

Aug. 21, 1962

R. D. DODGE ET AL

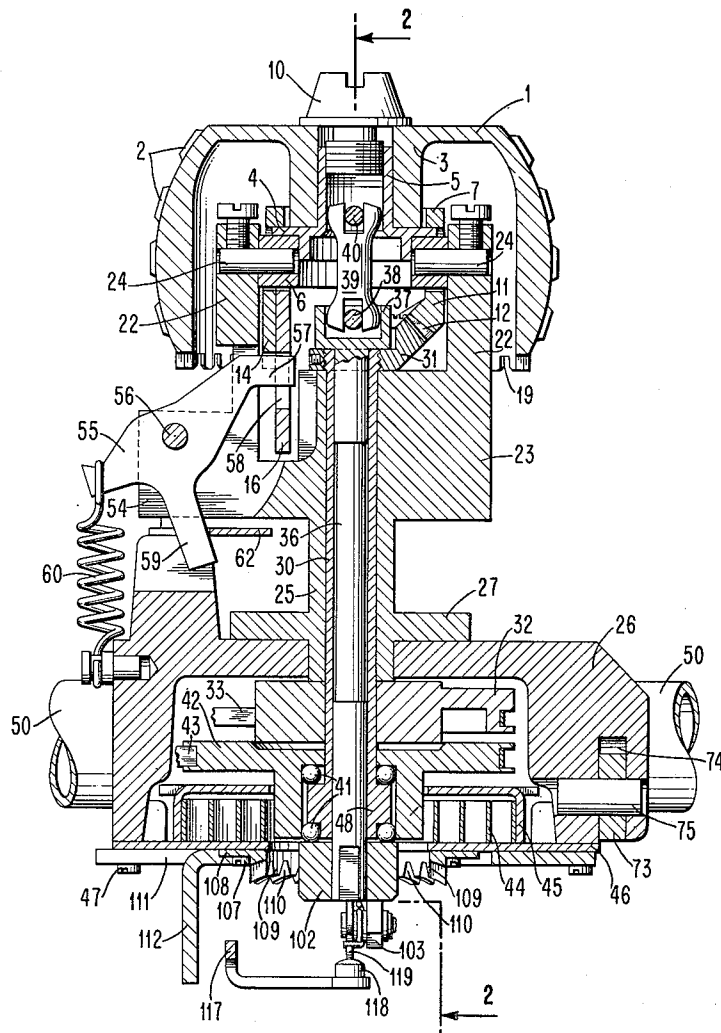
3,050,170

SINGLE ELEMENT PRINTING MECHANISM

Filed March 22, 1961

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FIG. 1



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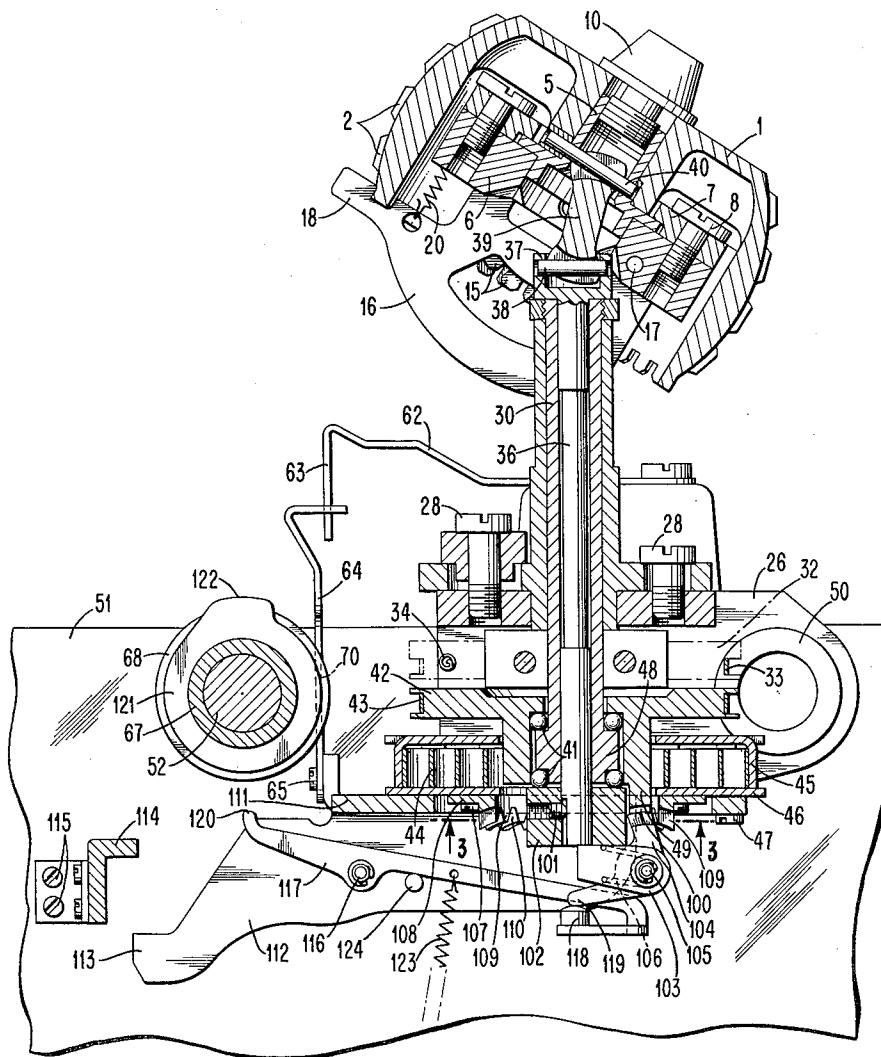
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FIG. 2



