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(54) A print wheel container assembly

(57) A print wheel container assembly 14 includes an abutment 52 for slightly deflecting all the petals 18 of a print wheel 12 to a common axial alignment relation while the print wheel is stored in the container, and over a period of storage time, the petals become set to remain substantially in common axial alignment when the print wheel is removed from the container.

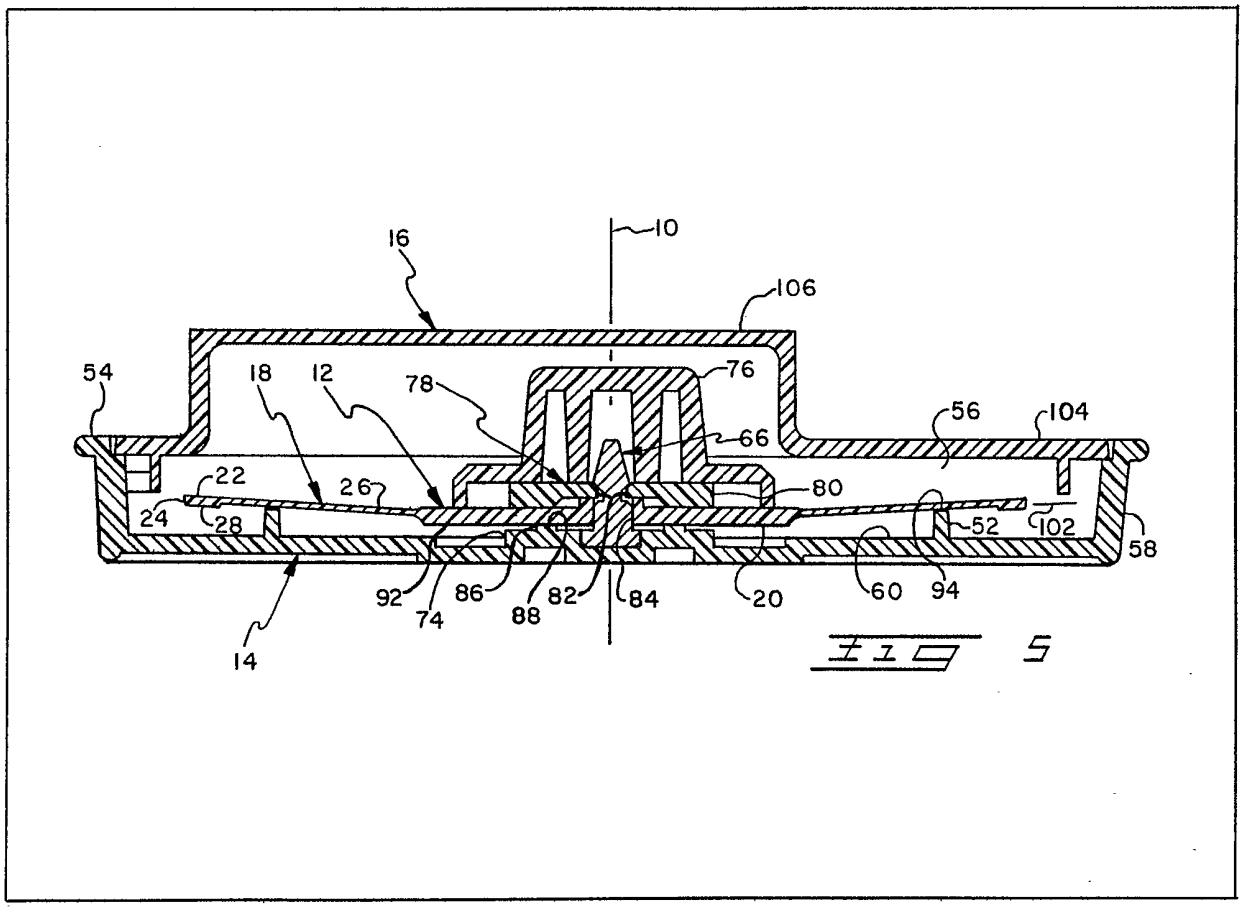

Fig 5

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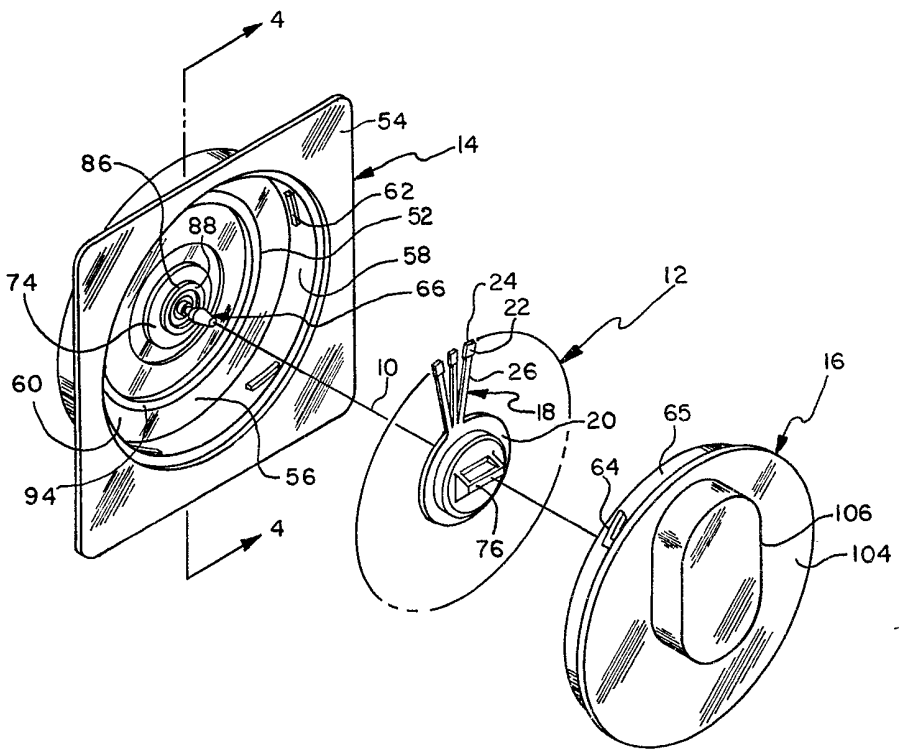

