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Tramposch

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[54] **METHOD OF MAKING PRINTING DISC**

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[52] **U.S. Cl.** **29/418;** 156/73.1; 156/293; 197/53; 264/248

[51] **Int. Cl.**[2] **B23P 17/00**

[58] **Field of Search** 29/418, 525, 527.1; 197/53, 6.7; 101/401.1, 401.2, 368; 264/248, 138; 156/73.1, 293

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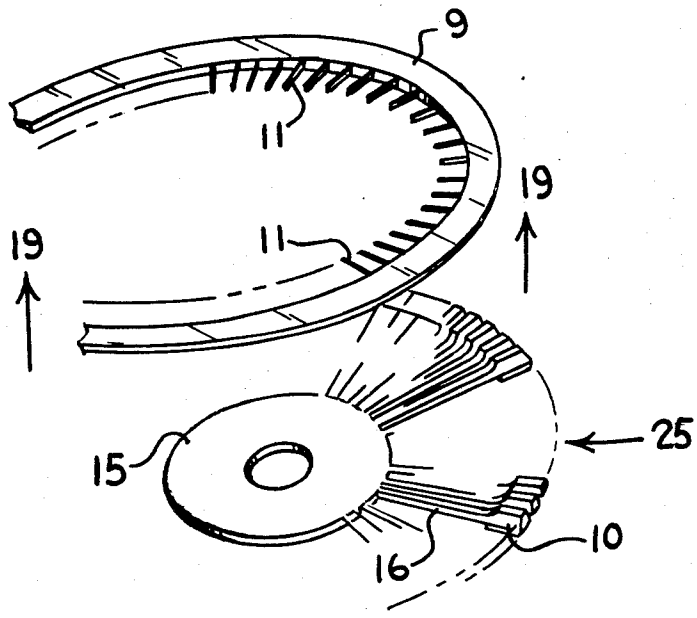
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[57] **ABSTRACT**

A composite of several materials constructed to form a printing disc, of the type used in high speed printers. The printing disc is manufactured in separate stages in order to achieve characteristics within the final assembly that are necessary for high speed quality printing. The assembled printing disc comprises a disc shaped member of flexible plastic. The hub of the disc has radially extending arms which each unite with a print head base member. The print head base member is plated with a layer of metal.

