METHOD FOR FABRICATING PRINTING DRUMS

Filed Nov. 15, 1967 3 Sheets-Sheet 1

Fig. 1.

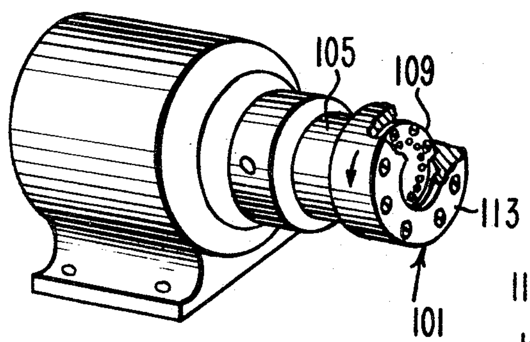


Fig. 2.

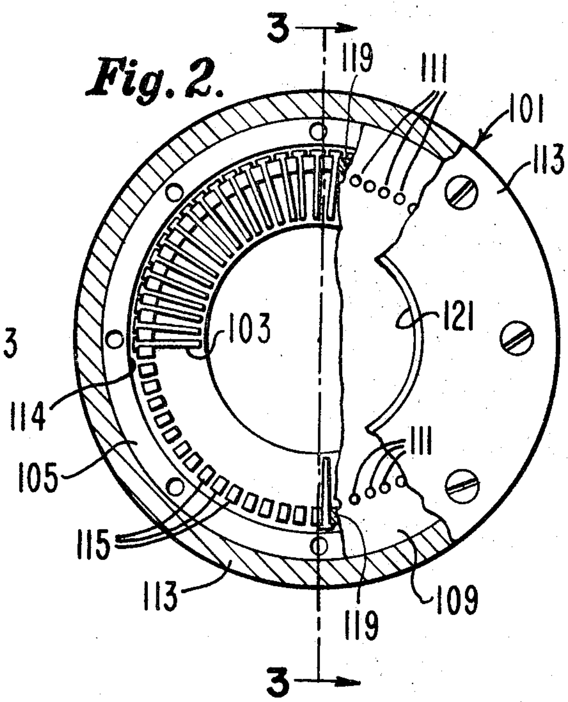


Fig. 3.

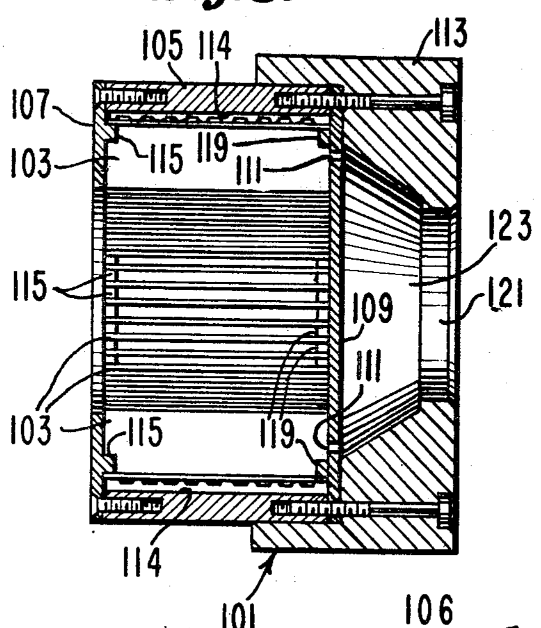


Fig. 4.

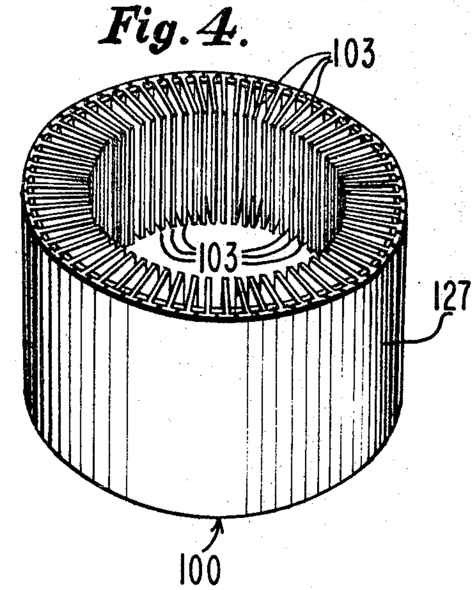
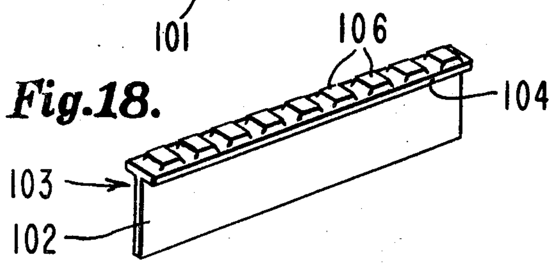


Fig. 18.