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FIG. 4

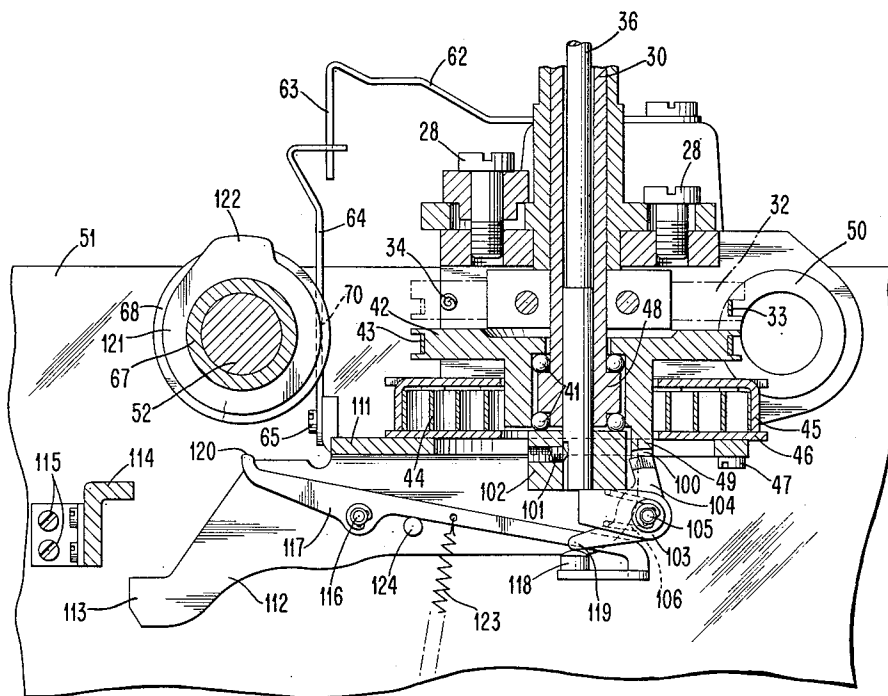
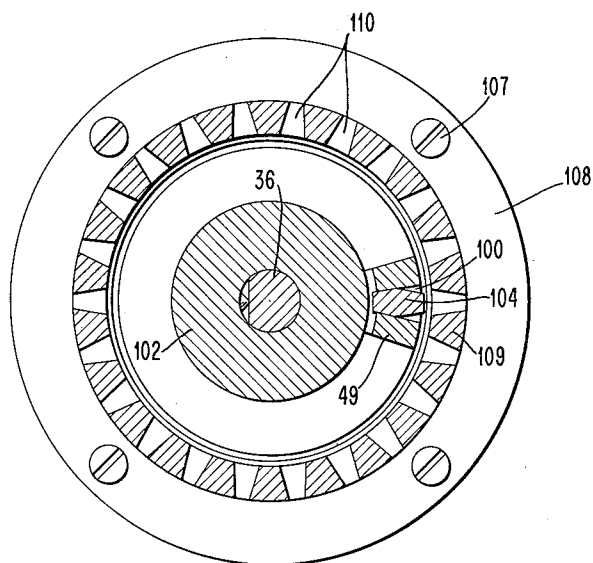


