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(54) **Roll change device for cluster mill.**

(57) The two work rolls of a cluster Rolling Mill are removed together without contacting each other or their support rolls. The mill housing is in two parts and to remove the rolls the upper work roll is biased into engagement with its support rolls, the upper housing is displaced away from the lower housing, the two rolls are supported at one end in cantilever fashion, the upper work roll and the lower work roll are separated from their support rolls and are then withdrawn axially from the mill.

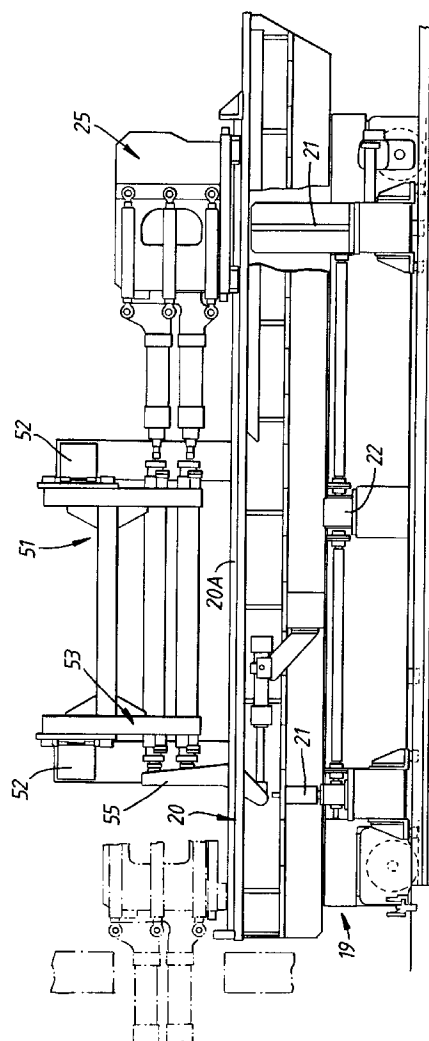


Fig.3

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This invention relates to the changing of the work rolls of a cluster mill stand.

Cluster mills, sometimes known as SENDZIMIR mills comprise a pair of slender work rolls each backed up by a plurality of support rolls. To achieve high quality surface finish of the strip being rolled in the mill stand, frequent changes of the work rolls is essential. Each roll change has to take place as quickly as possible and it is usual to replace the work rolls while strip material is present in the mill stand. To avoid damaging the rolls or the strip, the work rolls must be withdrawn and replaced by new rolls without the work roll contacting the support rolls or the strip.

According to a first aspect of the present invention a method of removing the work rolls of a split housing cluster mill stand comprises the steps of

- (a) biasing the upper work roll into engagement with its support rolls;
- (b) displacing the upper work roll away from the lower work roll;
- (c) supporting each of the two work rolls at one end in cantilever fashion;
- (d) removing the bias from the upper work roll;
- (e) raising the support rolls relative to the upper work roll;
- (f) raising the lower work roll above its support rolls and
- (g) simultaneously withdrawing the two work rolls axially from the mill stand.

By this method the two work rolls are simultaneously withdrawn axially in parallel spaced apart relation from the mill stand and each work roll is spaced from its support rolls.

When there is strip in the mill housing between the work rolls, there is an additional step in the method whereby the strip is raised to a position out of engagement with the upper and lower work rolls before the work rolls are supported at their ends in cantilever fashion.

The work rolls are removed from the stand and replacement rolls placed in position in the stand.

The work rolls are supported and displaced axially by means of a roll change device.

According to a second aspect of the present invention a roll change device for removing and replacing the work rolls of a split housing cluster mill comprises:

a carriage displaceable in a first direction and having upper and lower elongate support arms arranged one above the other and each extending in said first direction;

means by which each arm can be raised and lowered independently of the other and each arm having means by which the arm can be connected in cantilever fashion to an end of a work roll of or for a cluster mill.

It is convenient for each support arm to be secured to the carriage by means of links which retain

the arms in parallel relation and which permit each support arm to be raised and lowered independently of the other. The links include spherical bearings which permit the arms to have a degree of lateral movement relative to the first direction.