INVENTOR.
NEAL HEPNER.
BY
Russel C. Wells
ATTORNEY.

Fig. 5.

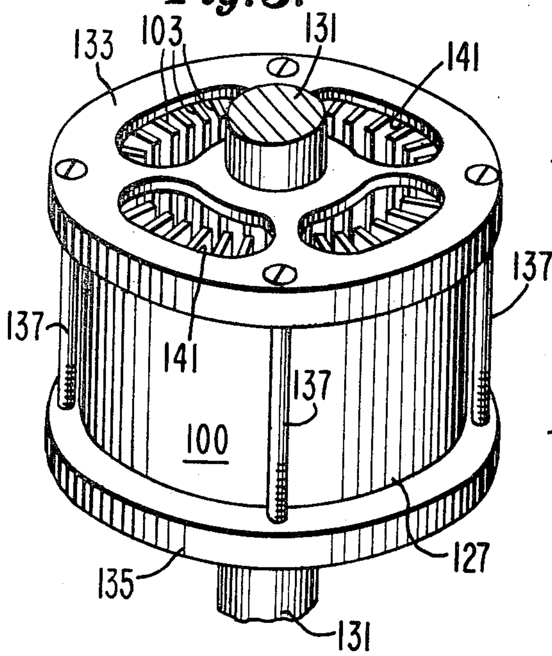


Fig. 6.

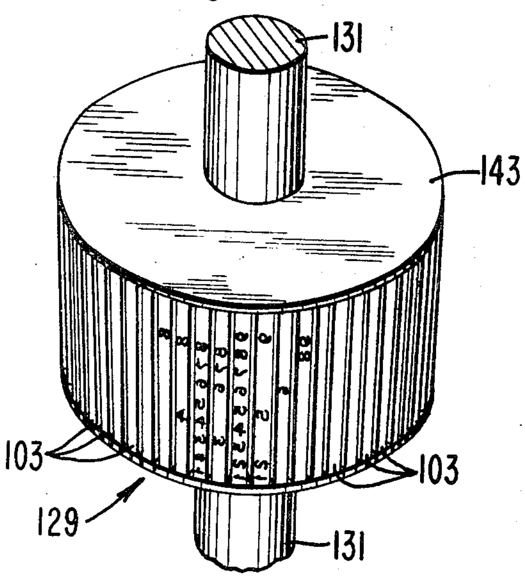


Fig. 7.

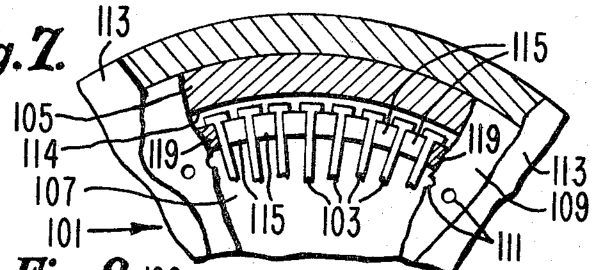


Fig. 8.

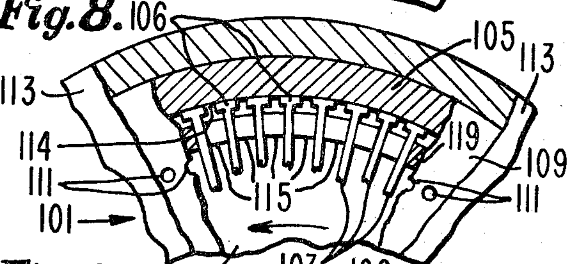


Fig. 9.

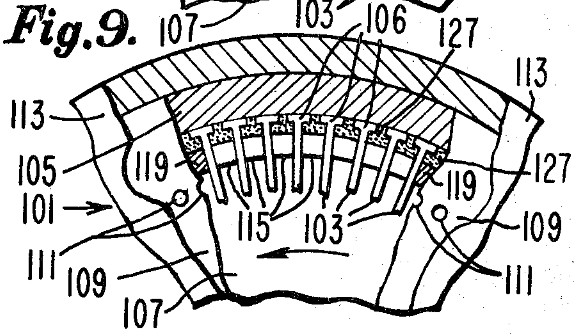


Fig. 10.