FIG. 3



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SINGLE ELEMENT PRINTING MECHANISM

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8 Claims. (Cl. 197—52)

This invention relates generally to printing mechanisms, and more particularly to a single element print head having improved means for centering it while moving the head to printing position.

There is shown in U.S. Patent 2,926,768, issued March 1, 1960, to F. E. Becker et al., a mechanism for simultaneously rotating and tilting a single element print head to selectively position the head to align type characters thereon for printing. The rotating and tilting are accomplished by moving each of a pair of tapes, singly or concurrently, varying predetermined amounts as required to position a particular character before a platen. The control mechanisms for the tapes are shown in U.S. Patent 2,919,002, issued to L. E. Palmer, on December 29, 1959. Briefly stated, the tapes are attached to pulleys fixed to concentric rotate and tilt shafts. Tape movement, controlled through linkages operated by typewriter keys, is transmitted through the inner shaft and a universal joint to the head for rotation, and through the outer shaft and enmeshed bevel gear segments for tilting.

Some play always exists in the universal joint and so a detenting of the head is required to correct for this. When the driving means for the rotate shaft is initially adjusted, this shaft is accurately positioned during the different printing operations. The driving means, however, includes many elements which are subject to wear, and, because of such wear, result in inaccurate positioning of the rotate shaft. A further detenting is required to correct for the inaccuracy in the driving means.

A comparatively rigid driving means is employed for positioning the rotate shaft, and it is impossible to override it by detenting to correct for inaccuracy. It would be possible to provide excessive play in the universal joint so the head could be detented to correct for inaccuracy resulting from wear. This would not be good, however, because it would always be necessary to detent for this large amount of play even when no wear existed.

In accordance with the invention this problem is solved by constructing a universal joint with as little play as possible and providing means to disconnect the rotate shaft from its driving mechanism just after the latter has completed its driving operation. A detenting mechanism acting on the head then positions the latter to correct for the small amount of play in the universal joint, as well as any inaccuracy in the position of the shaft due to wear in the driving mechanism. The shaft can easily be turned by the detenting means with the drive connections disconnected. When the printer is newly adjusted and there is no wear to take into account, then the detenting means only needs to correct for the small play in the universal joint. In some cases it may be possible that the inaccuracy in the position of the rotate shaft may be so great that it is not practical to make all correction by a single detenting means. If this is so, then one detenting means may be provided to correct for play in the universal joint while another detenting means is provided to correct the position of the rotate shaft after the driving connections are disconnected.

The mechanism shown in the Becker et al. patent for detenting the head in a tilting direction is usually sufficient due to the particular mechanism employed for driving it in this direction.

An object of this invention is to provide an improved mechanism for detenting a print head.

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Another object is to provide a mechanism which is operable to detent a print head so as to correct for any inaccuracy due to wear in a driving means therefor as well as to correct for play in driving connections.

Yet another object is to provide means for disconnecting a print head from a driving mechanism after it has been positioned by the latter, and then detenting the head to correct for any inaccuracy in its position.

Still another object is to provide with a print head which is positioned by a driving mechanism including a universal joint, one detenting means to correct for play in the universal joint, and another detenting means to correct for wear in the driving mechanism.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a front vertical sectional view of a single element print head with its operating mechanism, and having associated therewith the improved shaft detenting device.

FIGURE 2 is a vertical sectional view taken on the plane of line 2—2 in FIG. 1 showing the print head in a tilted position and the operating mechanism for the shaft detent.

FIGURE 3 is an enlarged sectional view taken of the plane of line 3—3 in FIG. 2.

FIGURE 4 is a sectional view showing the lower portion of the mechanism shown in FIG. 2 but with the lower detenting ring removed.

