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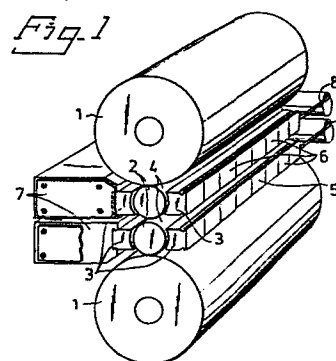
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⑤④ Arrangement at rolling mill.

⑤⑦ An arrangement at rolling mills, especially sheet and strip rolling mills, for supporting work rolls (2,46,70) therein, which rolls have smooth shell surface (4) along at least a substantial portion of their length, and two or more hydrostatic bearings (3,6,7,59,60,61,69) acting against said smooth shell surfaces (4) are provided for supporting the work rolls.

The arrangement is characterized in that the bearings (3,6,7,59,60,61,69) are movable to positions, in which they contact the smooth shell surfaces (4), that their portions (15,17,28,30,36,39,63) thereby contacting the shell surfaces (4) have small area and a lower wear resistance than said shell surfaces (4). The arrangement further is characterized in that hydrostatic pressure medium is intended to controlled flow out between said portions (15,17,28,30,36,39,63) and the shell surfaces (4).



Arrangement at rolling mill

This invention relates to an arrangement at rolling mills, especially sheet mills and strip mills, for mounting work rolls therein, which rolls have a smooth shell surface along at least
5 a substantial part of their length, and two or more hydrostatic bearings acting against said smooth shell surfaces are provided for supporting the work rolls.

Rolling mills for hot rolling sheet and strip of steel and other metals conventionally are designed as two-high rolling mill with
10 only two work rolls or as four-high rolling mill, in which the work rolls are supported each by a back-up roll of greater dimension. The work rolls are provided with a cylindric roll barrel and with a journal of smaller dimension at each end, which are provided with roller bearings or plain bearings for taking up horizontal and
15 vertical forces. In four-high rolling mills the vertical forces are taken up by the back-up roll, whereby the work rolls can be dimensioned so as to take into account that the roll journals must take up only the horizontal forces. In addition, however, regard must be paid to the fact, that for the work roll only a very small deflection
20 in horizontal direction can be permitted. For sheet and strip mills of four-high design, therefore, it is often necessary to choose a work roll diameter exceeding the diameter which is at optimum from the rolling aspect. This means that in many cases greater reductions per groove and also a smaller material thickness could be obtained, if
25 it were possible to choose a smaller work roll diameter. A greater roll diameter yields higher roll forces and, therefore, also implies an increase in the dimensioning of back-up rolls, bearings, roll adjusting devices and mill stands.

For cold rolling sheet and strip two-high and four-high rolling mills
30 are used, but also structural designs, at which the work rolls are supported by several rows of back-up rolls, where the diameter of the rolls in each row of back-up rolls is greater than the diameter of the rolls in the adjacent row of back-up rolls located closer to the associated work roll. At cold rolling, the outgoing thickness of the
35 strip normally must meet high precision requirements. The aim is,

therefore, a mill structure as rigid as possible.

In cold rolling mills of conventional design, the thickness tolerance is improved gradually with the rolling reduction, but only to a certain limit. The greater the rigidity of the mill, the faster this improvement in tolerance is obtained. The resilience, however, to its greatest part is due to the elastic deformation of work and backup rolls. It is, therefore, only to a certain degree possible to design the mill more rigid by choosing sturdy stands and bearings. The resilience of work rolls can be reduced by manufacturing them of cemented carbide, but there will still remain deformation in the contact between work and back-up roll and deflection of the latter.

Experts in this field since a very long time have understood that the aforesaid inconveniences could be eliminated to a great extent by supporting the rolls by means of hydrostatic bearings or combinations of hydrostatic bearings and normal plain or roller bearings. Proposals in this direction are made, for example, in GB-PS 18 321/1909 and 858 296.

One circumstance, which heretofore has obstructed practically the idea of supporting work rolls hydrostatically is that the work rolls more or less locally are deformed and worn in connection with both hot and cold rolling. Already this circumstance jeopardizes to a certain extent the function of the hydrostatic bearings, due to the fact, that the gaps between the portions surrounding the pressure medium chambers of the bearings and the shell surfaces of the work rolls thereby vary in size. At a hydrostatic bearing, the desired gap size is of the magnitude of only one or a few hundredth of millimeter. Therefore, small deformations of the work rolls have a great impact on the bearing function. Deformation and wear of work rolls also give rise to surface defects of the rolled material and, therefore, work rolls normally must be removed after a certain operation time and be reground and polished in order to restore the roll surface. Hereby, however, the work roll diameter is reduced, so that the rolls do not any longer fit the hydrostatic bearings, which were used before said regrinding. To remove and precision grind the hydrostatic bearings so as to agree with the shape of the work rolls reground would be unacceptable from a prac-

tical as well as economic point of view. The hydrostatic bearings heretofore suggested for roll support, moreover, are designed so that removal of the bearings would have necessitated substantially complete dismantling of the rolling mill.

- 5 The present invention has the object to provide a novel and improved arrangement for hydrostatic support of work rolls, by which arrangement the inconveniences heretofore involved with such support are eliminated at least to a substantial extent.

For achieving this object, according to the invention it is proposed
10 that at an arrangement of the kind referred to above in the introductory portion the bearings are movable to positions, in which they are in contact with the smooth shell surfaces, and their portions which contact the shell surfaces have a small area and a lower wear resistance than said shell surfaces. It is hereby possible, after the re-
15 grinding of the work rolls to adjust the hydrostatic bearings simply, rapidly and comfortably to the shape of the rolls ground, in that the bearings are moved into contact with the rolls, so that the rolls at their rotation effect the shape adjustment of the bearings required for the bearings to operate satisfactorily. According to the invention,
20 further, a hydrostatic pressure medium is intended to flow out, leak, in a controlled manner between said portions and shell surfaces, whereby effective cooling of the rolls and cleaning from particles, so-called scale etc., are obtained.