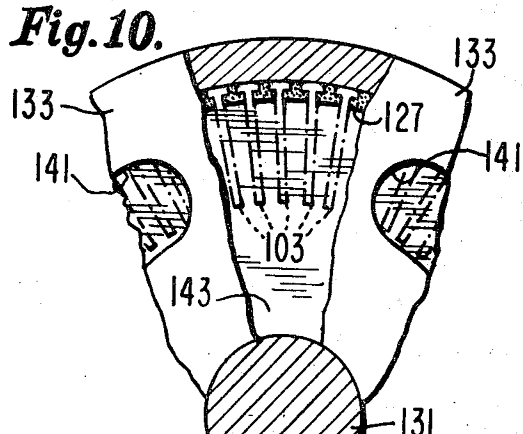
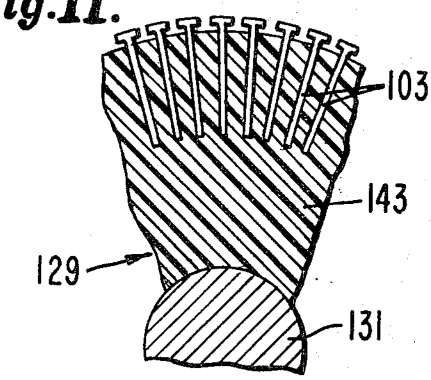


Fig. 11.



Sept. 15, 1970 N. HEPNER 3,529,054

METHOD FOR FABRICATING PRINTING DRUMS

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Fig.12.

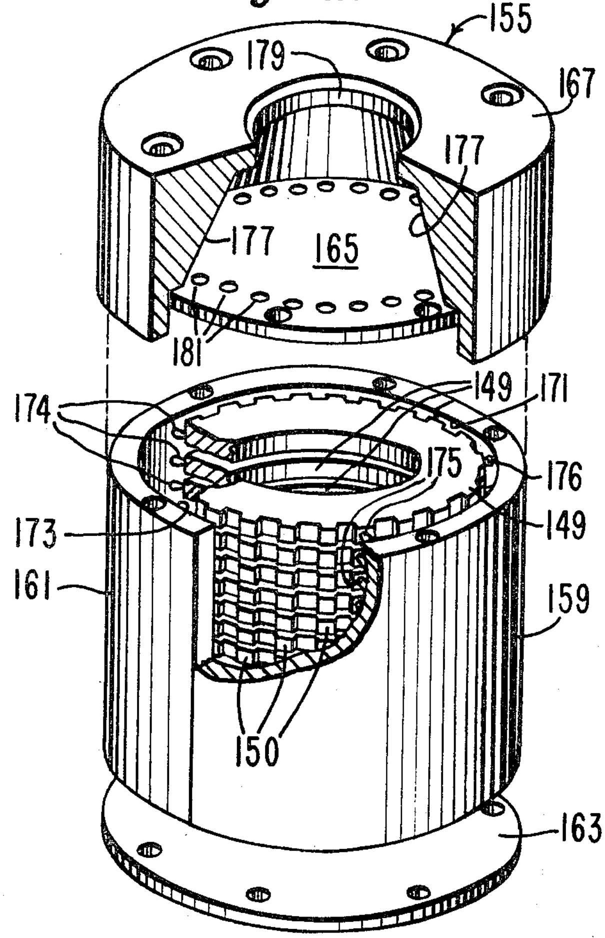


Fig.14.

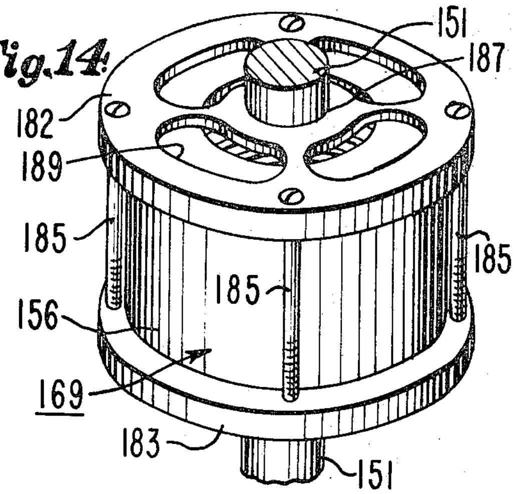


Fig.15.

