United States Patent

Rinberger

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[54] ADJUSTABLE SHEET ADVANCING DEVICE

[72] Inventor: **Helmuth Rinberger**, Munich, Germany

[73] Assignee: **Agfa-Gevaert Aktiengesellschaft**, Leverkusen, Germany

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **B30b 3/04**

[58] **Field of Search** ..... 100/168, 169, 170, 171; 68/250–269; 24/278, 263 A; 95/89 A; 226/177, 187

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Primary Examiner—Peter Feldman

Attorney—Michael S. Striker

[57] **ABSTRACT**

An adjustable device for advancing and/or compressing sheets or strips of photographic material comprises a pair of parallel sheet-engaging elastic rollers, a stub shaft extending axially from each end of each roller, preferably polygonal plastic bearing members rotatably receiving the stub shafts, a flexible metallic strap trained around each pair of bearing members, and means for changing the effective length of such straps to thereby move the axes of the rollers closer to or away from each other. The length changing means can comprise a screw which mates with one end portion of the respective strap and passes through a hole of the other end portion of such strap, a pressure transmitting plate interposed between the inner end of the screw and one of the corresponding bearing members, and an elastic cushion interposed between such bearing member and the plate.

15 Claims, 2 Drawing Figures

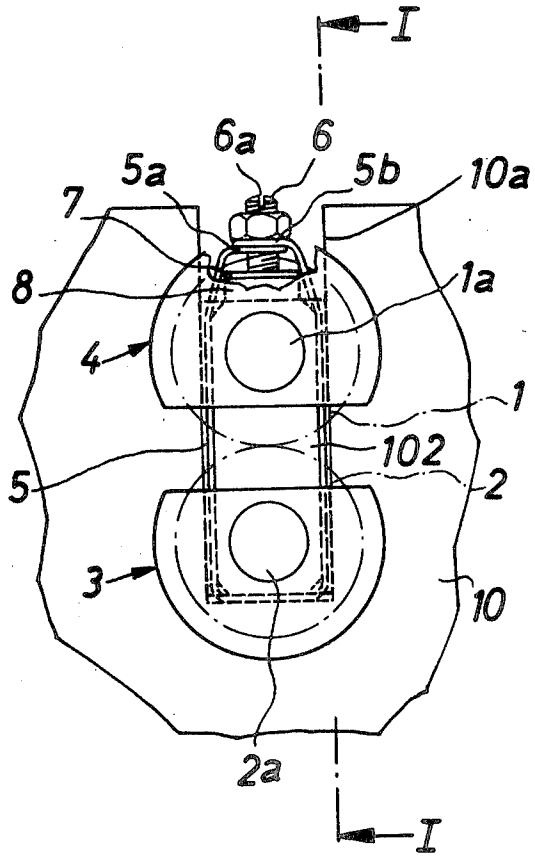


Fig.1

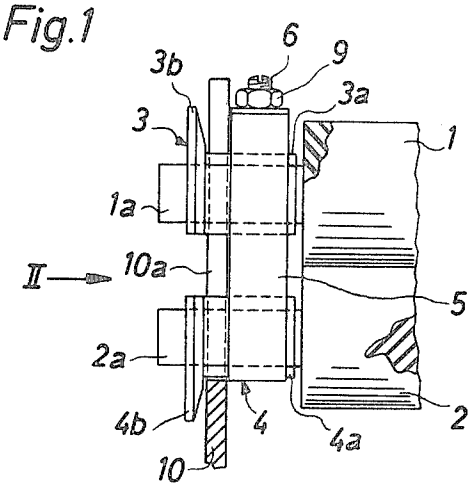
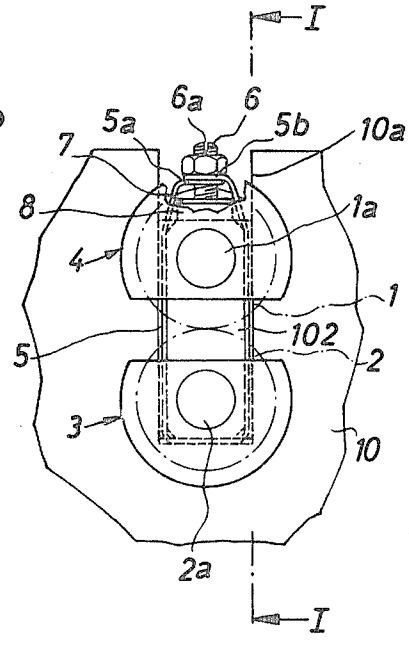


