Dec. 22, 1953 C. G. DUDIS 2,663,257

PRINTING WHEEL DEVICE

Filed March 22, 1951 2 Sheets-Sheet 1

FIG. 1

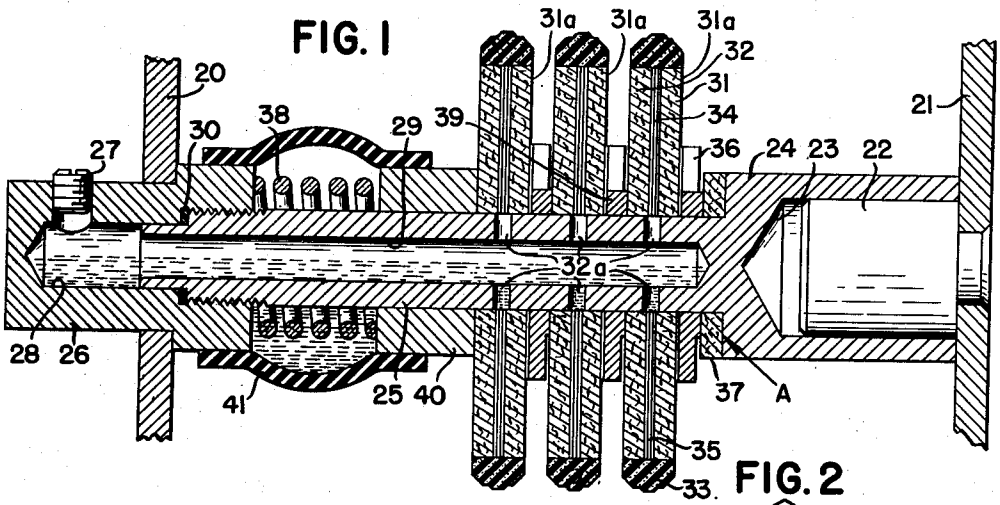


FIG. 2

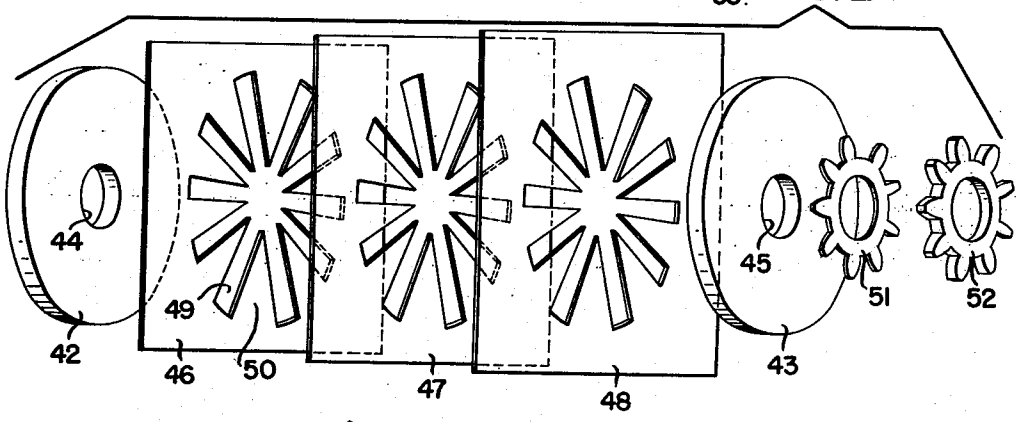


FIG. 3

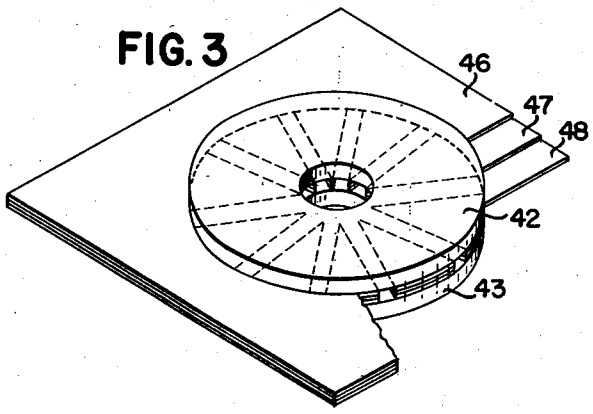


FIG. 4

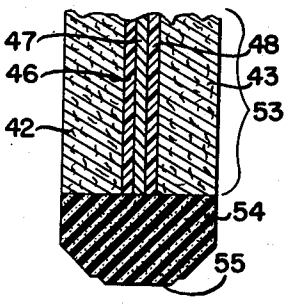


FIG. 5



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Dec. 22, 1953 C. G. DUDIS 2,663,257

PRINTING WHEEL DEVICE

Filed March 22, 1951 2 Sheets-Sheet 2

FIG. 6

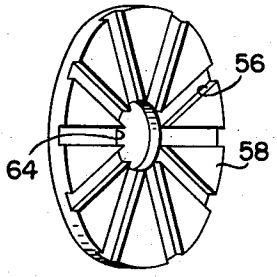


FIG. 7

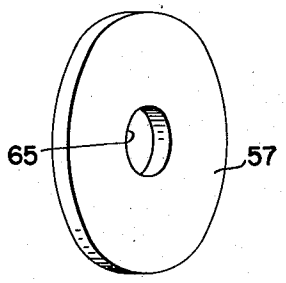


FIG. 8

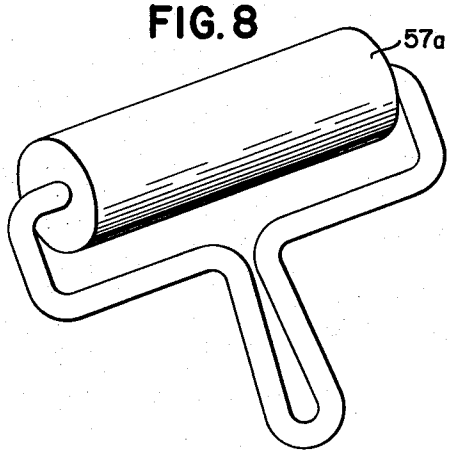


FIG. 9

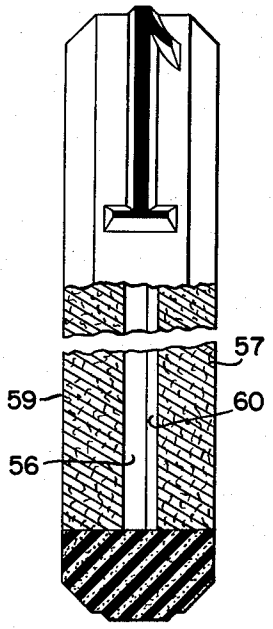
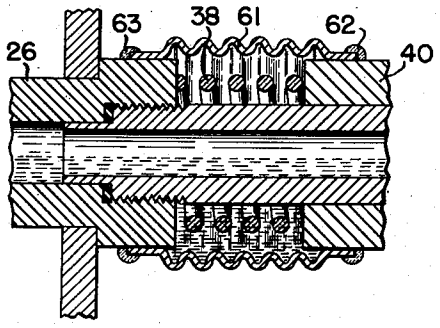


FIG. 10



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PRINTING WHEEL DEVICE

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Application March 22, 1951, Serial No. 217,024

29 Claims. (Cl. 101—327)

1

This invention relates to a printing wheel device, and particularly pertains to such a device having one or more printing wheels on a common axle and in which fluid ink may be fed to porous type on said printing wheels through axial and radial channels in the said axle, and through channels extending from the axial hole in a wheel to the porous type material on the periphery, without leakage.

It is known to provide ink-saturated porous type wheels, either fed from a font of ink within the wheel, as disclosed in United States Patent 2,199,265 to Lohrey, or fed from a font through radial holes in the axle as disclosed in United States Patent 2,262,884 to Compton.

