Aug. 27, 1968 J. P. JONES ET AL 3,398,563

ROLL APPARATUS

Filed Feb. 14, 1966 2 Sheets-Sheet 1

Fig. 1.

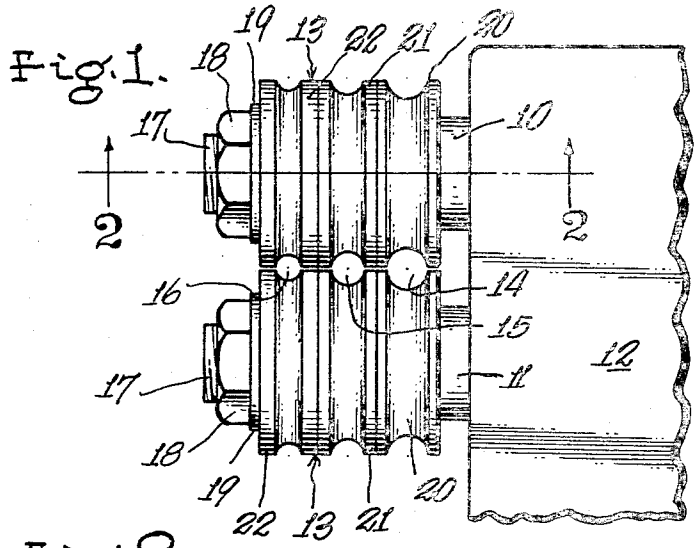
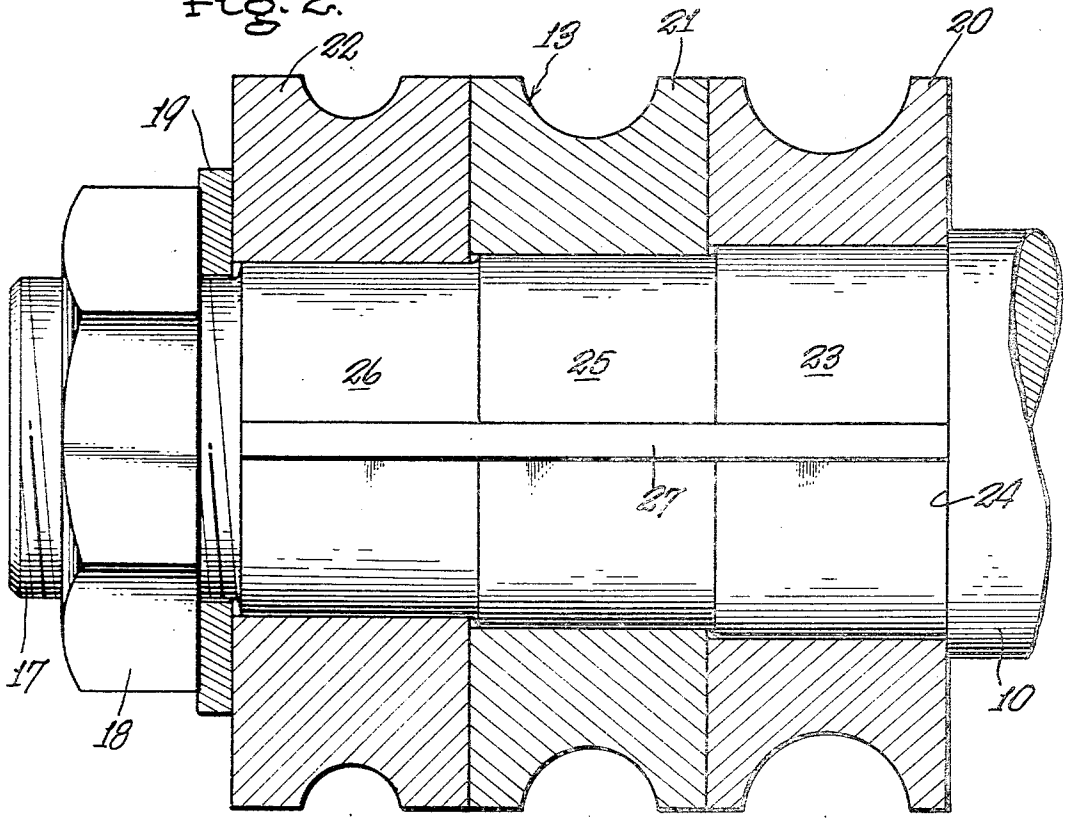


Fig. 2.



