

[54] PRINTOUT DRUM

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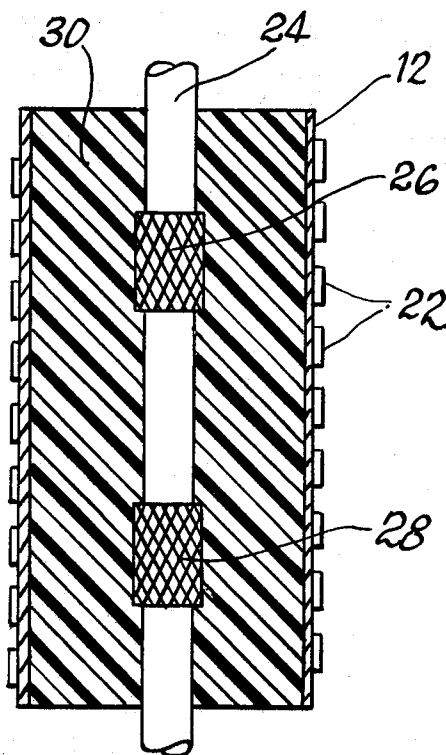
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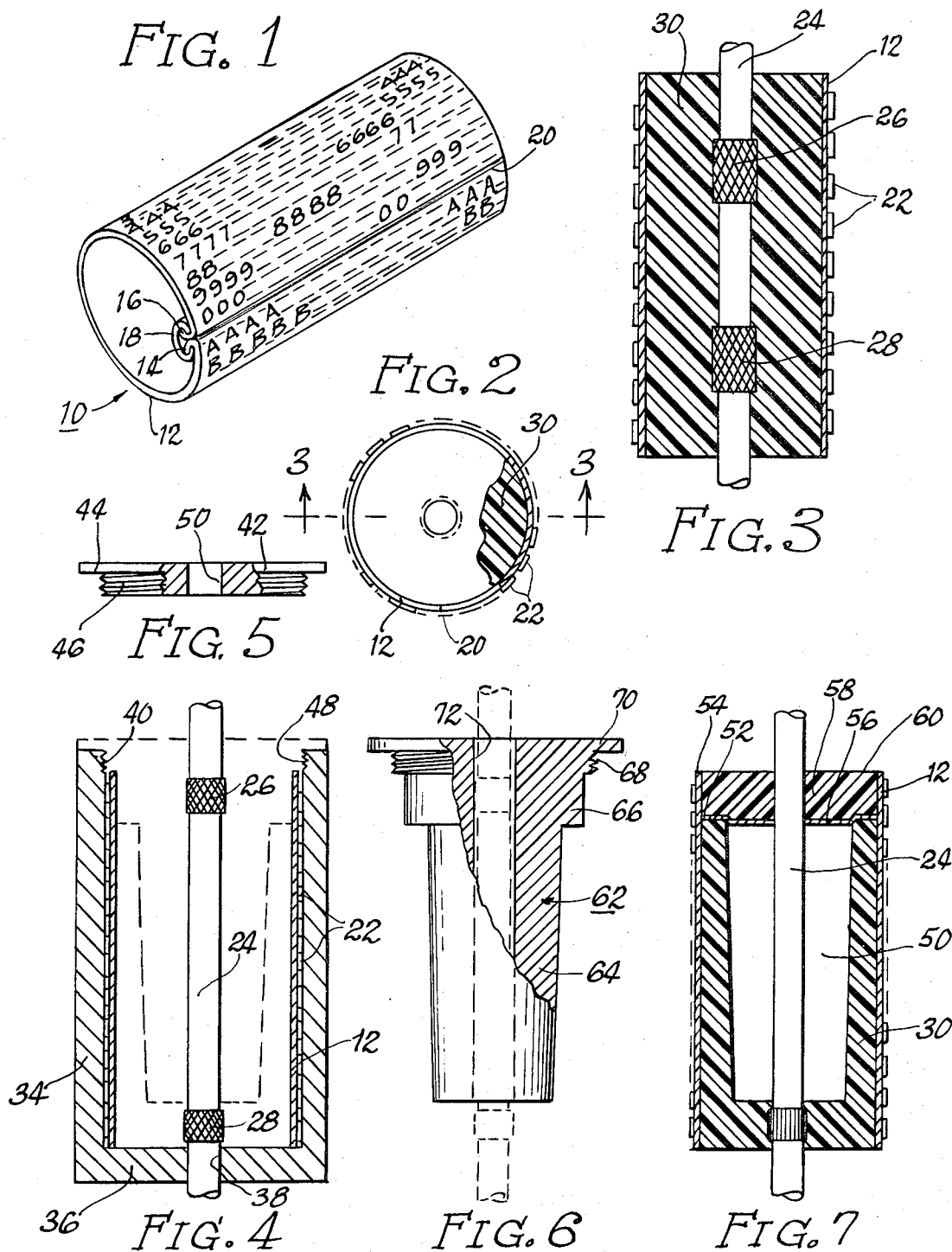
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ABSTRACT