One of the major problems in feeding ink to porous type on type wheels, either from the body of such wheels or through such wheels from ink fed thereto from the axle, is leakage. The ink tends to leak out at the axle bearing points and tends to drip from the wheel rim, due to the hydraulic static head existent at the axle hole and at the lower edge of the wheel. This invention eliminates such problems by providing adequate sealing means through a combination of axle-borne elements which cooperate with carbon-graphite and metal plates on the sides of the wheels mounted on said axle, and by providing adequate capillary control of the liquid being fed from the axle to the periphery of a wheel, so that dripping of ink will not occur. The invention may be used either with a single wheel on an axle or with a plurality of wheels grouped together on an axle, in close relation side by side.

The carbon-graphite plates, cooperating with the metal parts of adjacent wheels and on axle-borne collars and formations, form fluid seals that do not interfere with the rapid angular adjustment of said printing wheels.

The wheels themselves, which constitute a novel feature of the invention, each contain one or more capillary channels extending from the axial hole to the porous type rim, such channels being formed, in one form of the invention, by grooves cut on the inside surface of one of two non-porous carbon-graphite disk plates joined together face to face, and in another form of the invention such capillary channels are formed by spacing elements which themselves in some instances are bonding materials whereby the plates may be joined together, or in other instances where spacing elements are separate from the bonding material.

In the preferred form of the invention the porous type material which is bonded to the periphery of the central portion of a wheel fabricated of two carbon-graphite plates, is micro-porous, resilient rubber or artificial rubber, such as is described in United States Patent No. 2,392,521 to Chollar, such being heat moldable and vulcanizable to the rims of the carbon-graphite plates, specified, without the use of any intermediate bonding agent or adhesive. The carbon-graphite plates being non-porous and the bonding of the porous rubber type rim being directly to the graphite prevents any leakage of ink from the sides of the wheels, so made, except that which may appear at the bearing point of the wheel on the axle, because the micro-porous type material retains the ink in the rim by capillary action. Ink leakage at the axle bearing point of a wheel is confined by the novel sealing means, to be described, which uses the graphite-to-metal compression seal, the sealing characteristics of such combination of materials in parts rotating with respect to one another being well known. At either end of a group assembly of wheels or on either side of a single wheel if only one wheel is used, sealing collars are provided on the axle, in combination with a spring means, to confine the fluid ink and prevent it from leaking.

2

Therefore, it is an object of this invention to provide a printing wheel mechanism in which ink supplied to porous type on the wheel or wheels, through the supporting axle and from there through the interior of the wheel or wheels, is confined to said mechanism.

Another object of the invention is to provide such a mechanism in which escaped ink is controlled and confined to the mechanism by carbon-graphite to metal sealing of the wheels in a group on an axle, or by such sealing of one such wheel on an axle.

A further object of the invention is to provide a novel wheel construction for such a mechanism.

With these and incidental objects in view, the invention includes certain novel features of construction and combinations of parts, a preferred form or embodiment of which is hereinafter described with reference to the drawings which accompany and form a part of this specification.

Of the drawings:

Fig. 1 is a vertical axial section of a three-wheel embodiment of the invention, wherein the capillary channels in the wheel are formed by spacing and bonding material interposed between carbon-graphite plates of which the central portion of the wheels are fabricated.

Fig. 2 is a perspective diagrammatic view, in

exploded form, showing how the parts of a wheel of the device of Fig. 1 are fabricated.

Fig. 3 is a perspective view of the parts of Fig. 2 (except the gear) in assembled form, before trimming.

Fig. 4 is a radial transverse section through the outer half of one of the novel type wheels of the type shown in Fig. 1.

Fig. 5 is an edge view of one of the novel type wheels.

Figs. 6 and 7 are carbon graphite plates which may be bonded together without a separator, channels on the inner face of the plate (Fig. 6) providing the capillary formation.

Fig. 8 shows a typical roller for applying adhesive or other bonding media to the plate of Fig. 6.

Fig. 9 is an edge view of a wheel made with the plates of Figs. 6 and 7, with a transverse break and a radial section.

Fig. 10 shows a bellows type of seal for the compression spring seal in Fig. 1.