In order that the invention may be more readily understood it will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a sectional side elevation of a cluster mill;

Figure 2 is a sectional elevation of a part of the split housing of the mill;

Figure 3 is a side elevation of a roll change device;

Figure 4 shows in greater detail part of the roll change device of Figure 3;

Figure 5 is a partially sectioned plan of Figure 4; Figure 6 is a sectional end view of the device shown in Figure 4; and

Figure 7 is a sectional end view of an arm of the device and an end of a work roll.

Referring to Figures 1 and 2, a cluster mill comprises an upper housing 1 and a lower housing 3. The two housings are of generally rectangular shape and the lower housing rests on a foundation 5. Extending upwardly from the lower housing are four support columns 7, one at each corner. Each column, one of which is shown in detail in Figure 2, includes a piston rod 8 anchored at its lower end by a pin 8A in the lower housing 3 and extending upwardly through an opening in the upper housing. At its upper end, the rod carries a piston 9 which is located in a ram housing 9A secured to the upper housing. A further ram 10 is mounted on the housing 9A and the piston of the further ram projects through an opening in the housing 9A and engages the top of the piston rod 8.

When hydraulic fluid is introduced into the rams 10, the upper housing 1 is raised relative to the lower housing and when hydraulic fluid is introduced against the underside of pistons 9 the upper housing is lowered relative to the lower housing. A load cell 8B is associated with the piston rod 8.

The upper housing supports a slender work roll 11 backed up by a multiplicity of support rolls indicated generally by reference numeral 13. Similarly, the lower housing supports a slender work roll 15 which is backed up by a multiplicity of support rolls 17.

Figure 3 shows that on the roll change side of the mill there is a motorised car 19 which is movable on tracks leading from the mill to a roll change station (not shown). The car has an upper beam structure 20 which provides tracks 20A on which is mounted a motorised carriage 25. The upper beam structure 20 is mounted on a plurality of jacks 21 which are operated in unison by a drive mechanism 22 to raise and lower the beam structure 20 and the carriage 25.

Referring particularly to Figures 4 - 6, the car-

riage comprises a massive body 27 from which two elongate arms 28 and 29 project in the direction towards the mill stand. The upper arm 28 overlies the lower arm 29 and is supported from the body 27 by a pair of upper links 30, and a pair of lower links 31. Each link is of elongate form and carries an eye with a spherical bearing 33 at each end. one end of each link is pivotally secured by way of the bearings with the body 27 and the other end with the arm 28. The links support the arm in generally horizontal relation and the spherical links permit a limited movement laterally.

The lower arm 29 is supported on three links, two lower links 35 and one upper centrally disposed link 37. A hydraulic ram 39 mounted on the body 27 engages the underside of the arm 28 and by actuating the ram, the arm can be raised and lowered but the links keep the arm substantially horizontal. A further ram 41 is mounted on the body and engages the underside of the arm 29 and the links permit the arm to be raised and lowered whilst remaining substantially horizontal.

Figure 7 illustrates the outer end of one of the arms 28, 29 and also shows the adjacent end of the work roll 11, 15 which has a tapered end socket 47 and a peripheral groove 49. The outer end of the arm has a tapered end tip 43 arranged to fit into the socket 47 and just back from the tip is a sleeve 45 slideable relative to the arm and forming part of a push-off device to disengage the roll from the tapered end tip of the arm.

Referring again to Figure 3, a gantry 51 is supported on the car 19 and horizontal beams 52 overlie the surface 20A. A frame 53 is suspended on wheels running on the beams 52 and is movable in the direction normal to the direction of movement of the carriage 25. The frame provides upper and lower sets of support lugs for a pair of used work rolls and a pair of replacement work rolls. The lugs enter into the grooves 49.