A printout drum in which a metal tubular member carrying a plurality of characters on its outside surface has a centrally positioned shaft which is rigidly fastened to the tubular member by means of a hardenable resinous filler material filling at least a portion of the tubular member.

5 Claims, 7 Drawing Figures





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PRINTOUT DRUM

FIELD OF THE INVENTION

This invention relates to an improved printout drum, sometimes known as a "readout drum," of the type used in computer printout apparatus, and a method for producing the same.

BACKGROUND OF THE INVENTION

Computer printout apparatus generally requires the use of a rotating printout drum which has several thousand characters etched on its outside surface, and which characters cooperate with a large number of hammers to imprint data on a continuous paper web that is fed into engagement with the drum and hammers. Prior art printout drums generally comprise a solid metal cylinder, with a shaft either machined out of the solid material or defining a bore for snug receipt of the shaft. Conventionally, a photoresist material is applied to the surface of the cylinder and the surface is thereafter exposed photographically, treated and etched to provide a predetermined character configuration on the surface.

Solid printout drums have been found to be relatively expensive to produce, and it is very difficult to obtain accurate axial symmetry with respect to the central shaft and surface of the drum. Additionally, the solid cylindrical member requires that the photographic technique of applying the character configuration and the etching technique be accomplished while the unit is in its cylindrical form, which is a more difficult accomplishment than if the photographic and etching technique could be accomplished while the unit was in a planar form. Further, the relatively great weight of the solid metallic cylinder produces certain problems because of the high inertia caused by such relatively great weight.

The disadvantages of the aforementioned prior art printout drums are obviated by the present invention, which provides an improved printout drum that is relatively inexpensive to produce, has excellent axial symmetry with respect to the shaft and outer surface of the drum, is much lighter in weight than prior art printout drums and, in one embodiment of the invention, the surface of the printout drum can be photographically exposed, treated and etched while in planar form.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a method for producing a printout drum which includes the steps of etching characters on a rigid metallic member formed into a hollow cylinder, positioning a shaft within the cylinder and coaxially therewith, and filling at least a portion of the cylinder in situ with a hardenable flowable material to maintain the shaft in the coaxial position and stationary with respect to the cylinder.

In one embodiment of the invention, the characters are etched while the metallic member is in a planar state. Thereafter, the planar metallic sheet is formed into a tubular member with the ends of the sheet being extended inwardly with respect to the tube for a predetermined distance. A clasp is affixed to the ends with the clasp located entirely within the tube. The shaft is thereafter positioned within the tube and coaxi-

al therewith and at least a portion of the tube is filled in situ with a hardenable flowable material to maintain the shaft in the coaxial position.

A more detailed explanation of the invention is provided in the following description and claims, and is illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a tubular member prior to connection of a shaft thereto to form a printout drum in accordance with the principles of one embodiment of the present invention;

FIG. 2 is a top plan view of a printout drum constructed in accordance with the principles of the present invention;

FIG. 3 is a sectional elevation thereof, taken along the line 3—3 of FIG. 2, with the central shaft shown in full elevation;

FIG. 4 is a sectional elevation of a printout drum during one stage of construction in accordance with the principles of the present invention, with the central shaft shown in full elevation;

FIG. 5 is an elevational view of a cap used in the construction of the printout drum illustrated in FIGS. 2 and 3;

FIG. 6 is an elevational view, partially broken, of a die used in the construction of the printout drum illustrated in FIG. 7; and

FIG. 7 is a sectional elevation of a printout drum according to a second embodiment of the present invention.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

In FIG. 1, the printout drum 10 is shown prior to insertion of a central shaft therein. The drum of the illustrative embodiments of the invention is formed by rolling sheet steel or sheet aluminum into tubular form 12 with the ends 14 and 16 of the sheet bent inwardly and turned with respect to the formed tube, as shown in FIG. 1. An elongated clamp or clasp 18, having a generally C-shaped cross-sectional configuration throughout its length, is used to clamp ends 14 and 16 and to prevent the seam 20, which seam is defined by the sheet material adjacent the turned ends thereof, from opening.

