Aug. 23, 1960 J. J. SCHAEFER 2,949,852

PRINTING ROLL

Filed May 1, 1959 2 Sheets-Sheet 1

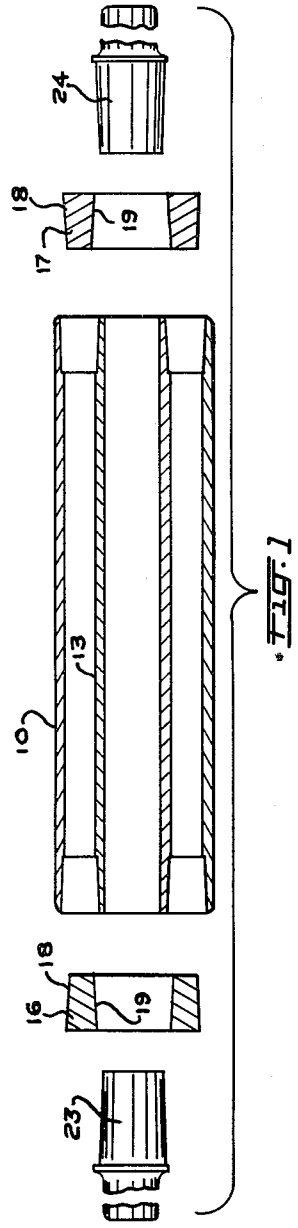


Fig. 1

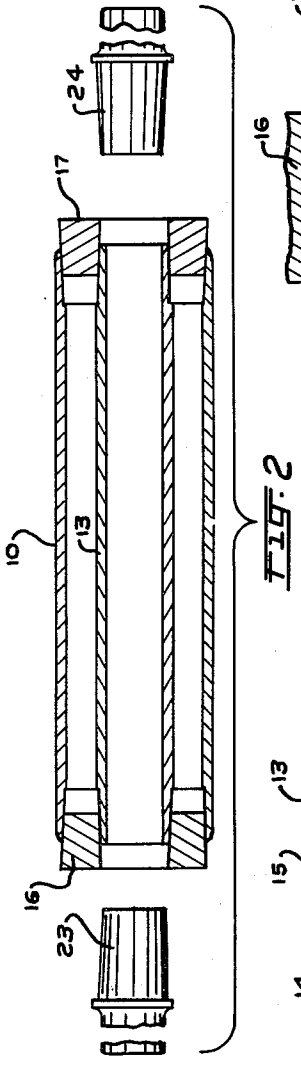


Fig. 2

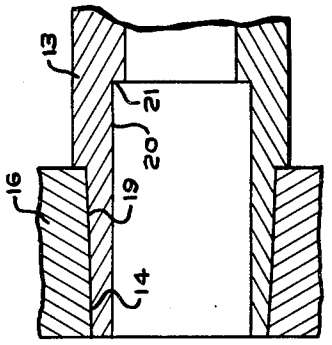


Fig. 8

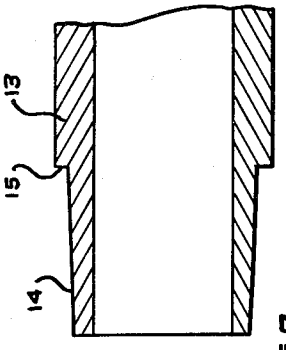


Fig. 7

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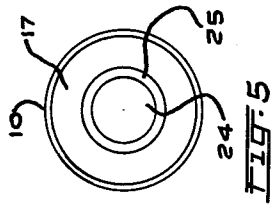