Fig 1

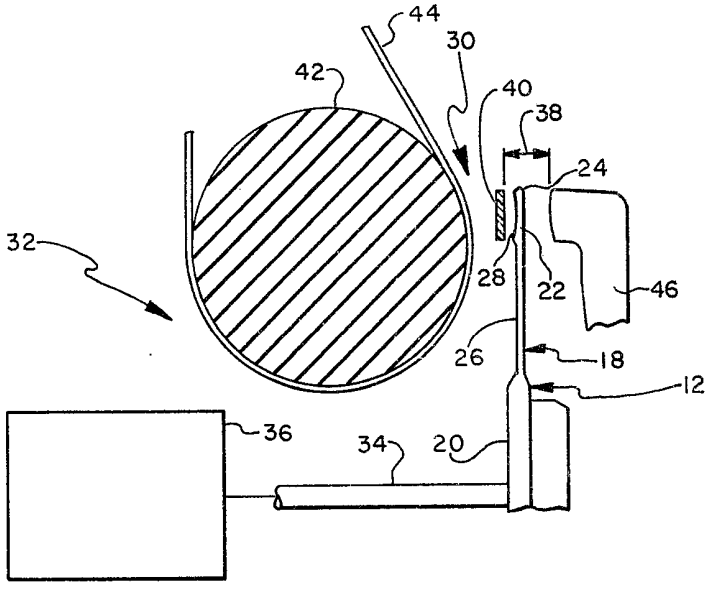

Fig 2

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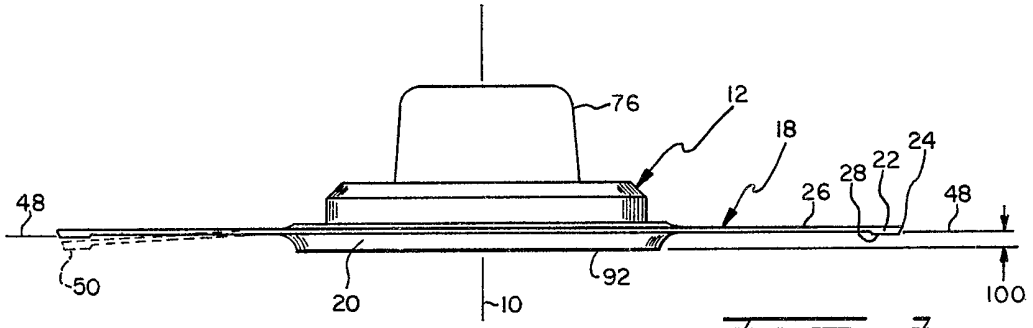

FIG 3

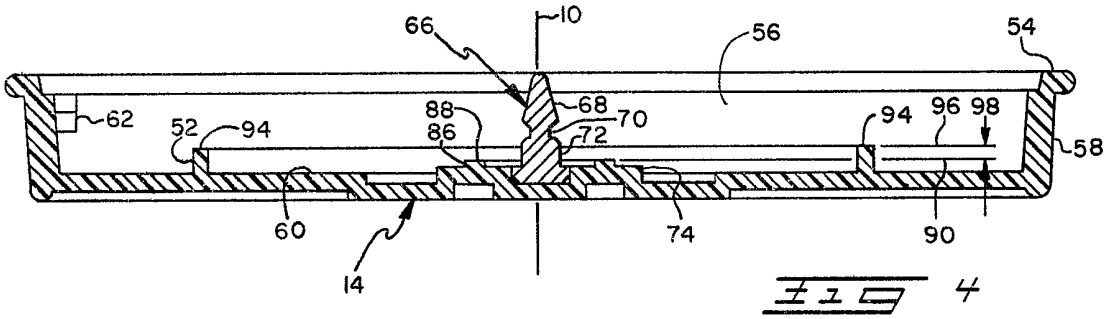

FIG 4

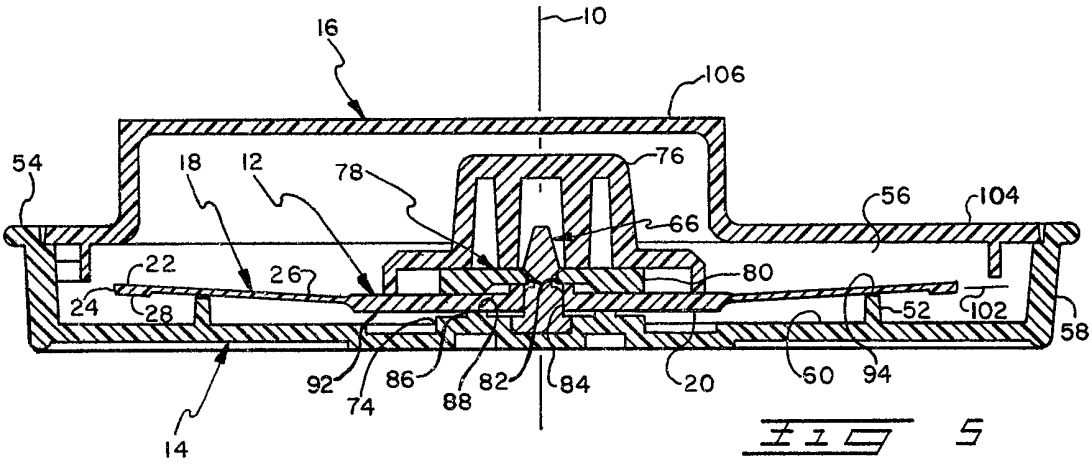

FIG 5

SPECIFICATION

A print wheel container assembly

The present invention relates to a print wheel container assembly for storing a print wheel having elastic deflectable petals. More particularly, this invention concerns a structural arrangement in the container serving to support all petals of the print wheel in common axial alignment during periods of storage.