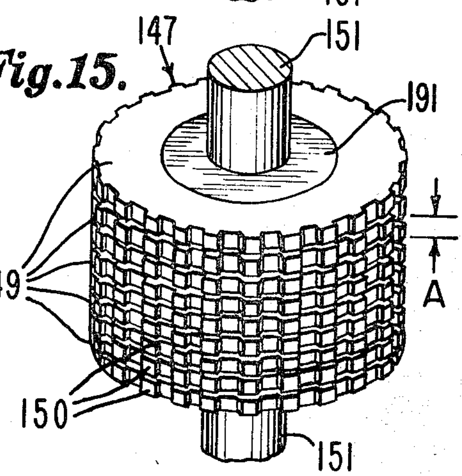


Fig.16.

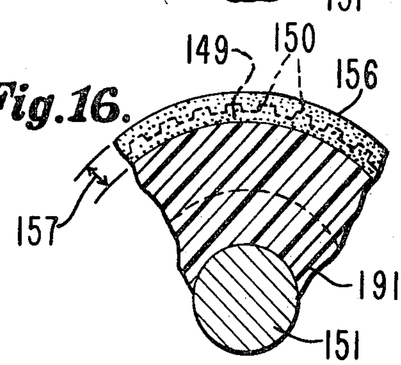


Fig.13.

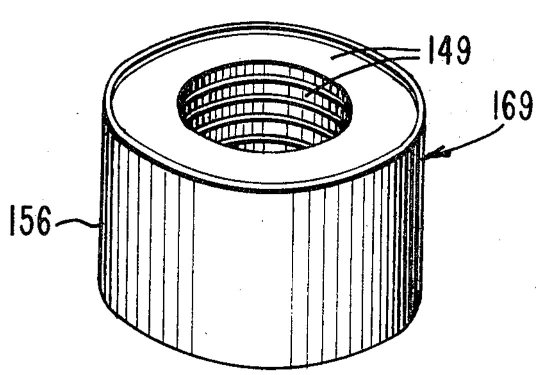
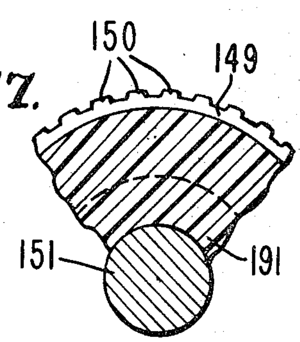


Fig.17.



United States Patent Office

3,529,054
Patented Sept. 15, 1970

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3,529,054
METHOD FOR FABRICATING PRINTING DRUMS

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Filed Nov. 15, 1967, Ser. No. 690,041
Int. Cl. B29c *5/04, 25/00;* B29d *3/00*
U.S. Cl. 264—261 2 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure embodies a method for fabricating a printing drum which comprises a mounting shaft, a plurality of type carrying segments to form a drum rim, and a solid connecting web such as a resin epoxy connecting the rim segments together and to the shaft. The method involves a preliminary fabrication of the drum rim by the use of apparatus including a rotatable fixture mold wherein the segments are held with their type characters in rows in parallel to an axis of rotation. A solidifiable, but readily removable material is introduced into the fixture-mold while the latter is rotating and the centrifugal force disperses the material outwardly so that on solidification it forms a temporary holding frame and sealer connecting the outer ends of the segments as a unitary structure. This step of the method makes it possible to place the resultant unitary structure into a second mold where the segments can be molded together and to the shaft, such as by means of a resin epoxy poured into the mold cavity to form a solid connecting web.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to a method for fabricating structures of various geometric shapes having an axis of rotation, and particularly to a method for fabricating printing drums and wheels.

Prior art

In the fabrication of various geometric shapes having an axis of rotation, such as printing drums or wheels, the cost of providing the accuracy required in the positioning of the type carrying members is high. The type carrying members around the periphery of a high speed printer drum, for instance, must be positioned so as to be in an accurate predetermined relationship with all of the other type carrying members. Accuracy in the relationship between the members must be maintained with regard to:

(a) The lateral relationship of each type character to each and every other type character;

(b) The angular relationship of each and every type character about the axis of rotation of the wheel or drum; and

(c) The radial distance between the axis of rotation and the type character face, i.e., the roundness of the wheel or drum.

Conventional methods used to accomplish the above criteria comprise a plurality of print wheels or drum segments mounted on a keyed shaft. Each wheel or segment is generally two columns wide and carries two complete sets of type characters. In order to maintain the positioning between the individual type characters, the mounting shaft, the keyways in both the shaft and wheel or segment, the mounting aperture in the wheel or segment, and the width of the wheel or segment all must be manufactured to extremely close tolerances. Due to the many individual members or parts involved in the fabrication of a type drum or wheel, tolerance build-up becomes a great

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problem. To avoid the build-up between the wheels or segments, it has been the practice to provide shims which are selectively positioned between the wheels and segments at various intervals to offset this cumulative build-up of tolerances.

