Sept. 1, 1959 G. A. WALKER 2,902,132

SINGLE ELEMENT PRINT HEAD

Filed Dec. 30, 1955

FIG. 1

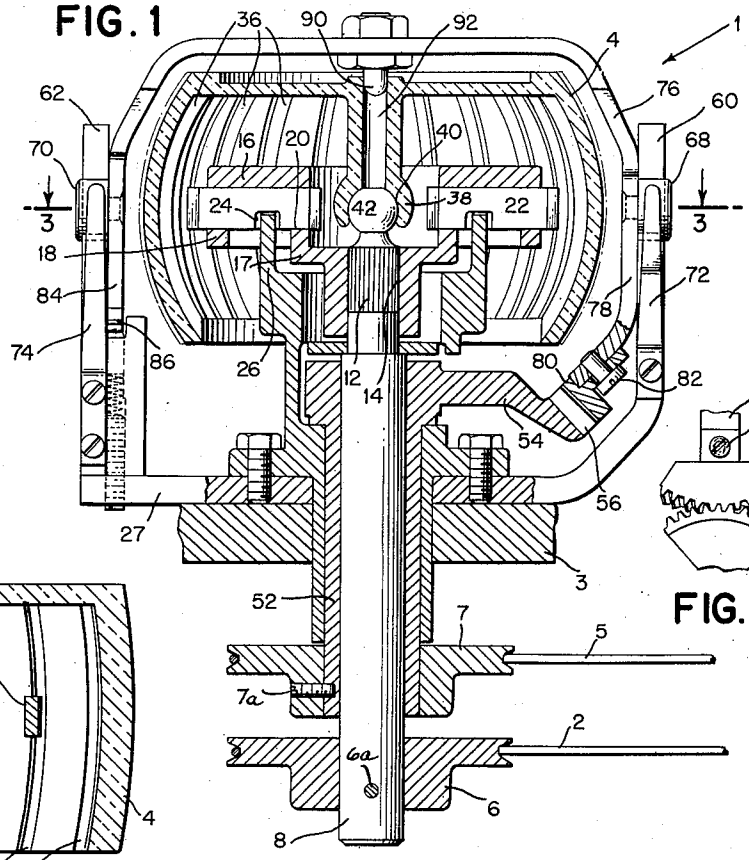


FIG. 6

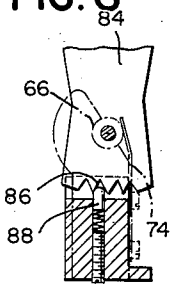


FIG. 4

FIG. 2

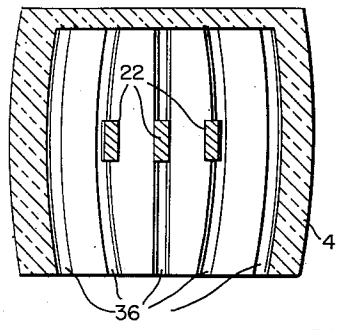


FIG. 3

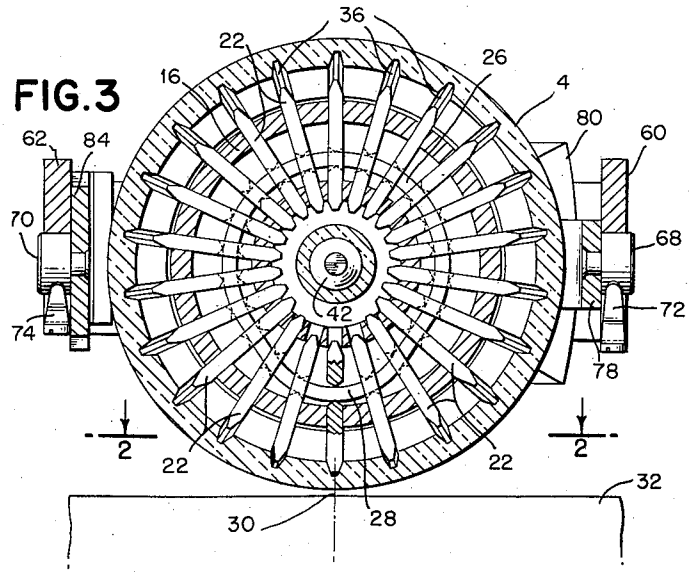
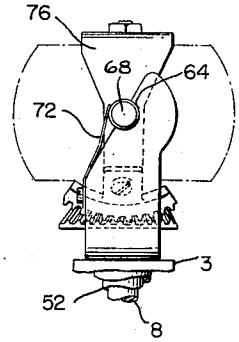


FIG. 5



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SINGLE ELEMENT PRINT HEAD

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Application December 30, 1955, Serial No. 556,514

10 Claims. (Cl. 197—52)

This invention relates to printing elements and more particularly to an improved support and driving mechanism for a single element printing head.

