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(54) MECHANICAL GRIPPING DEVICE

(71) We, GROUPEMENT POUR LES ACTIVITES ATOMIQUES ET AVANCEES, formerly Groupement Atomique Alsacienne Atlantique, a French Body Corporate, of 20 Avenue Edouard Herriot, 92 Le-Plessis-Robinson, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a mechanical gripping device.

According to the invention, there is provided a mechanical gripping device comprising a framework, two jaws pivotally mounted on the framework for movement between an open position and a closed position, a link arrangement for opening and closing the jaws, and a slide member for operating the link arrangement, which slide member is slidably arranged on the framework for displacement between two operative positions in which the jaws are respectively in their open and closed positions and which slide member entrains two balls for co-operation with respective seatings with which the framework is provided for respectively retaining the slide member in its operative positions, there being two pistons for effecting co-operation of the balls with their seatings, which are arranged for limited sliding movement within corresponding bores in the slide member and each of which is able to adopt selectively a ball-retaining position in which the peripheral surface of the said piston brings its associated ball into co-operation with the seating with which the said ball is associated to retain the slide member in its appropriate operative position and a ball-releasing position in which a portion of reduced size of the said piston permits release of the ball from the seating.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying single sheet of drawings which shows a

sectional view of one form of mechanical gripping device in accordance with the invention. 50

The mechanical gripping device comprises essentially a framework 1 provided at one end with two jaws 2 and 3 articulated on the framework by means of a pivot 4. A system of links 6 and 8 permits opening or closing the jaws when the common pivot 9 of the links is displaced longitudinally, i.e. vertically in the drawings, by means of sliding shoes 10, a slight degree of displacement of the pivot 9 in the downward direction tending to close the jaws 2 and 3. Such displacement of the pivot 9 results from the action of two links 11 and 12 constituting a toggle joint, the common pivot 13 of which is entrained, owing to the action of sliding shoes, in limited movement transversely of an elongate slide member 14, thereby effecting the opening or closure of the jaws. The link 12 is pivotally connected to the framework 1 by means of a pivot 15 at the upper portion of the framework. This link is provided with a stack 17 of washers which permit the pivot 13 to be moved aside sufficiently to permit displacement past the straight line joining the pivots 9 and 15 when the pivot 13 is in its rightward position as shown in the drawing, whilst at the same time providing the force necessary to retain the load gripped by the jaws. 80

The travel of the slide member 14 is limited by two stops 19 and 19' provided respectively with springs 20 and 20' and with devices for tension regulation 21 and 21'.

The slide member 14 is displaced in a cylindrical member 22 fast with, and forming a part of, the framework. This cylindrical member has at its two ends seatings 23 and 24 for respective balls 25 and 26 which are entrained by the slide member during its movement of displacement. In a modified arrangement, a set of balls may be employed at each end of the slide member. 85

Two pistons 27 and 27', of which only the right-hand piston 27 is shown, are arranged for limited sliding movement within corres- 95

ponding bores in the slide member 14. The piston 27 comprises a cylindrical portion 28, the diameter of which is equal to that of its bore in the slide member 14 and, at one end which is accessible through the righthand end of the member 14, a portion 38 which is also cylindrical but of reduced diameter so as to afford a certain degree of play or clearance, for the ball 25 in the seating 23, between the piston 27 and the slide member 14 when the piston 27 has been displaced leftward to the end of its bore in the slide member 14 to permit release of the ball 25 from its seating. The cylindrical portions 28 and 38 are connected by a tapered portion 30 in the form of a truncated cone. The interior of the piston 27 is hollow and houses a spring 31 bearing on the one hand on the guide member 14 and on the other hand on the end face of a cavity recessed in the piston 27.