FIG. 5

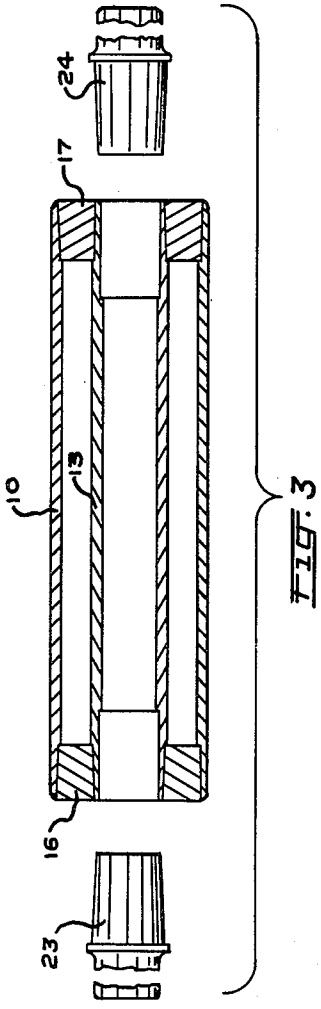


FIG. 3

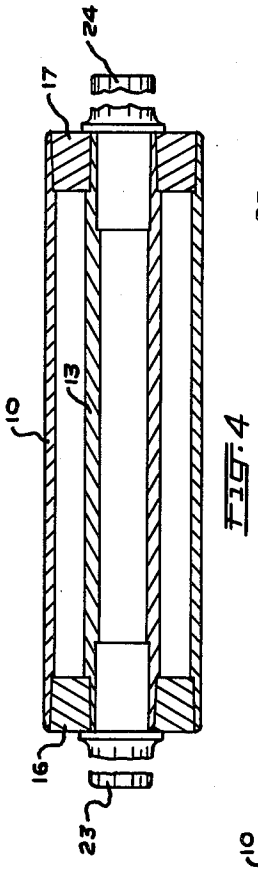


FIG. 4

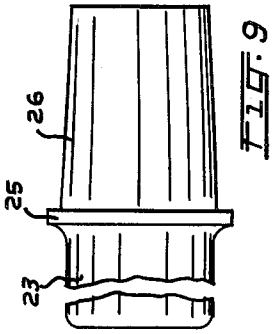


FIG. 9

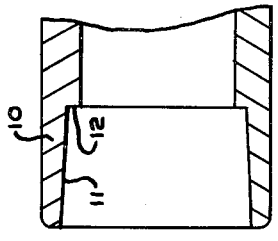


FIG. 6

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2,949,852

PRINTING ROLL

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Filed May 1, 1959, Ser. No. 810,343

7 Claims. (Cl. 101—375)

This invention relates to an improved printing roll and to a method for assembling the same. More especially, it relates to a printing roll having its chief load-bearing elements formed of a high yield strength material such as extruded aluminum alloy, or the like, and so constructed as to employ efficiently the inherent capabilities of such material in printing roll usages.

As is known, printing rolls are subjected to extremely high stresses when used in modern high speed presses and much attention has been directed toward the fabrication of rolls which are suitable for such usage without at the same time being unduly expensive and heavy. In particular, the usage of aluminum with its known characteristics of light-weight, high coefficient of heat conductivity, ease of plating and anodizing, and relatively low cost, has been considered. However, the comparatively low yield strength, and the porosity, of cast aluminum has been found to be a detriment; and when using extruded aluminum with its high-yield strength, the difficulty of assembling the roll has presented a particular obstacle. Although forcing of the gudgeons into the shell of the roll, or the shrink-fitting of the gudgeons in that shell, have both been proposed, it has been found that these methods still have certain inherent limitations.

An object of the present invention is to provide an improved method of assembling a shafted printing roll.

Another object is to provide an improved shafted printing roll.

Another object is to provide a strengthened shafted printing roll including an improved combination of stress sharing members incorporated in said roll.

Other objects and advantages will become apparent as the description proceeds and when considered in conjunction with the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of the several elements comprising the printing roll and shown in juxtaposed relation before assembly.

Fig. 2 is a view similar to Fig. 1 and showing the partially assembled gudgeons prior to application of endwise forces thereto.

Fig. 3 is a view similar to Fig. 1 and showing the gudgeons in assembled relation and prior to the forming of the enlarged recesses in the shaft member.

Fig. 4 is a view similar to Fig. 1 and showing the fully assembled roll.

Fig. 5 is an end view of Fig. 4.

Fig. 6 is a sectional view to a larger scale of one end of the shell member.

Fig. 7 is a sectional view to a larger scale of one end of the spacer.

Fig. 8 is a sectional view to a larger scale of one end of the tubular spacer following the formation of the enlarged recess therein, and

Fig. 9 is a side elevation view of one of the tapered shaft end members.

In accordance with the invention, there is provided a tubular shell preferably of a material having a high yield strength, such as extruded aluminum alloy. Within

the shell, a tubular spacer of smaller diameter is disposed and which spacer is to form a portion of the shaft of the roll and likewise is of a high yield strength material. At their respective ends the shell and spacer are rigidly joined by relatively short, tubular gudgeons which are encompassed by the shell and which encompass the spacer. These gudgeons likewise are formed of a high yield strength material. After these four structural elements are assembled, the ends of the spacer are suitably bored out to form enlarged cylindrical recesses axially of the roll. Thereafter, conventional tapered shaft end members, which may be formed of any suitable material, such as high tensile strength steel, are forced into the cylindrical recesses of the spacer with a tight fit to form the rigidly assembled printing roll.