In copending application Serial No. 547,482, filed November 17, 1955 on behalf of L. E. Palmer, et al., the complete details of a single element typewriter are given including the means for selecting the character on a single element spherical head which is to be printed. In still another copending application Serial No. 547,481, filed November 17, 1955 on behalf of J. E. Hickerson, et al., the details of one embodiment of the driving mechanism for a single element spherical printing head are given.

One of the main problems in dealing with single element spherical printing heads is that since the characters are arranged in rows of different circumference (depending on the location of the row with respect to a plane through the equator of the sphere) a "compensation factor" is required. That is, unless the tilting takes place in a plane at right angles to the tilt axis, then rotation is imparted to the head during tilting. This rotation during tilt (unless tilt is at right angles to tilt axis) causes a bind in the drive mechanism, or else a displacement of the character relative to a longitudinal line. To compensate for this condition, a double universal joint was employed in one embodiment of drive as shown in copending application Serial No. 547,481, referred to hereinbefore, and it is to compensate for this condition that the improved driving mechanism of this invention has been provided. Therefore it is a first object of this invention to provide an improved single element driving mechanism wherein the problem of the "compensation factor" has been eliminated.

It is still a further object of this invention to provide an improved driving mechanism for a single element printing head.

Another problem with the single element spherical printing head is to produce a uniform density of printing irrespective of the character being printed and accordingly, it is a still further object of this invention to improve printing uniformity by providing an improved driving mechanism for a single element spherical printing head wherein an anvil is provided behind the character that is being printed.

It is a still further object of this invention to provide an improved driving mechanism for a single element spherical printing head wherein the problem of the "compensation factor" has been eliminated and wherein an anvil is automatically provided behind the character which is being printed thereby improving the printing unformity.

Another problem with respect to single element printing heads is the correct registration of the character with the printing position. In some previous embodiments it was necessary to provide detent means within a spherical head to assure the correct registration of the character with a printing position, and accordingly, it is a still further object of this invention to provide an improved driving mechanism wherein the need for a detent mechanism within the spherical head has been eliminated.

It is a still further object of this invention to provide an improved driving mechanism for a single element spherical printing head wherein the accuracy of indexing has been greatly improved by eliminating play in the driving parts.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a vertical section taken through the center of the print head to show its driving mechanism.

Fig. 2 is a sectional view along plane 2—2 of Fig. 3 in direction of arrows.

Fig. 3 is a plan section taken along plane 3—3 of Fig. 1 in the direction of the arrows.

Fig. 4 is an auxiliary view of a portion of the tilting mechanism.

Fig. 5 is a side elevation of bearing support.

Fig. 6 is a side elevation of tilt detent.

Briefly, this invention relates to an improved mechanism for turning and tilting a single element spherical printing head in such a manner that the inner periphery of the print head is positively driven at only one point at a time, while the actual engaging point is stepped from point to point along the inner periphery of the print head. Actually, the inner periphery of the print head is equipped with longitudinal groves, and in this manner, the tilting of the print head relative to the driving means takes place along a longitudinal line so that the "compensation factor" is not involved.

Description

With reference to the drawings, and particularly Fig. 1, a printing mechanism 1 is shown supported in a rocker 3 which in turn is supported (in a manner not shown but described in application Serial No. 547,482) for rocking movement into and out of printing position. It will be understood that the printing mechanism is equipped with a single element spherical printing head 4 having characters arranged in rows and columns on its spherical surface. Accordingly, provision must be made for rotating and tilting the printing head so that a selected character will be indexed into a single printing position.