10 Claims, 5 Drawing Figures



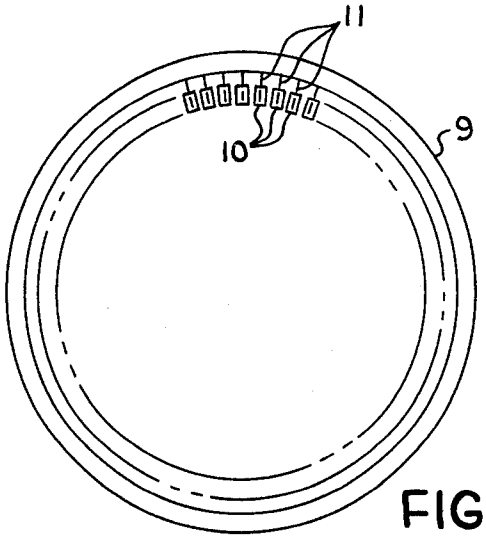


FIG. 1

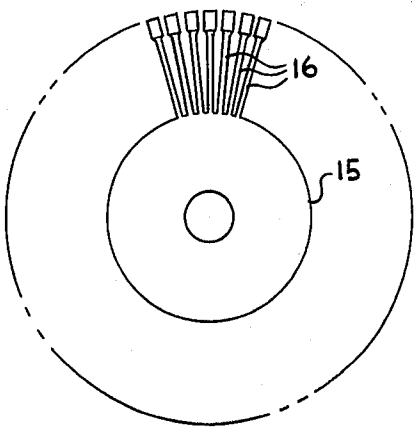


FIG. 2

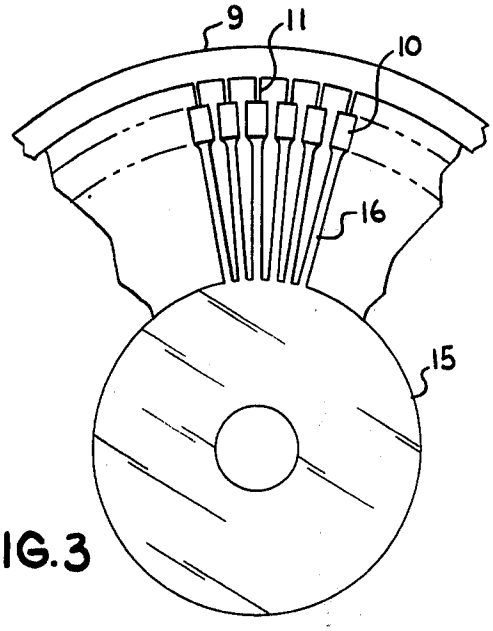


FIG. 3

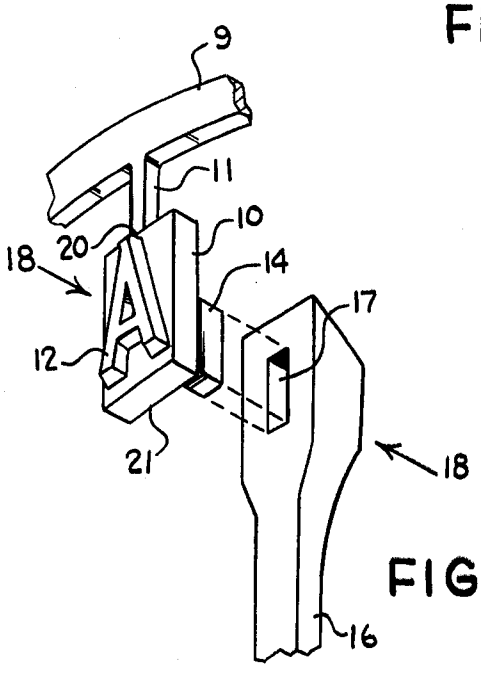


FIG. 5

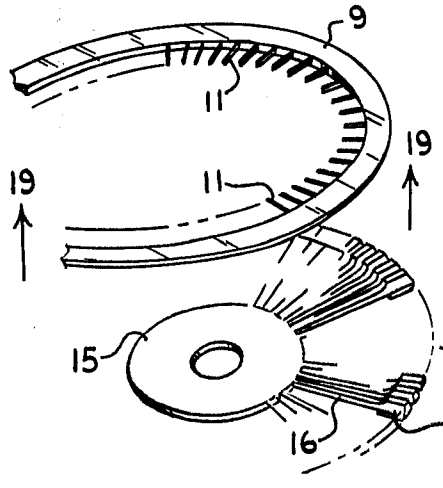


FIG. 4

METHOD OF MAKING PRINTING DISC

This invention pertains to a method of manufacturing a printing disc, to the finished printing disc article, and more particularly to a composite printing disc assembly that obtains the necessary characteristics for high speed quality printing.

BACKGROUND OF THE INVENTION

In order to achieve a high speed printing disc, it is necessary to make the arms of the disc very flexible and light in weight so as to accommodate rapid printing impacts. Many flexible and light weighted plastics are available for this purpose. However, if a high quality of printing is also a requirement, then it is necessary to have the character face of each arm of the disc composed of a material that is hard and durable. As used herein, the term "hard" or "hard plastic" is to mean a material having a high value for Young's Modulus and a high compressive strength.

Because the material requirements for high speed printing and quality printing are diametrically opposite, a compromise was originally sought for the disc material.

Many tests, however, proved that no adequate compromise could be made. Neither was it found possible to plate over the character surface of the arms without substantially destroying the crispness of the character image.

Furthermore, the method of electroforming a metallic cover upon the flexible plastic character head was not entirely satisfactory, because serious cracking developed in the metal after a relatively small number of impacts.

A pure metal print head attached to the plastic arm was not satisfactory. The metal print head had the necessary structural strength, but weighed too much for high speed printing.

The present inventive composite printing disc assembly seeks to achieve the objective of providing a disc that can operate at high speeds and deliver a high quality of printing.