In the field of impact printing devices, e.g., serial printers, typewriters and the like, it is well known to employ a wheel or disc-type print element commonly termed in the art a "daisy" wheel. These wheels are constructed from thin discs of resilient plastics or metal material. Print wheels are generally characterized by having a plurality of elastic petals radially extending from a central hub. An enlarged pad is located at the terminus end of substantially all petals, (some petals may have their pads omitted to form a window for visibility purposes) the pad serving to support a type character embossed on one face thereof. The arm portion of the petal, connecting the pad to the hub, is relatively thin for flexibility to perform impact printing.

In the printing machine, the print wheel is rotated during the character selection process thereby causing the character bearing pads of the petals to rotatably pass through a gap at the printing station. This gap is usually defined on one side by a ribbon proximate a platen supporting a sheet of paper and on the other side by a hammer used to deflect the selected petal towards the platen. For rapid typing speed and good print quality purposes, the gap is made relatively narrow so as to minimize the required deflection of the pad to the platen. Accordingly, to provide equal throw among all petals and to avoid the possibility of rotating petals becoming snagged, e.g., with the ribbon, it is extremely important that the petals of the print wheel be in a relative common alignment relationship, e.g., lying in one plane.

Though print wheels are manufactured with petals that are intended to be commonly aligned, even alignment is difficult to maintain along all petals which usually number in the range between 88 and 96 petals on the print wheel. One reason found contributing towards petal misalignment or deforming is attributed to internal stresses that may deflect petals during the cooling process in moulding print wheels. Another reason found to cause the petals to deform relates to the manner by which print wheels are stored for prolonged periods of time when not in use in the printing machine. Print wheels are conveniently stored to rest on a plane perpendicular to their central axis. The petals extend freely outward in cantilever fashion during storage periods. Consequently, the unsupported petals are continually being subjected to the pull of gravity which constant pull, over a period of time, causes the petals to bend downwardly under the weight of the enlarged pad carried at the terminus end of each petal, and subsequently to retain this deformed shape.

The purpose of the present invention is to overcome the problem of uneven or deformed petals on a print wheel.

Accordingly, the present invention provides a print wheel container assembly for storing a print wheel of the type having a central mounting structure and a plurality of petals extending therefrom, the container assembly including attaching means co-operable with the mounting structure of the print wheel for detachably retaining the print wheel in the container assembly, and abutment means arranged to support uniformly the plurality of petals relative to said attaching means when the print wheel is stored in the container assembly.

In a preferred embodiment of the invention, a circular rib uniformly projects upwardly from a base wall of the print wheel storage container. Assembly of the print wheel to the container causes the rib to engageably support all the petals. The rib deflects the petals under a constant tensional load so that, after a period of time, the petals remain set in common axial alignment, when the print wheel is removed from the container.

In order that the present invention may be more readily understood, an embodiment thereof will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is an exploded view, in perspective, showing component parts comprising a print wheel container assembly according to the preferred embodiment of the present invention;

Figure 2 is a side elevational view showing the print wheel in a suitable printing machine for the purpose of illustrating the relationship among parts at a printing station that define a gap through which petals of the print wheel rotate;

Figure 3 is a side elevational view isolating a print wheel showing cantilever petals in a plane with a deformed petal represented in dashed lines;

Figure 4 is a side elevational view, in section taken along line 4—4 of Figure 1; and

Figure 5 is a cross sectional side elevational view, similar to Figure 4, showing the assembled relationship among component parts comprising the preferred embodiment of the present invention.

Referring to Figure 1, component parts comprising a print wheel container assembly according to the present invention are shown in an exploded perspective view arranged along a common axis 10 prior to assembly. Generally, the present assembly includes main components comprising a print wheel 12 and a container 14. A lid 16 is also shown along axis 10 for lock connection to the container 14 so as to protectively cover the assembled print wheel 12.