Referring first to Fig. 1, a suitable tubular shell **10** may be formed of 6061 T6 extruded aluminum with a yield strength of about 41,000 p.s.i. As an example, using a typical shell having an outside diameter of about 10.375 inches and a length of 46.125 inches, the wall thickness may be about 0.8125 inch. At its ends the shell is formed with a pair of similar inwardly extending tapered internal surfaces having a taper of about 0.100 inch per linear foot and with the larger diameter at the ends of the shell. These surfaces terminate at a shoulder disposed normal to the axis of the shell, one such tapered surface **11** and shoulder **12** being shown in Fig. 6. The axial length of these surfaces preferably corresponds to the axial length of the gudgeons later to be described.

Positioned interiorly of and along the axis of the shell is a suitable tubular spacer **13** which likewise may be formed of 6061 T6 extruded aluminum. As an example, when using a shell of the aforementioned dimensions, this spacer may have an outside diameter of about 4.500 inches, a length equal to the length of the shell and a wall thickness of about 0.500 inch. At its ends the spacer is formed with a pair of similar inwardly extending tapered outer surfaces having a taper of about 0.100 inch per linear foot and with the smaller diameter at the ends of the spacer. These surfaces terminate at a shoulder disposed normal to the axis of the spacer, one such tapered surface **14** and shoulder **15** being shown in Fig. 7. The axial length of these surfaces corresponds to the axial length of the gudgeons and of the tapered surfaces on the shell.

Provided for cooperation with the shell and spacer is a pair of similar gudgeons **16** and **17** formed of 6061 T6 or F extruded aluminum. As an example, when employed with the described shell and spacer, each gudgeon may have an outside tapered surface **18** and an inside tapered surface **19**, the axial length of the gudgeon being about 4.5625 inches. The tapered gudgeon surfaces are parallel with the tapered surfaces of the shell and spacer with which the gudgeon is to be fitted, but the smallest diameter of the outer periphery of the gudgeon is about equal to the average diameter of surface **11** of the shell. Likewise, the average diameter of the inner periphery of the gudgeon is about equal to the smallest diameter of the surface **14** of the spacer.

In carrying out the method of the invention, the aforementioned four structural elements are placed in juxtaposed position in a suitable jig and are brought into contact with each other, as seen in Fig. 2. At this time, the gudgeons are disposed about halfway within the ends of the shell and the ends of the spacer are disposed about halfway within the central openings of the gudgeons. Thereafter, upon being placed in a suitable press capable of exerting a force of about 30–35 tons upon each gudgeon, or a total force of about 60–70 tons upon the entire assembly, those gudgeons are forced into seated engagement with shoulders **12** and **15**. As this occurs, each gudgeon encompasses the corresponding end of the

spacer with a strong hoop stress and in turn is encompassed by the corresponding end of the shell with a strong hoop stress, these stresses, however, being well below the yield strength of the aluminum alloy.

An intermediate of the final printing roll and comprising four structural parts in rigid engagement with each other accordingly is formed at this stage. As a significant feature, these four parts are in mutual stress sharing relation, the gudgeons, for example, serving to share the loadings upon the shell and spacer, and the spacer serving to share torsional stresses imparted to the shaft end members of the roll during its intended use. Moreover, the assembly is light in weight since aluminum is employed and since substantial open space is formed within the roll assembly.

It will be understood that next following the insertion of the gudgeons, or at some subsequent stage, the outward bulging of the shell at its ends due to the presence of the gudgeons, will be machined away as the shell is brought to its desired cylindrical outer dimension in preparation for copper plating, or for other desired treatment.

The intermediate roll, as thus described, is then placed in a suitable boring machine for the formation of the enlarged recesses in which shaft ends are to be engaged in order to complete the shafted roll. During the formation of these recesses, the inward bulging of the spacer at its ends due to the presence of the gudgeons, will be machined away. At each end of the spacer **13** while thus assembled, an elongated cylindrical enlarged recess having a surface **20** is bored out along the axis of the roll and terminating at a shoulder normal to that axis, one such surface **20** and shoulder **21** being shown in Fig. 8. Usually, the length of the recess is greater than the length of the gudgeons. In the roll as described, these recesses may be about 3.625 inches in diameter.

