Aug. 27, 1963 W. R. OSBAN 3,101,563

SQUEEZE-ROLL ASSEMBLY

Filed July 28, 1961 4 Sheets-Sheet 1

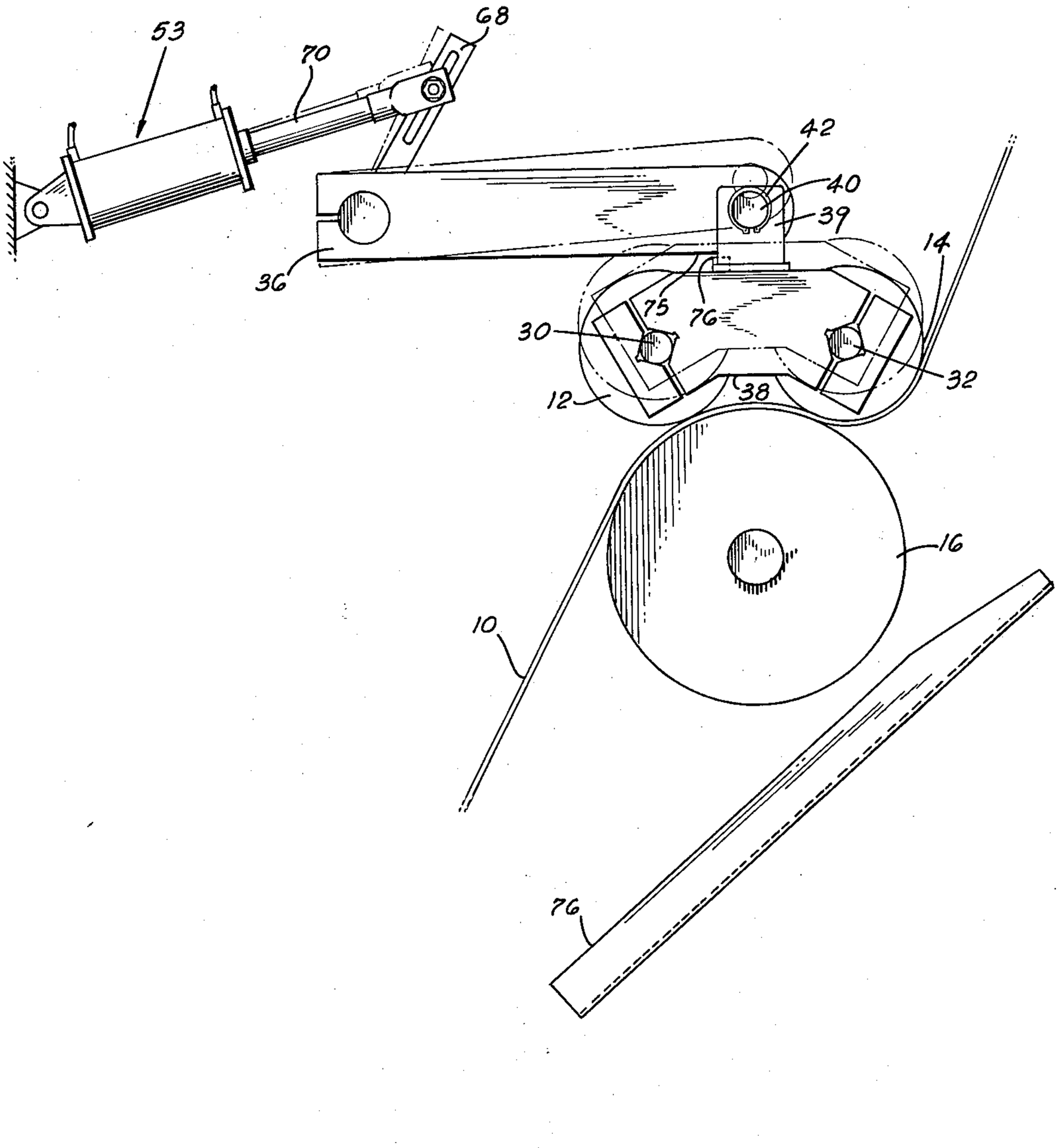

Fig. 1.