The mode of functioning of the mechanical gripping device will readily be understood; when the framework carrying the jaws is positioned exactly at one of the predetermined locations, a jack 32 is disposed opposite each piston. Under the action of the jacks, the slide member is displaced, the closed gripper opens and the open gripper closes, providing respectively for the release or engagement of an elongate cylindrical element, such as a metal tube. The mechanism for opening or closing the jaws is as follows:

Considering the mechanical gripping device in the position shown in the drawing, the peripheral surface of the portion 28 holds the ball 25 firmly in the seating 23 to lock the slide member 14 in position. Displacement of the piston 32 towards the left will first of all compress the spring 31, whereupon the piston will travel into abutment against the slide member, the ball 25 being disposed initially before (i.e. to the left of) the tapered portion 30 and then opposite the portion 38 of reduced diameter. The ball 25 is then able to leave its seating 23 and to free the slide member which is then able to move to the left in the drawing. This movement continues under the thrust of the jack 32 until the instant at which the slide member contacts the stop 19' whereupon the ball 26 is urged against the seating 24 by the tapered surface of the piston 28' and locks the slide member in its leftward position. Meanwhile, the pivot 13, entrained by the slide member, has passed to the other side of the straight line joining the centres of the pivots 9 and 15 to lift the pivot 9 and thus open the jaws 2, 3. The action of the jack 33 has the reverse effect. It should be noted that the gripping portions 34 and 35 of the jaws, which are designed for example for the gripping of 5 inch tubes, will be able, by adding a supplementary jaw portion 36 fastened to the main jaw by a screw 37, to engage $3\frac{1}{2}$ inch tubes. When it is required to grip elongate

objects such as drill pipes, there may be employed two such gripping devices mounted on a rigid beam and oriented perpendicularly to the axis of this beam. The two pairs of jaws of the mechanical gripper assembly thus formed can then grip an elongate object at spaced locations, as is desirable.

In a preferred application of the gripper assembly, it is designed to grip cylindrical objects of elongate shape, such as drill pipes, disposed at a first predetermined location and to deposit them at a second predetermined location owing to the action of fixed jacks disposed at predetermined points and adapted, at will, to effect opening or closing of the jaws. It is also possible for the mechanical gripper assembly to include more than two spaced apart pairs of jaws in which case the several pairs of jaws may be disposed equidistantly spaced from each other, the two end jaws being located at points relatively close to the ends of the beam. The gripping devices are arranged on the beam in such manner that they are strictly parallel to each other, in accordance with current technical procedure.

An advantage of the mechanical gripping device described is that it is extremely simple in design and the cost price thereof is extremely low.

The main features which the device described has are as follows:—

Locking of the slide member is obtained by the change in the position of the links constituting a toggle joint. Secure locking of the slide member is achieved due to the fact that the cylindrical portion of large diameter of each position applied its associated ball into a seating constituting a portion of the framework. Such safe locking is obtained due to the action of two springs impeding the movement of the pistons, in such manner that either piston is not able to be displaced until it is subjected to a force greater than the opposing action of its spring, whereupon the associated ball is able to take up a position opposite the portion of the piston of similar diameter, and to free the slide member.

WHAT WE CLAIM IS:—

1. A mechanical gripping device comprising a framework, two jaws pivotally mounted on the framework for movement between an open position and a closed position, a link arrangement for opening and closing the jaws, and a slide member for operating the link arrangement, which slide member is slidably arranged on the framework for displacement between two operative positions in which the jaws are respectively in their open and closed positions and which slide member entrains two balls for co-operation with respective seatings with which the framework is provided for respectively retaining the slide member in its operative positions, there being two pistons for effecting co-operation of the balls

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2. A device according to claim 1, wherein the two pistons are arranged at respective ends of the slide member and the portions of reduced size are accessible through the ends of the slide member for actuation by jacks, there being springs which so bias the pistons that whenever a said ball is aligned opposite its seating, the surface of a tapered portion, connecting said peripheral surface and the surface of the portion of reduced size, urges the ball into co-operation with its seating.

3. A device according to claim 1 or 2, wherein the jaws are arranged on a common pivot and the link arrangement comprises two connecting links, pivotally connected

together at one of their ends and having their other ends respectively pivoted to the jaws, and a toggle joint of which the common pivot is slidably mounted on the slide member for motion transverse to the direction of slide member displacement and of which the free ends are pivotally connected to the framework and to said one ends of the connecting link respectively.

4. A mechanical gripping device substantially as hereinbefore described with reference to the accompanying drawings.

5. A mechanical gripper assembly comprising at least two mechanical gripping devices in accordance with any one of claims 1 to 3, the gripping devices being mounted on a beam.

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