SUMMARY OF THE INVENTION

The invention is a plastic and metal composite assembly structured in a novel manner. The print disc hub with its radially extending arms is composed of a flexible plastic such as acetal homopolymer or acetal copolymer. The printing characters are each disposed upon individual print head base members which are fastened to the ends of the arms. The base members are composed of a hard durable plastic such as a glass-filled polysulfone or urea. The character faces on each print head member are plated with a **0.001** inch layer of metal. The metallic plating may consist of a flashing of copper covered over by a layer of nickel, and a final coating of chrome.

The aforementioned assembly is constructed by first injection or compression molding an annular shaped ring having a font of characters extending inwardly therefrom. The characters are individually disposed upon a print head base which also contains an interlock extension.

Next, the printing disc base is injection molded. The arms contain an aperture in their end portions for receiving a respective interlock extension. The interlock extensions are generally press-fitted into the apertures. The area surrounding the apertures can be heated before or after the insertion of the interlock extensions causing a softening of the plastic, thus resulting in a secure fit. The plastic may be heated by conventional means or by the use of ultrasonics.

After the base members are connected to the arms of the disc, the annular ring is removed from the plastic composite structure by a cutting operation.

It is an object of the invention to provide an improved printing disc;

It is another object of this invention to provide a novel compositely assembled printing disc, and a method of making same;

It is still a further object of the invention to provide a high speed printing disc providing a high quality of printing.

These and other objects of this invention will become more apparent and will be better understood with reference to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a plan view of a first molded member of the printing disc composite assembly of this invention, comprising an annular ring containing a font of characters;

FIG. **2** is a plan view of a second molded member of the printing disc composite of this invention comprising a disc shaped base having radially extending arms;

FIG. **3** is a plan view of the first and second molded members joined together;

FIG. **4** is a partial perspective view of the compositely assembled printing disc of the invention with a portion of the first molded member just having been removed therefrom; and

FIG. **5** is an enlarged perspective view of the interlocking of typical print head with a corresponding arm of the disc shaped base.

Generally speaking, the invention is for a printing disc assembly constructed of a composite of structural members. The composite assembly comprises a disc shaped member having a plurality of flexible arms extending outwardly from a hub portion of the disc member. A plurality of print head base members are annularly arranged with respect to each other and each are respectively secured to a corresponding flexible arm at its end portion. The print heads each have a character face, and a bonding surface which is secured to the arm.

Now, referring to FIG. **1**, a first injection or compression molded member is shown. This member can be molded from filled materials such as: (a) polysulfone; (b) urea; (c) nylon; (d) epoxy; (e) phenole; and (f) melamine. This first molded piece has an annular ring shaped section **9**, and a plurality of inwardly extending print head base members **10**.

A typical print head base member **10** can be seen in FIG. **5**. The print heads are attached to the ring **9** by means of finger **11**.

The print heads have a character face **12** on one side, and an interlocking extension **14** on the other side.

FIG. **2** shows a second injection molded disc shaped member having a hub **15** and a plurality of flexible, radially extending arms **16**. The ends of the flexible arms each contain an aperture **17** as shown in FIG. **5**. The interlock extensions **14** of the print heads **10** are generally press-fitted into the apertures **17** of the flexible arm members **16** as shown by arrows **18** in FIG. **5**. The resulting composite assembly is shown in FIG. **3**.

The second molded member can be injection molded from materials such as: (a) acetal homopolymer; (b) acetal copolymer; and (c) polypropylene.

The materials for the disc shaped member must be highly flexible so as to withstand many printing impact cycles.

The materials for the print heads must be hard and durable so as to provide a high printing resolution.

After press-fitting the print heads **10** and the arms **16**, the area around the resulting interlock can be heat treated to soften the plastic and provide a tighter fit. Also, the plastic about the aperture and/or the interlock extension can be heated for a short period of time prior to insertion of the extension **14** into the aperture **17** to provide greater holding strength. If the first molded member is molded from a acetal homopolymer, then the area around the aperture is heated to about **300°F.**, which is the temperature at which this material softens. Care must be exercised, so as not to overheat the material to about **320°F**, which is the point at which acetal homopolymer starts to deform. When the two interlocking parts are heat treated so that one or both of the plastics begin to soften, the holding strength of the interlock will be enhanced.