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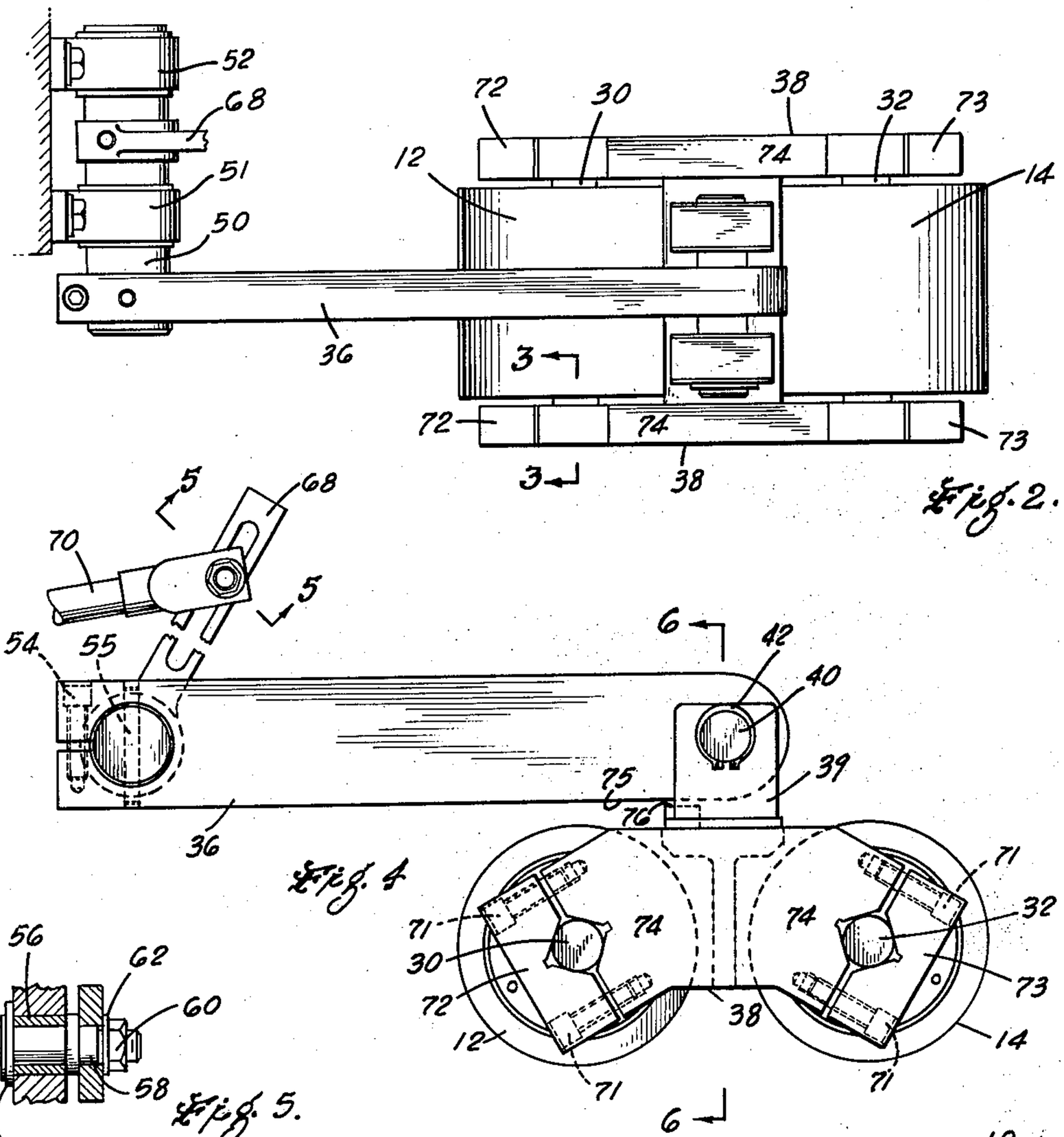

Fig. 2.

Fig. 4

Fig. 5.

Fig. 3.

Fig. 6.