It is a primary object of the invention to eliminate the need of close tolerances on the shaft and segments of a printing wheel or drum.

It is a further object to remove the requirement of having shims separating the segments and keys and keyways to locate the segments on the shaft.

SUMMARY OF THE INVENTION

The above-mentioned objects are accomplished through the method described and claimed wherein the type segments are circumferentially located. The segments are then bonded together at their outer extremities. The bonding is by use of a dissolvable compound which encapsulates and seals the type faces, supports each segment in its desired position, and bonds each segment together in the desired geometric shape. Then a permanent plotting or molding compound having the necessary strength, adhesion and stability for bonding the segments and the shaft into an integral unit, is introduced into the cavity formed by the temporary bonding compound. The sealing requirement of the temporary bonding compound is to prevent the permanent molding compound both from escaping the cavity during the curing and from adhering to the type faces.

By use of the method described herein, significant savings can be made in the manufacture of printing drums. Therefore, it is another object of the invention to substantially reduce the fabrication cost of printing drums and wheels.

IN THE DRAWINGS

FIG. 1 is a perspective view of apparatus which may be employed to perform a step of the method;

FIG. 2 is an end view of a fixture-mold partly broken away and in section for performing certain preliminary steps of the method;

FIG. 3 is a sectional view, taken along the line **3—3** of FIG. 2;

FIG. 4 is a perspective view of a drum rim structure fabricated with the use of the fixture-mold of FIGS. 2 and 3 and the apparatus of FIG. 1;

FIG. 5 is a perspective view of another fixture-mold to receive the rim structure of FIG. 4 to complete the method;

FIG. 6 is a perspective view of the finished printing drum;

FIGS. 7 to 11 are fragmentary sectional views, illustrating the steps of the method;

FIG. 12 is an exploded perspective view of a fixture-mold for use in performing certain preliminary steps of another embodiment of my method;

FIG. 13 is a perspective view of a drum rim structure fabricated with the use of the fixture-mold of FIG. 12;

FIG. 14 is a perspective view of another fixture-mold for use in the final steps of the method;

FIG. 15 is a perspective view of the completed printing drum;

FIGS. 16 and 17 are fragmentary sectional views illustrating certain steps of the method; and

FIG. 18 is a perspective view of a rim structure element of the drum rim structure of FIG. 5.

DETAILED DESCRIPTION

Referring to the drawings by characters of reference, and in particular to FIGS. 2, 3, 4, and 18, there is illustrated a fixture-mold **101** for use in fabricating a plurality of rim segments **103** into a drum rim structure **100**. The mold **101** is of sectional construction comprising a sleeve **105**, a first end plate **107**, a second end plate **109**, and an end cap **113**. The several sections of the mold **101** are fastened together by any suitable means such as screws and bolts which are shown in FIG. 3. The two axially opposed end plates **107** and **109** and the sleeve **105**, when fastened together, define an annular molding chamber surrounding a cylindrical fixture chamber or cavity, into which the rim segments **103** are placed and held. Each rim segment **103** has an elongated web **102** to which a rim forming head or flange **104** is attached. As is illustrated in FIG. 18, along the broad surface of the head **104** there is securely located in a row a plurality of type faces or characters **106**.

In the cylindrical fixture cavity, the rim segments **103** are located and held between a plurality of spacers **115** which are integral with and on the inner surface of the first end plate **107** and a plurality of spacers **119** which are integral with and on the inner surface of the second end plate **109**. Both sets of spacers **115** and **119** are equally spaced in an angular relationship about the center of the plates **107** and **109**. The circumferential distance between adjacent spacers is slightly larger than the thickness of the web **102** of the rim segment. Therefore, each segment is held by adjacent spacers so as to permit movement within the fixture in the radial directional only. The distance between the spacers **115** and **119** and the inner wall **114** of the sleeve **105** or the annular molding chamber defines the radial thickness of the drum rim cavity and is slightly greater than the thickness of the head **104** of the rim segment **103**.

In the second end plate **109**, there is also a plurality of ports or apertures **111** equally spaced in an angular relationship about the center of the plate **109**. With respect to the spaces **119**, the apertures **111** are located adjacent to each spacer and on the inside of each spacer. It is through these apertures **111** that the molding material **127** enters into the cylindrical fixtures cavity.

The end cap **113** provides an inlet cavity **123** to the mold **101**. The cavity is conical in shape extending from the inlet **121** to the surface of the second end plate **09**. The major diameter or flared end of the inlet cavity **123** is equal to or greater than the diametric distance spanning two apertures **111**; thereby each aperture **111** is wholly within the conical cavity.