As described in U.S. application, Serial No. 547,482, a selecting mechanism is provided for exerting a force simultaneously on a turn wire 2 and a tilt wire 5. The wires 2 and 5 respectively are attached to a rotation or turn pulley 6 and a tilt pulley 7, and the manipulation of these pulleys indexes a selected character into printing position.

Rotation

Turn pulley 6 is connected via some positive drive means, for example, a pin 6a, to a shaft 8 which is supported for rotation relative to rocker 3 by means of suitable bushings. Shaft 8 is equipped at its upper end with a splined portion 12 which is engageable for positive drive with a complementary splined element 14 in a pin barrel 16.

The pin barrel 16 is somewhat in the shape of an inverted bell having an annular ring 17 and a turned down lip 18. The ring 17 and lip 18 are perforated in a horizontal plane along radial lines to provide bearing guides 20 for a plurality of drive pins 22.

With reference to Fig. 3, it can be seen that the pins 22 in passing through the guides 20 form pie shaped sections, and the guides are so shaped as to permit the pins to slide radially in and out along radial lines.

Each pin 22 is further equipped with a groove 24 which rides on a ring cam 26. The ring cam 26 is stationary and secured to a yoke 27 which in turn is

supported in rocker 3. The ring cam 26 has a single lobe 28 which is so positioned that the major radius is directly in line with a print position 30 shown located on a platen 32 (Fig. 3).

With the mechanism above described it can be appreciated then that as the pins 22 are rotated in a common plane about the axis of shaft 8, and therefore relative to the stationary ring cam 26, the inter-engagement of the groove 24 and the ring cam 26 will drive the pins radially in and out as they pass print position 30. For example as the pins are moved counterclockwise as viewed in Fig. 3 from nine o'clock past print position 30 towards three o'clock, the pins are first gradually advanced radially outwardly so that at the print position 30 each pin in turn is at its maximum radial distance from the center of shaft 8, and then the pin is gradually withdrawn.

The single element spherical print head 4, as generally described in the copending applications, Serial Numbers 547,481 and 547,482, is a hollow truncated plastic sphere with the characters of a type font arranged on it in rings and columns. The print head 4 of the present invention is further provided with a plurality of internal grooves 36 (equal in number to the pins 22) which are in the form of longitudinal lines having their greatest inter-distance along the equator. The print head 4 is further equipped with a central stub 38 which provides a ball socket 40 engageable with a ball 42 located on the end of shaft 8. The arrangement of parts is such that the ball 42 is directly at the center of the print head 4 when it is assembled on the printing mechanism 1. The ball socket 40, in view of the resilient qualities of the plastic print head, can be sprung into and out of engagement with the ball 42 thereby providing a releasable bearing support at the exact center of the spherical print head 4. In view of the supporting means, the print head 4 is concentric with respect to the axis of shaft 8, and it can be appreciated therefore, that as the pins are driven radially outwardly, each will sequentially engage its corresponding groove 36 and thereby provide the positive driving means for rotating the print head about the axis of shaft 8 in response to rotation of shaft 8.

Furthermore, the shape of the radially outer ends of the pins 22 is complementary to the shape of the grove 36 and accordingly, the pin 22 at printing position 30 provides a positive interconnection with minimum play between shaft 8 and print head 4. Accordingly, this inter-engagement of the drive pin 22 at print position 30 with the print head 4 serves the dual function of eliminating the need for an internal detent arrangement for the print head 4 and also of providing an anvil directly behind the character which is being printed thereby improving the uniformity of print density.

Compensation factor

With the arrangement of the drive pins 22 and the internal grooves 36 of the print head 4 as shown in Fig. 3, it can be seen that while the pin 22 at print position 30 is in positive driving relation with the print head, the pins on either side of the print position are in partial driving relation with the print head, and accordingly, some relative play between the drive pins and the print head 4 is permissible at all points except print position, and since the groove 36 at print position 30 lies in a plane perpendicular to the tilt axis there will be no binding of the drive mechanism if the head is tilted at the same time that it is being rotated about the axis of shaft 8.

Tilt control

Tilt pulley 7 is secured by some positive drive means, for example, a set screw 7a, to a bushing shaft 52 which is supported for rotation relative to shaft 8. The bushing shaft 52 has a radial arm 54 at its upper end which carries a gear sector 56. Actually, the radial arm 54 extends through a cut away slot in the support portion of the ring cam 26 so that the arm can be rotated (through approximately 60°) relative to the ring cam 26.