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SQUEEZE-ROLL ASSEMBLY

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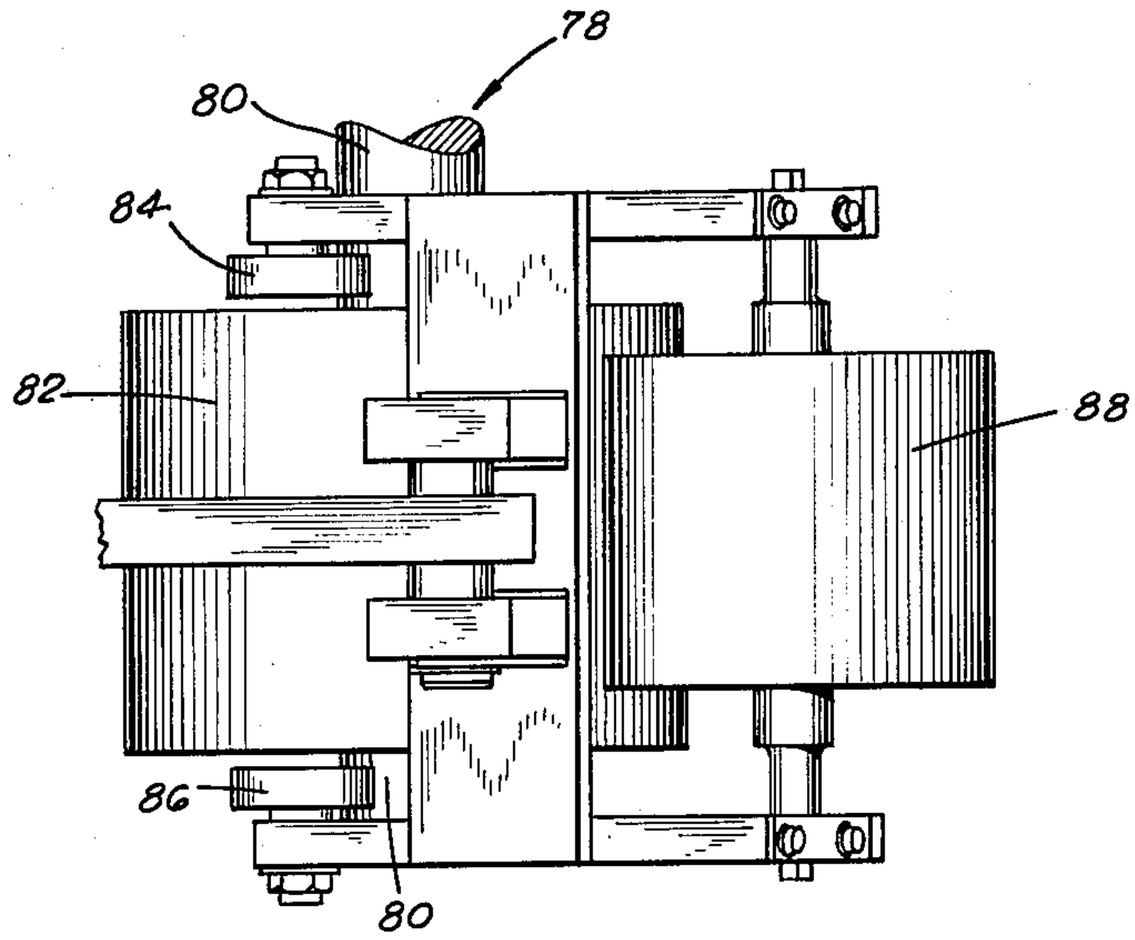

Fig. 7.

