United States Patent

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[54] **ROLLER FRAME STRUCTURE WITH ONE OR MORE PRESSING DEVICES FOR MAINTAINING CONSTANT THE GAP BETWEEN THE ROLLERS**
6 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **72/237,** 72/244, 72/245
[51] **Int. Cl.** **B21b 31/30,** B21b 31/32
[50] **Field of Search** 72/237, 243, 244, 245, 246; 72/240; 254/93

[56] **References Cited**

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ABSTRACT: Roller frame in which the rollers are urged toward each other under a certain preload as by a threaded spindle with hydraulic piston-cylinder means acting between the rollers in separating direction. The pistons bottom in the cylinders at a predetermined point and the cylinders are supplied with fluid under pressure in conformity with the movement of the rollers away from each other when a strip is passing therebetween.

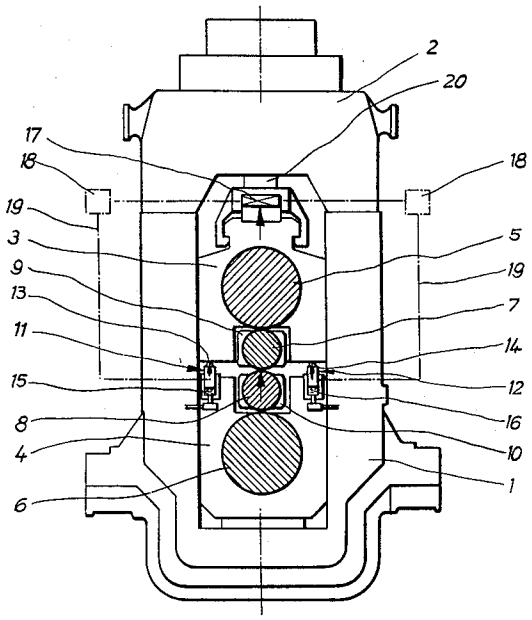
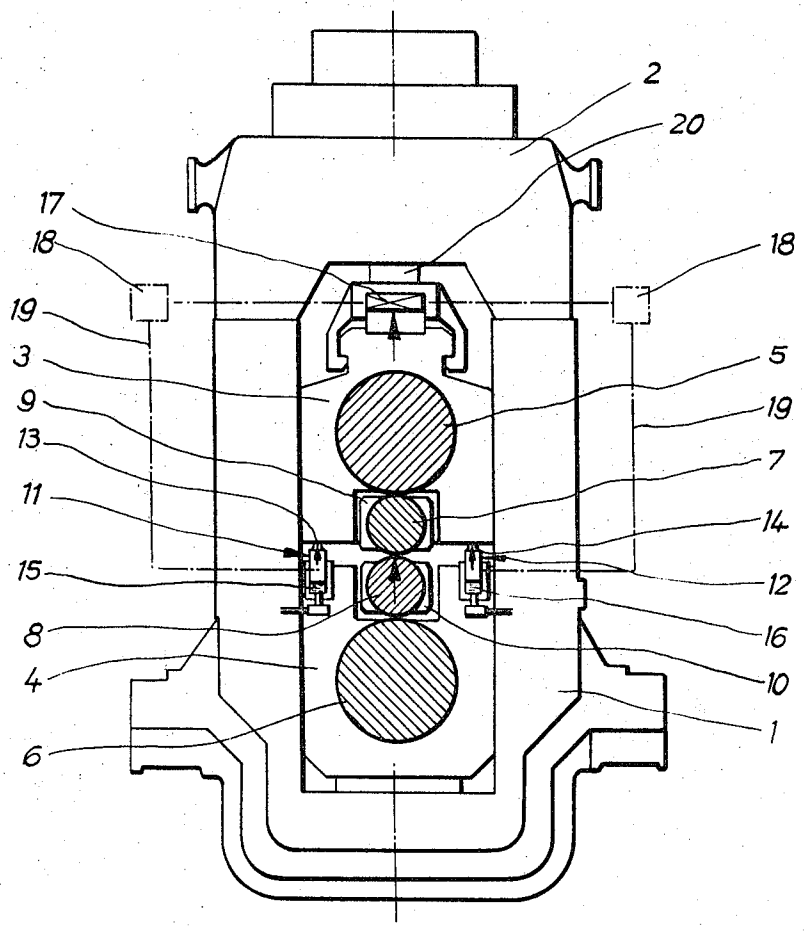