To change the work rolls the upper work roll has a device not shown inserted into the groove 49 to bias the work roll against its support rolls. The car 19 is moved into position and the height of the beam structure 20 is raised or lowered as appropriate by the jacks 21 to substantially align the lower support arm 29 with the lower work roll. By means of the rams 10, the upper part of the housing is raised by a distance that can vary due to the difference in roll diameter determined by the state of the roll grind, to separate the work rolls, matching the distance between the ends of the arms 28 and 29. If there is strip in the mill it is raised by fingers (not shown) away from the bottom work roll. The arms 28, 29 take up the position shown in figure 7 where the tapered end tips 43 are slightly below the centre line of the sockets in the rolls. Balancing pressure is applied to the rams 39, 41 to reduce the effective weight of the arms. The carriage 25

is driven forward so that the ends of the arms easily enter the tapered sockets 47 of the rolls, so that the arms and the rolls are in cantilever relation. By operating the lower ram 41, the arm 29 and hence the roll is raised away from the support rolls but below the strip and the upper roll. The biasing means are withdrawn from the groove 49 so that the rolls are now supported entirely on the arms. The upper housing 1 is raised further but the upper work roll remains supported on the arm so that there is clearance between both of the rolls and their support rolls, between the work rolls and between each work roll and the strip. The carriage is now displaced away from the mill to withdraw the rolls simultaneously whilst supported in cantilever fashion. The frame 53 is moved on the beams 52 until lugs on the frame are beneath the grooves in the rolls and by operating the jacks 21, the carriage and hence the rolls are lowered onto the lugs. The sliding sleeves 45 push the rolls off of the ends of the arms so that the rolls are supported entirely on the lugs. The frame is now moved so that new rolls supported on the frame are aligned with the arms and the arms are connected to the new rolls. Using the jacks 21 the rolls are lifted from the lugs on the frame and the frame is moved sideways away from the supported rolls. Cylinder 41 is actuated to raise arm 29 carrying lower new rolls. The carriage 25 is driven forward to advance the new rolls into the mill. The upper roll is moved upwardly against its support rolls by cylinder 39 and the biasing device is reinserted into groove 49 to support the roll. The bottom roll is lowered onto its support rolls by retracting cylinder 41 and the support fingers lower the strip to the pass-line. The arms are withdrawn from the rolls, the roll change device is retracted and the upper part of the mill housing is lowered until the work rolls are in rolling relation with the strip. The biasing means is removed.

This invention enables work rolls of a split housing cluster mill to be removed quickly and replaced without them contacting each other, their support rolls or the strip when it is present in the mill.

The rolls are removed and replaced simultaneously and the roll change device enables slight misalignment between the arms and the ends of the rolls to be taken up by the use of links with spherical bearings.

Centering devices (not shown) but in the form of spring loaded plungers are conveniently located on the links 30, 31 and 35 to engage the adjacent lateral walls of the body 27 and position the links relative to the body so that the arms are correctly aligned with the longitudinal axes of the work rolls.

The gantry 51 may alternatively take the form of a wheeled trolley which is movable on tracks located in the foundations.

When the tapered ends 43 enter into the tapered sockets 47 in the rolls, one or both rolls may be moved

axially before the connection is fully made. To limit the axial movement a retractable spring loaded buffer 55 is mounted on the car 19 to allow limited axial movement of one roll relative to the other. For a similar reason, small cylinders may be mounted in the mill against the ends of the rolls to react against axial forces applied to the rolls by the carriage.

Claims

1. A method of removing the work rolls from a cluster rolling mill stand comprising upper and lower housings with a work roll supported by a plurality of support rolls in each housing comprising the steps of:

- (a) biasing the upper work roll into engagement with its support rolls;
- (b) displacing the upper work roll away from the lower work roll;
- (c) supporting each of the two work rolls at one end in cantilever fashion;
- (d) removing the bias from the upper work roll;
- (e) raising the support rolls out of engagement with the upper work roll;
- (f) raising the lower work roll out of engagement with its support rolls; and
- (g) simultaneously withdrawing the two work rolls axially from the mill stand.

2. A method as claimed in claim 1 in which metal strip is present between the two work rolls and wherein after the upper work roll has been displaced away from the lower work roll, the strip is raised and held in a position where it is out of engagement with both of the work rolls.