With the second end plate **109** and the end cap **113** removed, the rim segments **103** are loaded into the fixture cavity by slideably inserting a web **102** between each spacer **115**. The head portion **104** is positioned between the spacer **115** and the inner wall **114** of the sleeve in the molding chamber. The second end plate **109** is then positioned over the opposite end of the rim segment **103** thereby securely holding each segment **103**. The end cap **113** is then placed over the end plate forming the completed fixture-mold. This is illustrated in FIG. 7.

The next step in the method is to cause the mold **101** to rotate about its axis. This may be accomplished by coupling the mold to the axis of a motor as is illustrated in FIG. 1. When the mold is rotating, the centrifugal force whichi s generated, causes the rim segments **103** to move in a radially outward direction so that the type faces **106** are in an abuting relationship with the inner surface **114** of the sleeve. This step is illustrated in FIG. 8.

During rotation, a predetermined amount of molding material **127** is introduced into the molding chamber through the inlet **121**. The tapered sides of the inlet chamber **123** direct the material toward the apertures **111**. The material is placed in rotation in the chamber, and when the material reaches the apertures, it enters therethrough into the annular molding the apertures, it enters therethrough into the annular molding cavity under rotation and does not splash against the rim segments **103**. With the apertures so positioned, the material is directed into the annular cavity without touching the segments **103** in the area where the material is not to be molded. The reason for avoiding any contact other than that desired, is to prevent contamination which may be detrimental to any subsequent operations. The radial thickness of the rim depends upon the amount of material **127** which is introduced into the inlet **121**. This step is illustrated in FIG. 9.

The purpose of the molding material in such a drum rim structure **100** as shown for example in FIG. 4, is to provide a temporary holding fixture which holds the rim segments together unaided and which also seals the encapsulated flange **104** of the rim segments during a subsequent molding operation. Since the structure **100** is used as a temporary holding fixture, one of the fusible alloys such as Cerrolow 117, an alloy comprising bismuth 44.7%, lead 22.6%, tin 8.3%, cadmium 5.3% and indium 19.1% as marketed by Cerro de Pasco Sales Corporation was chosen for the molding material **127**. This material has a melting temperature of 117° F. which is well suited for this application. Other materials could also have been used such as rubber, plaster, resin, epoxy, phenolic, etc., depending upon the ultimate use of the drum rim structure **100**.

When the molding material has hardened, the mold **101** is disassembled and the unitary drum rim structure **100** is removed from within the sleeve **105**. Next the drum rim structure is placed within a second mold, as illustrated in FIG. 5 to complete the method of fabricating a printing drum **129** which is illustrated in FIG. 6.

The second mold, as shown in FIG. 5, comprises a pair of end caps **133** and **135** which are placed over each end of the rim structure **100**. Both caps **133** and **135** have a coaxial aperture **139** to locate and support a mounting shaft **131**. Also, the top end cap **133** has a plurality of openings **141** therein to allow a permanent molding compound to be poured into the inner chamber of the rim structure. The bottom end cap has no other openings other than the shaft location aperture. Both caps **133** and **135** are coupled together through a series of bolts **137** placed outwardly of the structure **100**.

After the second mold is assembled, a permanent molding material **143** is poured into the chamber. By way of illustration in the fabrication of the printing drum **129**, the molding mixture **143** comprised:

28 parts by weight of Shell Epon Resin 815, an epichlorohydrin bisphenol A-type epoxy resin having an average molecular weight of approximately 330 and an equivalent weight of about 185 as marketed by Shell Chemical Co.,

12 parts by weight of Genamid 250, a fatty amidoamine resin having an amine value of approximately 425 as marketed by General Mills, Co., which is the hardener, and

60 parts by weight of Reynolds Aluminum #200, a filler comprising 98% pure aluminum powder and 2% impurities.

This mixture provides a strong bond between the rim segments **103** and the shaft **131** and with the aluminum filler, the shrinkage is reduced to an acceptable amount. This step is illustrated in FIG. 10.

After the molding mixture **143** has cured the end caps **133** and **135** are removed. Next, the dissolvable molding material **127** is removed from the periphery of the drum. By using Cerrolow 117, this step is carried out by immersing the unit in a water bath at a temperature above 117° F. which is the melting point of the material. With the material **127** removed, the drum is complete as is illustrated in FIG. 6, and this step is illustrated in FIG. 11.