Fig. 1



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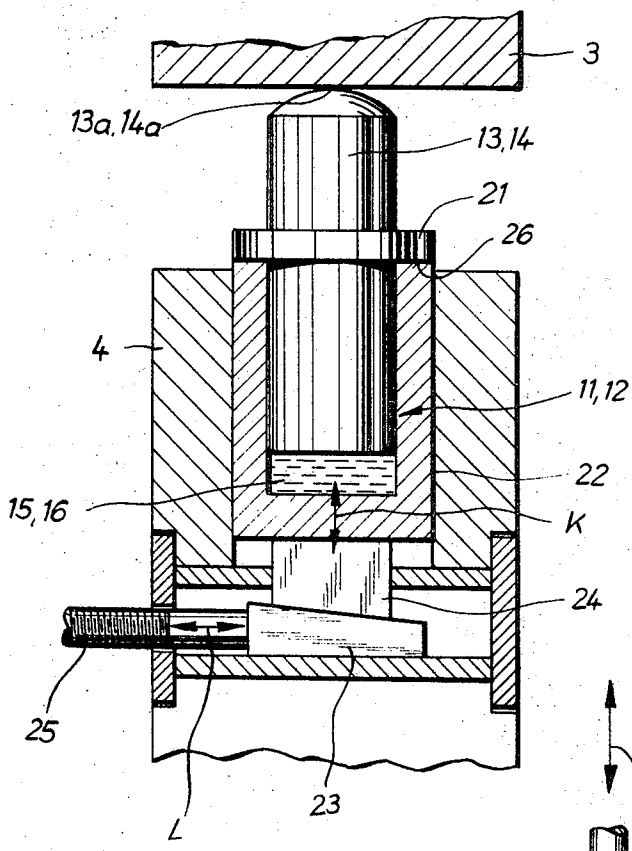


Fig. 2

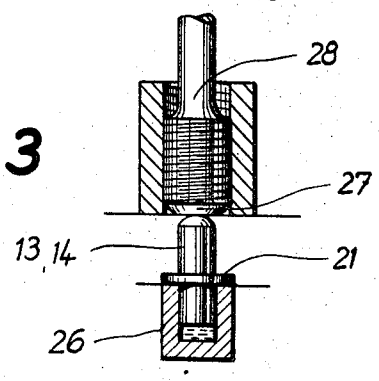


Fig. 3

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ROLLER FRAME STRUCTURE WITH ONE OR MORE PRESSING DEVICES FOR MAINTAINING CONSTANT THE GAP BETWEEN THE ROLLERS

The present invention relates to a roller frame structure with one or more pressure exerting devices for maintaining constant the gap between the rollers. In my copending U.S. Pat. application Ser. No. 627,812, filed Apr. 3, 1967, now abandoned, there has been set forth a method of maintaining constant the gap between the rollers on a roller frame structure according to which the pressing devices are formed by small hydraulic pressure medium cylinders which produce only the control pressure during the rolling operation. These pressing devices have the advantage that they can be controlled in a short time in a fine, sensitive manner. Furthermore, the said small pressure exerting devices require only little space.

Inasmuch as the roller pressure as it occurs during the rolling in the roller frame structure generally is considerably higher than the control pressure which is compensated for by the small pressing device, it will be appreciated that at the instant the material to be rolled is introduced into the roller gap, a correspondingly sudden increase in pressure and power between the rollers occurs, as a result of which, the material to be rolled leaves the roller gap at a thickness in excess of the previous adjustment of the roller gap. In order to obtain the desired rated thickness of the material to be rolled, a correction is necessary by adjustment of the roller frame structure so that the small pressure exerting devices can be adjusted upwardly or downwardly by the medium value of the occurring pressure.

This means that only after a certain delay following the introduction of the material to be rolled into the roller gap the actual control can be effective. The smaller the difference between the roller gap adjustment and the thickness of the material as it comes out from said gap at the start of the rolling operation, the faster the control can start and be effective. The ideal case would, of course, be that immediately after introducing the material to be rolled into the roller gap, the pressure medium value of the control would be arrived at without any correction.

It is, of course, possible to adjust the roller gap prior to the start of the rolling operation so that it will be narrower to a corresponding extent so that after the rolling operation has been started the desired rated thickness of the rolled material will be obtained, in which instance the expected increase in thickness was taken care of by the previous narrower adjustment. This solution, however, is not satisfactory because on one hand the magnitude of the increase cannot be reduced, and on the other hand errors cannot be avoided.