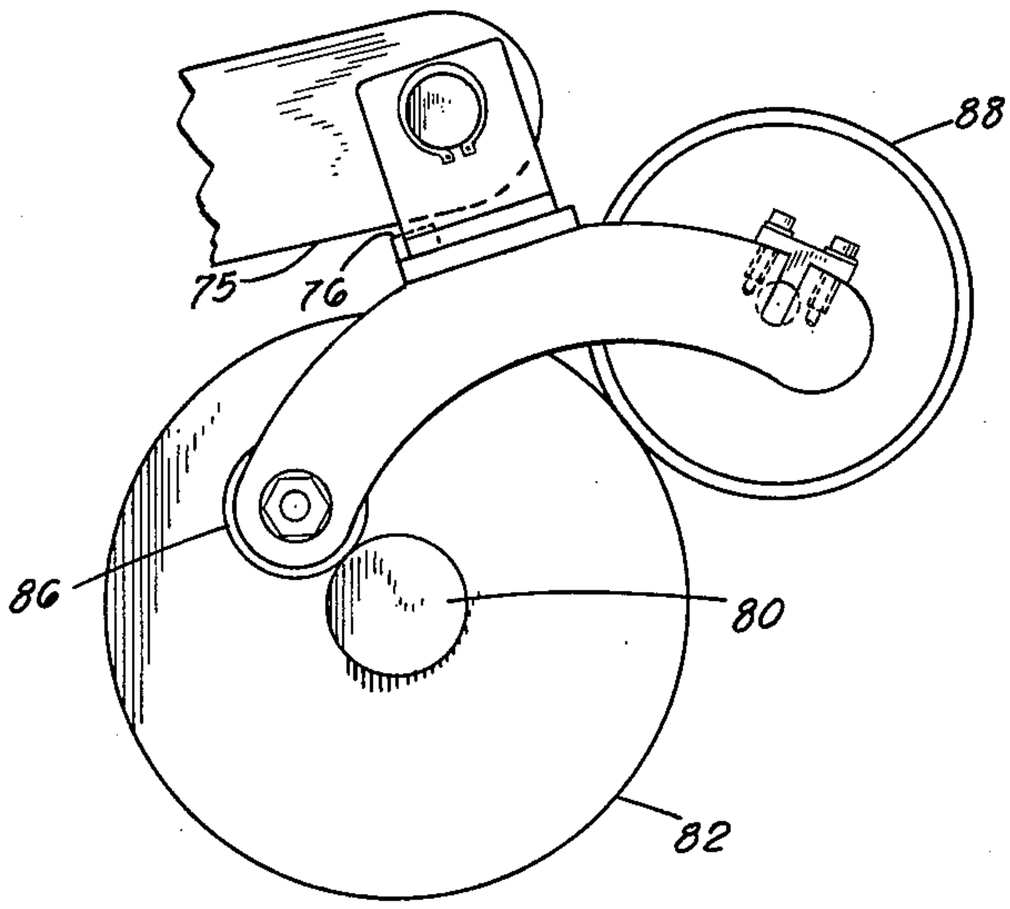

Fig. 8.

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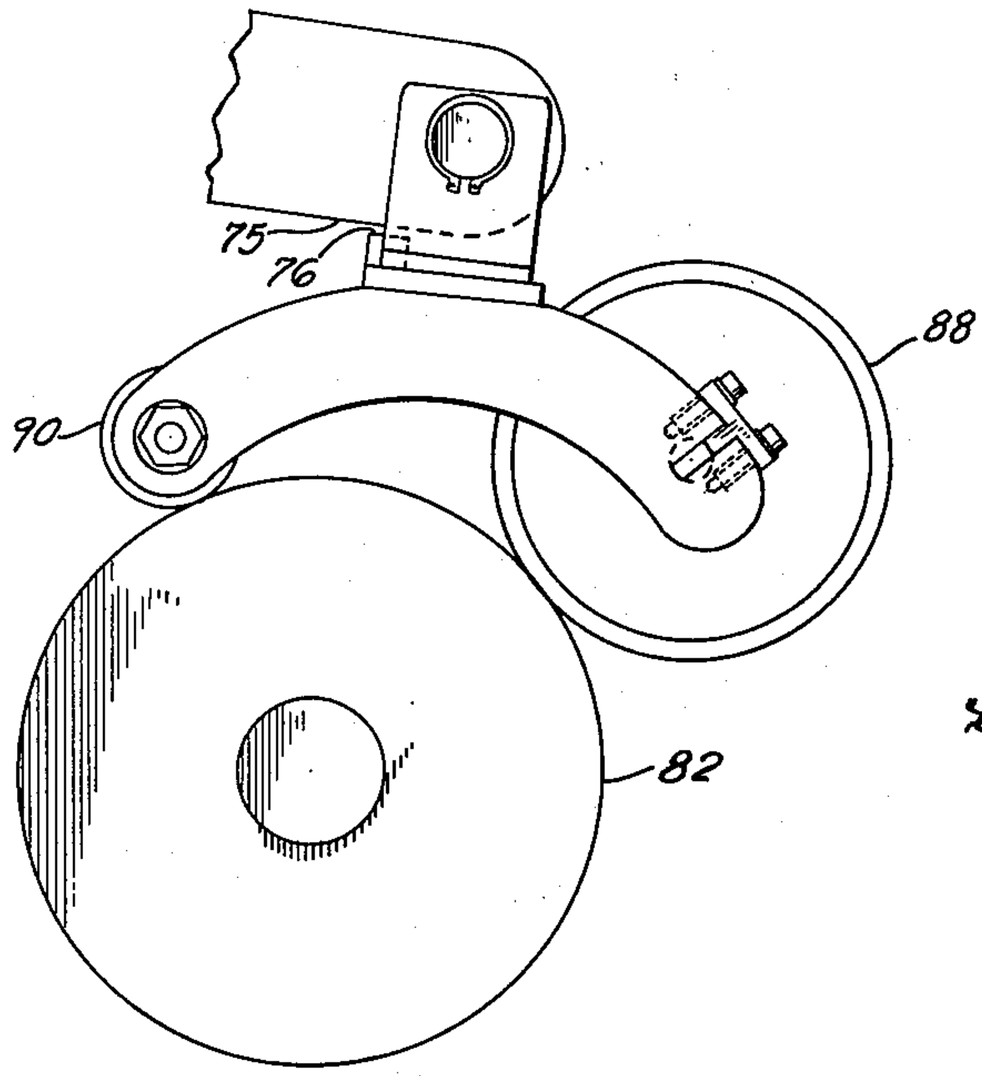