Referring to FIGS. 1 and 2 it will be noted that there is shown a print head and operating means therefor generally like that shown and described in the patent issued to Becker et al., referred to above. This comprises a head 1 in the form of a hollow truncated sphere and having characters 2 arranged on its outer surface in rows and columns. Extending downwardly from the upper end of the head is a cylindrical portion 3 resting upon a flange 4 of sleeve-shaped member 5 which is rotatably supported by block 6. Overlying flange 4 is a plate 7 which is fastened to block 6 by screws 8 for holding sleeve member 5 on the block. A cap 10 is threaded into member 5 and engages the upper end of head 1 for holding the latter in place.

Brazed to the right-hand side of block 6, as shown in FIG. 1, is plate 11 having a beveled gear portion 12 formed thereon. Another plate 14 is brazed to projecting portions on the left side of the block and has radially extending teeth 15 along its lower edge. Guided in openings between plate 14 and the block is member 16 which is pivoted at 17 and has projecting portion 18 engageable with any one of the notches between teeth 19 around the lower edge of print head 1 for detenting the latter in a rotated position. Spring 20 urges member 16 toward a position in which portion 18 engages teeth 19.

Extending along opposite sides of block 6 are arms 22 of yoke 23. Pins 24 extend through openings in the yoke arms and the block to support the latter for tilting motion about a horizontal axis. At the lower end of the yoke is a sleeve portion 25 extending into an opening in a support 26 which serves as a base for supporting the print head and its positioning mechanism. A flange 27 on sleeve portion 25 engages the top of the support and is attached to the latter by screws 28. Extending through sleeve portion 25 and an opening in yoke 23 is a tubular shaft 30 carrying bevel gear segment 31 which meshes with bevel gear portion 12 for operating the latter to tilt the print head about pins 24. Fixed to the lower end of the tubular shaft is a pulley sector 32 which is rotated by a tape 33 against the action of spring 34. Extending

through tubular shaft 30 is shaft 36 having an enlarged head 37 at its upper end resting upon the end of tubular shaft 30. Formed in this head is a recess, and a pin 38 extends across the recess and is received within a slot in member 39 so as to permit a rocking of the latter about a horizontal axis while it is rotated about its own longitudinal axis by shaft 36. At the upper end of member 39 is another slot receiving pin 40 which extends across and is fixed at its ends to sleeve-shaped member 5. Rotation of member 39 causes member 5 and print head 1 to rotate therewith while permitting a tilting of the head relative to member 39.

Mounted for rotation about tubular shaft 30 is a driving pulley 42 supported on anti-friction bearings 41 located above and below flange portion 48 at the lower end of the tubular member. Pulley 42 may be rotated by tape 43 against the action of helical spring 44. This spring is connected at its inner end to a hub portion of pulley 42, and is connected at its outer end to a housing consisting of a cap 45 and cover plate 46 attached to the bottom of support 26 by screws 47. Tapes 33 and 43 extend out through hollow trunnions 50 to their actuating mechanisms, which may be like that shown in the aforementioned patent issued to L. E. Palmer, for tilting and rotating print head 1 to its different printing positions.

The hub of pulley 42 has a downwardly extending portion 49 having a groove 100 therein. Suitably secured to the bottom of shaft 36, as by set screw 101, is collar 102 to which is fixed a support bracket 103. A double wedge-shaped detent pawl 104 (FIGURE 3) in the configuration of a bell crank is pivotally mounted on stud 105 secured in bracket 103. A spring 106 is also mounted on stud 105 to constantly urge detent pawl 104 in a counterclockwise direction, as seen in FIG. 2, so as to be only engaged with groove 100 on hub portion 49 to rigidly couple pulley 42 with shaft 36. With pawl 104 in the position shown in FIG. 2, the rotation of pulley 42 by tape 43 will be directly transmitted to shaft 36.