Print wheel 12 is composite structure prominently characterized by a plurality of spokes or petals, commonly denoted by numeral 18, that radially extend from a central hub portion 20. Individual petals 18 include a pad 22 carried at a terminus end 24 of a beam or arm 26 that

connects pad 22 to hub 20. The pad 22 is enlarged, with respect to the thin elongated arm 26, to provide sufficient surface area for supporting of an embossed type character 28 thereon, as is profiled in the Figures 2, 3 and 5.

To fully appreciate the significance of the present invention, a brief description is given now relating to the general relative arrangement of the print wheel 12 to component parts at a printing station 30 in a suitable printing machine 32. In Figure 2, print wheel 12 is axially coupled to rotate with a selector shaft 34 that is rotatably driven by a suitable motor 36 e.g., stepper motor or the like. Petals 18 emanate from hub 20 for vertical radial support of pads 22 at the printing station 30. Pads 22 are supported for horizontal alignment so they are located to pass through a space gap 38 defined on the left side by a ribbon 40 proximate a platen 42 supporting a sheet of paper 44 and on the right side by a print hammer 46. Print hammer 46 is pulse operable, by a remote connected power source such as a solenoid (not shown), for stroke movement whereby hammer 46 is propelled in a substantially straight path towards and away from platen 42 for printing.

In the printing operation, print wheel 12 is rotated by motor 36 to align a particular selected character 28 at printing station 30 within gap 38. Print hammer 46 is then propelled quickly towards platen 42. Pad 22 of petal 18 is pushed by hammer 46 thereby causing arm 26 to bend about hub 20 until character 28 impacts paper 44 through ribbon 40. After impact printing, hammer 46 is returned to the rest position of Figure 2. Typically, petals 18 are deformably elastic to accommodate repeated bending of arm 26 and self-restoring to the vertical position in gap 38 of Figure 2. Gap 38 is purposely made narrow so as to minimize deflection of arm 26 of petal 18 during printing and to promote rapid typing speed.

From the foregoing general description, particularly regarding the close relationship of petals 18 within gap 38, it is easily understood that common axial alignment among all petals 18 of print wheel 12 is extremely important. Evenly aligned petals 18 provide equal deflection for all petals 18 to platen 42 which equal deflection is needed to produce uniform printing among all type characters 28. Additionally, the absence of misaligned petals 18 reduces the possibility of petals 18 snagging printing machine components e.g., ribbon 36, proximate gap 38 during selective rotation of print wheel 12.

Referring to Figure 3, heretofore some petals 18 of print wheel 12 have been noted to extend in a defiected relationship from a substantially common plane 48 as illustrated by dashed lines 50. Thus, these deflected or deformed petals 50 are misaligned with respect to straight petals 18 extending along plane 48. It should be pointed out that the dashed representation of a deflected petal at 50 is an illustrated example and that other petals may be deflected at any location about hub 20 and at differently deflected relations with respect to plane 48. Deformed petals, e.g., like dashed lines 50, have sometines been observed to be present upon completion of the manufacture moulding process. These deformed petals 50 are believed to be caused as a result of internal stresses deflecting arms 26 during the hardening process of the mouldable elastic material. It is also observed that the deformed petals 50 deflect in the same axial direction away from common plane 48 which direction is according to the dashed line example 50 of Figure 3. Another reason causing the petals 18 to become deformed is attributed to the general manner print wheels are stored when removed from service in the printing machine. In this regard, print wheels 12 are generally stored (for convenience of stacking) to rest on the hub 20 perpendicular to axis 10 with petals 18 freely extending outward in cantilever fashion. The free petals 18 are continually subjected to the pull of gravity. This gravity action is noted to cause the petals 18 to seek a relaxed state beyond the elastic limit thereby causing a permanent set. Any attempts to structurally reinforce the petals 18, such as a strengthening rib or the like, would reduce the elasticity of the arms 26.