Fig. 9.

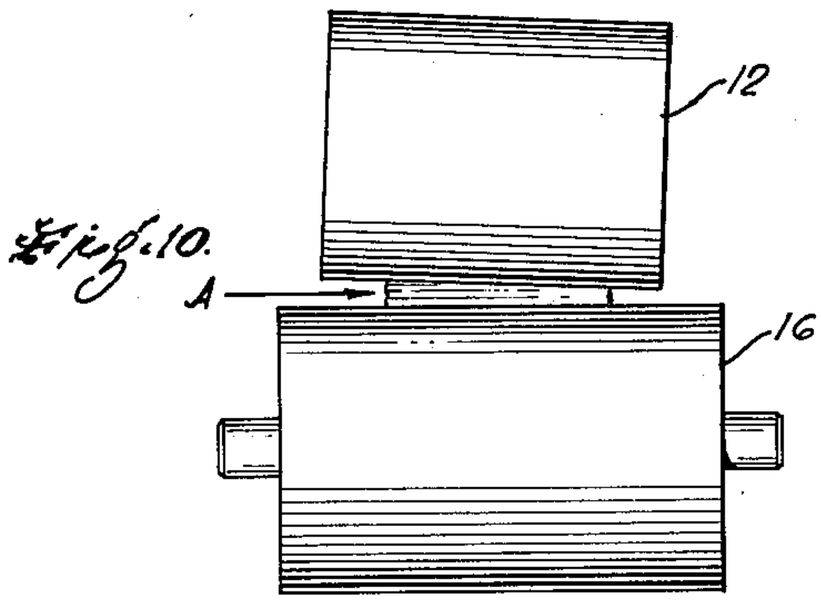

Fig. 10.

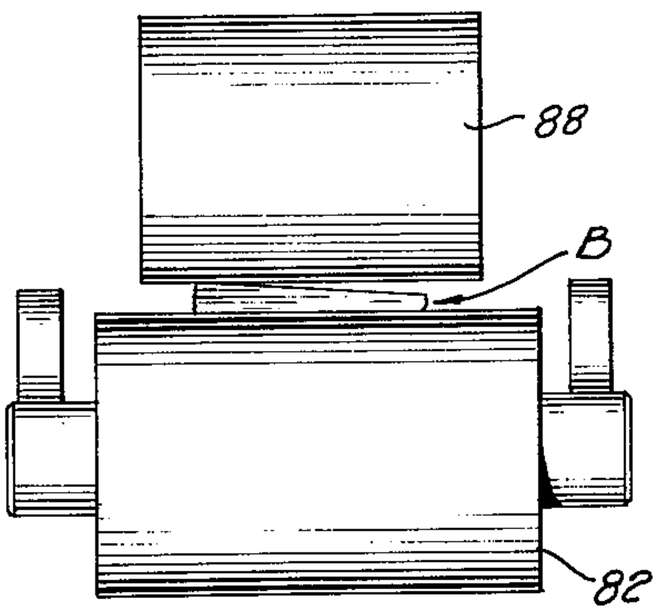

Fig. 11.

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SQUEEZE-ROLL ASSEMBLY

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10 Claims. (Cl. 68—258)

This invention relates to process equipment and especially to a new and improved squeeze-rool assembly for use in such equipment. Although the apparatus of this invention is useful in almost all process equipment wherein rolls are employed for squeezing or compressing the material being processed, it is particularly adapted for use in the textile art, especially in the production of synthetic fibers by wet- or dry-spinning technique, and specifically such fibers produced from a polymer of acrylonitrile.