In order to maintain a satisfactory bearing function, the hydrostatic
25 bearings can be moved into contact with the work rolls at times also between the regrinding operations of the work rolls, in order thereby to adjust the bearings to such minor wear or deformation of the work roll surfaces which do not necessitate regrinding of the work rolls. According to a further development of the invention, it is in connection therewith proposed that said portions of the bearings when in con-
30 tact with said shell surfaces exercise a grinding or polishing effect on said surfaces. The arrangement, therefore, also comprises means for effecting a reciprocatory relative movement between the bearings and work rolls substantially in parallel with the geometric axes of the
35 work rolls. Hereby, simultaneously with the adjustment of the bearing gaps, minor deformations and irregularities in the roll surfaces are

levelled, so that a satisfactory roll surface finish can be maintained for a long time without requiring tedious removal and revision of the work rolls. This results in substantial capacity gains.

The arrangement according to the invention advantageously can be utilized at both two-high and four-high rolling mills. When the invention is applied to four-high rolling mills where hydrostatic bearings are provided for supporting the work rolls in a direction substantially transversely to a plane including the two work roll axes, while back-up rolls are provided for supporting the work rolls on the substantially diametrically opposed sides of the work roll gap, the hydrostatic bearings preferably are movable to positions, in which the plane including the two work roll axes is moved in parallel in relation to a plane including the two back-up roll axes. The hydrostatic bearings can be placed so that the plane including the work roll axes, seen in relation to the rolling direction, is located somewhat in front of the plane including the back-up roll axes, whereby a substantial part of the roll forces acting in the rolling direction, which forces normally can amount to about one tenth of the roll forces acting perpendicularly to the rolling direction, can be deflected to the back-up rolls, which results in a reduced load of the hydrostatic bearings of the work rolls. It is, of course, also possible to mount the back-up rolls in the way prescribed according to the invention for the work rolls. The way of mounting the back-up rolls, however, is less critical, because the back-up rolls are not subjected to appreciable wear. The back-up rolls, therefore, at many applications can without inconvenience be mounted by utilizing conventional mounting technique.

The hydrostatic bearings according to the invention preferably are divided by partition walls in a manner known per se into a plurality of pressure chambers, which are distributed along the length of the work rolls and have preferably individually adjustable supply of pressure medium, in such a manner, that portions of the partition walls contacting the work rolls preferably are elastically deformable to adapt to the shape of said shell surfaces. It is hereby prevented that the work roll surfaces are locally subjected to a heavier wear caused by the partition walls when the hydrostatic bearings adapt their shape to that of the work rolls.

The invention is described in greater detail in the following, with reference to the accompanying drawings, in which

- Fig. 1 is a schematic perspective view of an embodiment of an arrangement according to the invention, where the bearing relates to the work rolls in a four-high rolling mill and the bearings are divided into a plurality of pressure chambers, bearing pockets, and where for the sake of clarity support ramps for the bearing pockets are not shown on one side of the rolling mill,
- Fig. 2 is a vertical section in parallel with the rolling direction through an embodiment of a pressure chamber according to the invention abutting a work roll,
- Fig. 3 is a vertical section in parallel with the rolling direction through a second embodiment of a pressure chamber according to the invention, where the pressure chamber comprises a bearing insert hydraulically movable to and from the roll,
- Fig. 4 is a section as in Figs. 2 and 3 through a third embodiment of a pressure chamber according to the invention, where the pressure chamber comprises a bearing insert hydraulically movable to and from the roll,
- Fig. 5 is a schematic perspective view of a pressure chamber embodiment according to the invention, seen to the side intended to abut a roll,
- Fig. 6 is a vertical section, A-A according to Fig. 7, in parallel with the rolling direction through a schematically shown two-high rolling mill, where the rolls are supported by an embodiment of an arrangement according to the invention,
- Fig. 7 is a vertical section, B-B according to Fig. 6, perpendicular to the rolling direction and, thus, in parallel with the geometric axes of the rolls,
- Fig. 8 is a schematic vertical partial section in parallel with the rolling direction through a four-high rolling mill where the work rolls are mounted in a cassette according to the invention,
- Fig. 9 is a schematic lateral view partially in section, of a portion of a device for effecting a reciprocatory movement of the pressure chambers in parallel with the geometric axis of the work rolls at an arrangement according to the invention, and

- Fig. 10 is a schematic horizontal partial section through the work roll gap at a cassette according to Fig. 8 where horizontal sections have been laid in through certain parts.

In Fig. 1 the numeral 1 designates the back-up rolls of a four-high rolling mill, and 2 designates the work rolls located between the back-up rolls 1. The geometric axes of all four rolls 1,2 normally are located in one and the same vertical plane.

The work rolls are intended to be supported according to the present invention by means of hydrostatic bearings 3 arranged so as to support the work rolls 2 in a direction substantially transverse to a plane including the two work rolls. Two or more hydrostatic bearings 3 act against a smooth shell surface 4 of each work roll 2. In this case, Fig. 1, two bearings 3 are located against each roll 2 on diametrically opposed sides of the roll in the rolling direction, where each bearing is a ramp 5 extending along the roll 2, which ramp can comprise a single, long pressure chamber (not shown in Fig. 1), but preferably in a manner known per se is assembled of a plurality of small pressure chambers 6 or bearing pockets 6 located in rows to the side of each other, as indicated in Fig. 1. Each ramp 5 or row of bearing pockets is secured in a suitable way, for example by dovetail groove, on a supporting ramp 7 where, thus, four supporting ramps are provided. Each supporting ramp 7, and therewith each bearing 3, is individually movable to and from a work roll 2 by suitable, for example hydraulic, devices (not shown in Fig. 1).

The numeral 8 in Fig. 1 designates conduits for pressure medium supply to each bearing 3.

In Fig. 2 the numeral 7 designates a supporting ramp or the like, on which pressure chambers 6, bearing pockets 6, are secured by dovetail-like grooves. The chambers 6, of course, can be secured on the ramp 7 by means of screwing with bolts or in some other way.

The supporting ramp 7 comprises a longitudinal passageway 9, through which a pressure medium, for example an oil emulsion or water, is intended to be transported and via communication channels 10, one channel or more per chamber 6 or pocket 6, to be introduced into the bearing through one and, respectively, more corresponding channels 11 in the chamber 6, as shown in Fig. 2.

Each pressure chamber 6 or bearing pocket 6 comprises a recess 12, feeding chamber 12, intended to face to the roll 2, into which recess the channel(s) 12 open, and into which the hydrostatic pressure medium is intended to be fed under pressure, in such a manner, 5 that the recess 12 with pressure medium is intended to constitute the carrying part of the bearing.

The recess 12 is defined by two pairs of sidewalls 13, 14 in parallel with each other, of which the sidewalls 13 extending in parallel with the axle of the roll 2 are shown sectionally in Fig. 2. Each of the 10 sidewalls 13 comprises a contact element 15 located in or at the wall 13, preferably in a longitudinal recess as shown in Fig. 2, where the contact element 15 projects from the free edge 16 of the wall 13.

