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MANDREL AND CYLINDER FOR GRAVURE PRINTING

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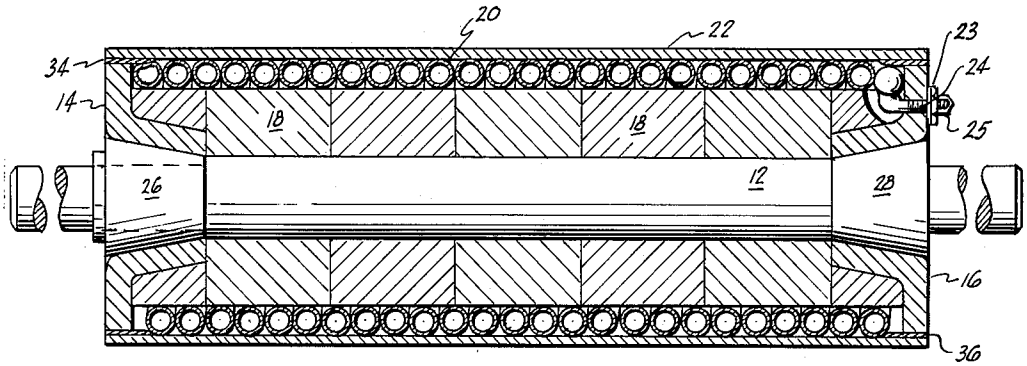

Fig. 1.

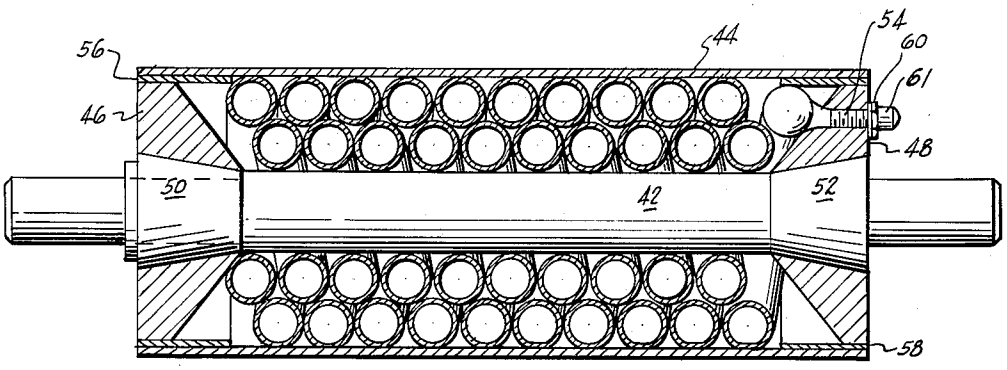

Fig. 2.

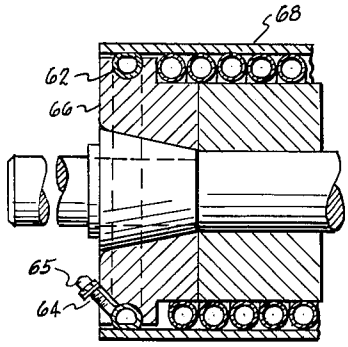

Fig. 3.

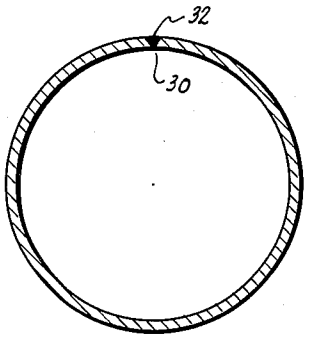

Fig. 4.

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MANDREL AND CYLINDER FOR GRAVURE PRINTING

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This invention relates to operations such as gravure printing, requiring the use of a removable and replaceable cylinder.

One primary object of the present invention is to generally improve gravure printing. In current practice, thick steel cylinders are used which are electroplated with copper to receive the etching or engraving which is to be printed. Many cylinders are stored for reuse. The cylinder may be etched anew by deplating and again plating and etching the same. At present, the cylinder used is heavy, say one half to one inch thick even for small cylinders in a range of say four to twelve inches diameter. There is a problem in handling and storing the cylinders, as well as their high initial cost.

One object of the present invention is to make possible the use of relatively light, thin walled cylinders.

Another object is to provide an improved mandrel for carrying such cylinders.