It has been found that the foregoing problem can be solved by providing structure for supporting the petals 18 against the pull of gravity during periods of storage. Moreover, by supporting the petals 18 under a pretensional load, the petals 18 will deflect under the stress so as to relax in the supported position wherein the petals 18 continue to lay in a common plane when disassociated from the support structure. The petal supporting structure is preferably an abutment in the form of a raised circular rib or ring 52 embodied in print wheel container 14 as described below with reference being made to Figures 1, 4 and 5.

In Figure 1, container 14 is preferably made from a rigid mouldable plastics material including a square shaped flange 54 having a circular shaped cavity 56 defined by an upstanding circular wall 58 extending from a bottom wall 60. Cavity 56 is sized so as to easily accommodate therein print wheel 12. Angular projections 62 extend inwardly towards axis 10 from upstanding wall 58 within cavity 56 at spaced locations. These projections 62 cooperate with similar opposing angular constructions 64 (only one being visible) formed on the outer surface of circular side wall 65 of lid 16 for removably attaching lid 16 to container 14. A print wheel mount pin or post 66 includes a con pointed head 68 and a neck 70 connected to a cylindrical shaft 72, as best viewed in Figures 4 and 5. Pin 66 is a metal component so as to provide rigidity and resist wear is firmly attached, e.g., by a suitable known manufacturing technique, such as sonic welding, to a platform 74 centrally located on bottom wall 60 along axis 10.

Referring to Figure 5, hub 20 of print wheel 10 rigidly supports a substantially hollow finger-grip cap 76. A mounting structure 78 including a yieldable member 80 is housed within the

hollowed portion of cap 76. Opposing jaws 82 of yieldable member 80 are axially held aligned with a central hole 84 through hub 20. Yieldable member 80 is resiliently expandable within cap 76 so that jaws 82 are allowed to operatively clamp about neck 70 of pin 66.

A raised ring shape projection 86 being concentric about axis 10 extends upwardly from platform 74. A flat top surface 88 of ring projection 86 defines a planar surface 90 which is perpendicular to axis 10. Ring projection 86 is radially spaced about pin 66 for alignment with a flat surface 92 of hub 20.

A ring abutment 52 is integrally formed from bottom wall 60 and is concentric about axis 10. Ring abutment 52 is radially spaced further from pin 66 than ring projection 86 for alignment with arms 26 of petals 18. A flat top surface 94 of ring abutment 52 defines a second or support plane surface 96 of container 14. Plane surface 96 is parallel to and vertically raised with respect to plane surface 90 as denoted by arrows 98 in Figure 4.

As shown in Figure 3, lower flat face surface 92 of hub 20 is parallel to and vertically below common plane 48 of petals 18 by arrows 100. The misalignment differential 98 of container 14 is slightly greater than the spaced differential 100 between flat face surface 92 and common plane 48 of print wheel 12. Namely the surface 94 (plane 96) is vertically above the plane 48 of petals 18.

Assembly of print wheel 12 onto pin 66 in recess 56 of container 14 is accomplished by applying a pushing force to cap 76 along axis 10 with central hole 84 through hub 20 aligned to receive pin 66. During assembly, print wheel 12 is snapped to the assembled position of Figure 5 through the resilient action of jaws 82 riding over cone pointed head portion 68 to clamp hold about neck 70 of pin 66. In the assembled position of Figure 5, flat face surface 92 of hub 20 is supported in abutting relation on flat top surface 88 of raised ring projection 86. Thus, hub 20 of print wheel 12 rests along planar surface 90 perpendicular to axis 10. Print wheel 12 is held firm in the assembled position through the gripping clamp action from jaws 82. The unequal vertical differential spacing between 98 of container 14 and 100 of print wheel 12 causes all petals 18 to engageably abut on flat top surface 94 of ring abutment 52. As an engaging consequence, all petals 18 are forced to deflect upwardly so they collectively extend along a common line 102. It should be noted that the angular deflection of petals 18 from common plane 48, exaggerated in Figure 5 for clarity, is minimal and within an acceptable deflection tolerance limit. In actuality the petals are bent at an angle less than 2° which amounts to approximately .010 inch deflection from plane 48 at pad end 22. The important concern is that the petals 18 are uniformly arranged while print wheel 12 is assembled for storage in container 14.