When the bearing is moved to a position where it is in contact with the smooth shell surface 4 of the roll 2, the free edges 17 of the contact 15 elements constitute portions, which contact the shell surface 4 and have a relatively small area. The free edges of the contact elements and the free edges 16 of the sidewalls 13 have a configuration agreeing substantially with the rounding of the roll 2, as appears schematically from Fig. 2.

20 Also the second embodiment shown in Fig. 3 comprises a supporting ramp 7 and secured therein a pressure chamber 6 or bearing pocket 6. In said pressure chamber 6 a recess 18 is located which is intended to face to the roll 2, and in which a piston 19, bearing insert 19, is located and intended to be moved in the direction to and from the 25 roll 2. Said recess 18 is defined by two pairs of sidewalls 20,21, which are in parallel with each other, and of which the walls 20 extend in parallel with the axle of the roll 2 and are shown in Fig. 3. The piston 19, which seals by sealings 22 against the walls 20,21 and has a substantially rectangular cross-section in a plane perpendicular to its 30 direction of movement, comprises a recess 23 facing to the roll 2. To said recess 23, which corresponds to the recess 12 at the embodiment according to Fig. 2, the hydrostatic pressure medium is intended to be supplied under pressure through a conduit 24 or the like, which opens into the recess 18 behind the piston 19 and extends through the recess 35 18, and which is connected to a passageway 25 extending through the piston 19 and opening into the recess 23. Said conduit 24 communicates

with a main system 9 for medium supply which extends through the supporting ramp 7 and is indicated by dashed line in Fig. 3.

A conduit 26 also opens into the recess 18 behind the piston 19, through which conduit a pressure medium is intended to be transported for operating the piston 19 in the direction to and from the roll 2.

In or at each of the sidewalls 27 of the recess 23 which extend in parallel with the axle of the roll 2, a contact element 28 is located, for example inserted in the outer surface 29 of the sidewall 27, as shown in Fig. 3, where the free edge 30 of the contact element 28 is intended to project from the free edge 31 of the sidewall 27 and to constitute portions of the bearing contacting the roll 2 in a way corresponding to that shown at the embodiment according to Fig. 2.

At the embodiment according to Fig. 4, which to a great part corresponds to that according to Fig. 3 and comprises a recess 32, feed conduits 33, 34 and a piston 35, a contact element 36 is located in the piston 35 and faces to the roll 2. Said contact element 36 extends in the recess 32, and the cross-section of the element 36 in a plane perpendicular to the direction of movement of the piston 35 is the same as that of the recess 32 and preferably rectangular. The contact element 36 has a configuration adapted to the rounding of the roll 2, as shown in Fig. 4.

The element 36 consists of a porous material, for example a sintered metal or a ceramic, which is permeable in respect of the hydrostatic pressure medium. The element 36 preferably comprises a longitudinal recess 38 facing to the inner surface 37 of the piston 35, by means of which recess pressure medium supplied through the conduit 34 is intended to be distributed over the element 36.

The numeral 39 in Fig. 5 designates contact elements, each of which has the form of a plane plate, and an element is intended to abut the inner surface of each sidewall 40 of a recess located in the pressure chamber 6 as shown in Fig. 5, which sidewalls 40 are in parallel with the axle (not shown) of the roll 2. Said elements 39 are intended to be retained in place by a clamping device comprising two plates 41, which are intended to abut each a contact element 39 and to be clamped

apart by means of screws 42 or the like located between the plates 41, whereby the contact elements 39 are pressed against their respective sidewalls 40.

The contact elements 15, 28 and 39 at the embodiments according to 5 Figs. 2, 3 and 5, respectively, which elements constitute portions contacting the roll shell surfaces 4 when the bearings are moved against the rolls, have in common that they, their edges, have a relatively small area and a lower wear resistance than said shell surfaces. The portions, elements, consist, for example, of a material 10 corresponding to the kind of material used in brake linings. Upon contact with the rolls the elements are worn, whereby adaptation to the rounding of the roll is effected, for example after the regrinding of the roll, by which the roll diameter is reduced.

The material of the elements also can be selected so that the elements 15 exercise an appreciable grinding or polishing effect on the shell surfaces 4 of the rolls. The elements may consist of honing material, grinding stone material or the like.

Also at the embodiment according to Fig. 4 the effective contact area is relatively small, due to the porosity of the material. The 20 wear resistance of the material compared to that of the roll shell surfaces 4 also in this case can be selected so that a desired degree of grinding or polishing effect can be obtained.

In Fig. 5 the numeral 43 designates end wall elements, of which one element 43 is located at the inner surface of each sidewall 44 of the 25 pressure chamber 6 extending perpendicularly to the axle of the roll (not shown in Fig. 5). The free edges 45 of the end wall elements 43 have a shape adapted to the rounding of the roll 2 and are intended to seal against the shell surface 4 of the roll 2. The end wall elements expediently are made of an elastic material, for example nylon, teflon 30 or the like, whereby the diameter of the roll is permitted to vary without jeopardizing the sealing function. At a definite design of the elements 43, thus, sealing is possible even when the roll has been reground several times and the roll diameter thereby has been reduced.

At the embodiments according to Figs. 2-4 elastic end wall elements 35 corresponding to the elements 43 are also provided in a suitable way.

At the embodiments according to Figs. 3 and 4 the end wall elements preferably are located on the side surfaces of the respective piston perpendicular to the axle of the roll 2.

In two-high rolling mills according to Figs. 6 and 7 the rolls 46 are mounted according to the present invention.

For each roll a bearing box 48 is provided which is movable in vertical direction and guided in stands 47 of the mill. The said movement is intended to be effected by means of a wedge 49, which is movable preferably in parallel with the axles of the rolls 46 and acts against the upper surface 50 of the bearing box 48 and against the inner surface 51 of an end element 52, which is associated with the stand 47 and holds together the same, and which inner surface 51 is angular relative to said upper surface 50, as shown in Figs. 6 and 7, where said wedge 49 is intended to be adjusted, for example by means of a fixed screw mounted at the wedge, which screw co-operates with a nut 54 and a fixed holder-on member 55. Coarse adjustment of the roll gap, thus can be carried out in this way by means of the wedges 49.