A more specific object is to support the cylinder along its entire length. Another object which is fulfilled by the same means is to improve the means for gripping or driving the cylinder.

Still another object of the invention is to provide an improved means to seal the ends of the cylinder against the entry of ink.

To accomplish the foregoing objects, and other more specific objects which will hereinafter appear, my invention resides in the improved cylinder and mandrel, and their relation one to another, as are hereinafter more particularly described in the following specification. The specification is accompanied by a drawing, in which:

FIG. 1 is a longitudinal section through a mandrel and cylinder combination embodying features of my invention;

FIG. 2 illustrates another form of the invention;

FIG. 3 is a fragmentary view of another form of the invention generally similar to that shown in FIG. 1, but illustrating an improved ink seal; and

FIG. 4 is explanatory of one method of making the thin walled cylinder.

Referring to the drawing, and more particularly to FIG. 1, the improved mandrel of my invention comprises a shaft **12** with end plates **14** and **16** received thereon. A core **18** surrounds the shaft **12** between the end plates. A helical winding of rubber tubing **20** is wound about the core **18** between the end plates, and is dimensioned to readily receive a cylinder **22** thereover when the tubing **20** has not been inflated.

The tubing is closed at one end, in this case the left end, and is provided with an air valve **24** at the other end. This may include an externally and internally threaded stem, the same as that used on vehicle tires, and a conventional air valve is screwed into the stem. Compressed air may be admitted by means of a conventional air hose and fitting, and serves to inflate the tubing **20** so that it supports the cylinder **22** entirely along its length, and grips the cylinder to rotate the same.

It will be understood that in preferred form, the shaft **12** is the regular press shaft of the gravure printing press. The endplates **14** and **16** may be received with a tapered fit on tapered hubs **26** and **28** in accordance with present gravure printing press practice. The cylinder **22** may be made of steel which is copper plated and ground to form

a smooth cylindrical surface, which then is appropriately etched, all in accordance with known methods.

One method of forming the present light weight cylinder is shown in FIG. 4, in which the sheet steel has been rolled to cylindrical form, with edges abutting at **30**. These edges are bevelled to form a V-groove or channel which facilitates welding the edges. The welding material is shown at **32**, and the outer surface is ground smooth before the cylinder is copper plated. The sheet material used may be, say ⅛ inch in thickness, in which case the weight of the cylinder will be from one fourth to one eighth of the weight of the cylinders previously used, for the same overall size range.

Moreover, in accordance with the present improvement, the cylinder need not be made of steel, and aluminum or other non-ferrous metals also may be used, with additional saving in weight. This is so because with my improved mandrel the cylinder is not unsupported between its ends, and therefore does not need the strength and rigidity heretofore required.

The cylinder runs in a bath of ink, and it is therefore desirable to seal the ends of the cylinder against entry of ink. In FIG. 1 there are bands or short cylinders of soft sealing material indicated at **34** and **36**. These may be rubber, but preferably are a synthetic rubber which is resistant to attack by the solvents used in conventional quick drying gravure inks. The tubing **20** also preferably is made of an appropriate synthetic rubber.

The air stem **24** is preferably sealed by a soft washer and nut **23**, and it is closed by a cap **25**.

The core **18** in the present case is made up of a series of short cylinders. These may be made of a relatively lightweight plastics material. The material used is not critical, and any desired material may be employed because he primary function of the core is merely to fill the space between the shaft **12** and the helical tubing **20**.

A modified form of the invention is shown in FIG. 2. In this case, there are a plurality of layers of helically wound tubing, and if desired, the tubing may fill the entire space between the shaft **42** and the cylinder **44**, thus eliminating the need for the core material shown at **18** in FIG. 1. As before, there are end plates **46** and **48**, and these may be received on frusto conical hubs **50** and **52**. The hubs may be tightened axially in accordance with current gravure printing practice.

A single length of tubing may be used which is closed at one end, in this case, the right end of the inner layer, and which has a conventional tire air valve at its other end, as indicated at **54**. The tubing is of sufficient length to provide enough layers to fill the space between the shaft and the cylinder. However, it will be understood that intermediate arrangements may be employed in which a core is used but is reduced in diameter to receive multiple layers of tubing without, however, requiring that the tubing reach all the way to the shaft.

Alternatively, several shorter tubes may be used, one for the inner layer, and another for the outer layer. With three layers, three tubes are used. Each is closed at one end and has an air valve at the other end. All then are wound in the same direction, with no crossovers. The air valves are displaced around the end plate.