Fig.2



INVENTOR.
HELMUTH RINBERGER

BY
Herbert S. Haber

ADJUSTABLE SHEET ADVANCING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to improvements in devices for advancing, compressing and/or squeezing sheets or strips of photographic material or the like. More particularly, the invention relates to improvements in adjustable devices for changing the pressure between elastic rollers and a sheet or strip of material which is caused to pass through the nip between such rollers.

Presently known devices for supporting the shafts of rollers which advance or otherwise treat sheets or strips of photographic material or the like normally comprise a pair of rigidly mounted bearing blocks, one for each of two stub shafts extending axially from one end of each roller. One of the shafts is rotatable directly in one of the bearing blocks and the other block comprises a reciprocable insert which receives the other shaft and is movable toward and away from the one shaft to thereby vary the distance between the axes of the rollers. The insert is biased outwardly by a spring or the like and a screw is provided in the other bearing block to effect movement of the insert against the opposition of such spring. As a rule, the bearing blocks consist of high-quality metallic material which is expensive and must be machined and otherwise treated in complicated machinery in a time-consuming operation. Aluminum or like metals are not suited because they cannot stand the corrosive effect of fluids which are often employed in connection with the processing of photographic materials. Also, it was found that the just described device cannot employ bearing blocks which consist of synthetic plastic material because such material is likely to creep with age in response to uninterrupted application of deforming stress and to thus change the pressure between the peripheral surfaces of the rollers.

It is also known to couple the bearing blocks for two adjacent stub shafts of elastic rollers by means of an endless elastic band consisting of rubber or the like. Such solution is satisfactory in certain rudimentary apparatus but it cannot be resorted to in apparatus wherein the pressure between the peripheral surfaces of the rollers must be regulated with at least some degree of precision. Moreover, the useful life of a rubber band is rather limited and its bias cannot be determined with a requisite degree of accuracy.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved advancing and/or compressing device for sheets and/or strips of photographic material or the like wherein the pressure with which the rollers bear against a sheet or strip which is placed or caused to move therebetween can be selected and maintained with a high degree of accuracy and by resorting to a simple, compact and relatively inexpensive structure consisting of a small number of parts.

Another object of the invention is to provide an advancing and/or compressing or squeezing device whose useful life exceeds the useful life of many presently known devices and which can be employed in connection with driven rollers, idler rollers or with combinations of idler and driven rollers.

A further object of the invention is to provide a lightweight advancing device which is capable of withstanding the influence of corrosive substances employed in connection with the processing of photographic films or the like.

The improved device is used for advancing and/or compressing of photographic sheets, strips or the like and comprises a pair of parallel rollers which preferably consist (at least in part) of soft rubber or other elastomeric material, a stub shaft extending axially from each of the rollers, a pair of preferably plastic bearing members each rotatably accommodating one of the shafts, a flexible metallic strap (preferably consisting of rustproof spring steel) trained around the bearing members, and means for adjusting the effective length of the strap to thereby effect changes in the distance between the axes of the rollers. A strap and two bearing members are provided at both axial ends of the rollers.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved advancing device itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary side elevational view, substantially as seen in the direction of arrows from the line I—I of FIG. 2, of an advancing device which embodies the invention; and