In each bearing box three recesses 56,57,58 are provided which extend in parallel with the axles of the rolls 46. In each of the recesses a hydrostatic bearing according to the invention is located. The bearings are shown relatively schematically in the Figures. Bearings 59,60 are located on diametrically opposed sides of the roll 46 in the rolling direction, and a bearing 61 is located on a diametrically opposed side of the roll 46 in relation to the roll gap 62. The contact elements comprised in the bearings 59,60,61 are designated uniformly by 63 in the Figures.

In the Figures two pressure chambers are shown by way of example. The number of pressure chambers, of course, can be varied. Conduits 64 or the like are provided for pressure medium supply to each bearing.

Each bearing is movable individually to and from the roll 46 by means of two wedges 65,66 located in the recess behind the bearing. One of the wedges is movable, for example in the same way as the wedges 49.

The arrangement according to the invention at the rolling mill shown in Figs. 6 and 7 also comprises means for effecting reciprocatory

movement between the bearings 59,60,61 and rolls 46 substantially in parallel with the geometric axes of the rolls 46. According to the embodiment shown in Fig. 7, at one end of each bearing one end of a slewing bracket 67 is hingedly attached, the other end of which 5 is supported and eccentrically attached on a member 68, which driven by a motor is intended to rotate, whereby the bearing by means of the slewing bracket 67 is caused to move in the said reciprocatory manner. A bearing 68, for example in the form of a needle bearing 68, is located between the bearing and the wedge package 65,66 located 10 ed behind the bearing in the recess 56,57,58.

In Figs. 8,9 and 10 an arrangement according to the invention is shown, where four bearings 69 are assembled in a cassette or the like, and the cassette also is intended to comprise a pair of work rolls 70.

For each roll 70 and pair of bearings 69 two supporting frames 71 15 are provided which extend in parallel with the axle of the roll. In each supporting frame 71 two wedges 73,74 are provided which are located in a recess 72 in the frame. The bearing proper 69 is attached to the wedge 74 located closest to the roll 70. The bearing 69 is movable to and from the roll 70 by moving the wedge 74. Between the 20 supporting frames distance members 75, for example springs 75, are provided which are intended to keep apart the rolls 70 in unloaded state.

The cassette is intended to be inserted into an existing rolling mill, preferably from the side and, thus, in the longitudinal direction of 25 the rolls. The cassette is intended to be placed between the two rolls in a two-high rolling mill or between the work rolls 76 in a four-high rolling mill with back-up rolls 77, as shown in Fig. 8, where the driving is intended to be effected by friction between the rolls 70 and the work rolls in the existing mill.

30 The mounting of the cassette in a stand 78 is shown schematically in Fig. 10. Between the supporting frames 71 two end wall elements 79 are located perpendicularly to the longitudinal direction of the rolls 70, in which elements the rolls 70 are simply attached by means of end journals 80. Through preferably one end wall element,79 conduits 81 for pressure medium supply and screws 82 or the like extend 35

for moving the wedges 74.

A cassette according to the invention can be used, for example, at plate rolling. A billet first is rolled by means of the ordinary work rolls of the plate rolling mill, and the cassette is inserted into the mill first when the thickness of the original billet has been reduced to a suitable degree.

Figs. 9 and 10 show an embodiment of a means for effecting reciprocatory movement of the bearings in parallel with the rolls. Such means must not per se be combined with a cassette according to Figs. 8-10, but are more generally applicable at a bearing according to the invention.

For each pair of bearings 69 located on each side of a plane through the axles of the rolls 70 a disc 84 or the like hingedly suspended and provided with a central hole 83 is located in a plane which is in parallel with the plane through the axles of the rolls. One slewing bracket 85 or the like per bearing 69 of said pair extend between the bearing 69 and disc 84 and are hingedly attached to the same and located in the plane of the disc 84. A rotary axle 86 substantially perpendicular to the plane of the disc comprises two axle elements 87, which are located eccentrically in relation to the geometric axis of the axle 86, which axle elements 87 are intended to co-operate with the hole 83 each in its disc 84, whereby upon rotation of the axle 86 and axle elements 87 the disc 84 is caused to carry out gyratory movement, and the bearings 69 hereby via the slewing bracket 85 are caused to move reciprocatory. A bearing, for example in the form of needle bearing 88, preferably is provided between each wedge 74 and the bearing 69 and at the attachment of the bearing, as shown in Figs. 8 and 10.

Some embodiments of an arrangement according to the invention have been described above, from which the mode of operation of the arrangement partly should have become apparent.

Pressure medium for the hydrostatic function of the bearings, thus, is supplied through expedient channels, where the feed pressure can be adjusted. At embodiments, where each bearing in a manner known per se is divided by partition walls into a plurality of pressure chambers distributed along the length of the work rolls and with preferably in-

dividually adjustable pressure medium supply, sealing between adjacent chambers is achieved by means of elastically deformable end wall elements 43, which can be said to be partition walls between the chambers, and which agree in shape with the shell surfaces 4 5 even when the shape of said surfaces varies, for example by re-grinding the rolls.

It is a characterizing feature of arrangements, bearings, according to the invention, that an intentional controlled leakage, leak flow, of pressure medium is intended to take place, where the leakage 10 occurs between the contact elements and the shell surface 4 through a gap 89, Fig. 3. The size of the flow and gap is controlled a.o. by the pressure, at which the pressure medium is supplied to the carrying part of the bearing, such as the recesses 12, 23 or the like.

At low feed pressure contact is established between contact elements 15 and roll, whereby the elements are worn against the shell surface 4, and where an adaptation to the rounding of the roll is obtained. At contact elements with grinding or polishing properties, cutting of the shell surface is obtained, whereby the surface is conditioned.

20 The means for effecting reciprocatory movement in parallel with the axles of the rolls are hereby utilized, whereby variation in the cutting in the longitudinal direction of the rolls is prevented. The function of said means should be obvious in view of the above description.