In the production of synthetic fibers, including polyacrylonitrile fibers, there has long been need for suitable means to improve the form of the band of tow as it leaves a bath in the case of synthetic fibers produced by a wet-spinning method, and to obtain more uniform stretching when the bath is a stretch bath. In many fiber-producing and other processing applications, there also has been need to otherwise improve the physical form of the tow, mat, felt, web, fabric, etc., of textile or other material being processed, and/or to allow a squeeze roll to be used in conjunction with a roll which does not run concentrically.

It is a primary object of the present invention to provide a new and improved squeeze-roll assembly which has a relatively long service life and requires less cost for maintenance than conventional assemblies of this kind.

Another object of the invention is to provide a squeeze-roll assembly which provides uniformity of pressure on the material being processed.

Still another object of the invention is to provide a squeeze-roll assembly with a dual-roll arrangement that makes possible uniformity of moisture removal and which is superior to the ordinary single squeeze-roll arrangement in applications where prevention of slippage is required.

A further object of the invention is to provide a squeeze-roll assembly that improves the appearance and physical form of a tow of wet-spun synthetic fiber after leaving a bath, and which permits more uniform stretching when the bath is a stretch bath, due to the self-alignment feature that assures more even pressure across the full width of the tow.

Another object of the invention is to provide a squeeze roll that can be used in conjunction with a roll which does not run concentrically.

Still other objects of the invention will be apparent to those skilled in the art from the following more detailed description and the accompanying drawing showing various embodiments of the invention.

The novel features of the invention are set forth in the accompanying claims. The invention itself, however, will be more readily understood from the following description taken with the accompanying drawing, which is illustrative of the invention, and wherein

FIG. 1 is a side elevational view of one embodiment of the squeeze-roll assembly of the present invention;

FIG. 2 is a plan of view part of the apparatus shown in FIG. 1;

FIG. 3 is a section taken on line 3—3 of FIG. 2.

FIG. 4 is a more detailed side elevational view of part of the embodiment of the invention shown in FIG. 1;

FIG. 5 is a section taken on line 5—5 of FIG. 4;

FIG. 6 is a section taken on line 6—6 of FIG. 4;

FIG. 7 is a plan view of another embodiment of the invention,

FIG. 8 is a side elevational view of part of the embodiment of the invention illustrated in FIG. 7.

FIG. 9 is a side elevational view of the arrangement of rolls in still another embodiment of the invention; and

FIGS. 10 and 11 show somewhat schematically how the effect on the material being squeezed is influenced by that to which the squeeze roll(s) is (are) self-aligned, e.g., to the cross-section of the material being squeezed or with regard to the primary roll.

Referring now to the drawing and more particularly to FIGS. 1 through 6 thereof, there is shown by way of illustration how the self-alignment feature of the invention is made possible by mounting two squeeze rolls in a rigid frame which holds the axes of the squeeze rolls parallel. This assembly is allowed to contact a primary roll (third roll) in such a manner that the squeeze rolls assume line contact with the said primary roll. (Parenthetically it may here be noted that when right cylinders whose axes are parallel contact a third right cylinder, the axis of the third cylinder is parallel to the other two). The main or primary roll (alternatively designated as a "third" roll, supra) may be driven by a suitable source of power (not shown) or it may be non-driven as desired or as conditions may require.

FIG. 1 shows material **10** being processed, e.g., a tow of wet- or dry-spun polyacryonitrile or other synthetic material, as it passes between the squeeze rolls **12**, **14**, and the primary roll **16**.

Each of the squeeze rolls **12**, **14** is comprised of (*a*) a resilient roll covering material **18** and (*b*) a metal shell **20**. The roll covering material contacts the material **10** that is being squeezed. This covering **18** may be, for example, a layer of rubber of, say, ¾-inch thickness and of about 40 to 60 durometer. Various other grades and thicknesses of natural or synthetic rubber, or any other suitable resilient material, can be used as desired or as conditions may require. The metal shell **20** gives the required rigidity to the roll and serves for the mounting of the bearings **22**, which allow the squeeze rolls to rotate freely on their respective shafts.