3. For use in a method of removing the work rolls from a cluster rolling mill stand comprising upper and lower housings and with a work roll supported by a plurality of support rolls in each housing, a work roll change device comprising a carriage displaceable in a direction parallel to the longitudinal axes of the work rolls,

upper and lower elongate support arms arranged in parallel relation one above the other and mounted in cantilever fashion on the carriage, each arm being securable to an end of a work roll,

means for raising and lowering the carriage and

means for raising and lowering each arm independently of the other.

4. A work roll change device as claimed in claim 3 in which each support arm is pivotally secured to the carriage by means of elongate links which retain the arms in parallel relation whilst permitting

independent raising and lowering of the arms.

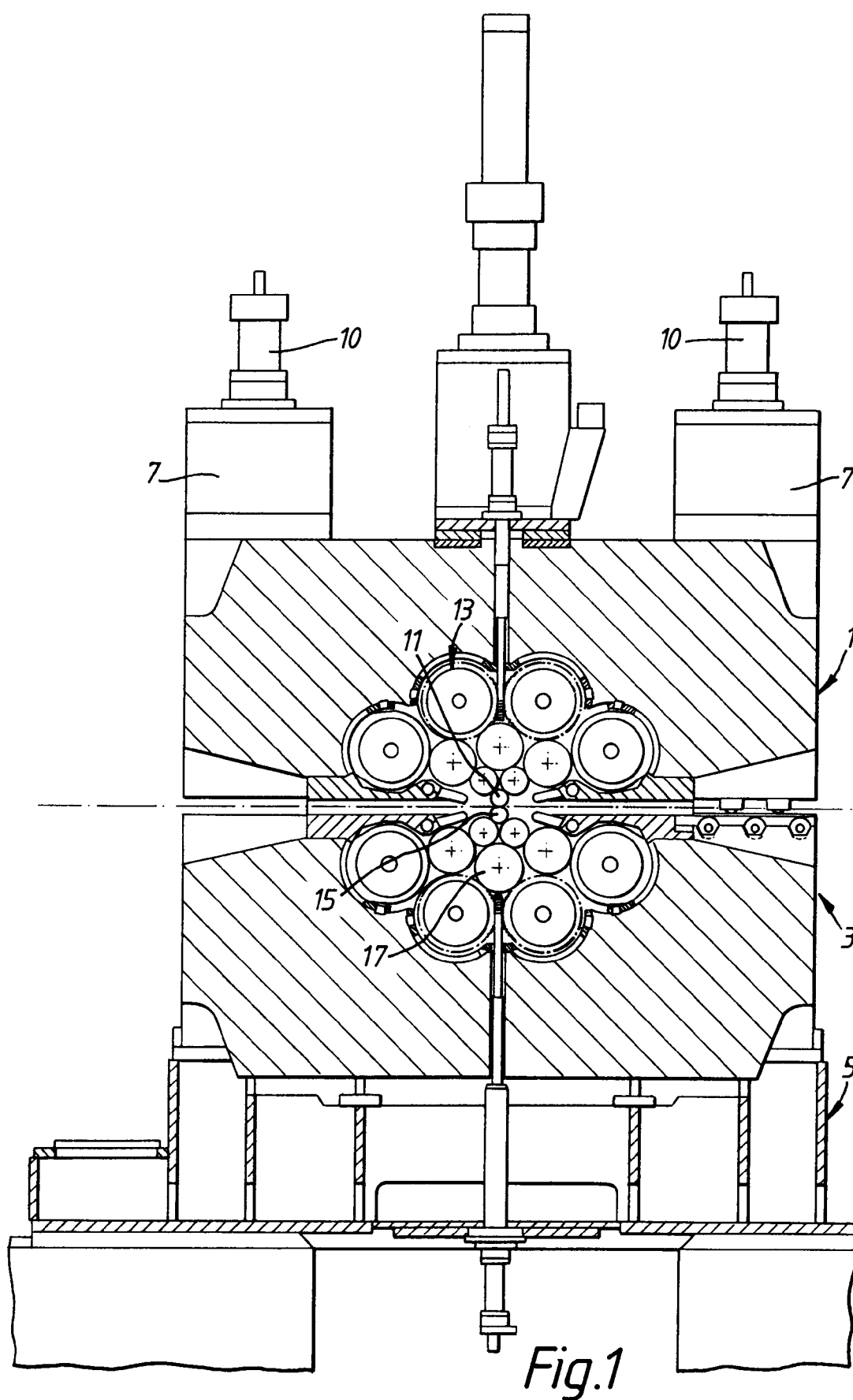
5. A work roll change device as claimed in claim 4 in which the links are pivoted to the arms and to the carriage by spherical bearings which permit the arms to have limited lateral movement.