FIG. 2 is a front elevational view as seen in the direction of the arrow II in FIG. 1, with one bearing member partly broken away.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The device which is shown in FIGS. 1 and 2 is designed for transport, compression and/or squeezing of photographic sheets, strips or like materials. The material is caused to pass through the nip 102 between two rollers 1, 2 which preferably consist of soft rubber or another suitable elastomeric material. These rollers are respectively mounted on metallic stub shafts 1*a*, 2*a* which extend with clearance through and beyond an open elongated slot 10*a* provided in a wall 10 which constitutes a support and forms part of a frame or housing for the improved device. The shafts 1*a*, 2*a* respectively extend through bores or holes provided therefor in two bearing members 3, 4 which consist of synthetic plastic material and are reciprocable along the two parallel vertical surfaces in the slot 10*a* of the wall 10 toward or away from each other to thereby respectively increase or reduce the pressure with which the peripheral surfaces of the rollers 1, 2 bear against the adjacent side of a strip or sheet, not shown. The bearing members 3, 4 respectively comprise main portions or sleeves 3*a*, 4*a* of rectangular outline which are guided in the slot 10*a* of the wall 10, and substantially semicircular slightly conical flanges 3*b*, 4*b* which are adjacent to the outer side of the wall 10, i.e., to that side which faces away from the rollers 1 and 2. The axial length of the sleeves 3*a*, 4*a* exceeds substantially the axial length of the respective flanges 3*b*, 4*b*.

Those portions of the sleeves 3*a*, 4*a* which are disposed between the rollers 1, 2 and the wall 10 are preferably rounded and are surrounded by a band or strap 5 of metallic material, preferably rustproof 3*a*, 4*a* toward or away from each other against the opposition of or under the action of the elastic rollers 1, 2. The strap 5 resembles a hose clamp and its end portions 5*a*, 5*b* are respectively provided with a tapped bore and a hole bounded by a smooth surface. The end portion 5*b* is outwardly adjacent to the end portion 5*a*. The thread in the bore of the end portion 5*a* can be formed by rolling or by otherwise deforming the material of the strap 5.

The adjusting means for changing the effective length of the strap 5 comprises a threaded member here shown as a screw 6 whose threads mate with the internal threads of the end portion 5*a* and which extends outwardly through and beyond the hole in the end portion 5*b*. The outer end portion of the screw 6 is slotted, as at 6*a*, to take the working end of a coin, screwdriver or other rudimentary tool which enables the operator to change the effective length of the strap 5. The inner end portion of the screw 6 abuts against a pressure transmitting plate 7 which in turn bears against an elastic cushion 8 interposed between the parts 3*a* and 7. A locknut 9 meshes with the screw 6 adjacent to the outer side of the end portion 5*b* to prevent unintentional changes in effective length of the strap 5. When the screw 6 is rotated in a direction to move the pressure transmitting plate 7 downwardly, as viewed in FIG. 1 or 2, the cushion 8 causes the sleeve 3*a* to move toward the sleeve 4*b* and to thus reduce the distance between the axes of the rollers 1 and 2. Such movement of the sleeve 3*a* is opposed by the cushion 8 as well as by the rollers 1 and 2. The purpose

of the flanges 3*b*, 4*b* is to prevent tilting of the bearing members 3, 4, i.e., to maintain the axes of the shafts 1*a*, 2*a* in exact parallelism irrespective of the distance between such axes.

FIGS. 1 and 2 merely show one end portion of the improved advancing device. The other end portion of this device also comprises two stub shafts which are mounted in bearing members similar to the members 3, 4 and slidable in the slot of a second wall or support. The flanges of the four bearing members cooperate to insure controlled sidewise movements of the roller 1 and to prevent tilting of the roller 2.

The elasticity and the size of the cushion 8 determine the pressure between the rollers 1, 2 and the advancing sheet or strip in each angular position of the screw 6. It will be noted that the width of the pressure transmitting plate 7, as considered at right angles to the common plane of the axes of the shafts 1*a*, 2*a*, is less than the width of the adjacent bearing sleeve 3, preferably by at least 10 percent. This insures that the long stretches of the strap 5 bear against the adjacent sides of the sleeves 3*a*, 4*a* so that such sleeves can be moved sideways only by overcoming the friction between their external surfaces and the strap. Such dimensioning of the pressure transmitting plate 7 enables the strap 5 to damp the movements of sleeves 3*a*, 4*a* toward or away from each other in each selected position of the screw 6.

It is clear that the illustrated adjusting means for changing the effective length of the strap 5 constitutes but one of several satisfactory length changing devices. For example, the bore in the end portion 5*a* need not be tapped if this end portion is coupled to a rotary nut which meshes with the screw 6 and can be rotated to thereby change the effective length of the strap. Furthermore, the end portions 5*a*, 5*b* of the strap 5 can be fixed to a square nut and the screw 6 can pass through and can rotate with reference to such nut to thereby effect a change in the effective length of the strap. The end portions of the strap then hold the square nut against rotation with the screw.