It is, therefore, an object of the present invention to provide a roller frame structure which is improved over that of my above-mentioned copending application Ser. No. 627,812 now abandoned.

It is another object of this invention to provide a roller frame structure in which the roller gap can be adjusted from the very start to the rated value of the thickness which the rolled material should have.

These and other objects and advantages of the invention will appear more clearly from the following specification, in connection with the accompanying drawings, in which:

FIG. 1 is a side view of a roller frame structure according to the invention.

FIG. 2 is a section through the pressure fluid cylinder piston system used in connection with the present invention.

FIG. 3 illustrates a modification with an adjustable counter surface of the piston.

The roller frame structure according to the present invention is characterized primarily in that the cylinders of the pressing devices, or the counter surface of the pistons in said cylinders are adjustable in conformity with the desired magnitude of the roller gap, and that the piston displaceable in said cylinders has an abutment for limiting the piston movement in one direction.

Preferably, the cylinders are designed in the form of adjustable bushings and are longitudinally adjustable by means of a wedge, spindle or the like, arranged between the cylinder bottom and a wall of a lower structural member.

According to another embodiment of the present invention, the counter surface of the piston is formed by a stud or the like which is adapted to be screwed into and out of an upper structural member.

According to a preferred embodiment of the invention, the fluid operable pistons are equipped with a flange adapted to engage the upper cylinder wall. The flange diameter need not exceed the cylinder diameter so that when the piston flange engages the upper marginal area of the cylinder, the cylinder together with the flange is adapted at least partially, to be moved into the bore receiving said cylinder.

Instead of the flange on the fluid operable pistons, the said pistons or the cylinder bottoms may be provided with extensions extending into the fluid pressure chamber of the cylinder.

Referring now to the drawings in detail, the roller frame structure **1**, with its cap **2** has inserts **3** and **4** for the supporting rollers **5** and **6**, respectively, which supporting rollers **5** and **6** are respectively engaged by the working rollers **7** and **8** which are journaled in corresponding inserts **9** and **10**, respectively. Between the inserts **3** and **4** there are provided small pressure fluid receiving cylinders **11**, **12** in such a way that the pistons **13** and **14**, respectively pertaining thereto, press against the upper insert **3** when the pressure fluid in the fluid chambers **15**, **16** is placed under pressure.

Between the pressure screw or spindle **20** which threadedly engages a nonillustrated nut in cap **2** and the upper insert member **3** there is provided a pressure measuring box **17** which is connected with a device **18** each that in its turn communicates with the pressure fluid cylinders **11** and **12** respectively.

The devices **18** forming a part of the control mechanism which determines the pressure in the pressure fluid chambers **15** and **16** receive the values received by the pressure measuring box, said values representing the total of the effective roller pressure and the pressure in the cylinders **11**, **12**. Through conduit **19**, the devices **18** control the pressure in the chambers **15**, **16** so that this pressure corresponds to the control pressure between the adjusting pressure for the rated thickness and the actual or effective roller pressure during the rolling operation.

According to the embodiment of the pressing devices according to FIG. **2**, each plunger **13**, **14** has an annular flange **21** which preferably is located on the upper plunger half. The cylinder **11**, **12**, into which immerses the plunger **13**, **14**, is designed in the form of a bushing **22** which is displaceable in the lower insert member **4** in the direction of the arrow K. In the cylinder bushing **22** below the plunger **13**, **14**, there is provided the pressure fluid chamber **15**, **16**.

The bushing **22** forming the cylinder is, by means of a wedge **23**, and an intermediate member **24** displaceable in the direction of the arrow K. Wedge **23** is, by means of a spindle **25**, adjustable in the direction of the arrow L.

With the plunger flange **21** resting upon the upper cylinder rim **26**, the cylinder bushing **22** is, by means of a wedge **23** adjusted in such a manner that the plunger head **13***a*, **14***a* engages the upper insert **3** whereby the roller gap assumes the desired magnitude; in other words the roller gap is, by means of the wedge **23** adjusted as to the desired thickness of the rolled material. Fluid under pressure of, for instance, 100 tons, is introduced into the fluid pressure chamber **15**, **16**, whereas the roller frame structure is preloaded by means of a pressure screw or pressure spindle **20** at a pressure of 400 tons. This means that the flange **21** engages the upper marginal area **26** of the cylinder at a pressure of 300 tons, namely, 400 tons adjusting pressure in the roller frame structure minus 100 tons counter force from the pressure fluid chamber **15**, **16**. The pressure measuring box **17** indicates the value of 400 tons, the load in the roller gap is zero because the load is ab-

sorbed by the pistons **13**, **14**, and the cylinder as well as the members **23**, **24**. When at the starting of the rolling operations 400 tons of rolling pressure is required, at the introduction of the material a force of 400 tons is obtained at which the working rollers **7**, **8**, are pressed against each other whereby also the plungers **13**, **14**, are relieved.