Secured to the underside of plate 46 by screws 107 is a ring member 108 having depending teeth 109 thereon to form an annulus of detent notches 110. A detent notch is provided and centered for each peripheral column of type characters on the print head. The ring member is located concentrically with respect to shaft 36 and is spaced from pulley hub portion 49 to provide rotational clearance for the hub and detent pawl 104. A plate 111 is attached to support 26 also by screws 47 and has a depending arm 112 formed thereon extending to the left in FIG. 2. An end 113 of arm 112 is engageable with an anvil 114 secured by screws 115 to print mechanism carrier 51, which may be like that described in the aforementioned patent to Palmer. The carrier is slidably mounted on shaft 52 for longitudinally positioning the print head mechanism along the shaft and a platen (not shown). The anvil limits the upward travel of arm 112 to create a snap action of print head 1 against the platen at printing time.

Pivotally supported on pin 116 in arm 112 is a lever 117, best seen in FIG. 2. The lever extends to the right on arm 112 and is appropriately formed so that end 118 is aligned with and adjacent to end 119 of detent pawl 104, end 119 being aligned with the longitudinal axis of shaft 36. Lever 117 also extends to the left from pivot end 116 and is terminated by cam-follower end 120 which is aligned with cam 121 fixed on a sleeve 67 keyed from rotational movement with shaft 52, but longitudinally positionable along the shaft as described in the patent to Becker et al., above. Cam 121 has a single lobe 122 thereon and when shaft 52 is rotated during a printing operation, member 26 will be rocked clockwise on trunnions 50 raising end 120 into contact with cam 121. Lobe 122 will engage end 120 and will operate lever 117 in a counterclockwise direction about pin 116 to rotate detent pawl 104 on its pivot 105 positively forcing the pawl into engagement with one of the plurality of notches 110

to precisely position shaft 36. The resulting motion of pawl 104 is so limited that the pawl is not entirely disengaged from groove 100 in hub portion 49. Referring to FIG. 3, it will be noted that the pawl 104 normally fits snugly in groove 100 to connect pulley 42 rigidly to shaft 36. As the pawl is moved into the adjacent notch 110, clearances are provided to effect disconnection between the pawl and the sides of groove 100 so shaft 36 can rotate relative to pulley 42 when detenting takes place by engagement of the pawl with notch 110. The time that pawl 104 is engaged with one of the notches 110 is, of course, determined by lobe 122, and the engagement need only be sustained from the conclusion of rotational positioning by pulley 42 until print head 1 strikes the platen. Spring 123 urges lever 117 against stop 124 when the lever is not operated so that end 118 is maintained out of engagement with pawl end 119 allowing the spring to disengage the pawl from detent notches 110.

Formed in one side of yoke 23 is a slot 54 guiding lever 55 which is pivotally supported by pin 56 carried by the yoke. The lever 55 has an arm 57 extending through an arcuate opening 58 in member 16 and another arm 59 projecting below the yoke. Arm 57 acts on member 16 to position the latter about its pivot 17 and also, when raised, extends between teeth 15 on plate 14 to center the print head in its tilted position. A spring 60 tends to swing lever 55 to a position for engaging its arm 57 with teeth 15. With the lever in this position, member 16 is rocked upwardly by spring 20 to engage the projecting portion 18 with teeth 19 on the print head.

Pivotally mounted on support 26 is a lever 62 engageable with arm 59 on lever 55 for rocking the latter in a clockwise direction against the action of spring 60. The outer end of lever 62 is bent downwardly (FIG. 2) to provide a portion 63 which is engaged by lever 64 pivotally supported at its lower end on stud 65 fixed to carrier 51. The engagement between lever 64 and portion 63 of lever 62 is such that support 26 may be rocked on its trunnions 50 relative to carrier 51 without affecting the actuation of lever 62 by lever 64. A face cam 68 fixed on sleeve 67 adjacent cam 121, acts on projecting portion 70 of lever 64 to swing the lever about stud 65 when shaft 52 is rotated each printing cycle.

During a printing operation, shaft 52 is caused to make one revolution. At the beginning of the revolution, projecting portion 70 on lever 64 rests against the high portion of the cam 68 so that lever 64 is rocked to its left-hand position. This causes lever 62 to be rocked against arm 59 of lever 55 to hold the latter in such a position that its arm 57 is disengaged from teeth 15. At the same time, arm 57 acts against member 16 at the lower edge of opening 58 and causes member 16 to be rocked downwardly about its pivot 17 so the projecting portion 18 is removed from teeth 19 around the lower edge of the print head. During this time lever 117 is out of contact with cam 121 and rests against stop 124 so that pawl 104 is engaged only with detenting hub portion 49 of rotation pulley 42. With the parts in this position, tapes 33 and 43 may be actuated to tilt and rotate the print head.