It is also within the purview of the invention to replace the bearing members 3, 4 with substantially U-shaped bearing members or shells. An advantage of U-shaped bearing members is that they can be produced in simpler molds. If the improved advancing device utilizes such U-shaped members, their legs should extend at least slightly beyond the axes of the respective shafts to prevent uncontrolled stray movements of the shafts, i.e., the depth of recesses in such U-shaped bearing members should exceed the radii of the respective shafts. With reference to FIG. 2, the open end of the recess in a U-shaped bearing member which would replace the member 3 would face downwardly and the open end of the recess in the other bearing member (replacing the member 4) would face upwardly. Moreover, if the legs of U-shaped bearing members are dimensioned in the just described way, they are held against rotation in response to changes in effective length of the strap which is trained around such legs and around the connecting webs of the U-shaped bearing members.

An advantage of the improved device is that it allows for accurate adjustment of the pressure between the rollers 1, 2 and that it comprises a small number of simple, lightweight and inexpensive parts. The straps 5 can be formed by stamping from sheets of spring steel and the bearing members can be produced by injection molding or the like in relatively simple forms. Since the straps consist of metallic material, the selected pressure between the rollers 1 and 2 can be maintained for extended periods of time. The conical flanges 3*b*, 4*b* facilitate simultaneous introduction of two bearing members 3 or 4 into the slots 10*a* of the respective supports 10.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended

1. In a device for advancing and/or compressing photographic sheets or the like, a combination comprising a pair of parallel rollers; a shaft extending axially from each of said rollers; a pair of bearing members each rotatably accommodating one of said shafts; a flexible metallic strap means including engaging means and trained around said bearing members closely surrounding the same; resilient means arranged between said engaging means and at least one of said bearing members; and adjusting means for changing the effective length and longitudinal tensional stressing of said strap means to thereby vary the compression of said resilient means and effect changes in the distance between the axes of said shafts.

2. A combination as defined in claim 1, wherein said rollers consist at least in part of elastomeric material.

3. A combination as defined in claim 1, wherein said strap comprises two overlapping end portions, one of said end portions having a tapped bore and the other of said end portions having a hole registering with said bore, said adjusting means comprising a threaded member extending through said hole and mating with said one end portion, and a pressure transmitting member interposed between said threaded member and one of said bearing members, said threaded member being rotatable about its axis to thereby effect movement of said pressure transmitting member toward or away from the one end portion of said strap.

4. A combination as defined in claim 3, wherein said strap is a band consisting of stainless steel.

5. A combination as defined in claim 3, wherein the thread in said tapped bore is impressed into said one end portion of the strap.

6. A combination as defined in claim 3, wherein said threaded member has a slotted end portion remote from said pressure transmitting member.

7. A combination as defined in claim 3, further comprising a locknut outwardly adjacent to the end portions of said strap and mating with said threaded member to normally hold the latter against rotation.

8. A combination as defined in claim 3, wherein said adjusting means further comprises an elastic cushion interposed between said one bearing member and said pressure transmitting member.

9. A combination as defined in claim 3, wherein the width of said pressure transmitting member, as considered at right angles to the common plane of the axes of said shafts, is less than the width of said one bearing member.

10. A combination as defined in claim 9, wherein the width of said one bearing member exceeds the width of said pressure transmitting member by at least 10 percent.

11. A combination as defined in claim 1, wherein said bearing members comprise aligned portions of rectangular outline and wherein said strap is trained around such portions of said bearing members.

12. A combination as defined in claim 1, further comprising a support having an elongated slot accommodating portions of said bearing members.

13. A combination as defined in claim 12, wherein said support is provided with two parallel surfaces flanking said slot, each of said bearing members having a pair of parallel surfaces each abutting against one surface of said support to hold the bearing members against rotation with reference to said support.

14. A combination as defined in claim 12, wherein each of said bearing members further comprises a substantially conical flange and wherein said portions of said bearing members are disposed between said flanges and the respective rollers.

15. A combination as defined in claim 1, wherein said bearing members are U-shaped and have recesses accommodating the respective shafts, the depth of each of said recesses being at least equal to the radius of the respective shaft.

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