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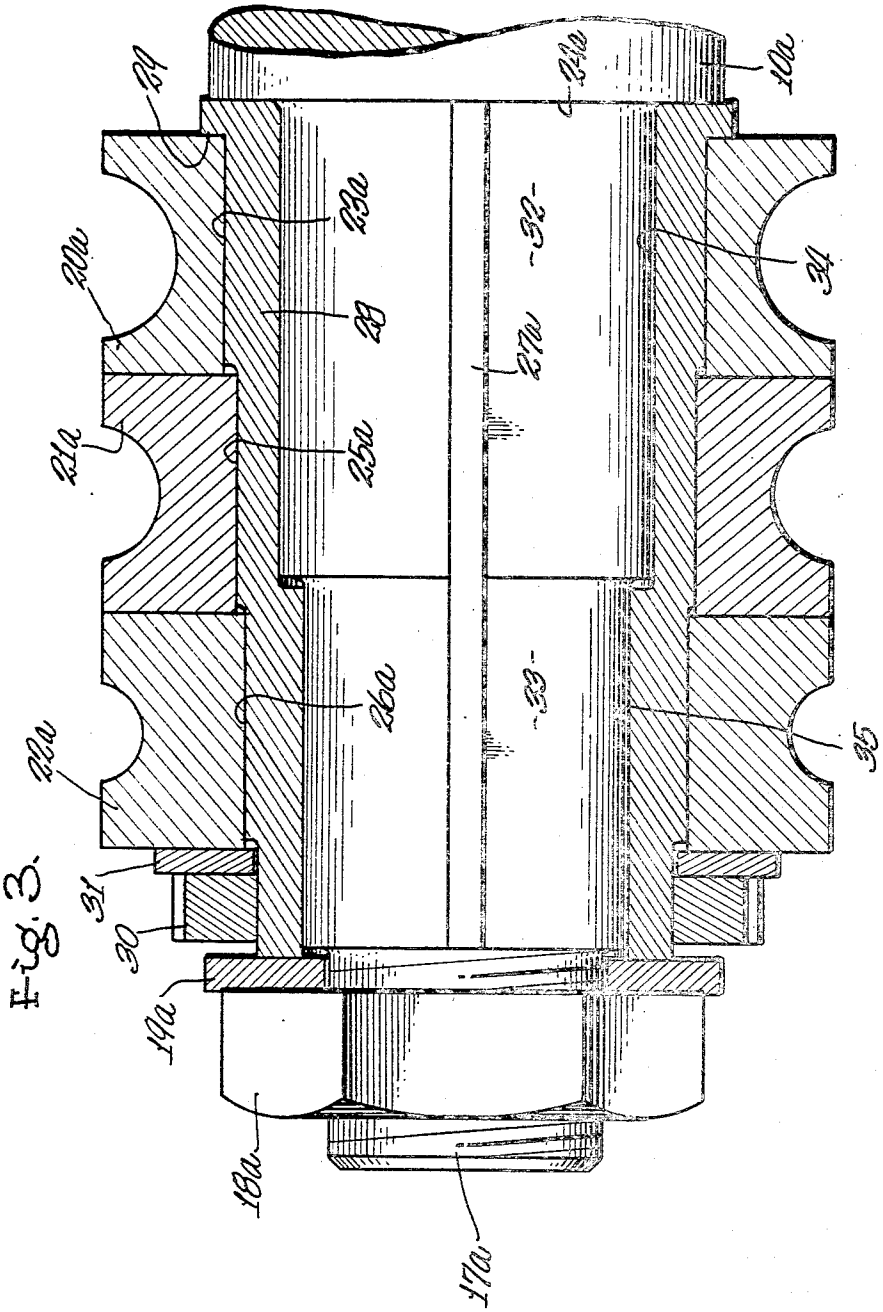


Fig. 3.

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ROLL APPARATUS

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ABSTRACT OF THE DISCLOSURE

An assembly wherein a shaft is rotatably carried by a support and projects therebeyond and such shaft removably supports roll means having axially spaced portions adapted to be subjected to different magnitudes of radial force. The normal position of the roll means on the shaft is with the roll means portion subject to the greatest radial force disposed closer to the support than the other roll means portion, means being provided to prevent accidental alteration of the normal positions of the roll means on the shaft.

The present invention relates to roll apparatus for enlongated material, particularly to apparatus providing material passes in side-by-side relation, and the principal object of the invention is to provide new and improved apparatus of the character described.

Many manufacturing processes, such as, for example, the manufacture of tubing, require the latter to be fed through a pass formed by juxtaposed rolls which are appropriately contoured. In the event different tubing sizes are to be accommodated, differently contoured rolls must be employed. Since it may be necessary to feed a given size of tubing through many roll passes before completion of the manufacturing process, it will readily be apparent that a change of tubing size and/or shape will require the time-consuming operation of changing the many rolls which form respective passes therefor.

In an attempt to reduce the necessity of changing rolls when a different size or shape of tubing is to be made or processed, it has been normal practice to provide two or more roll passes, of the most common size or shape, in side-by-side relation for selective use. While the provision of multiple passes as above-mentioned has proven practical, certain difficulties have arisen in actual practice as will next appear.