Suitable attaching means are provided, such as screw fasteners, one of which is shown at **24**, for holding the end cover plates, one of which is shown at **26**, to the metal shell **20**. The shaft seal **28** provides a seal between the end cover plate **26** and the shaft **30**, thereby preventing moisture from entering the bearings **22**. The squeeze rolls **12** and **14** are aligned on shafts **30** and **32**, respectively, and rotate thereon. O-ring seals, one of which is shown at **34**, seal the outer periphery of the end cover plates **26** and the metal shell **20**, and further serve to prevent moisture from entering the bearings area.

The arm **36** is connected to the roll frame **38** having an extension **39** by means of the pin **40**. This pin is easily removable for changing the roll assembly when the resilient roll covering material **18**, e.g., rubber, becomes excessively worn or damaged. The retaining ring **42** holds the pin **40** in place.

A spherical self-aligning bearing **44** allows the roll frame and related parts **38** to move freely within limits on the arm **36**. This bearing is a commercially available device which is obtainable, for example, from Southwest Products Company, Monrovia, California. The spacer **46** serves to locate the self-aligning bearing **44** in its proper position while the retaining ring fastener **48** holds it in place.

The mounting shaft **50**, which is supported by bearings **51** and **52**, raises and lowers the squeeze rolls **12** and **14** and their related parts including the squeeze roll frame **38**. This mounting shaft is pivoted by suitable means, e.g., by an air cylinder **53** (FIG. 1), which applies squeezing force between the squeeze rolls **12** and **14** and the primary roll **16** (FIG. 1).

The arm 36 is the link between the mounting shaft 50 and the squeeze roll frame 38. This arm is of such length as will locate the squeeze rolls and supporting frame in the best position realtive to the primary roll 16.

The frame 38 is made so that it rigidly fixes the shafts 30 and 32 in parallel position. These shafts are held through extensions thereof in V-shaped grooves which give accurate positioning with a minimum of attention.

The clamping screw 54 locks the arm 36 on the mounting shaft 50 in the proper position. The locking pin 55 positively positions the mounting shaft 50 and the arm 36. This is in addition to the clamping screw 54.

With more particular reference to FIG. 5, there is shown in this sectional view taken along the line 5—5 of FIG. 4, a bearing 56, a pivot bolt with shoulder 58, a nut 60, a washer 62, another washer 64, and a suitable fastening means 66 such as a snap ring, cotter pin, or the like. In this way, the arms 68 and 70 are adjustably connected to each other and thereby to the arm 36 and the air cylinder 53. The slotted arm 68 allows stroke adjustment and may be locked at a selected distance.

The clamping screws 71 hold together the end sections 72 and 73 to the main body portion 74 of the roll frame 38.

The slide 76 (FIG. 1) serves to guide to a collection reservoir any liquid, e.g., water, which may have been squeezed from the material 10 that is being processed.

FIGS. 7 and 8 illustrate another embodiment of the present invention. In this embodiment the shaft 78 (including the shaft extensions 80) and the primary roll (e.g., a driven roll) 82 must all be concentric. In ordinary practice the diameters of shaft 78 and the shaft extensions 80 are substantially the same. Aligning rolls 84 and 86 ride on shaft extensions 80. The rolls 84 and 86 are mounted, e.g., by means of a rigid frame, so that their axes are on a line which is parallel to the axis of squeeze roll 88. When the aligning rolls 84 and 86 are of equal diameter, shaft 78 and shaft extension 80 also are of equal diameter, and the axes and surfaces of squeeze roll 88 and primary roll 82 are parallel even when non-uniform, cross-sectional material is being squeezed. The alignment is maintained by the three-point contact between the aligning surfaces.

During certain phases of the operation of the embodiment of the invention illustrated in FIGS. 7 and 8, e.g., when the squeeze roll is raised away from the primary roll, the edges indicated at 75 and 76 may sometimes collide thereby preventing the roll assembly from overturning. Similarly, in other illustrated embodiments of the invention the edges 75 and 76 where they have been identified in a partciular figure act in a similar manner.

Another embodiment of the invention is illustrated in FIG. 9. In this embodiment the two aligning rolls, one of which is shown at 90 in FIG. 9, contact (i.e., are in operative relationship with) the surface of the primary roll 82 instead of the shaft 78 and the shaft extension 80 as shown in FIGS. 7 and 8. The squeeze roll 88 also is in operative relationship with the surface of the primary roll 82. The aligning rolls are mounted, e.g., by means of a rigid frame, so that their axes are on a line which is parallel to the axis of the squeeze roll.