Since in the particular example shown in the drawing and referred to above the flange **21** rests on the marginal area **26** at a pressure of 300 tons, and since now the rollers are pressed apart or the roller gap is widened under a pressure of 400 tons, the flange **21** is lifted off the upper marginal portion **26** of the cylinder to an extent which corresponds to the expansion of the frame structure at a force of 100 tons.

The pressure in the fluid pressure chambers **15**, **16** is, in the example referred to above, left at 100 tons. Since the flange **21** is lifted off the cylinder bushing **22** to the extent which corresponds to the expansion of the frame structure under a pressure of 100 tons, the same stroke will be available for the movement of flange **21** relative to the cylinder bushing **22** so that a control of the control pressure of 100 tons in upward and downward direction may be effected.

With the roller frame structure according to the invention, in the particular example referred to above, it is possible to store already a preload of 300 tons which at the introduction of the band between the rollers can immediately be taken over. In this way the jump in the frame structure will be reduced and the small pressure fluid pistons will be effective in a short time and without controlling the preload.

With the embodiment according to FIG. **3**, the plunger **13**, **14** has likewise an annular flange **21**, and the plunger itself has its lower end in a cylinder **26**. In contrast to the longitudinal adjustable cylinder bushing **22** according to FIG. **2**, this cylinder may be fixedly arranged in the lower insert. The adjustment of the desired magnitude of the roller gap will, in conformity with FIG. **3**, be effected by a counter surface **27** which is formed by a threaded spindle **28** which is adjustable in the upper insert in the direction of the arrow S. Instead of adjusting the wedge **23** in the direction of the arrow L according to FIG. **2**, with the embodiment of FIG. **3** the threaded spindle is adjusted in the direction of the arrow S whereby the magnitude of the roller gap is changed. In all other respects the operation of the arrangement according to FIG. **3** corresponds to that described in FIG. **2**.

It is, of course, to be understood that the present invention is, by no means, limited to the particular embodiments shown in the drawings, but also comprises any modifications within the scope of the appended claims.

I claim:

1. In a strip rolling apparatus having at least one pressurizing device for maintaining constant roller gap; a preloadable frame, a pair of rollers in the frame adapted for having strips pass therebetween, means supporting said rollers in said frame and including bearing members, at least one of said bearing members being movable in the frame toward and away from the other bearing member thereby to vary the gap between said rollers, means urging said one bearing member toward said other bearing member with a predetermined force, and a plurality of hydraulically operable means acting between said bearing members for exerting control forces on the bearing members tending to keep the gap between the rollers constant, each of said hydraulically operable means comprising cylinder-piston means, each piston and its cylinder having cooperating abutment means thereon to limit the movement of the piston in the cylinder in one direction limiting movement of the bearing members toward each other and adjustable in the direction of separation of the rollers, each piston acting on one of the bearing members and its cylinder being supported by the other of the bearings members and with the axes of said pistons and cylinders parallel to the direction of relative movement of said bearing members, means for supplying hydraulic fluid under pressure to said cylinders, and adjustable means interposed between each of said hydraulically operable means and one of the bearing members pertaining thereto and adjustable for adjusting the gap between said rollers when said abutment means are engaged.

2. A strip rolling apparatus according to claim **1** in which said adjustable means comprises a screw threaded member.

3. A strip rolling apparatus according to claim **1** in which said adjustable means comprises a wedge member.

4. A strip rolling apparatus according to claim **1** in which said cooperating abutment means comprises a collar on the piston and the end surface of the cylinder in which the piston is mounted.

5. A strip rolling apparatus according to claim **4** in which the cylinder is adjustably mounted in a bore in its bearing member and said collar is receivable in said bore.

6. A strip rolling apparatus according to claim **1** in which the said predetermined force is exerted on said one bearing member by a threaded spindle, a load sensitive element interposed between said spindle and said one bearing member, and means under the control of said load sensitive element for controlling the supply of hydraulic fluid to said cylinders.