In many roll pass devices, the rolls are mounted on the outboard ends of cantilever mounted shafts. This provides the great advantage of accessibility to the rolls when they must be changed. Such an arrangement, however, does have the disadvantage in that since the shafts are cantilever mounted, they can safely exert a smaller working force on the material fed between the rolls at the free ends of the roll shafts then they can at places spaced closer to the point where the shafts are supported. Accordingly, where multiple passes in side-by-side relation are combined with cantilever supported rolls, it has been recognized by the machine designers that the pass which requires the exertion of the most force, usually the pass which accommodates the material piece of the largest cross-section, should be closest to the point of support of the roll shafts. Unfortunately, in practice, careless workmen could set up a machine with the heavy working roll portions at the free ends of the roll shafts and thus damage to the machine could easily result.

It is, therefore, a primary advantage of the present invention that damage caused by carelessness of the type hereinabove mentioned is obviated. This and other advantages will readily become apparent from a study of the following description and from the appended drawings.

In the drawings accompanying this specification and

forming a part of this application there is disclosed, for purpose of illustration, embodiments which the invention may assume, and in these drawings:

FIGURE 1 is a fragmentary elevation view of apparatus providing three roll passes in side-by-side relation for three different sizes of tubing,

FIGURE 2 is an enlarged, fragmentary sectional view generally corresponding to the line 2—2 of FIGURE 1, and

FIGURE 3 is a view like FIGURE 2 but of a modified structure.

With reference to FIGURE 1, there is illustrated a pair of parallel shafts, **10**, **11** in spaced, side-by-side relation rotatably supported in cantilever fashion by a suitable housing or support **12**. Mounted on each shaft **10**, **11** are peripherally grooved roll means **13**, such roll means cooperating to provide passes **14**, **15** and **16** in side-by-side relation through which, for example, respective sizes of tubing may extend.

As herein shown, the largest pass **14** is positioned closest to the support **12** while the smallest pass **16** is positioned at the free ends of the shafts. While the passes **14**, **15** and **16** are shown of different sizes, this is illustrative only, a basic concept of the invention being that regardless of size, the pass **14** exerts the most force upon tubing passing therethrough while the passes **15**, **16** exert progressively less force on tubing respectively passing therethrough.

Providing for retention of the roll means **13** on respective shafts, each of the latter has a reduced diameter threaded shank **17** at its free end on which nuts **18** are respectively threaded. Interposed between each roll means **13** and its nut **18** is a washer **19**, each roll means being forceably clamped against a shoulder on its shaft by its retention nut **18** as will later appear.

In order to provide for varying the sizes of the passes **14**, **15** and **16**, each roll means **13** is preferably formed of separable roll portions **20**, **21** and **22**, respectively forming, with its companion roll portion, the passes **14**, **15**, and **16**. Since the pass **14**, formed by the roll portions **20**, is the pass which exerts the greatest force on the tubing extending therethrough, it is of the utmost importance that the roll portions **20** be installed on their respective shafts **10**, **11** only in the position illustrated, i.e., closely adjacent the support **12**. To insure such proper installation of the roll portions **20**, installation of roll portions **22** at the free ends of their respective shafts, and installation of roll portions **21** intermediate respective roll portions **20**, **22**, the following construction is employed:

With reference to FIGURE 2, it will be seen that shaft **10** is reduced in diameter at **23** to provide a seat for closely fitting within the roll portion **20**, a shoulder **24** on the shaft insuring positive axial location thereof. Adjacent shaft seat **23**, the shaft **10** is further reduced in diameter at **25** and is still further reduced in diameter at **26** adjacent shaft portion **25**. Shaft portion **25** forms a seat for closely fitting within the roll portion **21** while the shaft portion forms a seat for closely fitting within the roll portion **22**. To insure that the roll portions **20**, **21** and **22** will be locked against rotation, shaft **10** may carry a key **27** which fits within keyways formed in respective roll portions.

With the construction above-described, it will be apparent that roll **20** can properly be assembled with shaft **10** only on its seat **23** since the bore of such roll portion is to large for this roll portion to fit on either of the shaft seats **25**, **26**. Similarly, the bore in roll portion **21** is too large to properly fit on shaft seat **26** and too small to fit with the shaft seat **23**. Finally, the roll portion **22** can only be assembled with the shaft seat **26** since its bore is too small to fit with the shaft seats **23** or **25**. Accordingly, it it will thus be evident that the roll portions can only be

assembled with the shaft **10** in the manner illustrated thus insuring that excessive loading at the free end of the shaft will not occur. Although not shown, shaft **11** and its roll portions **20, 21** and **22** may be identical to shaft **10** and its roll portions aforesaid.