The characters are etched on the surface of tubular member 12 while the sheet metal is in its planar state and prior to formation of the tube. The etching process requires the application of a photoresist material to the surface of the drum, photographic exposure of the photoresist to expose to light the areas where the photoresist is to remain on the surface, and treatment of the photoresist to remove the unexposed portions thereof, thereby baring portions of the metal to enable such portions to be attacked by an etchant. It has been found that photographic exposure of the photoresist while it is on the surface of a planar form is more effective than photographic exposure of the photoresist on a curved surface. Likewise, etching the characters on a planar sheet has been found to be advantageous over etching the characters on a curved surface.

It is preferred that the sheet metal used to form tube 12 be at least 0.016 inches in thickness so as to allow a character thickness of 0.008 inches and a wall

thickness of 0.008 inches. Clamp 18 is formed of relatively thin sheet metal so that the clamp will be distorted when the filler material is added, as will be described in more detail below.

The completed printout drum includes tubular member 12 having preselected characters 22 formed thereon with a central shaft 24 coaxially positioned with respect to the tubular member. Shaft 24 carries outstanding locking members 26 and 28, which preferably are formed integral with the shaft. The shaft is held firmly in place with respect to tubular member 12 by means of a hardenable plastic material 30, which serves to provide a very stable structure that is extremely lightweight. In a preferred embodiment, the filler material comprises substantially closed cell polyurethane foam having a density between 5 pounds per cubic foot and 30 pounds per cubic foot. In a specific example, a 97 percent closed cell Polylyte polyurethane system, sold by Reichhold Chemicals, Inc., was used.

A non-liquid hardenable filler material may be used satisfactorily. For example, a printout drum was successfully constructed using a filler consisting of Cylolac JS resin sold by the Marbon Chemical Division of Borg-Warner Corporation. Cylolac JS resin is an acrylonitrile-butadiene-styrene copolymer having a density between 31 and 36 pounds per cubic foot.

In certain applications it may be desirable to have a printout drum cylinder which rotates about a coaxial but stationary shaft. The cylinder can thus be driven, providing a low inertia system. The construction of such a printout drum would require the placement of a bearing sleeve coaxially within the tubular member with the sleeve being held firmly in place with respect to the tubular member by means of the hardenable filler as discussed above. The sleeve should be grooved or knurled to provide a rough surface for locking engagement with the hardenable filler material. The bearing sleeve can be positioned with respect to the tubular member in a manner substantially identical to the positioning of a shaft, although the illustrations in this application specifically show the positioning of a shaft. Therefore, as defined in the specification and claims of this application, the term "shaft means" designates either a shaft or a shaft bearing sleeve or means for holding a shaft.

During computer printout, because of the movement of a large number of hammers against a rotating drum, occasionally a detrimental wave is set up in the drum which may cause uneven printing. The occurrence of this detrimental wave with a prior art solid steel drum is unfortunate but cannot be avoided. Using the principles of the present invention, however, the composition of the filling material may be varied, for example by adding sand, and a different resonance characteristic of the drum will occur. In other words, by varying the composition of the filler material, the printout drum can be "tuned" with respect to the particular printout apparatus and hammer arrangement.

In the manufacture of the printout drum illustrated in FIG. 3, referring to FIG. 4 it is seen that the tubular member 12 having the characters 22 formed thereon is placed in a hollow cylindrical fixture 34, the bottom 36 of which defines an aperture 38 for snugly receiving shaft 24 which is positioned therein. The inside surface 40 of the upper portion of fixture 34 is threaded to

receive a cap 42 (FIG. 5) having a top plate 44 and an outside-threaded member 46 which engages the inside threads 48 of surface 40. Cap 42 defines a central aperture 50 which is positioned over shaft 24 to maintain the shaft in place in the fixture 34, coaxial with tubular member 12.

Prior to connecting cap 42 to the fixture 34, a hardenable filler material, such as a urethane resin, is poured in situ in the tubular member 12 while the resin is in flowable form. Cap 42 is then placed over the shaft 24 and is screwed in place while the resin is allowed to harden and expand, to fill the space and interstices defined by ends 14, 16, clamp 18, shaft 24 and locking members 26 and 28. After the resin has hardened, the cap 42 is unscrewed from the fixture 34 and the drum is removed from the fixture in its form as shown in FIGS. 2 and 3.

In a second embodiment of the invention, as shown in FIG. 7, there is a space 50 defined about the shaft 24. Providing space 50 enables the printout drum to be as lightweight as possible, and, if desired, various electrical components may be carried by the drum within the space 50.

