressure even when the coil is set down at the point of arrival. During this last operation, the parts **23** descend in the sleeves **24** and oil coming from the tank **32** re-enters the compression chambers of the rams **26**, passing through a pipe **32***a* and a check valve **33**. A radio-electric signal transmitted to the receiver of the set **36** is then applied to actuate the electromagnetic valve **35** and cause the accumulator **31** to feed the ram **20** through the pipes **20***a*,**20***c* to open the gripper and thus release the coil. The ram **20** for the opening and closing of the gripper is actuated by the oil from the accumulator **31** and is connected at its two ends to the tank **32** through the electromagnetic valve **35** and the pipe **35**a so that the oil expelled from the said ram re-enters this tank **32**.

In analogous manner, and again by means of a radio-electric signal transmitted to the receiver of the set **36**, an electromagnetic valve **37** is actuated which allows oil to pass through a pipe **37***a* from the accumulator **31** into a ram **34** for actuation of the rotation of the gripper around the vertical suspension pivot **7**, the oil issuing from this ram re-entering the tank **32** through **34***a*.

As seen in FIGS. **5** and **6**, the rotation ram **34** is carried by a bracket **42** on hollow case **5** and comprises a piston **40** whose rod is attached to a rack **41** which engages with a pinion **38** mounted on a shaft **39** carried by case **5**. Upon feeding hydraulic fluid to the ram **34** on one side or the other of the piston **40**, the piston moves in one direction or the other and moves the rack **41** in one direction or the other so that the pinion **38** turns in one direction or the other, which in turn rotates the case **5** and the entire gripper in one direction or the other.

A gripper like that described is advantageous in several respects. First of all, it operates without an external source of energy, to open, close and rotate in both directions, which renders it possible to omit a winder with a supply cable. Its very structure ensures that its bulk is reduced in length as well as in height.

I claim:

1. Handling gripper for rigid products such as coils having a horizontal axis, comprising a framework formed by a rigid hollow casing of a double T-shaped form, a fastening attachment to a lifting hook, a vertical suspension pivot carried by said fastening attachment and passing through a ball thrust bearing carried by said rigid hollow casing, horizontally telescopic arms housed in said hollow casing having two elements telescopic relative one to the other and relative to said hollow casing, vertical telescopic grasping arms suspended from the ends of said horizontally telescopic arms, a vertical hydraulic ram housed in each said vertical telescopic grasping arm, an oil accumulator receiving compressed oil from said vertical hydraulic ram, each said vertical arm having parts movable relative to each other when a load is lifted by said gripper, said relatively movable parts actuating said rams to send oil to said accumulator so as to recover a part of the potential energy of the handled load, a reserve tank containing oil under pressure, a horizontal hydraulic ram acting between said framework and one of said horizontally telescopic arms, means for supplying compressed oil from said accumulator to said horizontal hydraulic ram for actuating said horizontally telescopic arms, a rotating ram and means for supplying said rotating ram with compressed oil from said accumulator for rotating the gripper about said vertical suspension pivot.

2. Handling gripper according to claim **1** in which each vertical telescopic grasping arm comprises a fixed part unitary with the horizontally telescopic arms and on which is located a sliding sleeve terminating in a grasping nose for a coil, a vertical hydraulic ram being connected to said fixed part and to said sliding sleeve.

3. Handling gripper according to claim **2**, in which said sleeve has longitudinal grooves in which roll ball races carried by said fixed part.

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