The embodiment of the invention seen in FIGURE 3 is similar to that heretofore disclosed and thus corresponding parts are identified with the same reference characters as before but with the suffix "*a*" added. In this embodiment, the roll portions **20***a*, **21***a* and **22***a* are not mounted directly on the shaft **10***a* but instead are mounted on a sleeve **28**. Sleeve **28** is formed to provide the roll portion seats **23***a*, **25***a* and **26***a* on which the roll portions are respectively mounted. Sleeve **28** is flanged at one end to provide a shoulder **29** for abutment with the roll portion **20***a* and is externally threaded at its other end to receive a nut **30** which bears against a washer **31** to maintain the roll portions assembled with the sleeve. The roll portion seats **23***a*, **25***a* and **26***a* are dimensionally related to each other in the same manner as the previously described seats **23**, **25** and **26** for the reasons previously set forth.

With the construction of FIGURE 3 as thus far described, it will be apparent that the roll portions **20***a*, **21***a* and **22***a* can properly be assembled on the sleeve **28** only in the proper order illustrated; however, means are also preferably provided to insure against improper disposition of the sleeve **28** on the shaft **10***a*. In order to insure against improper disposition of the sleeve on the shaft, the latter is presently provided with a large diameter seat portion **32** adjacent the shaft support and a small diameter seat portion **33** adjacent the free end of the shaft. Such shaft seat portions of course, closely fit with respective cooperating internal sleeve seats **34, 35**, the sleeve being retained on the shaft by the washer **19***a* and the nut **18***a*. It will be seen that if an attempt is made to improperly dispose the sleeve on the shaft in a reverse position from that herein shown, that is, to first enter the free shaft end into the small end of the sleeve, the latter does not fit entirely over the shaft since the internal sleeve seat **35** is too small to fit over the shaft seat **32**. Thus, the structure of FIGURE 3 accomplishes the same result as the structure of FIGURE 2 in that it is impossible to mistakenly mount the most heavily loaded roll portion at a place on the supporting shaft other than that adjacent the shaft support.

The construction of FIGURE 3, while slightly more complex than that of FIGURE 2, provides an important practical advantage thereover: Since the roll portions **20***a*, **21***a* and **22***a* are secured on the sleeve **28**, all of the roll portions may be removed from and replaced on the shaft **10***a* simultaneously. Thus, when rolls must be changed, the operation can be performed with great dispatch simply by removing the sleeve-roll assembly as a unit from the shaft and by having at hand another previously assembled, sleeve-roll assembly which can immediately be installed on the shaft to replace the one just removed. This it will be appreciated, greatly reduces down-time of the mill since the rolls of a roll set are handled with the ease of a single roll.

While the use of three roll portions, each cooperating with a companion roll portion to provide a pass, have herein been shown, it will be apparent that this is illustrative only, and that a greater or lesser number of roll portions may be provided and/or a greater or lesser number of material receiving passes. While a material pass has herein been described as being formed of juxtaposed roll portions carried by respective shafts, it is to be understood that the invention is equally applicable where only one roll-carrying shaft is required. Finally, while the present invention has been described as providing passes for tubing, this is illustrative only and various other elongated materials having various cross-sectional configurations may be accommodated with a properly configurated roll portion periphery.

In view of the foregoing it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments, are illustrative only and that our invention is not limited thereto.

We claim:

1. In combination: a support, a shaft rotatably carried by said support and projecting therebeyond, roll means removably mounted on said shaft and providing first and second portions spaced axially of said shaft, said first roll means portion being adapted to be subjected to a greater radial force than said second roll means portion and said first roll means portion being assembled on said shaft at a predetermined position closer to said support than said second roll means portion, and means preventing assembly of said first roll means portion on said shaft at a position further from said support than said predetermined position.

2. The construction of claim **1** wherein said roll means portions are separable from each other.

3. The construction of claim **2** wherein said preventing means comprises a pair of seats spaced axially of said shaft for closely fitting within respective roll means portions aforesaid, the seat for said second roll means portion being too small to operably fit within said first roll means portion for the purpose aforesaid.

4. The construction of claim **3** wherein the seat for said first roll means portion is too large to fit within said second roll means portion.

5. The construction of claim **1** wherein said roll means portions are separable from each other and are removably mounted on a sleeve, and wherein said sleeve is removably mounted on said shaft.

6. The construction of claim **5** wherein one end of said sleeve is adapted to be disposed adjacent said support when said sleeve is operably assembled with said shaft, wherein said preventing means comprises portions in part carried by said shaft and in part carried by said sleeve and interengaging to prevent operable assembly of the latter on said shaft with said sleeve one end spaced from said support, and wherein said preventing means further comprises a pair of seats carried by and spaced axially of said sleeve for closely fitting within respective roll means portions aforesaid, the seat for said second roll means portion being too small to operably fit within said first roll means portion.

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