As before, the ends of the cylinder are preferably sealed against the entry of ink, and for this purpose annular sealing material is used as shown at **56** and **58** in the drawing. Also, the valve stem **54** may be sealed by an appropriate soft sealing washer and nut **60**. The valve stem is closed by a cap **61**.

The preferred form of the invention is that using a single layer of tubing as shown in FIG. 1, in contrast with the use of multiple layers of tubing as shown in FIG. 2. The reason is that a high inflation pressure may

be employed in FIG. 1, adequate to resist considerable stress. Thus, the cylinder may run in a press using an impression roll which is relatively hard, using say 80 to 95 Durometer rubber. This is used for printing on paper and paper board. The multiple layer tubing is more practical for a cylinder used in a press having a comparatively soft impression roll using, say 40 to 50 Durometer rubber. This is the type used in certain special cases, typically when printing on cellophane. In such case the stress involved is very low, and a low inflation or clamping pressure is adequate.

In that connection, it may be pointed out that the use of a single long tube, with crossover of convolutions, in the multi-layer arrangement shown in FIG. 2, is desirable only when working with a very low inflation pressure. For somewhat higher inflation pressure it is preferable to use multiple tubes, one for each layer, which are wound in the same direction so that there are no crossovers. If the ends slope, as shown in FIG. 2, the outer tube may be longer to take care of the increase in axial dimension as well as the increase in diameter. The winding of each layer may start with the air valve. The other end may be squeezed or deformed into position, unlike FIG. 2 which shows larger-than-necessary space at the ends. Of course, with still higher pressures the preferred arrangement is to use only one layer of tubing as shown in FIG. 1.

Another form of the invention is illustrated in FIG. 3, which corresponds generally to the left end of FIG. 1. The main difference here centers about the ink seal at the end of the cylinder. In the present case, there is an annular rubber tube or hollow ring **62**, having a valve stem **64** with a valve therein, all as in bicycle tire practice. The inner surface of the tube bears against the end plate **66**, and the latter is preferably grooved to receive the tube. The outer surface of the tube **62** bears against the inside of the cylinder **68**. It will be evident that inflation of the tube **62** by compressed air supplied through the air stem **64** serves to seal the cylinder against the entry of ink. The air stem **64** is capped at **65** to protect the air valve contained therein against entry of ink.

It will be understood that a similar seal is used at the other end of the cylinder, and that the air stem for the seal may be displaced from the air stem for the expandible helical tubing, so that the two stems will not interfere with one another.

Mandrels may be made in a series of different diameters to accommodate gravure cylinders of different diameter. However, manufacture of the mandrel is facilitated by the fact that a common diameter of tubing may be used for many different sizes of mandrel. The length of the tubing will differ, it being evident that a long tube is needed for a mandrel which is larger in diameter, or longer in length, but the necessary manufacturing operations on the tube arm comparatively simple and standardized. One such setp is to close one end of the tube, and another is to add an air valve stem at the other end.

It is believed that the construction and method of use of my improved mandrel and cylinder, as well as the advantages thereof, will be apparent from the foregoing detailed description. It will also be apparent that while I have shown and described my invention in several preferred forms, changes may be made in the structures shown, without departing from the scope of the invention, as sought to be defined in the following claims. In the claims the term "rubber" is intended to include synthetic rubbers and plastics having yieldable characteristics or properties suitable for the present purpose, as well as natural rubber.

I claim:

1. A mandrel for detachably receiving a rigid and accurately finished but relatively thin walled gravure cylinder, said mandrel comprising a press shaft, end plates received thereon, a helical winding of rubber tubing wound between said end plates and dimensioned to receive the cylinder thereover, said tubing being closed at one end and having an air valve at the other end, whereby the tubing may be inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means around said end plates to be received between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run, said cylinder having a thickness only a fraction of that of the usual rigid gravure cylinder, but sufficient to bridge the spacing between the coils of the helical tubing without loss of the desired accurate cylindrical configuration needed for gravure printing.

2. In combination, a rigid and accurately finished but relatively thin walled gravure cylinder, and a mandrel detachably mounted therein, said mandrel comprising a press shaft, end plates received thereon, and a helical winding of rubber tubing wound between said end plates and within said cylinder, said tubing being closed at one end and having an air valve at the other end, the tubing being inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run, said cylinder having a thickness only a fraction of that of the usual rigid gravure cylinder, but sufficient to bridge the spacing between the coils of the helical tubing without loss of the desired accurate cylindrical configuration needed for gravure printing.