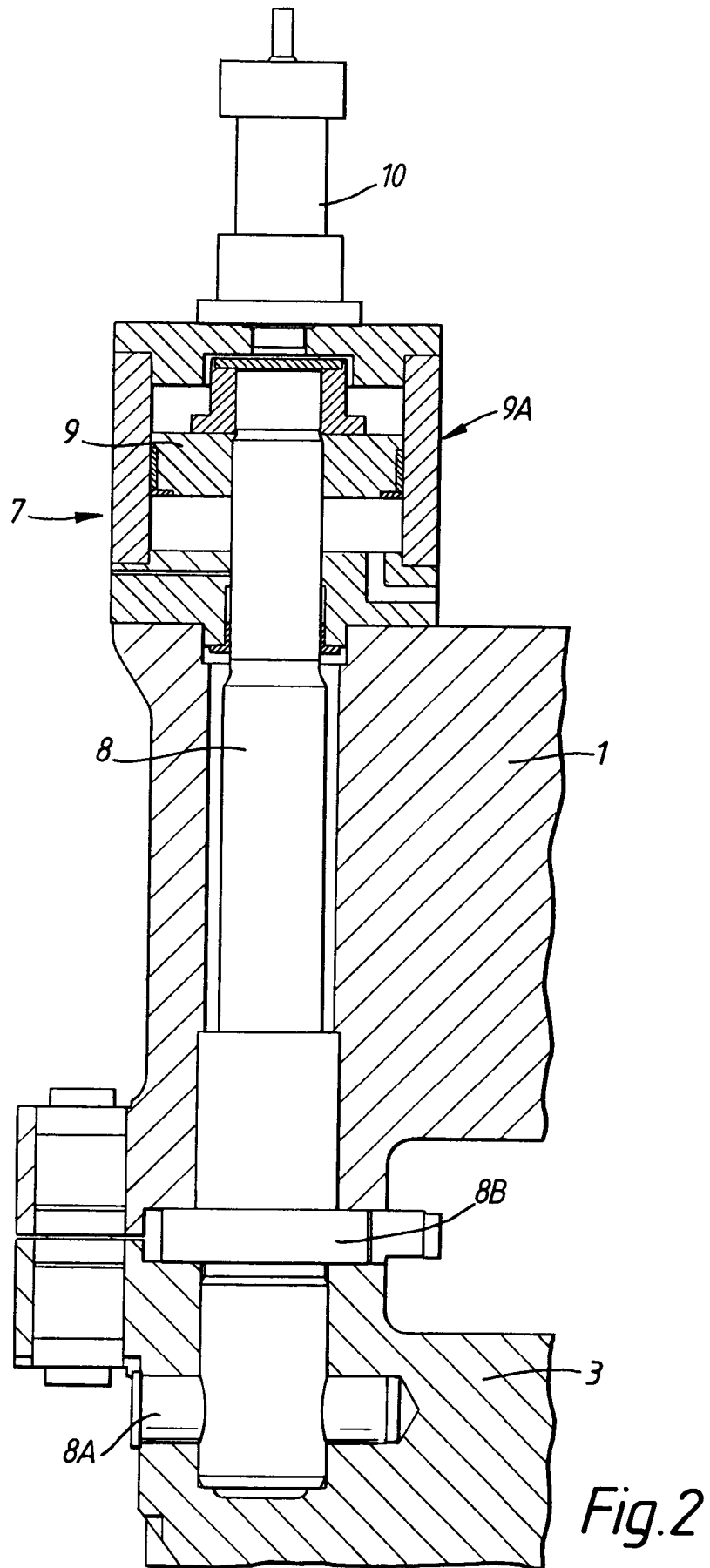
6. A work roll change device as claimed in claim 3, 4 or 5 in which the outer end of each arm has a tapered portion which is adapted to cooperate with a tapered socket at the end of the work roll.