The principle of operation of the embodiments shown in FIGS. 7, 8 and 9 is the same as that of the embodiments shown in FIGS. 1 through 6 with the exception that a somewhat different effect is obtained. For example, when the embodiment is that shown in FIGS. 1 through 6, the squeeze rolls 12 and 14 are self-aligning with respect to the cross-section of the tow or other flat band of material passing between (1) the squeeze rolls 12 and 14 and (2) the primary roll 16.

When the embodiment is as shown in, for example, FIGS. 7, 8 and 9, the squeeze roll 88 is always self-aligning with respect to the primary roll. (With further reference to the specific embodiment illustrated in FIG. 9 it will be understood, of course, that the band of material being squeezed is straddled and is not touched by the two aligning rolls, one of which is shown at 90.) The differing results thereby obtained are illustrated in FIGS. 10 and 11.

When the squeeze rolls are aligned with respect to the cross-section of the material 10, the latter tends to become somewhat wedge-shaped as illustrated at A in FIG. 10. The advantages of this arrangement are (1) a uniform squeezing action across the width of the band is obtained; and (2) there is a uniform restraining action across the width of the band when primary roll 16 is driven.

When the squeeze roll is aligned with respect to the primary roll, the material may have the form illustrated at B in FIG. 11. The advantage of this arrangement is that the squeeze roll tends to flatten and reshape any non-flat, non-parallel cross-section of the material.

More specific details of the operation of the apparatus other than those given hereinbefore will be obvious to those skilled in the art from the foregoing description and from a consideration of the various figures of the accompanying drawing.

I claim:

1. A self-aligning squeeze-rool assembly comprising a pair of squeeze rolls each with a shaft with which it is aligned and on which it rotates; a rigid frame in which the said pair of squeeze rolls is mounted, said frame holding the said rolls parallel to each other; an extension leading upwardly from said frame; a primary roll upon which the said pair of squeeze rolls is yieldably restable; an arm which is pivotally and detachably connected at its forward end to the said extension of the said frame; means including a spherical self-aligning bearing for permitting the rigid frame to move freely, within limits, on the said arm; and positive means including a mounting shaft connected to the rearward end of the said arm for raising and lowering the aforesaid squeeze rolls and their related parts including the aforesaid frame, said mounting shaft being pivotable so that a force can be applied that will effect squeezing between the aforesaid pair of squeeze rolls and the said primary roll.

2. A self-aligning squeeze-roll assembly comprising a primary roll; a squeeze roll yieldably restable against material being squeezed between said squeeze roll and said primary roll; a rigid frame for supporting said squeeze roll with its axis in fixed relation thereto; and an alignment roll mounted on said rigid frame with its axis in fixed relation thereto and parallel to the axis of said squeeze roll, said alignment roll being continuously pressed against an alignment surface; said frame being supported by an arm joined to said rigid frame by a self-aligning bearing to permit alignment of said squeeze roll by said alignment roll relative to said alignment surface.

3. Apparatus as defined in claim 2 wherein said primary roll has an axial shaft which comprises said alignment surface at each end thereof, said alignment roll consisting of two rollers mounted on said rigid frame in position to press against the alignment surface of the axial shaft on which said primary roll is mounted.

4. Apparatus as defined in claim 2 wherein said primary roll has an axial shaft which comprises said alignment surface at each end thereof, and said alignment roll comprising a pair of co-axial rolls mounted on said rigid frame in position to be pressed against said alignment surface under the influence of resiliently urging means.

5. Apparatus as defined in claim 2 including means for resiliently urging said rigid frame toward said primary roll to thereby press said alignment roll against said aligning surface and to press said squeeze roll against the material being squeezed in alignment with said aligning surface.

6. Apparatus as defined in claim 2 wherein said alignment roll is mounted on said rigid frame in position to

press against the material being squeezed which comprises said alignment surface.

7. Apparatus as defined in claim 2 wherein said alignment roll is mounted on said rigid frame in position to press against the surface of said primary roll which comprises said alignment surface.

8. Apparatus as defined in claim 2 wherein said self-aligning bearing comprises a spherical self-aligning bearing.

9. Apparatus as defined in claim 2 wherein said squeeze roll and said alignment roll comprises a pair of rolls both of which are pressed against the material being squeezed under the influence of resiliently urging means.

10. Apparatus as defined in claim 2 wherein said alignment roll comprises a pair of coaxial rolls mounted on

said rigid frame in position to be pressed against the surface of said primary roll under the influence of resiliently urging means.

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