For insertion in the recesses, a pair of shaft end members **23** and **24** are provided and may comprise solid steel. As an example, in the above described roll these members may each have an average diameter of 3.625 inches on that portion fitting within the recess. Due to their weight, they provide a relatively heavy mass located at the axis of the roll and serving to give the otherwise light weight roll a desirable dynamic stability. Each shaft end member moreover is tapered along that portion which is to fit within the recesses, a taper of about 0.100 inch per linear foot being provided. Preferably, each shaft end member has a collar **25** extending circumferentially between the extreme ends of the member and the tapered surface **26** extends from that collar to the inner end of the member as seen in Fig. 9.

In completing the assembly of the printing roll following the boring of the spacer in the intermediate roll, the shaft end members are positioned in juxtaposed relation to the intermediate roll and force is applied thereto by a suitable press. As they are fitted in place within the recesses, as seen in Fig. 4, the assembly of the roll is completed when the collars **25** of the shaft end members abut against the ends of the spacer. A press capable of exerting a total of about 60–70 tons pressure is adequate to complete this assembly step.

It will be understood that the completed roll is of the shafted type, that is, the shaft remains rigidly attached to the roll during the normal life of the same. Moreover, the spacer is rigidly attached to the shaft end members and in effect serves functionally as an integral shaft part and which is particularly well adapted to share in torsional stresses applied during the driving of the roll in fulfilling its printing purposes. As used herein, the term "shafted roll" is intended to signify a construction wherein the shaft remains integrally joined to the cylinder of the roll during useful life of that roll.

Although the foregoing example of a printing roll made in accordance with the invention referred to the use of 6061 T6 extruded aluminum, other aluminum alloys such as 7075 T6 having a yield strength of about 72,000 p.s.i., and other metals, may also be employed, provided they possess a yield strength of at least about 40,000 pounds per square inch.

While in accordance with the patent statutes there has been described what at present is considered to be the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and the appended claims, therefore, are intended to cover all such changes and modifications as fall within the true spirit of the invention.

What is claimed is:

1. A shafted printing roll including a tubular shell having inwardly extending tapered internal surfaces of diminishing diameter at each end thereof, a tubular spacer positioned along the axis of and within said shell, said spacer having inwardly extending tapered external surfaces of increasing diameter at each end thereof, a pair of tubular gudgeons having both inner and outer tapered surfaces engaging respectively the said external surfaces of the spacer and the said internal surfaces of the shell with a tight fit, said spacer having an enlarged cylindrical recess at each end along the axis of the roll comprising the afore-mentioned four structural elements in mutually assembled relation, and a pair of tapered shaft members each mounted rigidly within the respective recesses and projecting axially from the ends of said roll.

2. A roll as defined in claim 1 wherein said surfaces of said shell terminate at an internal shoulder disposed normal to the axis of said shell, and said surfaces of said spacer terminate at an external shoulder disposed normal to the axis of said spacer, the innermost end of said respective gudgeons being in contact with the respective shoulders of said shell and spacer.

3. A roll as defined in claim 1 wherein each of said shaft members includes a circumferentially projecting shoulder intermediate the ends of said members, said shoulder being in contact with an end of said spacer.

4. A roll as defined in claim 1 wherein the taper of said shell surfaces is about 0.100 inch per linear foot and said shell comprises extruded aluminum alloy.

5. A roll as defined in claim 1 wherein the taper of said spacer surfaces is about 0.100 inch per linear foot and said spacer comprises extruded aluminum alloy.

6. A roll as defined in claim 1 wherein the taper of said tapered gudgeon surfaces is about 0.100 inch per linear foot and said gudgeons comprise extruded aluminum alloy.

7. The method of assembling a shafted printing roll including, positioning in juxtaposition with each other a tubular shell, a tubular spacer disposed along the axis of and within said shell and a pair of tubular gudgeons disposed adjacent the ends of said shell and spacer, forcing said gudgeons toward each other and into tight encompassed engagement with said shell and into tight encompassing engagement with said spacer, thereafter forming an enlarged cylindrical recess in each end of said spacer while encompassed by said gudgeons, and inserting in each of said enlarged recesses a separate shaft member to form a rigid shafted roll.

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