It is to be realized that the molding materials and mixtures are by way of illustration only and not a limitation to the invention. The range of fusible alloys is great and one consideration used in selecting a particular alloy is its melting temperature. The particular molding mixture selected also determines in part the alloy to be selected.

because of the exothermic reaction of the mixture during curing and its effect on the alloy.

Referring to FIGS. 12 through 17, there is shown and illustrated a fixture-mold and the steps of another embodiment of the method. The fixture-mold **155**, shown in FIG. 12, is used to locate and hold a plurality of discs **149** in a predetermined spaced relationship for fabricating into a drum-like structure **169**, which is shown in FIG. 13. The discs **149** have a plurality of type faces or characters **150** spaced around the periphery so that the ultimate result of the method is a finished type drum **147**, shown in FIG. 15.

The fixture-mold **155** is of sectional construction comprising a first end plate **163**, a sectional sleeve **159** and **161**, a second end plate **165** and an end cap **167**. The several sections of the mold **155** are fastened together by any suitable means such as screws and bolts. The two end plates **163** and **165** and the sectional sleeve **159** and **161** when fastened together, form a cylindrical fixture cavity or chamber and an annular molding cavity or chamber within the fixture into which the several discs **149** are placed and held.

In the cylindrical fixture cavity, each disc is located and held by three projections **174, 175,** and **176** which extend from the inner walls **171** and **173** of the sleeve sections. These projections are angularly spaced apart about the axis of the cavity with one projection **174** located on the inner wall **173** of the sleeve section **161** at the apex of the section. The other two projections **175** and **176** extend from the inner wall **171** of the other sleeve section **159**. In the present embodiment, the projections **174, 175,** and **176** are basically shaped in the form of frustum of a cone with an impression of a type character formed in the outboard surface. The type face **150** on the disc **149** is located within the impression on each projection and securely held thereby. The axial distance between projections corresponds to the center to center distance "A" of adjacent type along a row of type. The length of the projections from the inner walls determines the amount of molding material **156** which will overlie and encapsulate the type faces **150**.

With both end plates **163** and **165** fastened to the sleeve section **159** which has two projections **175** and **176** per disc, the desired number of discs are loaded by positioning the correct type face on each projection **175** and **176** lying within a given circular plane of the cavity. After all the discs are loaded, the other sleeve section **161** is positioned over the discs and fastened between the two end plates **163** and **165**.

The second end plate **165** has a plurality of ports or apertures **181** equally spaced in an angular relationship about the center of the plate. The radical distance to the apertures **181** is such as to position them substantially above the type faces **150** of the discs **149**. It is through these apertures that the molding material **156** enters into the annular molding cavity.

The end cap **167** provides an inlet cavity to the mold **155**. The cavity is defined by an endless conical surface **177** extending from the inlet aperture **179** to the surface of the second end plate **165**. The diameter of the cavity at the end plate or flared end of the cavity is equal to or greater than the diametric distance spanning two apertures **181**; thereby each aperture is wholly within the conical inlet cavity. The end cap **167** is securely fastened over the second end plate **165** forming the completed fixture-mold **155** containing the discs therein.

The next step in the method is to cause the mold **155** to rotate about its axis. This may be accomplished by coupling the mold to the axis of a motor or any similar rotating shaft.

During rotation, a predetermined amount of molding material **156** is introduced into the mold through the inlet **179**. The tapered sides **177** of the inlet chamber direct the material toward the apertures **181**. The material **156** is placed in rotation in the chamber and when the material reaches the apertures, it enters therethrough into the annular molding cavity under rotation and does not splash against the discs **149**. With the apertures **181** so positioned, the material is directed into the annular cavity without touching the discs in the fixture chamber where the material is not to be molded. The reason for avoiding contact with surfaces that are not to be molded, is to prevent contamination which may be detrimental to any subsequent operations. The radial thickness **157** of the rim depends upon the amount of material **156** which is introduced into the inlet **179**.

The purpose of the molding material **156** in such a drum structure **169**, as shown for example in FIG. 13, is to provide a temporary holding fixture which holds the discs together unaided and which also seals the encapsulated type faces **150** of the discs during a subsequent molding operation. Since the structure **169** is used as a temporary holding fixture, one of the fusible alloys, such as Cerrolow 117, an alloy comprising bismuth 44.7%, lead 22.6%, tin 8.3%, cadmium 5.3% and indium 19.1%, as marketed by Cerro de Pasco Sales Corporation was chosen for the molding material. This material has a melting temperature of 117° F. which is well suited for this application. Other materials could also have been used such as rubber, plaster, resin epoxy, phenolic, etc., depending upon the ultimate use of the drum structure **169**.