It was found that by continually stressing petals 18 in the above-described deflected assembly relation, the internal acting stress force will gradually reduce towards zero and, over a period of time, result in the petals 18 yielding to an equilibrium state. The gradual reduction of the stress force within petals 18 is attributed to internal dimensional changes from a cold-flow phenomenon known as "creep". Creep is known to occur within elastic property materials when subjected to constant or nearly constant stress loads. Additionally, the rate of creep in effecting dimensional changes along petals 18 is dependent upon time, temperature, the elastic property of the material and the magnitude of the stresses involved.

Referring to Figures 1 and 5, lid 16 has a disc shaped top 104 integrally supporting the side wall 65. Top 104 is sized to cover recess 56 of container 14. An elongated projection 106 extends outwardly from top 104 to serve as a handle for manual manipulation of lid 16. Projection 106 is hollow to accommodate clearance for cap 76 in the assembled relation of Figure 5. To assemble lid 16 onto container 14, lid 16 is positioned to cover recess 56 with angular projections 64 radially misaligned with respect to angular projections 62 of container 14. From this position, lid 16 is manually rotated clockwise to cause associated angular projections 62, 64 to overlap in wedging fashion.

The above description of a print wheel container assembly in which petals 18 of print wheel 12 are maintained uniformly aligned comprises a container 14 for storing print wheel 12 wherein elastic petals 18 of the assembled print wheel 12 are engaged with an abutment 86 integrally formed from the container 14. The abutment 86 uniformly aligns all petals 18 under stress so that prolonged periods of storage establish a common relation among the petals 18, which relation is maintained when the print wheel 12 is removed from the container 14.

It should be understood that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the scope of the invention as set forth in the appended claims.

CLAIMS

1. A print wheel container assembly for storing a print wheel of the type having a central mounting structure and a plurality of petals extending therefrom, the container assembly including attaching means co-operable with the mounting structure of the print wheel for detachably retaining the print wheel in the container assembly, and abutment means arranged to support uniformly the plurality of petals relative to said attaching means when the print wheel is stored in the container assembly.

2. A print wheel container assembly according to claim 1, wherein said abutment means engagingly supports said petals under a tensional load.

3. A print wheel container assembly according

to claim 1 or 2, wherein said abutment means is a ring projection carried by said container assembly and arranged to contact the print wheel petals.

4. A print wheel container assembly according to claim 1, 2 or 3, wherein said attaching means includes a first plane surface of said container assembly and said abutment means includes a second plane surface of said container assembly for supporting said petals.

5. A print wheel container assembly according to claim 4, wherein said first plane surface and said second plane surface are flat and extend in parallel relation to each other.

6. A print wheel container assembly according to claim 5, wherein said first and second plane surfaces are arranged such that said print wheel is releasably fixed to said container assembly along the central axis of said print wheel, and said first and second plane surfaces are perpendicular to said axis.

7. A print wheel container assembly according to claim 6, wherein said first plane surface is axially out of alignment with respect to said second plane surface.

8. A print wheel container assembly according to any one of claims 4 to 7, wherein the print wheel mounting structure includes a central hub carrying said plurality of petals, said container assembly having a base wall, said first plane surface being formed from said base wall and arranged to engageably support said hub, and said second plane surface extending from said base wall and arrange to engage said plurality of petals.

9. A print wheel container assembly according to any one of the preceding claims, wherein the attaching means and abutment means are arranged such that storage of the print wheel in the container assembly deflects the plurality of petals for uniform alignment thereof.

10. A print wheel container assembly according to claim 9, wherein each of the petals is deflected by no more than 2° from the plane of the wheel.

11. A print wheel container assembly according to any one of the preceding claims, including a detachably retainable lid.

12. A print wheel container assembly substantially as hereinbefore described with reference to and as illustrated in Figures 1, 4 and 5 of the accompanying drawings.

13. In combination, a print wheel container assembly according to any one of the preceding claims, and a print wheel having a central mounting structure and a plurality of petals extending therefrom.

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