As tapes 33 and 43 are still being moved to effect, respectively, the tilting and rotation of the print head, member 26 is being rocked clockwise on its trunnions 50 (FIG. 2) to bring the print head into engagement with the platen. This movement of member 26 causes end 113 of arm 112 to move toward anvil 114, and to bring cam follower portion 120 of arm 117 into engagement with cam 121. The movement of tapes 33 and 43 is completed before anvil 114 is reached by end 113, and at this time lobe 122 rotates arm 117 to engage pawl end 119 to move pawl 104 into engagement with one of the notches 110 to precisely position shaft 36 relative to support member 26. Pawl 104, however, does not entirely leave notch 100, but this notch is V-shaped horizontally so that pivotal movement of the pawl results in a freeing of the

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shaft 36 from pulley 42. As the pawl moves into one of the notches 110, it dentents shaft 36 relative to the drive pulley and the supporting members 23 and 26 for locating the shaft accurately in the position selected.

As pawl 104 begins to enter a notch 110, the low dwell on cam 68 comes opposite projecting portion 70 on lever 64 permitting lever 62 to move to the right in FIG. 1 through the action of spring 60 and arm 59. This action permits arm 57 to move upwardly to engage teeth 15 for detenting the tilt of print head 1, and to release member 16 so that end portion 18 is swung into engagement with teeth 19 of the print head by spring 20 for rotational detenting of the head.

Through the cooperative action of pawl 104 and arm portion 18, the print head is rapidly and exactly positioned as a printing operation takes place. Pawl 104 functions as a detent for the head by rotationally positioning shaft 36 to correct for any inaccuracy in its location due to any tape stretch and wear in the shaft driving mechanism. Arm portion 18 refines the rotational location of the print head by counteracting for wear and play between pins 38 and 40 and the slots in the universal joint member 39.

The rocking of member 26 relative to carrier 51 to effectuate printing is shown and described in detail in the patent issued to F. E. Becker et al., mentioned above. Generally, member 26 is rocked upwardly on trunnions 50 through the cooperative action of a cam (not shown) on sleeve 67 and cam follower arm 73 attached to member 26 by pin 75 in slot 74. Arm 73 is pivotally mounted on carrier 51 by means of a pin and slot, not shown. The positive force applied to rotate member 26 about trunnion 50 is terminated before the print head strikes the platen. Inertia of the moving parts will cause the print head to continue its movement toward the platen so that arm end 113 will strike anvil 114 while member 26 is in free flight and just before the head contacts the platen. This produces a whipping action in the mechanism supporting the print head to effect a sharp engagement of the latter with the platen.

As soon as a printing operation has been completed, cam lobe 122 will have passed beyond lever end 120 permitting spring 123 to disengage lever end 118 from pawl end 119. Spring 106 then disengages pawl 104 from one of the notches 110 and re-engages it firmly in notch 100 for connecting the pulley in rigid driving relation with shaft 36. At the same time that lobe 122 becomes ineffective, projecting portion 70 on lever 64 engages a high dwell on cam 68 to move lever 62 to the left (FIG. 2) to effect the removal of the detenting members from teeth 15 and 19 so that print head is freed for rotational and tilting movement when shafts 30 and 36 are driven.

There is shown in FIG. 4 a mechanism like that of FIGS. 1-3 except for the removal of detenting ring 108. It is assumed in this case that the play in the universal joint is very small and that member 16 is capable of detenting for this play as well as for any inaccuracy in the driving mechanism which rotates the head. Pawl 104 is still rocked in a clockwise direction to free shaft 36 from pulley 42 but the inner edge of the pawl is not completely removed from groove 100. This prevents a turning of shaft 36 to a position in which it would be impossible for pawl 104 to re-enter groove 100.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various other changes in form and details may be made therein without departing from the spirit and scope of the invention.