General description

Referring to Figs. 1, 2, 3, 4 and 5, there will be first described a three type wheel preferred embodiment of the invention wherein the capillary channels extending from the axial hole in a wheel through the central portion formed of carbon graphite plates, are determined as to size by the use of film spacing material and a bonding adhesive film material.

The embodiment of the invention shown in the above Figures 1 to 5, and also that embodiment shown in Figs. 6 to 10 inclusive, are designed for a numeral type wheel having ten digit-representing type characters arranged at equal angular distances around the wheel and, for that reason, ten capillary channels are provided for each wheel, each capillary channel leading from the axial hole to a type character point on the rim. Such channels need not necessarily be radial in nature but may take any direction wanted, such as spiral or tortuous, as long as the capillary size is maintained. Moreover, although it is preferred that each digit be directly supplied by its own capillary channel, it is not absolutely necessary for this to be so, as there is a side movement of ink around the porous type material on the rim wherever it is supplied, thus tending to equalize the inking all around the wheel. In the use of low viscosity inks this may be very rapidly achieved, and the inking may be done by only a few capillary channels. Where non-evaporable types of ink are used, in which an oil base vehicle is required, the viscosity may make such equalizing of the ink by side movement in the porous type material a matter of some time.

Referring to Fig. 1, there is shown a typical plural type wheel assembly, such as might be found in a cash register, mounted between frame plate members 20 and 21. In plate 21 there is provided a supporting stud 22 riveted to the frame plate and extending inwardly toward the other plate 20. Mounted on stud 22, by an axial hole 23, is an axle 24 having a type wheel supporting portion 25, of smaller diameter, the other end of which is threaded to fit a threaded ink font 26 mounted through a hole in plate 20, leaving in position on the outside of plate 20 an access plug 27 leading to an ink reservoir portion 28 which opens into an axial hole 29 in the said type wheel supporting portion 25 of the axle 24. There is a seal 30 between the end of the axle and the member 26. The type wheels 31*a* are mounted

on the portion 25 of the axle, each in line with corresponding radial holes in the axle, shown at 32*a*. Taking the righthand wheel of the assembly of Figure 1 as an example, the wheel is formed of a disk plate 31 bonded to a disk plate 32, both of carbon graphite material forming a central bearing portion of the wheel. On the rim of said central disk portion is molded the porous type material 33. In the same plane with the radial holes 32*a* are radial channels in the wheel, one of said channels 34 extending upwardly and the other channel 35 extending downwardly, the section of Fig. 1 being taken on a line where oppositely extending radial channels are located. On to the outside of carbon-graphite plate 31 is bonded a metal gear wheel 36, preferably of steel. In the assembly shown the outer surface of wheel 36 is held against the plane surface of a carbon graphite collar 37 by a spring 38, to be described. The carbon graphite collar 37 is sealed to the axle by an adhesive. Carbon graphite collar 37 rests against the shoulder of the enlarged end of axle 24. The gear corresponding to gear 36 on the right side of the middle wheel bears against the carbon graphite plate 32 of the righthand wheel and is held there by the same spring 38, the bearing between the gear on the middle wheel and the plate 32 of the right wheel occurring on the hub 39. In a similar manner the left wheel of the assembly is sealed by means of a gear on its right plate bearing on the lefthand carbon graphite plate of the center wheel. At the left end of the assembly of wheels is a metal collar 40 which bears against the left carbon graphite plate of the left wheel, and a spring 38, formerly referred to, holds said collar 40 in sealing relation against the carbon graphite plate and holds the three wheels in compressed assembly whereby the metal-to-carbon graphite seals are maintained. It will be apparent that the contact surfaces between the steel elements and the carbon graphite plates must be carefully machined to make them plane and smooth. The spring 38 has its other end resting against the innermost face of member 26, and a flexible sleeve 41, preferably of oil-resistant rubber, covers the spring and seals therein any ink that may leak out between the collar 40 and the axle portion 25, there being a leakage point at the spring end of collar 40.

Ink may be supplied to the member 26, through plug 27, and from there such ink may fill the bore 29 of the bearing portion 25 of the axle 24, from which it is fed to the radial holes 32 into the type wheels and from there through the channels to the porous type material. The plug 27 may be removed to resupply the ink. The form of the invention shown, with the screw plug no higher than the axle, prevents the occurrence of too great a hydraulic head within the member 26 and in the axle.

Next will be described the method by which one of the novel type wheels of preferred construction may be made, particularly referring to the central portion made of the carbon graphite disks separated by spacing members.

Referring to Figs. 2, 3, 4 and 5, there is provided a left carbon graphite circular disk 42, a right carbon graphite circular disk 43, each of the same diameter and thickness and each having an axial hole of the same diameter, that for the disk 42 being numbered 44 and for the disk 43 being numbered 45.

The carbon graphite plates may be made from carbon, such as amorphous coke or lampblack, and graphite powders, either natural or artificial,

as is well known in the trade, pressed into shape and sintered into a rigid mass. These plates are then impregnated with wax or resin and ground and lapped to size so that the side surfaces are smooth and normal to the intended axis of the wheel. These plates, being non-porous and in compression with metal at bearing points, wear to a tight seal, which is more than sufficient to keep the ink from leaking from the assembly of wheels. In assembling the plates 42 and 43 as the outer walls of a central portion of a wheel there is used a film of thermo-setting bonding material 46, a film of metal foil 47, and another film of bonding material 48. The widths of films 46, 47 and 48 will determine the spacing between the carbon-graphite plates, and the capillary channels are formed by cutting out portions of said films. Films 46, 47 and 48 are shown, in phantom outline, as squares larger than the diameter of the plates. From each film within a circle, which is the diameter of the carbon-graphite plates, is cut out a pattern of holes including a circular hole the diameter of the axle hole, and radial lanes like lane 49 in film 46, ten in number and spaced at equal angular distances around the circle. This leaves triangular segments, such as segment 50, extending inwardly from that point of the film bounded by the imaginary circle equivalent in diameter to the diameter of plates 42 and 43.

The retention of these triangular segments at their broad end to the square film, aids in placing these in accurate position with reference to the carbon-graphite plates in preliminary assembly prior to the bonding operation. Foil 47 and adhesive film 48 are cut with the same pattern and the parts are assembled, as shown in Fig. 3, and heat-molded together, whereupon the portion of the film and foil extending beyond the periphery of the disk may be pared away as shown at the broken-away place in the view of Fig. 3. The films 46 and 48 preferably are of the type of thermo-setting adhesive material, that may be bought from the Minnesota Mining & Manufacturing Company, under their trade name "Scotch-weld." Also bonded to the outside surface of disk 43 by a film of the thermo-setting adhesive shaped in the form of a gear, as shown at 51 (Fig. 2), is a steel gear 52, the film and gear each having an axial hole like hole 45 in plate 43, heat and pressure being used to accomplish such bonding. Gears like gear 52 are used to drive the wheels individually to set up to the printing line the desired type character. The carbon graphite plates and gear bonded together form the central portion of the wheel.

To the periphery of the wheel's central portion, designated by 53 in Fig. 4, is the rim of porous resilient rubber type material 54, preferably oil resistant butadiene-acrylonitrile-copolymer material, made according to the Chollar patent to which reference was made. The periphery of said rim of type material is molded with type characters such as character 55. The view of the type wheel shown in Fig. 4 is a section through the thickness of the wheel at the outer edge thereof at a point cutting through the bonding film and the foil, the component parts being numbered as in Fig. 2 in the same general relationship. The gear and its bonding film are not shown in this view. The finished wheel is shown in Fig. 5.

It will be apparent that the principle of the invention is present even in an assembly of an axle and one-wheel and, therefore, a one-wheel printer is deemed to be covered by this disclosure.

It will also be understood that the central non-porous portion of one of the novel wheels need not be made entirely of carbon graphite disks, but may be made of metal or other type wheel material as long as the carbon graphite-to-metal seals are present at the wheel hub.

In a modified form of construction of the type wheel, one of the plates, such as shown in Fig. 6, is provided with radial grooves, such as groove 56. A film of adhesive may be applied with an applicator roller 57 (Fig. 8) made of some absorbent material of moderate firmness, and the rolling of the adhesive-charged roller 57a over the grooved face of the plate of Fig. 6 coats only the raised triangular-shaped surfaces, such as surface 58, and the plate 59 of Fig. 7 is pressed thereagainst with the axial holes 65 and 64 in alinement. Adhesive is only applied to the raised surfaces 58 to prevent the grooves 56 from becoming occluded in the bonding process. Referring to Fig. 9, the carbon graphite plate of Fig. 6 is identified by reference numeral 59, the capillary channel shown is identified by the number 56, which is the same number used for a similar channel in the plate of Fig. 6, the numeral 60 indicates the location of the bonding adhesive material, and the carbon graphite plate on the right side is numbered 57 and corresponds with plate 57 of Fig. 7. The adhesive may be any of the well known adhesive now available, such as phenol-formaldehyde resin base material.

Fig. 10 shows, as a substitute for seal 41 (Fig. 1), a metal type of bellows seal 61, welded to the collar 40 at 62, and to the element 26 at 63. This bellows permits the compression movement of collar 40 by spring 38 in a manner similar to the flexible sleeve 41 shown in Fig. 1, yet retains within it the ink leaking by collar 40.

It will be apparent that if the bellows are of the spring type and are welded to the axle-borne members under compression, the spring 38 may be dispensed with.

As a concrete example of a type wheel of 1⅛ inches in diameter, and of $\frac{1}{10}$ of an inch in thickness, and referring to Fig. 4, the plate 42 may be $\frac{48}{1000}$ of an inch in thickness, the adhesive film 46 may be made from $\frac{2}{1000}$ of an inch stock film, the metal foil 47 may be made of aluminum of $\frac{1}{1000}$ of an inch thickness, the adhesive film 48 may be of the same thickness as film 46, and the plate 43 of the same thickness as plate 42. Thus, when the pressure-heating step is completed it will leave capillary channels from the central axial hole to the rim of sufficient narrowness to hold the ink in the wheel without dripping. In this example it is assumed that ordinary non-evaporating types of oleic acid vehicle ink will be used, as is commonly used with printing wheels exposed to the atmosphere over long periods of time.

While the form of mechanism herein shown and described is admirably adapted to fulfill the objects primarily stated it should be understood that it is not intended to confine the invention to the one form or embodiment herein disclosed, for it is susceptible of embodiment in various other forms.

What is claimed is:

1. A printing wheel device including, in combination, an axle having an axial bore and one or more radial bores connecting the axial bore with the bearing surface of the axle; a type wheel having in a central bearing portion an axle hole and mounted thereby for rotation on the axle

with at least one of the axle radial holes within the axle hole in the wheel, said wheel having a porous type material rim on the periphery of the central bearing portion and said central bearing portion having one or more capillary channels extending from the axle hole of the wheel to the porous type material rim; and means including a carbon-graphite to metal rotational slip side seal on each side of said wheel to prevent fluid introduced into the axial bore from leaking out between the axle bearing surface and the surface of the axle hole of the wheel.

2. The device of claim 1 wherein at least one of the side seals includes a plate of non-porous carbon-graphite carried by the wheel and wherein it bears against the end surface of a metal collar on the axle.

3. The device of claim 1 wherein at least one of the side seals includes a metal surface on the side of the wheel which bears against the end of a graphite collar secured on the axle.

4. The device of claim 1 in which a seal on one side of the wheel includes a graphite plate, as part of the wheel, which plate bears against the end of a metal collar secured on the axle, and in which the seal on the other side of the wheel includes a metal plate carried by the wheel, which bears against the end of a graphite collar secured on the axle.

5. The device of claim 1 in which the rotational slip seal includes means for holding the carbon graphite-to-metal surfaces in contact under spring compression.

6. The device of claim 1 in which the central bearing portion of the wheel includes two side plates of carbon graphite material.

7. The device of claim 6 in which the graphite plates are of disk shape with parallel plane surfaces.

8. The device of claim 7 in which the graphite disks are mounted together by a separating material formed so as to leave capillary channels extending from the axial hole of said central portion to the periphery thereof.

9. The device of claim 7 in which the inner surface of one of the disks has formations therein which, when the disks are joined together to make the central portion of the wheel, provide the capillary channels extending from the axial hole of said central portion to the periphery thereof, on which is secured the porous type material.

10. The device of claim 1, in which the central portion of the wheel is fabricated of carbon graphite plane parallel disks formed and bonded together so as to leave capillary channels extending from the axial hole to the periphery thereof.

11. The device of claim 10 in which the rim is of porous resilient rubber-like material bonded to the periphery of said carbon graphite disks.

12. The device of claim 11 in which the rubber-like material is bonded directly to the periphery of the carbon graphite disks.

13. The device of claim 1 in which the seal surface of one side of the central portion of the wheel is a carbon graphite surface, and in which the seal surface on the other side of the central portion of the wheel is a metal surface.

14. The device of claim 13, in which the metal surface is the outside surface of a gear wheel secured to the central disk portion of the wheel.

15. A printing wheel device including, in combination, a type wheel axle having an axial bore and one or more radial bores at each of a plurality of type wheel stations on a central bearing portion, said radial bores connecting the axial bore with the bearing surface of the axle; a plurality of type wheels, on the central bearing portion, each having an axle hole and mounted thereby side by side on the axle each at its associated station for rotation thereon, each wheel being so positioned relative to the station with which it is associated that at least one of the associated radial holes of the axle is within the axle hole in the wheel, each of said wheels having a porous type material rim on a central bearing portion, said central bearing portion having one or more capillary channels extending from the axle hole of the wheel to the porous type material rim, and including a carbon graphite-to-metal rotational slip seal between each two of said wheels; and a carbon graphite-to-metal seal between the end wheels and formations carried by the axle, whereby fluid ink introduced into the axle's axial bore is prevented from escaping from the assembly of wheels and axle except through said capillary channels in the wheel.

16. The device of claim 15 in which each printing wheel has one side bearing surface made of carbon graphite and the side bearing surface on the other side of a metal piece.

17. The device of claim 16, in which the metal bearing piece has gear teeth on its periphery, whereby the wheel may be driven to a selected rotational position on the axle.

18. The device of claim 15, in which each wheel has on one side a carbon graphite plate and has on the other side a metal gear, the surfaces of the graphite plate and the metal gear which are outermost acting as bearing surfaces for cooperation with adjacent wheels.

19. The device of claim 18 in which the wheels are oriented on the axle in the same sense so that the gear bearing surface on one wheel works against the carbon graphite plate of the next adjacent wheel.

20. The device of claim 19 in which that end wheel of the assembly of wheels on the axle which has its metal gear outermost bears against the end of a graphite collar secured to the axle.

21. The device of claim 19 in which that end of the assembly which has the carbon graphite bearing surface outermost works against the end of a metal collar on the axle.

22. The device of claim 19, in which the end wheel of the assembly of wheels that has the metal gear bearing surface outermost works against a carbon graphite collar solid on with the axle, and wherein the wheel of the assembly that has the carbon graphite plate bearing surface outermost works against the end of a metal collar, fluid-sealed to the axle except where its bearing surface works against the graphite plate of said end wheel.

23. The device of claim 15, in which the assembly of wheels is held in compression against a formation of the axle and against axial movement thereon, by a slip collar spring-pressed against the other end of the assembly.

24. The device of claim 23 in which the collar is forced against the outer end of the assembly of wheels by a spring.

25. The device of claim 23 in which the end of the collar away from the wheel has a flexible non-porous member coupling it to another member solid with the axle whereby fluid escaping between said collar and said axle is retained in said flexible coupling.

26. The device of claim 15 in which the type

material is porous resilient rubber-like substance.

27. The device of claim 26, in which the rubber-like material is an oil-resistant copolymer of butadiene and acrylonitrile.

28. The device of claim 15 in which the axial bore is connected to a fluid storage well.

29. The device of claim 28, in which an access port is provided for the well.

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