7. A work roll change device as claimed in claim 3, 4, 5 or 6 in which the carriage is mounted on a car so as to be raised and lowered and said car is displaceable towards and away from the rolling mill in the direction parallel to the longitudinal axes of the work rolls.

8. A work roll change device as claimed in claim 3 in which a gantry provides supports for receiving the rolls withdrawn from the mill and supports for receiving a set of rolls awaiting entry to the mill.

9. A work roll change device as claimed in claim 8 in which the gantry is mounted on the car so as to be raised and lowered with the carriage.





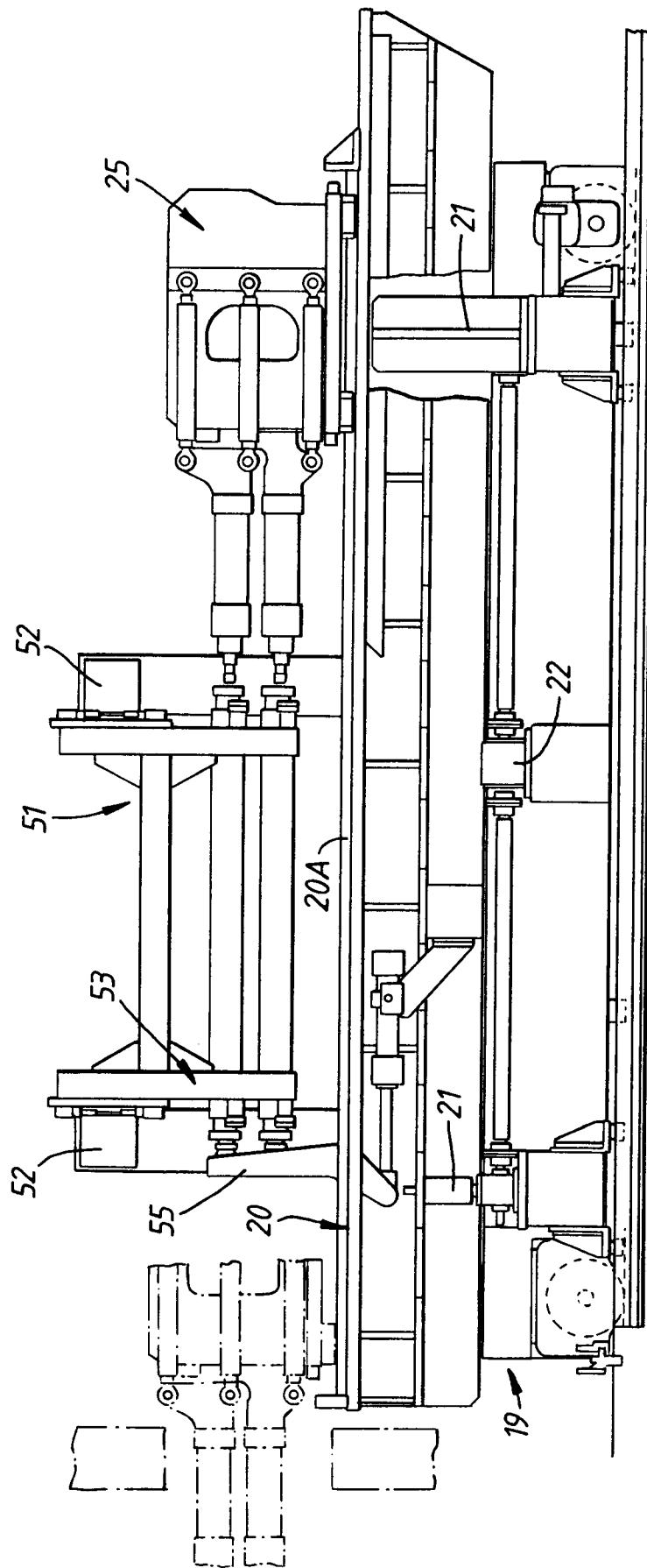


Fig.3

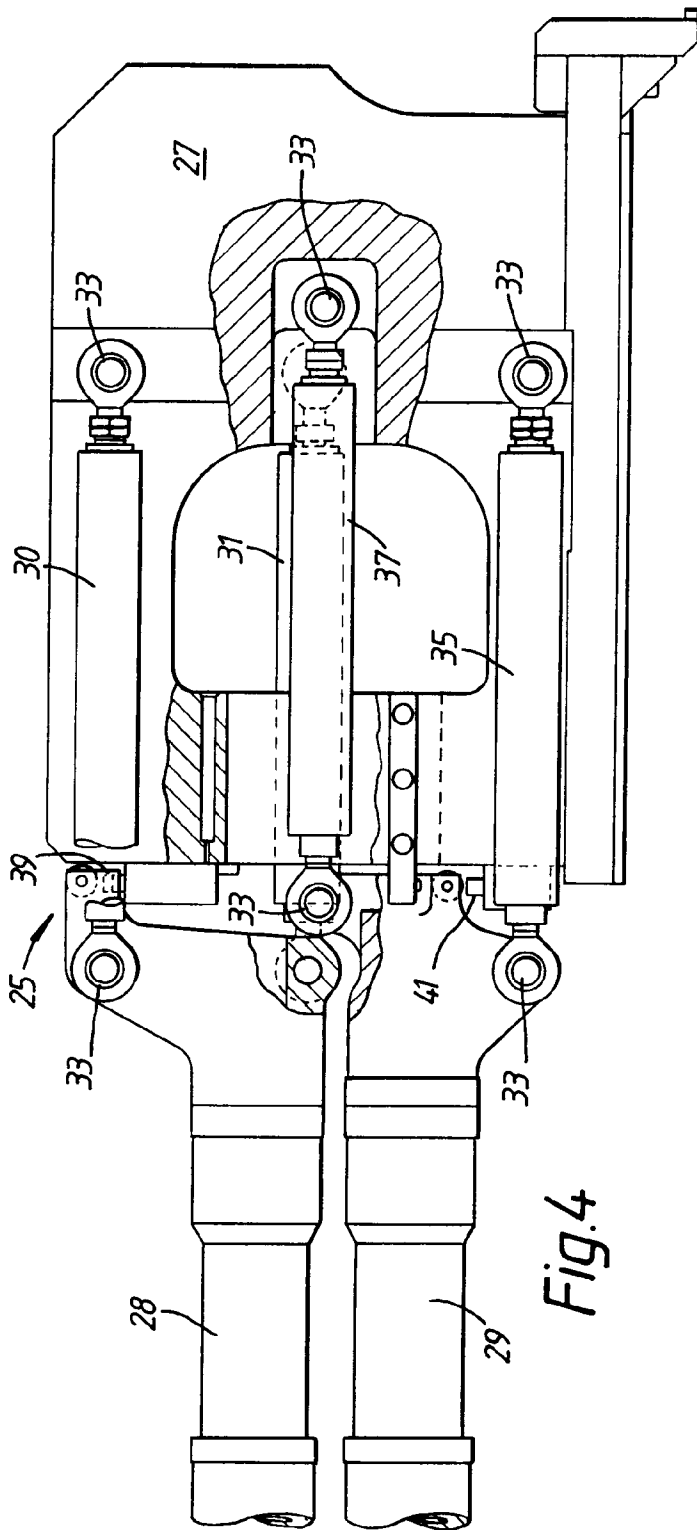


Fig. 4

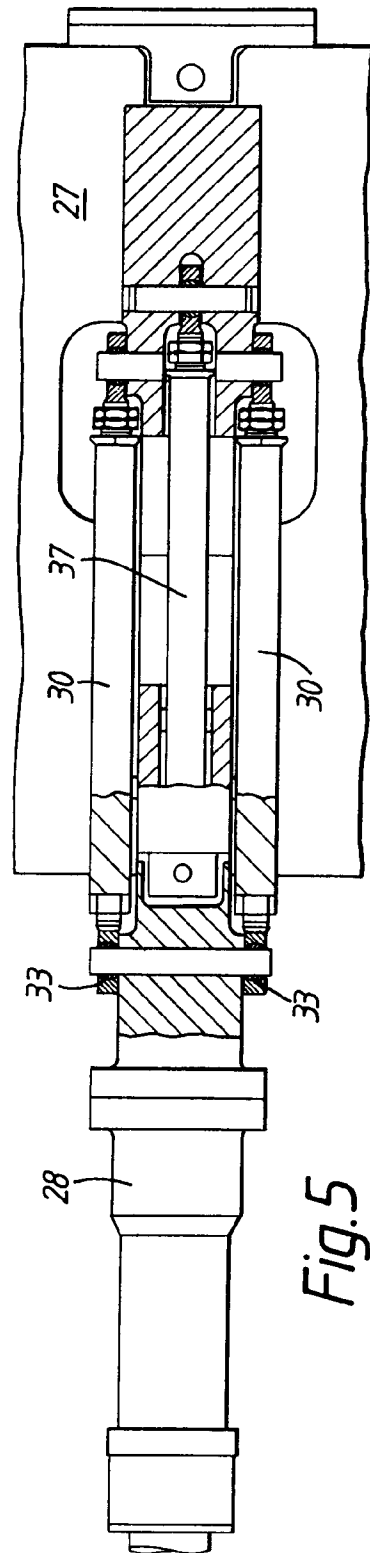


Fig. 5

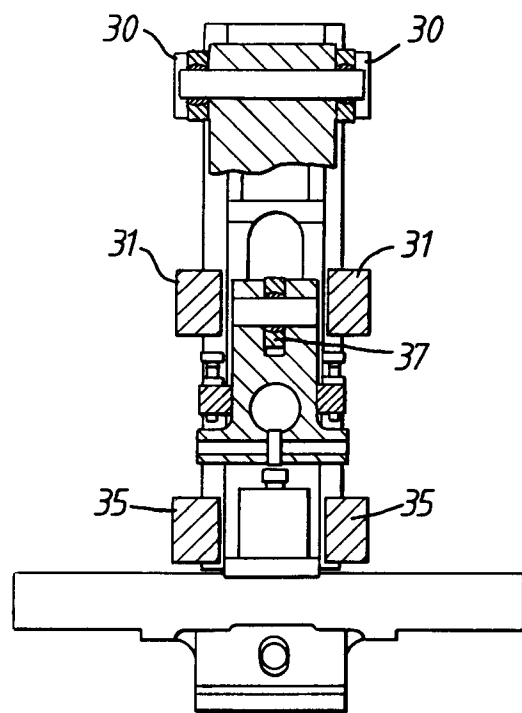


Fig.6

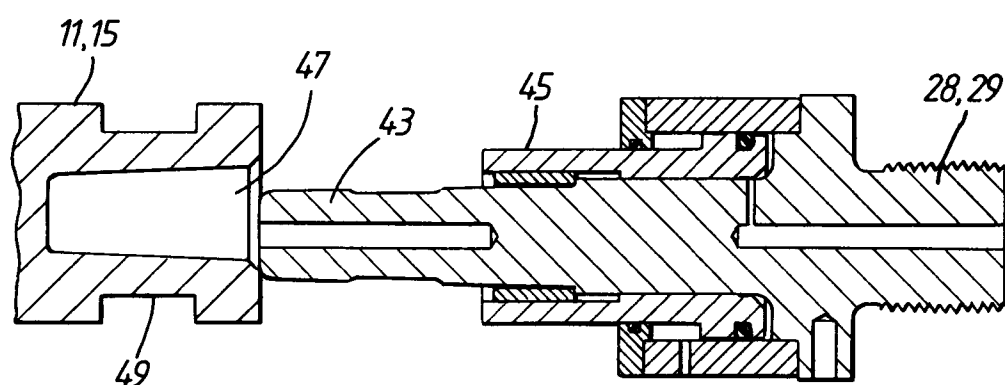


Fig.7