Heating the plastics can be performed in a conventional manner, or by the use of ultrasonics to create heat within the material.

After the two separately molded members of FIGS. **1** and **2** are joined together, (FIG. **3**) the annular ring **9** is removed from the disc shaped member (arrows **19** of FIG. **14**) by cutting the fingers **11** from the print heads **10**, generally about point **20** (see FIG. **5**).

The resulting assembly is a completed composite printing disc (arrow **25**) of FIG. **4**.

The print heads **10** are each plated with a layer of metal for appearance purposes as well as for improving the durability of the character face **12**.

Obviously, other materials, and variations in the method steps or composite structure of the disc will occur to those skilled in this art. For example, the interlock extensions **14** of the print heads can be designed as a pin extension or a duality of pins extending from bonding surface **21** (FIG. **5**).

Therefore, the invention should not be limited in scope and spirit by any obvious modifications. The invention should be interpretted with respect to the appended claims.

What is claimed is:

1. A method of making a printing disc for use in a serial printing apparatus, comprising the steps of:

A. molding a first member comprising an annular shaped ring member having a font of characters extending inwardly therefrom, each character disposed upon an individual print head base member, said base member having a character face and a bonding face disposed from said character face, said bonding face containing an interlock extension extending outwardly therefrom;

B. molding a second member comprising a disc shaped base having a radially extending plurality of arms, one arm for each base member, said arms each containing an aperture in an outer extending end portion thereof for receipt of a corresponding interlock extension of a respective character base member;

C. interlocking said plurality of arms each with a corresponding base member by inserting each respective interlock extension into a corresponding arm aperture to form a composite structure between said first and second members; and

D. removing the annular shaped ring member from the resulting composite structure to form a printing disc.

2. The method of making a printing disc of claim **1**, wherein said first molded member is injection molded.

3. The method of making a printing disc of claim **1**, wherein said first molded member is compression molded.

4. The method of making a printing disc of claim **1**, wherein said second molded member is injection molded.

5. The method of making a printing disc of claim **1**, further comprising the step of:

E. plating said first molded member with a layer of metal at least about the character faces of said base members.

6. The method of making a printing disc of claim **1**, wherein the interlocking of said plurality of arms with said respective base members further includes the step of ultrasonically bonding the arms and base members together after inserting said interlock extension into a corresponding arm aperture.

7. The method of making a printing disc of claim **1**, wherein the interlocking of said plurality of arms with said respective base members further includes the step of heating an immediate area surrounding the apertures to bond the arms and base members together after inserting said interlock extensions into their corresponding arm apertures.

8. The method of making a printing disc of claim **1**, wherein the interlocking of said plurality of arms with said respective base members is accomplished by press-fitting the interlock extensions into their corresponding apertures.

9. A method of making a printing disc for use in a printing apparatus; comprising the steps of:

A. molding a first disc shaped member having a plurality of radially extending flexible arms;

B. molding a second member having a general annular configuration, and including a plurality of interconnected radially extending character printing types, the number and relative positions of said printing types corresponding to that for the number of radially extending flexible arms;

C. securing said second member to said first member by connecting each of said printing types about respective corresponding outer ends of each of said flexible arms; and

D. severing said second member at a plurality of points so that each of said character types is capable of independent movement with its associated arm through a printing stroke.

10. A method of making a printing disc for use in a printing apparatus, comprising the steps of:

A. forming a first disc shaped member of flexible material, said disc shaped member having a plurality of radially extending flexible arms, said arms each having an end portion for receipt of a corresponding charcter element;

B. forming a second member comprising a plurality of individualized but connected character elements, said second member being composed of a durable hard material of a hardness which is relatively harder than said flexible material;

C. securing the first and second member together by joining each character element with a respective flexible arm end portion; and

D. removing material from said second member so as to provide a composite printing disc assembly having character elements which are mutually separated and capable of independent movement through individual printing strokes.

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