When the molding material has hardened, the mold **155** is disassembled and the unitary drum structure **169** is removed. Next the drum structure is placed within a second mold, as illustrated in FIG. 14 to complete the method of fabricating the printing drum **147** which is illustrated in FIG. 15.

The second mold, as shown in FIG. 14, comprises a pair of end caps **182** and **183** which are placed over each end of the drum structure **169**. Both caps **182** and **183** have a coaxial aperture **187** to locate and support a mounting shaft **151**. Also, the top end cap **182** has a plurality of openings **189** therein to allow a permanent molding compound **191** to be poured into the inner chamber of the drum structure. The bottom end cap **183** has no other openings other than the shaft location aperture. Both caps are coupled together through a series of bolts **185** placed outwardly of the drum structure **169**.

After the second mold is assembled, a permanent molding material **191** is poured into the chamber. By way of illustration in the fabrication of the printing drum **147**, the molding mixture **191** comprised:

28 parts by weight of Shell Epon Resin 815, an epichlorohydrin/bisphenol A-type epoxy resin having an average molecular weight of approximately 330 and an equivalent weight of about 185, as marketed by Shell Chemical Co.,

12 parts by weight of Genamid 250, a fatty amidoamine resin having an amine value of approximately 425, as marketed by General Mills, Co., which is the hardener, and

60 parts by weight of Reynolds Aluminum #200 a filler comprising 98% pure aluminum powder and 2% impurities.

This mixture provides a strong bond between the discs **149** and the shaft **151** and with the aluminum filler, the shrinkage is reduced to an acceptable amount. This step is illustrated in FIG. 16.

After the molding mixture **191** has cured the end caps **182** and **183** are removed. Next, the dissolvable molding material **156** is removed from the periphery of the drum. By using Cerrolow 117, this step is carried out by immersing the unit in a water bath at a temperature above 117° F. which is the melting point of the material. With the material **156** removed, the drum is complete as is illustrated in FIG. 15 and this step is illustrated in FIG. 17.

It is to be realized that the molding materials and mixtures are by way of illustration only and not a limitation to the invention. The range of fusible alloys is great and for the most part, the main consideration used in selecting a particular alloy would be its melting temperature. The particular molding mixture selectsd also determintes in part the alloy to be selected because of the exothermic reaction of the mixture during curing and its effect on the alloy.

What is claimed is:

1. A method for making an article of manufacture comprising the steps of:

temporarily and individually holding for radial movement only a plurality of flat structural members, each having at least one straight edge, on separate radii of an axis of rotation with said straight edge outwardly from said axis and parallel thereto, said plurality being angularly and evenly spaced about said axis,

moving the temporarily held structural members radially under centrifugal force to locate said straight edges precisely in the form of a circular cylinder,

applying a predetermined amount of moldable material by centrifugal force between the precisely located structural members to complete the circular periphery of said cylinder, and

hardening the moldable material to join the structural members together as a unitary cylindrical structure.

2. A method for making a printing drum comprising steps of:

temporarily and individually holding for radial movement only a plurality of flat structural members, each having a type-bearing straight edge, on separate radii of an axis of rotation with said type-bearing edges outwardly therefrom,

said plurality being angularly and evenly spaced about the axis,

moving the temporarily held structural members radially under centrifugal force to locate the faces of the type precisely in the form of a circular cylinder,

applying a shell of moldable material by centrifugal force between the precisely located type-bearing structural members to complete the circular periphery of the cylinder,

hardening the moldable material to join the structural members together as a unitary cylindrical structure,

temporarily closing one end of the unitary cylindrical structure to form a cavity therein,

filling the cavity with bonding material not adhering to the molding material,

curing the bonding material, and

removing the temporary closure and the molding material to form a printing drum.

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ROBERT F. WHITE, Primary Examiner

A. M. SOKAL, Assistant Examiner

U.S. Cl. X.R.

264—262, 264, 277, 311, 317

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,529,054 Dated September 15, 1970

Inventor(s) Neal Hepner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 21 should read --in rows parallel--.
Col. 3, line 38 should read --fixture cavity--.
Col. 3, line 41 should read --end plate 109--.
Col. 3, line 60 should read --which is generated--.
Col. 3, lines 69 & 70 delete --it enters therethrough into the annular molding the apertures,--.
Col. 4, line 20 should read --resin epoxy--.
Col. 5, line 51 should read --The radial distance--.
Col. 7, lines 2 & 3 should read --also determines in--.

SIGNED AND
SEALED
NOV 24 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents