

[54] DETENT MEANS FOR SETTABLE PRINT
WHEELS

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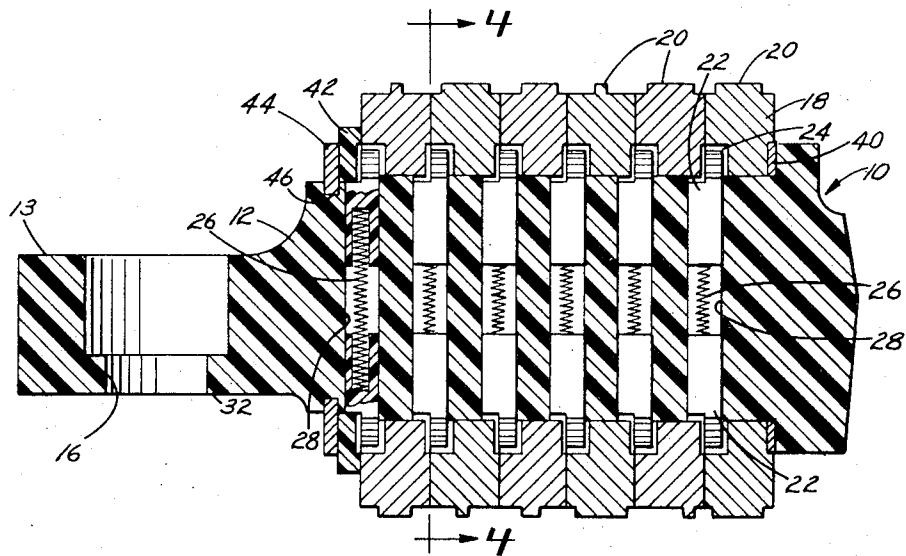
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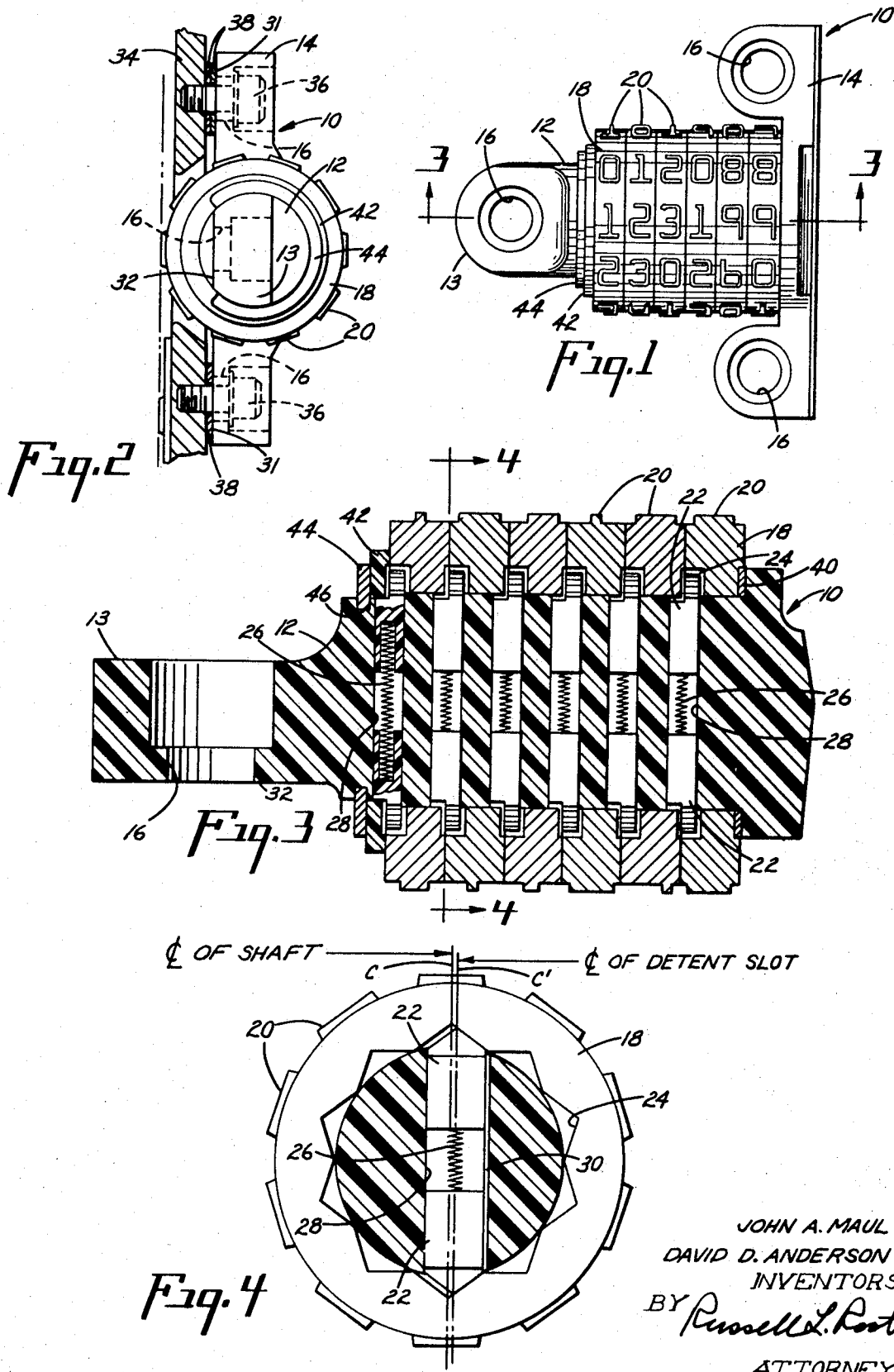
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[57] ABSTRACT

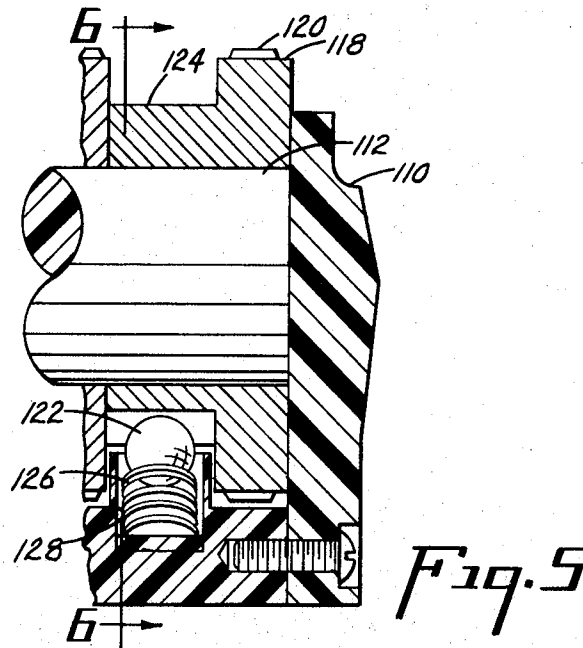
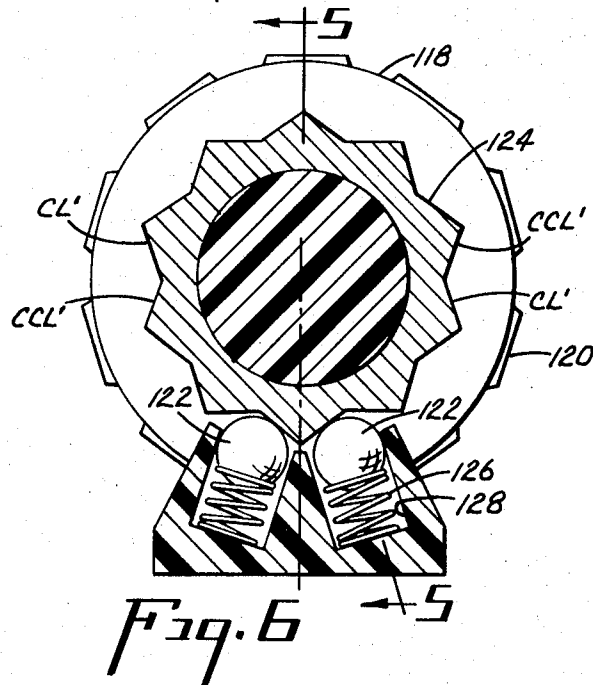
A print wheel assembly is disclosed having a print wheel rotatably disposed on a shaft for rotational movement to a print position. The print wheel includes an annular serrated portion having a plurality of clockwise faces and a plurality of counterclockwise faces, and detent means are provided for engaging the serrated portions to provide a locating action. The parts are so arranged that when a wheel settles in a detented position, a first detent means is spaced away from each of the counterclockwise faces and acts against one of the clockwise faces for exerting a first positive torque on the print wheel to urge the same in a clockwise direction, and a second detent means is spaced away from each of the clockwise faces and engages one of the counterclockwise faces for exerting a second positive torque on the print wheel substantially equal in magnitude but opposite in direction to the first torque. In a first embodiment, the serrated portion is an internally serrated portion of the print wheel. In a second embodiment, the serrated portion is an externally serrated portion of the print wheel. A T-shaped mounting bracket is formed to a crosspiece integral with the shaft and includes three mounting portions for attaching the assembly to a machine frame.

4 Claims, 6 Drawing Figures





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DETENT MEANS FOR SETTABLE PRINT WHEELS

RELATED APPLICATION

This application is a continuation-in-part of our application Ser. No. 777,616, filed Nov. 21, 1968, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to print wheels, especially to settable print wheel assemblies mountable upon the frame of a printing machine. Such assemblies are common and are exemplified by the date printing wheels which are used on data recorders or other printing machines.

Such prior print wheel assemblies generally include a support frame having a shaft on which individual print wheels are rotatably mounted in side by side relation. The detenting means may be mounted within the shaft or outwardly of the shaft and, in any case, acts upon a serrated periphery of each print wheel. As the wheels are being set, as by a stylus, they snap from one position to the next, and the detenting means is relied upon to bring the wheel to a level print position at each new setting. Detenting means of this sort can be overridden merely by turning the wheels to set them and do not prevent the turning of the wheels when reasonable force is exerted. As such they may be referred to appropriately as "non-locking" detent means, and this term will be used to identify detent means of this character in the subjoined claims.

Because there must be some lateral clearance for the detent member to permit it to slide in and out of its guide means, there is a slight degree of impositiveness in the locating effect achievable by such prior art detent mechanisms. This degree of impositiveness is negligible in most applications, but becomes significant when the print mechanism must provide print characters which not only meet the requirements for normal visual legibility, but which also must satisfy the requirements of mechanical reading equipment, sometimes referred to as "optical character recognition" or OCR equipment.

It is an object, therefore, of the present invention to provide a firm, positive detenting arrangement which will bring the print wheel to an accurately centered printing position each time the print wheel is rotated to a new position.

It is also an object of the invention to achieve the foregoing object for closely grouped wheels without adding materially to the cost of print wheel assemblies.

In addition, it is customary to mount the print wheel assembly upon the printing machine with which it is used in a manner which permits exact adjustment of the print wheel faces into coincidence with the printing plane, and such a mounting customarily has four support spaced points. Again, this type of mounting is of increased importance when the wheels are to be used for making impressions to be scanned by OCR equipment, so that solid, uniform impressions are made by all wheels.

The present invention has for another object, therefore, the provision of a suitable mounting having the requisite flexibility of adjustment, but which can be manufactured at significantly less cost than similarly functioning mountings heretofore available.

SUMMARY OF THE INVENTION

These and other disadvantages of prior art print wheel assemblies are overcome by the present invention, which provides a print wheel rotatably disposed on a shaft for rotational movement to any one of a plurality of print position. The print wheel includes an annular serrated peripheral portion having a plurality of clockwise faces and a plurality of counterclockwise faces. Cooperating with this serrated periphery are a pair of complementary detents, each having a loose slidable mounting in one of a pair of complementary guide slots. The slots are specially located so that when the print wheel is in detented position, with one of its faces approximately in print position, the first detent is spaced away from each of the counterclockwise faces and engages one of the clockwise faces to exert a first torque on the print wheel in one direction. Simultaneously the second detent is spaced away from each of the clockwise faces and engages one of the counterclockwise faces to exert a second torque on the print wheel substantially equal in magnitude but opposite in direction to the first torque. First and second spring means are provided to bias the first and second detents, respectively, against its associated surface.

The wheel supporting shaft is formed as an integral portion of a T-shaped member which can be molded or die cast as a single piece and over which the wheels can be slipped during assembly. This arrangement still gives three well-spaced mounting points so that there can be effected a precise adjustment of the printing plane of the print wheels to the printing plane of the machine to which the assembly is attached.

In a preferred embodiment, the serrated peripheral portion is an internally serrated portion of the print wheel, and the first and second guide means and the first and second detent means are disposed within the shaft. The wheel supporting shaft is provided with slots carrying the opposed detents slightly offset laterally from the centerline of the shaft section so that neither detent will move to a fully home position in the wheel serrations, and so that the detents will have an opposite action in the direction in which they seek to cam the print wheel. This eliminates the impositiveness which would otherwise be caused by the clearance between the detents and their associated slots to firmly position the wheel at a precisely defined location.

In a second embodiment, the serrated portion of the print wheel is an externally serrated portion of the print wheel.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages of the invention will become apparent to those skilled in the art upon an understanding of the embodiments shown in the drawings, wherein:

FIG. 1 is a top plan view of a preferred embodiment of a print wheel assembly according to the present invention;

FIG. 2 is an end elevation of the device of FIG. 1 looking from the left end, and showing in part the arrangement for mounting the assembly on a printing machine;

FIG. 3 is a longitudinal section taken on line 3—3 of FIG. 1, and drawn to a larger scale;

FIG. 4 is a transverse section taken on line 4—4 of FIG. 3;

FIG. 5 is a portion of a longitudinal section of a second embodiment of a print wheel assembly according to the present invention taken on line 5—5 of FIG. 6;

FIG. 6 is a transverse section taken along lines 6—6 of FIG. 5.

DESCRIPTION OF THE EMBODIMENTS

Referring now to the drawings in greater detail, FIGS. 1 through 4 show a settable print wheel assembly according to a preferred embodiment of the invention. The assembly includes a frame member 10, which is generally T-shaped and which includes a shaft portion 12 having a distal end 13, a crossbar 14, and mounting holes 16. One of the mounting holes 16 is at the distal end 13 of shaft portion 12, and the other two mounting holes 16 are in each of the free ends of the crossbar 14.

Print wheels 18, here shown as six in number, have an internal diameter which fits the shaft 12 and are rotatable on the shaft portion in stacked relation. Each wheel bears a series of type faces 20 designed to be selectively moved to print positions in the customary manner.

In devices of this kind, it is customary to provide a detenting mechanism associated with a shaft and acting on the internal peripheries of the print wheels to provide a locating effect which will determine each print position for the wheel is question and cause it to move from one print position to the next with a snap action when rotated by the operator with a stylus. In the case shown in the preferred embodiment, this detenting mechanism comprises a pair of detents or poppets 22 associated with each print wheel and designed to engage a serrated portion 24 of the inner periphery of the print wheel. To this end, each pair is urged apart by a compression spring 26 disposed between. The detents 22 for each wheel are slidably disposed in a passage or slot 28, which provides a guide means for defining a path of travel of each detent 22 and which extends transversely of the longitudinal axis of the shaft 12. Except for the configuration of the frame member 10 which will be discussed in detail hereinafter, the description thus far of the preferred embodiment shown in FIGS. 1 through 4 is substantially that of a conventional structure and provides a suitable mechanism for conventional use.

Turning to FIG. 4, we see that in order to allow for reasonable manufacturing tolerances, it is necessary for the detents 22 to be significantly narrower than their slots 28 to allow for ready assembly and to remove all changes for binding during operation. With this in mind, it will be apparent that the resulting effect is to introduce sufficient side play to permit an imprecise location for the print wheel even when the detents 22 are properly seated. While this will not affect ordinary visual printing results a great deal, when the impression is to be read by OCR equipment, even a small angle of rotation out of the printing plane can cause a variation in printing strength over the character face sufficient to cause a doubtful or even an unreadable character.

The present invention overcomes this problem in a very simple manner without adding materially to the cost of the assembly. This solution can be understood by noting the two centerlines C and C' indicated on FIG. 4. The line C is the transaxial centerline of the shaft 12 and of the wheels 18, and the line C' is the centerline of the slots 28. These do not coincide as they

normally would, but the slot centerline is offset to one side by a very small amount.

The result of offsetting the centerline, as seen in FIG. 4, is that the oppositely acting detents 22 do not seat directly in the center of the opposing recesses provided by the serrated portion 24 of the print wheel 18, but strike against those sloping surfaces which are on the same side of center. Consequently, the detents 22 are both cammed in one direction by the action of these sloping surfaces (leftward as seen in FIG. 4) so that the clearance between the detents and guide means 28 all accumulates on one side as indicated at 30 in FIG. 4. This gives a precisely determined location to the detents 22 and allows them to communicate this to the wheel 18 through the sloping surfaces of the serrated portion 24. It will further be noted that the camming action of the detents 22 on the print wheel 18 is such that they are seeking to turn in opposite directions relative to the shaft 12, so that the print wheel 18 enjoys an accurately centered position balanced between these opposing equal forces with a flat face of each detent 22 in positioning contact with one face of its cooperating recess. Because the angular relationship between each sloping surface and the centerline C of the print wheel 18 is the same, the tangential component of each of these forces is equal. Furthermore, since each of these tangential components acts on the print wheel 18 at the same distance from the rotational axis of the print wheel 18, the rotational torque acting to rotate the print wheel 18 in one direction will be equal in magnitude but opposite in direction to the rotational torque acting to rotate the print wheel 18 in the opposite direction.

It will be appreciated that the off-center distance and clearances shown in FIG. 4 are, of course, greatly exaggerated for purposes of ready explanation, and in the actual device they would be scarcely detectable by a visual inspection. To indicate the general order of dimensions used, in a device in which the overall print wheel diameter is about three-fourths of an inch, the centerline of the detent slot is offset only 0.0015 inches from the shaft centerline to get the effect noted. Despite this minuscule difference, however, the difference in centering effect is readily detectable by feel and the improved reliability of the printing results is readily apparent to the eye. For printing wheels of customary sizes the centerline offset distance needed to achieve the benefits here noted will generally be between 0.0005 inches and 0.005 inches; in other words, they are very slight but readily measurable.

In a more general sense, it can be seen that what is required to effect operation in accordance with the present invention is a portion providing a serrated periphery 24 made up of slope-faced teeth drivingly associated with each print wheel 18, and two spring urged detent members cooperating therewith which are of such size and configuration and are so located that they enter between the teeth at about the same time to detent the print wheel 18 in any position in which it is to be set. In addition, however, there is a more precise requirement for the location of these detent members, and for the purpose of accurately defining this location, we may note that each tooth (or notch) of the serrated periphery 24 has two types of faces. If we think of exerting a force against one of these faces alone, for example, face CL in FIG. 4, in a direction across the pitch circle of the serrated periphery 24 and against the face

(i.e. radially outwardly in the form shown), the force will tend to cam a print wheel 18 in a clockwise direction and this may be referred to as a "clockwise" face. Such a force acting only against the other type of face, namely a face CCL, will, of course, tend to cam the wheel in a counterclockwise direction, and any of the faces CCL may be referred to as "counterclockwise" faces. When these face designations are used hereinafter, they will be understood to have the foregoing significance. The means for locating the detent members 22, then, can perhaps best be described by saying that they are so arranged that when the detent members 22 experience their maximum projection towards the serrated periphery 24 (i.e. when they are in the detenting position) one detent member is spaced from all counterclockwise faces and is in contact with one clockwise face only of a tooth, while the other detent member is spaced from all clockwise faces and is in contact with a counterclockwise face only of a tooth, so that there is a balancing or centering action in addition to the main detenting action, which firmly and precisely defines the printing location of the print wheel 18. Another way of expressing this relationship would be to describe the location of the detent members 22 as being spaced arcuately so that their action points are either slightly less than or slightly greater than an exact tooth spacing, or an exact multiple thereof.

Turning to the mounting of the print wheel assembly shown in FIGS. 1 through 4, it is noted that the T-shaped frame member 10 has flattened areas 31 (FIG. 2) at the ends of the crossbar 14 surrounding the opening 16 therein, and the distal end 13 of the shaft 12 has a partially cylindrical profile and that its total structure lies entirely within the projection of the cylindrical outline of the main body of the shaft 12. This permits the print wheels 18 to be readily assembled onto the frame member 10 by merely slipping them over the end 13 and onto the shaft 12.

The frame member 10 thus presents three mounting points which are spaced relatively far apart at the apexes of an equilateral triangle. This permits the installer to adjust the print wheel assembly so that its type faces will lie precisely in the printing plane of the printing machine rather than a small angle to it. It is fundamental geometry that three points are sufficient to determine a plane, and the three-well spaced points herein provided make it possible to effect this adjustment readily and accurately, as by means of suitable shims 38 (FIG. 2).

By reason of its T-shaped construction, it is possible for the frame member 10 to combine the accuracy of the positioning aspect with a very low cost construction, for a frame member 10 of the type shown in the drawings can be readily molded in a single piece, preferably of suitable plastic material.

It is also preferable to mold the detents 22 of suitable plastic material, and it is possible to similarly construct the print wheels 18 if desired. However, for long life, and especially in OCR applications such as contemplated herein, it is preferable to die-cast or otherwise construct the print wheels 18 of metal.

When the wheels 18 are assembled on the shaft 12, there is preferably provided a washer 40 at the crossbar end of the stack and a washer 42 at the distal end of the stack, together with a snap ring 44 engaging in an annular groove 46 in the shaft 12 to retain the parts in assembled relationship.

Referring now to FIGS. 5 and 6, a settable print wheel assembly according to a second embodiment of the invention is shown which includes a frame member 110 which is only partially shown. The frame member 110 includes a shaft portion 112 for supporting print wheels 118 in a manner similar to that by which shaft portion 12 of the frame member 10 supports print wheels 18 in the preferred embodiment.

Print wheels 118, only one of which is here shown, have an internal diameter which fits on the shaft 112 and are rotatable on the shaft portion in stacked relation. Each print wheel 118 bears a series of type faces 120 designed to be selectively moved to print positions in the customary manner.

A detenting mechanism provides a locating effect which will determine each print position for the print wheel 118 and cause it to move from one print position to the next with a snap action when rotated by the operator with a stylus. The detenting mechanism of the second embodiment comprises a pair of detent balls 122 associated with each print wheel 118 and designed to engage a serrated portion 124 of the outer periphery of the print wheel 118. To this end, each ball 122 is urged against the serrated portion 124 by a compression spring 126. The balls 122 for each print wheel 118 are slidably disposed in a passage or slot 128, which provides a guiding means for defining the path of travel of each detent ball 122.

Turning to FIG. 6, we see that in order to allow for reasonable manufacturing tolerances, it is necessary for the balls 122 to be of significantly smaller diameter than their slots 128 to allow for ready assembly and to remove all chance for binding during operation. With this in mind, it will be apparent that the resulting effect is to introduce sufficient side play to permit an imprecise location for the print wheel 118 even when the balls 122 are properly seated.

As best seen in FIG. 6, the externally serrated portion 124 is made up of sloped-faced teeth drivingly associated with each print wheel 118. When a force is exerted against any one of the faces CL', a clockwise torque will be exerted on the print wheel 118. In a similar manner, when a force is exerted on any one of the faces CCL', a counterclockwise torque will be exerted on the print wheel 118. Accordingly, the faces CL' may be referred to as "clockwise" faces, while the faces CCL' may be referred to as "counterclockwise" faces. The passages or guiding means 128 are arranged such that when the ball members 122 experience their maximum projection toward the serrated periphery (i.e. when they are in the detented position), one ball member 122 is spaced from all counterclockwise faces and is in contact with one clockwise face of a tooth, while the other ball member 122 is spaced from all clockwise faces and is in contact with a counterclockwise face of one tooth.

In the second embodiment, the preload and spring rate of each spring 126 is equal and the direction of travel or path of each ball 122 is in the same angular relation to a radially projecting reference line 129 of the shaft 112. Furthermore, the angle of each face CL' and CCL' relative to the reference line 129 is equal. Therefore, the tangential component of force acting on the print wheel 118 by each ball 122 is equal. Furthermore, since the components of force of each ball 122 act at an equal distance from the rotational axis of the print wheel 118, the rotational torque applied by each

ball will be equal in magnitude to the rotational torque applied by every other ball 122. However, since one of the balls acts only on a face CL', the torques of equal magnitude act in opposite directions to maintain the printing wheel 118 in a predetermined printing position.

The mounting means of the printing wheel assembly of the second embodiment is similar to that of the first embodiment. A T-shaped frame member has flattened areas for associating the print wheel assembly with the underside of the printing bed of the printing machine. The assembly is anchored in place by screws passing through openings in the flattened areas and threaded into suitable tapped openings in the bed.

While preferred embodiments of the invention have been described and illustrated, it is to be understood that these are capable of variation and modification. Accordingly, the aim of the appended claims is to cover all such variations and modifications as may fall within the true spirit of the invention.

What is claimed is:

1. In a print wheel assembly comprising a frame member including a shaft, said shaft including guide slot means extending into said shaft and opening at the exterior thereof, a print wheel rotatably disposed on said shaft for rotational movement to any one of a plurality of print positions, said print wheel including an annular internal serrated peripheral portion having a plurality of slope-faced teeth in line with said guide slot means, each of said teeth including a clockwise face and a counterclockwise face, and non-locking detent means slidably and loosely guided in said guide slot means and spring urged towards said peripheral portion to cooperate with the teeth of said wheel to urge the wheel approximately into any selected print position, said non-locking detent means constituting the sole means for determining the static rotary position of said wheel, the improvement which comprises:

said guide slot means comprising at least one pair of complementary guide slots, and said non-locking detent means comprising at least one pair of cooperating detents including a first detent and a second detent each guided in one of said complementary guide slots for movement towards and away from said peripheral portion, said detents each being spring urged for independent movement towards said peripheral portion, the position of said complementary guide slots being so arranged that when the print wheel is at rest approximately at one of said print positions, the first detent of said pair is spaced away from each of said counterclockwise faces and only engages one of said clockwise faces to exert a first positive torque on said print wheel in one direction, and the second detent of said pair is spaced away from each of said clockwise faces and only engages one of said counterclockwise faces for exerting a second positive torque on said print wheel substantially equal in magnitude but opposite in direction to said first torque, whereby the joint action of the detents serves to urge said print wheel precisely into the corresponding print position and hold it there regardless of any side play existing between said detents and their guide slots.

2. In a print wheel assembly comprising a frame member including a shaft, said shaft including guide slot means extending into said shaft and opening at the

exterior thereof, a print wheel rotatably disposed on said shaft for rotational movement to any one of a plurality of print positions, said print wheel including an annular internal serrated peripheral portion having a plurality of slope-faced teeth in line with said guide slot means, each of said teeth including a clockwise face and a counterclockwise face, and non-locking detent means slidably and loosely guided in said guide slot means, and spring urged towards said peripheral portion to cooperate with the teeth of said wheel to urge the wheel approximately into any selected print position, said non-locking detent means constituting the sole means for determining the static rotary position of said wheel, the improvement which comprises:

said guide slot means comprising at least one pair of complementary guide slots, and said non locking detent means comprising at least one pair of cooperating detents including a first detent and a second detent each guided in one of said complementary guide slots for movement towards and away from said peripheral portion, said detents each being spring urged for independent movement towards said peripheral portion, the position of said complementary guide slots being so arranged that when the print wheel is at rest approximately at one of said print positions, the first detent of said pair is spaced away from each of said counterclockwise faces and only engages one of said clockwise faces to exert a first positive torque on said print wheel in one direction, and the second detent of said pair is spaced away from each of said clockwise faces and only engages one of said counterclockwise faces for exerting a second positive torque on said print wheel substantially equal in magnitude but opposite in direction to said first torque, whereby the joint action of the detents serves to urge said print wheel precisely into the corresponding print position and hold it there regardless of any side play existing between said detents and their guide slots,

said teeth being of even number,

said complementary guide slots being constituted as portions of a single straight transaxial opening through the shaft with one detent guided in each end thereof, and the opening being positioned with its centerline offset from the parallel transaxial centerline of the shaft by a slight but measurable amount to effect the cooperation of the detents independently with the clockwise and counterclockwise tooth faces aforesaid.

3. In a print wheel assembly comprising a frame member including a shaft and a member located outwardly of said shaft, said member including guide slot means extending into said member and opening towards said shaft, a print wheel rotatably disposed on said shaft for rotational movement to any one of a plurality of print positions, said print wheel including an annular external serrated peripheral portion having a plurality of slope-faced teeth in line with said guide slot means in said outwardly located member, each of said teeth including a clockwise face and a counterclockwise face, and a non-locking detent means slidably and loosely guided in said guide slot means, and spring urged towards said peripheral portion to cooperate with the teeth of said wheel to urge the wheel approximately into any selected print position, said non-locking detent means constituting the sole means for

determining the static rotary position of said wheel, the improvement which comprises:

said guide slot means comprising at least one pair of complementary guide slots, and said non-locking detent means comprising at least one pair of cooperating detents including a first detent and a second detent each guided in one of said complementary guide slots for movement towards and away from said peripheral portion, said detents each being spring urged for independent movement towards said peripheral portion, the position of said complementary guide slots being so arranged that when the print wheel is at rest approximately at one of said print positions, the first detent of said pair is spaced away from each of said counterclockwise faces and only engages one of said clockwise faces to exert a first positive torque on said print wheel in one direction, and the second detent of said pair is spaced away from each of said clockwise faces and only engages one of said counterclockwise faces for exerting a second positive torque on said print wheel substantially equal in magnitude but opposite in direction to said first torque, whereby the joint action of the detents serves to urge said print wheel precisely into the corresponding print position and hold it there regardless of any side play existing between said detents and their guide slots.

4. In a print wheel assembly comprising a frame member including a shaft, said frame member including guide slot means extending into the material of the frame member and opening at the exterior thereof, a print wheel rotatably disposed on said shaft for rotational movement to any one of a plurality of print positions, said print wheel including an annular serrated peripheral portion having a plurality of slope-faced teeth in line with said guide slot means, each of said teeth in-

cluding a clockwise face and a counterclockwise face, and non-locking detent means slidably and loosely guided in said guide slot means, and spring urged towards said peripheral portion to cooperate with the teeth of said wheel to urge the wheel approximately into any selected print position, said non-locking detent means constituting the sole means for determining the static rotary position of said wheel, the improvement which comprises:

said guide slot means comprising at least one pair of complementary guide slots, and said non-locking detent means comprising at least one pair of cooperating detents including a first detent and a second detent each guided in one of said complementary guide slots for movement towards and away from said peripheral portion, said detents each being spring urged for independent movement towards said peripheral portion, the position of said complementary guide slots being so arranged that when the print wheel is at rest approximately at one of said print positions, the first detent of said pair is spaced away from each of said counterclockwise faces and only engages one of said clockwise faces to exert a first positive torque on said print wheel in one direction, and the second detent of said pair is spaced away from each of said clockwise faces and only engages one of said counterclockwise faces for exerting a second positive torque on said print wheel substantially equal in magnitude but opposite in direction to said first torque, whereby the joint action of the detents serves to urge said print wheel precisely into the corresponding print position and hold it there regardless of any side play existing between said detents and their guide slots.

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