3. A mandrel for detachably receiving a rigid and accurately finished but relatively thin walled gravure cylinder having a thickness of about ⅛ inch, said mandrel comprising a press shaft, end plates received thereon, a core on said shaft between said end plates, a helical winding of rubber tubing wound about said core between said end plates and dimensioned to receive the cylinder thereover, said tubing being closed at one end and having an air valve at the other end, said air valve projecting through one of the end plates, whereby the tubing may be inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means around said end plates to be received between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run.

4. In combination, a rigid and accurately finished but relatively thin walled gravure cylinder having a thickness of about ⅛ inch, and a mandrel detachably mounted therein, said mandrel comprising a press shaft, end plates received thereon, a core on said shaft between said end plates, and a helical winding of rubber tubing wound about said core between said core and said cylinder, said tubing being closed at one end and having an air valve at the other end, said air valve projecting through one of the end plates, the tubing being inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run.

5. A mandrel for detachably receiving a rigid and accurately finished but relatively thin walled gravure cylinder, said mandrel comprising a press shaft, end plates received thereon, a helical winding of rubber tubing wound between said end plates and dimensioned to receive the cylinder thereover, said tubing being closed at one end and having an air valve at the other end, whereby the tubing may be inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means around said end plates to be received between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run, said means being an

annular rubber tube having an air valve, the inner surface of said tube bearing against the periphery of the end plate and the outer surface of said tube being dimensioned to bear against the inside of the cylinder, whereby inflation of the annular tube by compressed air supplied through the second air valve serves to seal the end of the cylinder against entry of ink from the ink fountain in which the gravure cylinder is run.

6. In combination, a rigid and accurately finished but relatively thin walled gravure cylinder, and a mandrel detachably mounted therein, said mandrel comprising a press shaft, end plates received thereon, and a helical winding of rubber tubing wound between said end plates and within said cylinder, said tubing being closed at one end and having an air valve at the other end, the tubing being inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run, said means being an annular rubber tube having an air valve, the inner surface of said tube bearing against the periphery of the end plate and the outer surface of said tube bearing against the inside of the cylinder, said annular tube being inflated by compressed air supplied through the second air valve in order to seal the end of the cylinder against entry of ink from the ink fountain in which the gravure cylinder is run, said cylinder having a thickness only a fraction of that of the usual rigid gravure cylinder, but sufficient to bridge the spacing between the coils of the helical tubing without loss of the desired accurate cylindrical configuration needed for gravure printing.

7. A mandrel for detachably receiving a rigid and accurately finished but relatively thin walled gravure cylinder having a thickness of about ⅛ inch, said mandrel comprising a press shaft, end plates received thereon, a core on said shaft between said end plates, a helical winding of rubber tubing wound about said core between said end plates and dimensioned to receive the cylinder thereover, said tubing being closed at one end and having an air valve at the other end, said air valve projecting through one of the end plates, whereby the tubing may be inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means around said end plates to be received between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run, said means being an annular rubber tube having an air valve, the inner surface of said tube bearing against the periphery of the end plate and the outer surface of said tube being dimensioned to bear against the inside of the cylinder, whereby inflation of the annular tube by compressed air supplied through the air valve serves to seal the end of the cylinder against entry of ink from the ink fountain in which the gravure cylinder is run.

8. In combination, a rigid and accurately finished but relatively thin walled gravure cylinder having a thickness of about ⅛ inch, and a mandrel detachably mounted therein, said mandrel comprising a press shaft, end plates received thereon, a core on said shaft between said end plates, and a helical winding of rubber tubing wound about said core between said core and said cylinder, said tubing being closed at one end and having an air valve at the other end, said air valve projecting through one of the end plates, the tubing being inflated by compressed air to support and grip the cylinder to insure rotation of the cylinder with the mandrel, and means between said end plates and said cylinder to seal the same against entry of ink from the ink fountain in which the gravure cylinder is run, said means being an annular rubber tube having an air valve, the inner surface of said tube bearing against the periphery of the end plate and the outer surface of said tube being inflated by compressed air supplied through the second air valve in order to seal the end of the cylinder against entry of ink from the ink fountain in which the gravure cylinder is run.

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