25 At high feed pressure the gap and leakage are distinct. The function of the bearing here is that of a hydrostatic bearing. The leakage of pressure medium, which at cold rolling, for example is an emulsion of oil in water, and at hot rolling, for example, is water, implies essential advantages. The roll surface, for example, is cooled effectively. Furthermore, the surface of the roll and of the rolled material is cleaned, whereby particles, so-called scale, etc. are removed. 30

At conventional rolling mills and arrangements, the work rolls are subjected to deflection induced a.o. by the roll force. The work rolls may be, for example, the two rolls of a two-high rolling mill 35 or the work rolls of a four-high rolling mill. The deflection gives rise to, at times unacceptable differences in thickness of the rolled

material transversely to its longitudinal direction, in such a way that the thickness is greater centrally on the product than at its edges. Conventionally this is counteracted by so-called cambering, whereby the rolls are given slightly bobbin shape. However, this method is, of course, very inflexible. According to the present invention this problem can be substantially reduced, for example at four-high rolling mills, in that the bearings are movable to positions, in which the plane including the two work rolls is moved in parallel in relation to a plane including the two back-up rolls, which movement normally takes place in the rolling direction. By controlling the movement, the deflection can be controlled, and the component of the roll force acting on the work rolls to a substantial degree can be deflected to the back-up rolls. The said movement hereby can take place by means of the described wedge arrangements and/or by means of the bearings when they comprise bearing inserts and adjusting devices as at the embodiments according to Figs. 3 and 4, whereby the bearings are divided into a plurality of pressure chambers distributed along the length of the work rolls and preferably with individually adjustable pressure medium supply, and where each pressure chamber 6 comprises a member, such as the bearing inserts of said pistons 19,35, which are individually movable to and from the roll. In a substantially corresponding way, the deflection of each roll can be controlled in a two-high pair of rolls, for example according to Figs. 6 and 7, where wedge systems or the like are provided and the pressure chambers can be provided with pistons 19,35.

As should have become apparent from the description and introductory portion, an arrangement according to the invention at rolling mills offers several advantages over the prior art. The invention, for example, implies that bearings simply can be adapted to variations in the diameter of the work rolls, without dismantling the bearings for regrinding. The invention further implies that the shell surface of the roll can be conditioned at demand by the bearings, without dismantling the rolling mill. The invention further offers the possibility of very flexible cambering, which can be adapted to the product and rolling sequence. The invention in this way renders possible a.o. substantial gains in capacity. By said leak flow

of pressure medium, the rolls are cooled effectively, and particles etc. are removed, whereby the service life of the rolls increases and the product quality is improved. By means of said cassette arrangement, which is rendered possible by the low space requirements of
5 the bearings, an existing rolling mill can be completed, whereby the capacity of the mill in respect of rolling thin products increases substantially and whereby in certain cases thinner products can be rolled.

It is, of course, also possible to imagine minor changes and more
10 embodiments beyond what has been described above.

More bearings per roll, for example, than shown in the Figures can be provided, and the bearings can be moved in a way other than by wedge systems, for example hydraulically by means of pistons.

The movement of the pistons 19,35, bearing inserts, can be effected,
15 for example, mechanically instead of hydraulically.

The means for effecting said reciprocatory relative movement between bearings and rolls can operate in a different way, for example hydraulically or pneumatically.

The invention, thus, must not be regarded restricted to the embodiments
20 set forth above, but can be varied within the scope of the attached claims..

Claims

1. An arrangement at rolling mills, especially sheet and strip rolling mills, for supporting work rolls therein, which rolls have a smooth shell surface along at least a substantial portion of their length, and two or more hydrostatic bearings acting against said smooth shell surfaces are provided for supporting the work rolls, characterized in that the bearings (3,6,7,59,60,61,69) are movable to positions, in which they are in contact with the smooth shell surfaces (4), that their portions (15,17,28,30,36,39, 10 63) thereby contacting the shell surfaces (4) have small area and a lower wear resistance than said shell surfaces (4), and that hydrostatic pressure medium is intended to controlled flow out between said portions (15,17,28,30,36,39,63) and the shell surfaces (4).
2. An arrangement as defined in claim 1, characterized in 15 ed in that said portions (15,17,28,30,36,39,63) of the bearings when they are in contact with said shell surfaces (4) exercise a grinding or polishing effect on the same, and the arrangement preferably also comprises means (67,68,69,83,84,85,86,87) for effecting reciprocatory relative movement between bearings (59,60,61,69) and work 20 rolls (2,46,70) substantially in parallel with the geometric axes of the work rolls (2,46,70).
3. An arrangement as defined in claim 1 or 2, where hydrostatic bearings are provided for supporting the work rolls in a direction substantially transversely to a plane including both work rolls, 25 while back-up rolls are provided for supporting the work rolls on substantially diametrically opposed sides of the work rolls, characterized in that the hydrostatic bearings (3,6,7,59,60, 69) are movable to positions, in which the plane including the two work rolls is moved in parallel in relation to the plane including 30 the two back-up rolls.
4. An arrangement as defined in any one of the claims 1 - 3, characterized in that the bearings (3,6,7,59,60,61,69) in a manner known per se are divided by means of partition walls (14, 21,44) into a plurality of pressure chambers distributed along the

length of the work rolls, with preferably individually adjustable pressure medium supply, and that portions (43,45) of the partition walls contacting the work rolls preferably are elastically deformable for adapting to the shape of said shell surfaces (4).

5 5. An arrangement as defined in any one of the claims 1 - 3, characterized in that the bearings in a manner known per se are divided into a plurality of pressure chambers (6) distributed along the length of the work rolls, with preferably individually adjustable pressure medium supply, and that the pressure
10 chambers are formed in rows of bearing supports (59,60,61,69) movable individually to and from the work rolls (2,46,70).

6. An arrangement as defined in claim 5, characterized in that portions (43,45) of adjacent bearing support walls (14, 21,44) contacting the work rolls preferably are elastically deform-
15 able for adapting to the shape of said shell surfaces (4).

7. An arrangement as defined in any one of the claims 1 - 6, characterized in that the portions (15,17,28,30,36,39, 63) of the defining walls (13,27) of the pressure chambers (6) extending in parallel with the work rolls, which portions contact the work
20 rolls (2,46,70), are formed on separate bearing inserts.(19,35).

8. An arrangement as defined in the claims 1 - 7, characterized in that said portions (15,17,28,30,39,63) contacting the shell surfaces (4) consist of brake lining material or the like.

9. An arrangement as defined in claim 1 - 8, characterized
25 ed in that the bearings are movable to said positions by means of at least one wedge (74,66) movable substantially in parallel with the longitudinal direction of the rolls (2,46,70).

10. An arrangement as defined in claims 2 - 9, comprising means for effecting reciprocatory relative movement between bearings and
30 rolls substantially in parallel with the longitudinal direction of the rolls, characterized in that for each pair of bearings (69) located on each side of a plane through the axes of the rolls (70) a hingedly suspended disc (84) or the like with a central hole (83) is located in a plane in parallel with the plane through the

axles of the rolls, and one slewing bracket (85) or the like per bearing (69) of the pair extends between the bearing (69) and the disc (84) and is hingedly attached to them and located in the plane of the disc (84), and a rotatable axle (86) substantially perpendicular to the plane of the disc comprises two axle elements (87) located eccentrically in relation to the geometric axis of the axle (86), which axle elements co-operate with the hole (83) each of one disc whereby upon rotation of the axle (86) and axle elements (87) the disc (84) is caused to carry out gyratory movement, and the bearings (69) hereby via the slewing brackets (85) are caused to carry out reciprocatory movement.

11. An arrangement as defined in any one of the preceding claims, characterized in that a pair of work rolls (70) with bearings (69) are located in a cassette or the like, which is intended preferably in parallel with the axles of the rolls (70) to be inserted between the work rolls (76) of an existing rolling mill.

Fig. 1

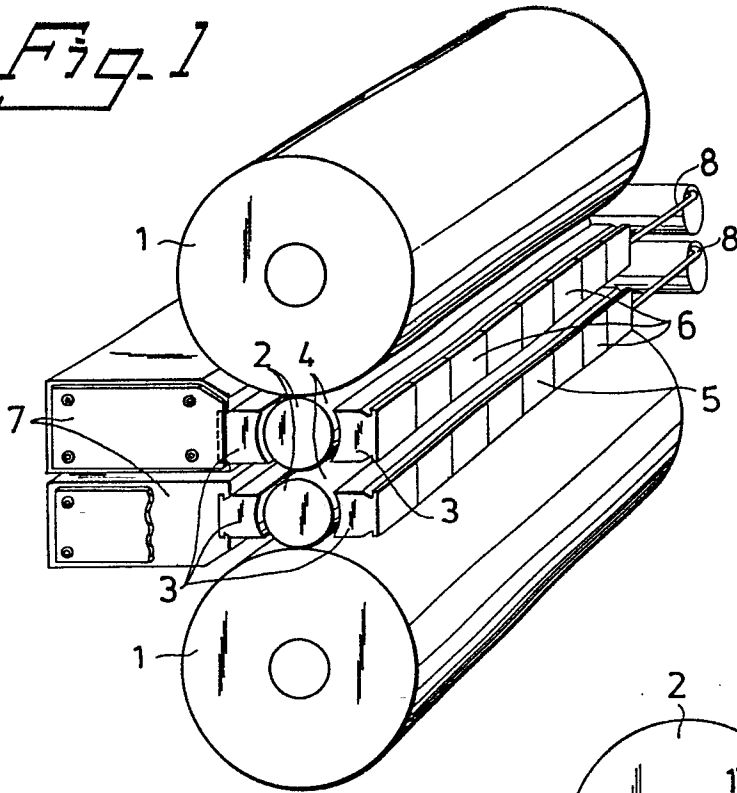


Fig. 2

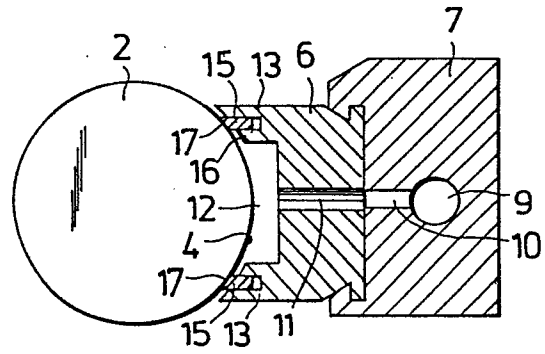


Fig. 3

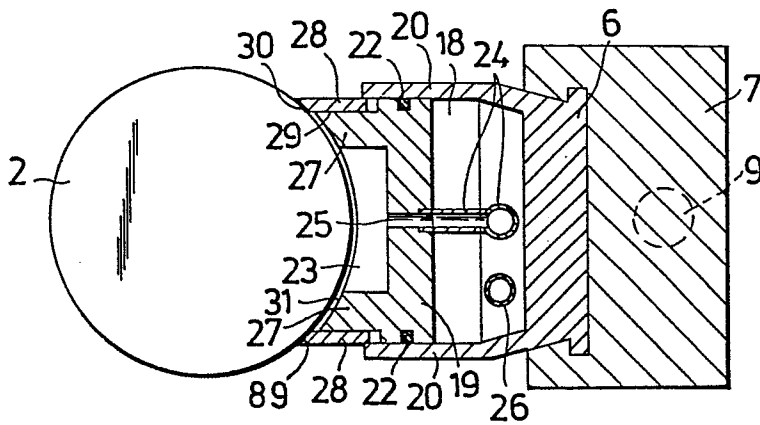


Fig. 4

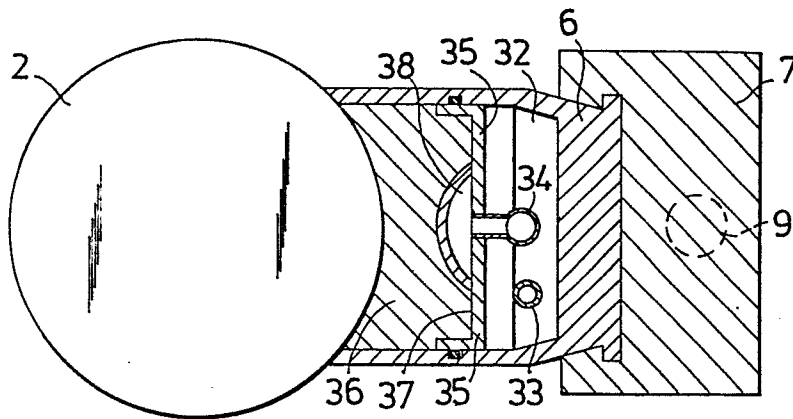
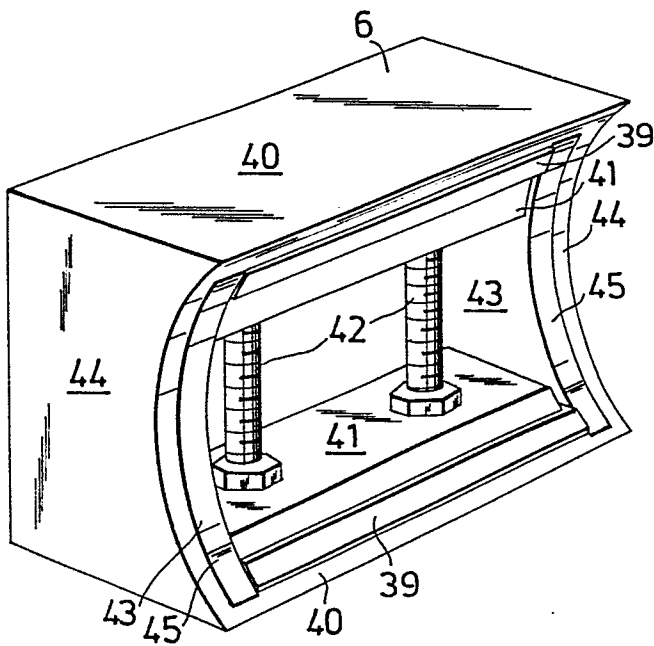


Fig. 5



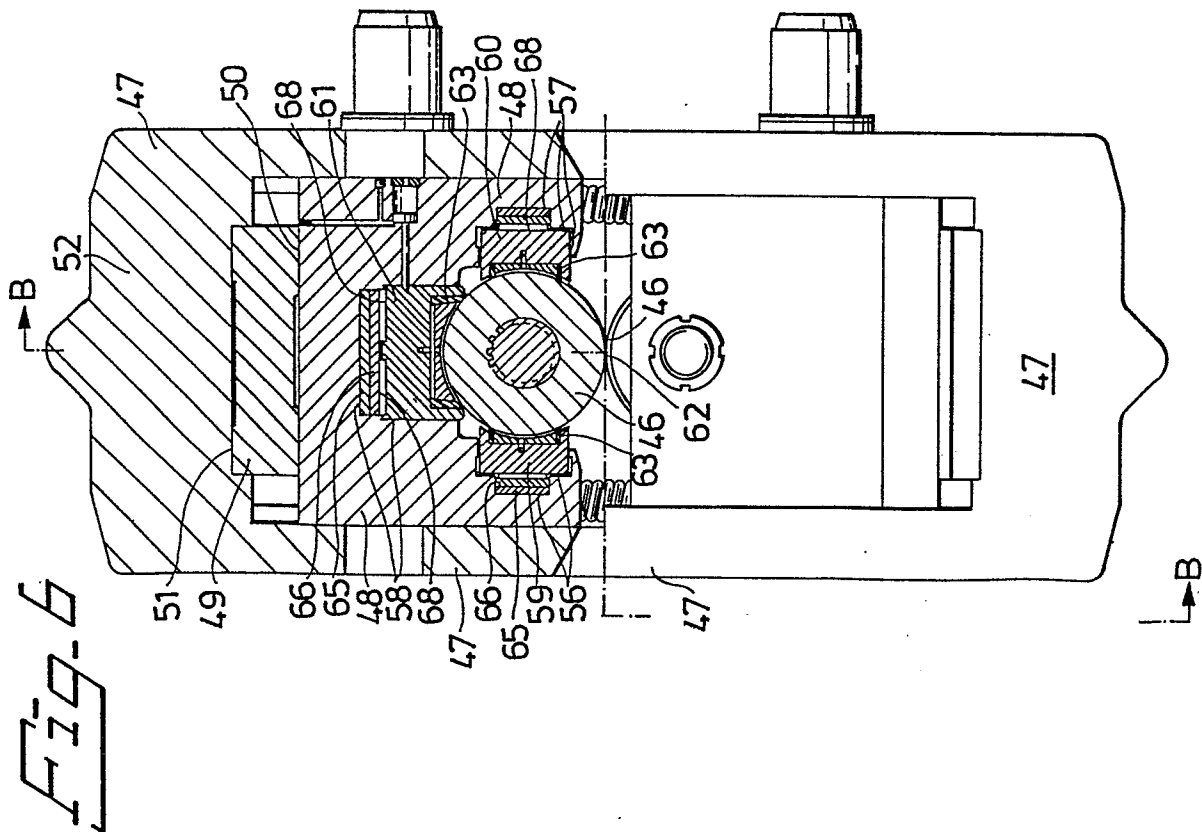
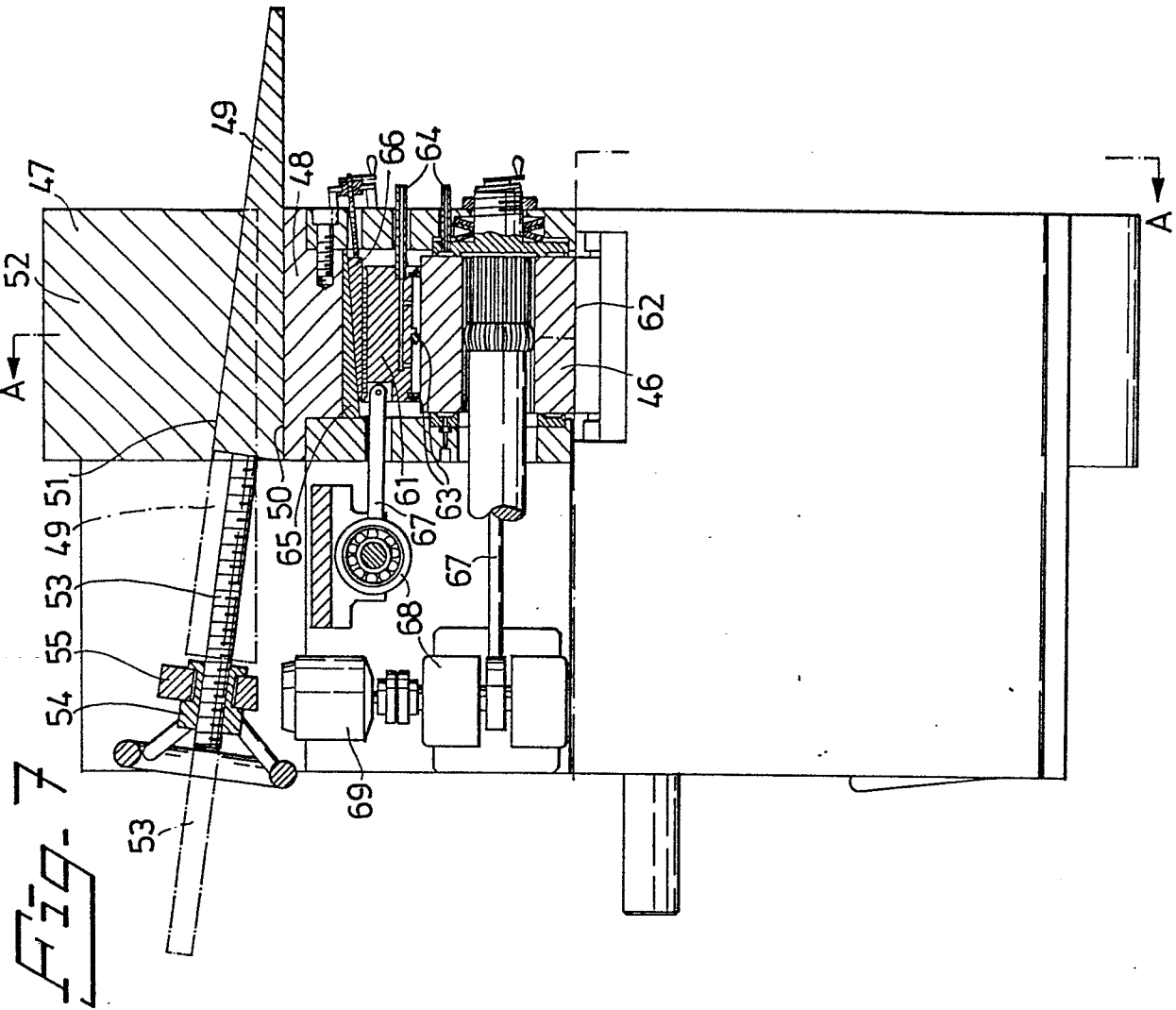