The drum illustrated in FIG. 7 is similar to the drum illustrated in FIG. 3, except that it has space 50 as described above, and shaft 24 is hollow to allow electrical leads to pass from electrical equipment carried within the space to the outside of the drum. In order to obtain access to any electrical equipment within space 50, filler material 30 is set to have a top surface 52 that is spaced a predetermined distance from the end 54 of the tubular member 12. A metal washer 56, which defines a central aperture that snugly receives shaft 24, is positioned to engage the top surface 52 of filler material 30. A removable insert 58, formed of a plastic material and also defining an aperture for snugly receiving the shaft 24, is press-fitted into the tube 12 to fit snugly therein with a frictional fit. The top surface 60 of member 58 is aligned with end 54 of tubular member 12 and contains grooves for enabling it to be grasped and removed with an appropriate tool. In another form, member 58 has external threads for engagement with inside threads provided on the upper surface of member 12.

In order to obtain the construction illustrated in FIG. 7, the unit is formed generally similar to the formation of the unit shown in FIG. 3, but a die 62, illustrated in FIG. 6, is utilized in place of cover member 42. Die 62 has a tapered body portion 64, a cylindrical portion 66 for providing the space into which washer 56 and member 58 can be positioned, an outside-threaded member 68 and a top plate 70 which has the same function as top plate 44 of cap 42. Die 62 defines a central aperture 72 which receives shaft 24 and aligns it to remain coaxial with respect to tubular member 12.

When die 62 is screwed into fixture 34 so that threaded member 68 engages the inside threads 48 of surface 40, the die will fill a portion of the space defined by tubular member 12 as indicated in phantom lines on FIG. 4. The die is screwed into the fixture after a predetermined amount of resin in flowable form is poured into the tubular member and the die remains screwed into the fixture 34 until the resin hardens, in the manner described above with respect to the FIG. 4 embodiment. Thereafter the die 62 is removed, the tu-

bular member and its associated shaft are removed from the fixture and washer 56 and member 58 can be placed in the tubular member 12 when desired.

A novel printout drum has been shown and described which uses a hardenable filler thereby allowing the shaft to be held to precise axial symmetry with respect to the tubular member. Using the hardenable filler, the printout drum is much lighter in weight than prior art printout drums, is less expensive to manufacture and has much lower inertia because of its lightness in weight. Additionally, by using a sheet which is subsequently formed into a tubular member, a more perfect circular cross-sectional configuration can be achieved than by utilizing conventional extrusion techniques. Further, the formation of characters on the surface of the unit can be done more effectively while the unit is in planar form, than if the surface of the unit were curved.

Although two illustrative embodiments of the invention have been shown and described, it is to be understood that various modifications and substitutions may be made by those skilled in the art without departing from the spirit and scope of the present invention.

What is claimed is:

1. A printout drum which comprises: a metal tubular member having a circular cross-sectional configuration and having a plurality of characters on its outer surface; a solid, substantially rigid, resinous filler material filling at least a portion of said tubular member; a centrally positioned shaft located coaxially with said tubular member and spaced from the inner surface thereof, said shaft having a segment embedded in said filler material to thereby maintain the axial and coaxial posi-

tioning of said shaft fixed and stationary with relation to said tubular member; said filler material including a cylindrical portion in engagement with the inner surface of said metal tubular member and spaced from said shaft to define a cavity surrounding said shaft, and a disc-like annular portion formed integral with said cylindrical portion and disposed at one end of said metal tubular member, transversely to the axis thereof, with said shaft segment being embedded in said disc-like annular portion of the filler material, and a removable closure means positioned at the opposite end of said tubular member with said shaft being disposed in an aperture formed in said closure means, said closure means cooperating with said cylindrical portion of the filler material to seal said cavity when in place and to allow access to said cavity upon removal.

2. A printout drum as defined in claim 1, wherein said segment of the shaft embedded in said filler material includes locking means which positively retain the relative positioning of said shaft with respect to said tubular member during operation of said drum.

3. A printout drum as defined in claim 1, wherein said filler material comprises a polyurethane foam.

4. A printout drum as defined in claim 3, wherein said polyurethane foam has a density of about 5 lbs. per cubic foot.

5. A printout drum as defined in claim 1, wherein said tubular member has a longitudinal seam extending the length thereof said seam being defined by inwardly turned ends of a metal sheath used to form said tubular member, and a clasp member engaged with said inwardly turned ends to maintain the integrity of said seam.

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