We claim:

1. In a printing mechanism, the combination, comprising:
 - a shaft;
 - a printing element connected to said shaft and having a ring of detent notches therein;

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a base supporting said shaft for rotation and having an annulus of detent teeth thereon concentric with the axis of said shaft;

a rotatable member;

connective means on said shaft operable in a first position for coupling said shaft to said member for rotation therewith, and movable to a second position to engage a pair of said teeth and disengage said member for positioning said shaft relative to said base;

detent means on said base engageable with one of said notches for positioning said printing element relative to said base;

and operating means for moving said connective means from said first position to said second position to engage a pair of said teeth and for engaging said detent means with one of said notches.

2. The device as described in claim 1 wherein said connective means includes:

a pawl pivotally mounted on said shaft for coupling said shaft with said rotatable member and for engaging said teeth;

and a resilient element for urging said pawl into engagement with said rotatable member.

3. In a device of the class described:

a support;

a shaft rotatably mounted in said support;

a print element on said shaft having a first set of detenting teeth thereon;

a second set of detenting teeth on said support;

first detent means mounted on said support including a detent member engageable with said first set of teeth;

means on said support for rotating said shaft;

second detent means including a pawl movably mounted on said shaft interconnecting said shaft with said rotating means and engageable with said second set of teeth;

and operating means for said first and second detent means for selectively engaging said detent member of said first detent means with said first set of teeth and said pawl with said second set of teeth.

4. A printing mechanism comprising, in combination:

a shaft;

a printing element flexibly mounted on said shaft having a plurality of type characters spaced about the periphery thereof and a corresponding detent notch therein for each of said characters;

a base rotatably supporting said shaft, said base having a plurality of detent teeth thereon with each pair of teeth defining a print position for said shaft relative to said base;

a rotatable member for rotating said shaft and said element to an approximate printing position;

connective means on said shaft for rigidly coupling said member with said shaft for rotation with said member, said connective means being movable to a nonrigid coupling position for engagement with a pair of said teeth;

detenting means on said base engageable with a detent notch in said element to position said element and one of said type characters at a printing position relative to said base from said approximate printing position;

and means for moving said connective means into engagement with said pair of teeth at said printing position, and for engaging said detenting means with said notch corresponding to one of said characters at said approximate printing position after said member is rotated, whereby said shaft and said element are each positioned relative to said base.

5. In a printing mechanism;

a multiple character print head;

a rotary support for said print head which can be rotated to bring different ones of said print head characters selectively to printing position;

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driving means for differentially rotating said support;
 means to couple said driving means to said support,
 said coupling means being movable from a first position in which it rigidly connects said driving means
 and said support to a second position in which it 5
 disconnects said driving means from said support;
 means for detenting said print head in any one of its
 selectable positions;
 and common operating means for moving said coupling means to said second position and for conjunctively actuating said detenting means to detent
 said print head. 10
 6. In a printing mechanism, the combination, comprising:
 a base; 15
 a shaft rotatably supported on said base and having a
 printing element attached thereto;
 a member for rotating said shaft relative to said base;
 connective means for rigidly connecting said shaft with
 said rotating member and being movable so as to 20
 provide a nonrigid connection between said shaft
 and said rotating member;
 detenting means engageable for detenting said printing
 element relative to said base;
 and means for moving said connective means to provide 25
 said nonrigid connection and for engaging said
 detenting means.
 7. The device as described in claim 6 wherein said
 connective means includes:

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a pawl pivotally mounted on said shaft engageable with
 said rotating member for providing said rigid
 connection;
 and a resilient element on said shaft urging said pawl
 into engagement with said rotating member.
 8. In a printing mechanism, a device for detenting a
 print head in a printing position, comprising:
 a base;
 a multiple character printing element having a plurality
 of detent notches therein each corresponding to a
 character;
 shaft means for supporting said printing element and
 rotatably mounted on said base;
 a member for rotating said shaft means and said element
 differentially to angularly position a character on said
 element at a printing position;
 connective means for rigidly coupling said shaft means
 and said member, and adapted to be moved to a
 position permitting relative motion between said shaft
 means and said rotating member;
 detenting means attached to said base and operable for
 engaging one of said detent notches corresponding to
 said positioned character;
 and means for moving said connective means and oper-
 ating said detenting means, whereby said character
 is precisely located in a printing position relative to
 said base.

No references cited.