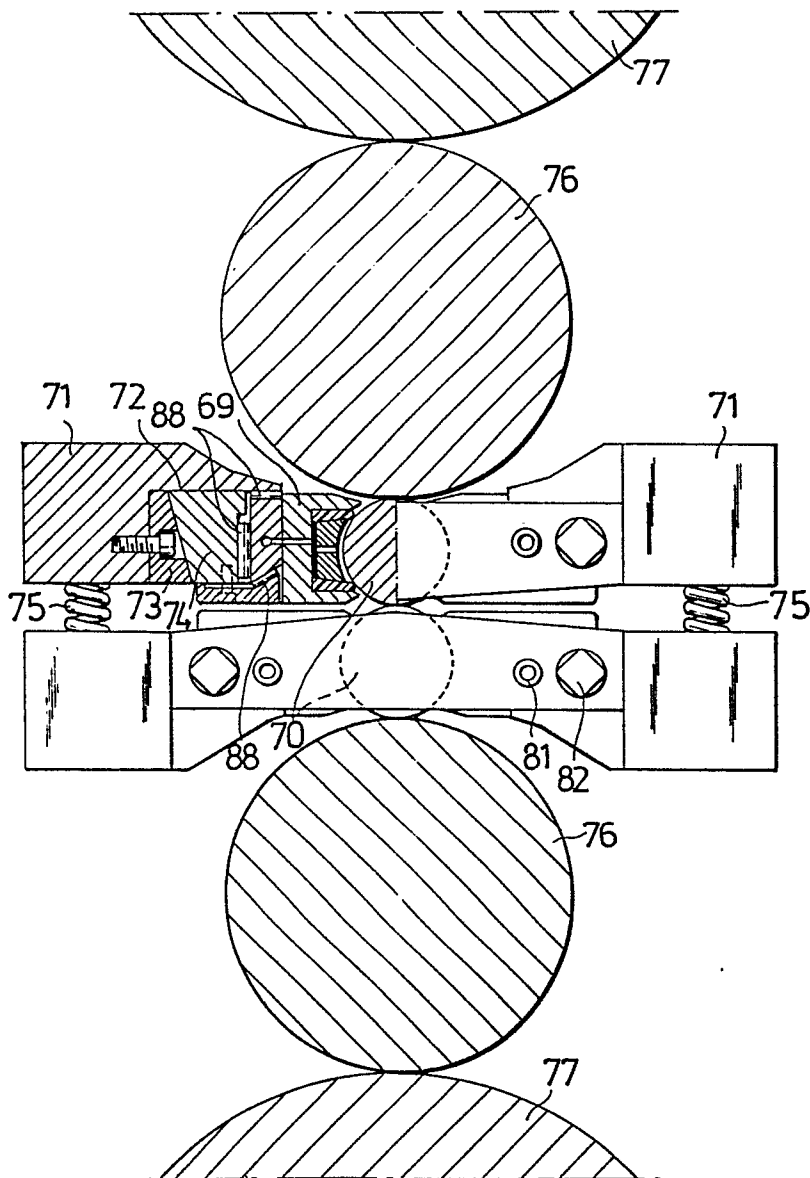
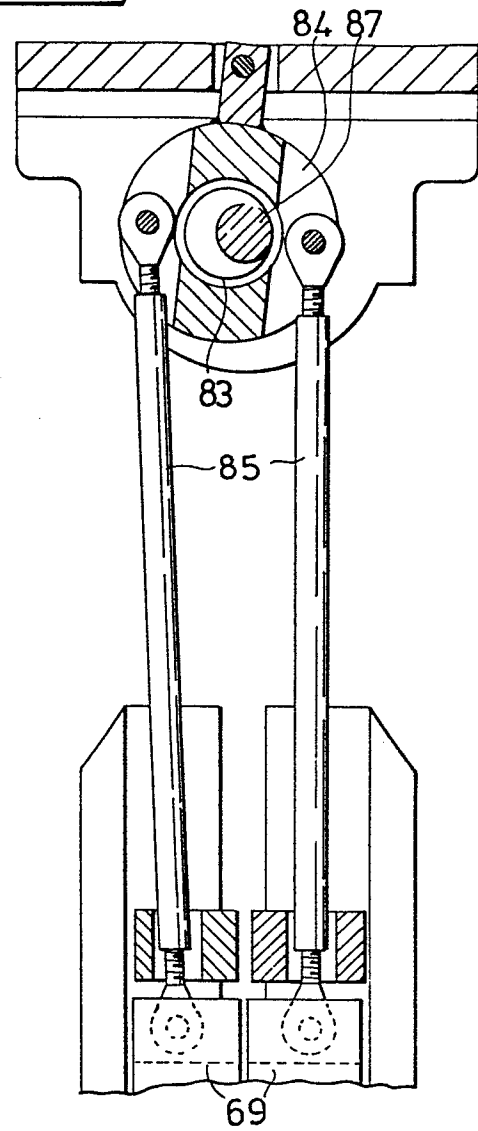
Fig. 8*Fig. 9*

Fig. 10