In order to tilt print head 4, yoke 27 is provided with a pair of arms 60, 62 which extend up beyond a horizontal plane passing through the center of ball 42. The arms 60, 62 in turn, are provided with half bearings 64, 66 respectively, engageable with trunnions 68, 70 respectively. As shown in Fig. 5, the trunnion 68 is held in engagement with the half bearing 64 by means of a spring 72 while a corresponding spring 74 is provided on arm 62 to hold trunnion 70 in engagement with half bearing 66. It will be noted that the half bearings 64 and 66 are so shaped that during a print stroke the force of the print stroke is transmitted (as later described) to the arms 60 and 62 of the yoke 27 without any tendency of the trunnions being lifted out of the half bearings.

The trunnions 68, 70, in turn, are riveted or otherwise secured to a cradle 76 which is substantially of inverted U-shape and which acts to tilt print head 4 about ball 42. More specifically, one leg 78 of the cradle 76 is equipped with a removable gear sector 80 which is connected by means of a set screw 82 in such a manner that an adjustment can be made between sector 80 and the corresponding gear sector 56 to eliminate any gear tooth back lash. The opposite leg 84 of the cradle 76 is equipped with a plurality of notches or ball sockets 86 (see Fig. 6 also), with one notch being provided for each row of type on the print head 4. The yoke 27, in turn, is equipped with a ball detent 88 of conventional type which is spring biased into engagement with one notch 86 at a time. This arrangement insures the proper alignment of a corresponding row of type in printing position.

The cradle 76 is further provided with a center bearing stud 90 which is engageable with a complementary bore 92 in the center stud 38 of the printing head 4. Accordingly, through the inter-engagement of the bearing stud 90 with the bore 92 and the ball socket 40 with the ball 42, a sturdy support is provided for the print head 4 thereby preventing twisting of the print head during a print blow.

Interchangeable print head

It can be appreciated that in some instances it is desirable to change a type font to accommodate a variation in print conditions. With the structure described, it is a simple matter to remove one print head 4 and replace it with another. More specifically, the springs 72 and 74 on yoke arms 60, 62 respectively are first raised out of engagement with the trunnions 68, 70 respectively and then the cradle 76 can be lifted away from the yoke 58 with the bearing stud 90 being lifted out of the corresponding bore 92. Then the print head 4 can be snapped away from the ball 42 and replaced with one having a different type font. The cradle 76 is again assembled in the yoke 27 and the printing mechanism 1 is again ready for operation.

It has been found that through the use of this improved print head drive mechanism an accurate turning and tilting mechanism is provided for a single element spherical printing head wherein the problem of the "compensation factor" has been removed, and furthermore, in view of the fact that, in the form of drive pin 22, an anvil is positioned behind the character being printed, the printed product has a very uniform color density.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the in-

tention therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. An improved support and drive mechanism for a single element spherical print head comprising a rotatable supporting shaft, means mounting the spherical center of said print head for universal movement relative to one end of said shaft, means interconnecting said print head for rotation with said shaft, said interconnecting means comprising a plurality of drive pins angularly positioned about said spherical center and movable radially relative thereto, means connecting said drive pins for rotation with said shaft, and stationary means engaging said pins for effecting, on rotation of said shaft, sequential radial movement of said drive pins relative to said shaft and into engagement with said print head to effect a driving of the latter with said shaft.

2. An improved support and drive mechanism for a single element spherical print head comprising a supporting shaft, means mounting the spherical center of said print head for universal movement relative to one end of said shaft, and means interconnecting said print head and said shaft comprising a plurality of drive pins radially positioned relative to said spherical center, means mounting said drive pins for rotation with said shaft, and stationery means engaging said pins for effecting radial movement of said drive pins relative to said shaft, and into driving engagement with said print head, said radially moving means being so arranged that only one pin at a time is in full driving engagement with said print head.

3. An improved support and drive mechanism for a single element spherical printing head comprising a supporting shaft, means mounting the spherical center of said print head for universal movement relative to one end of said shaft, and means turning said print head about the axis of said shaft comprising a plurality of drive pins mounted in a plane including the spherical center of said print head, a plurality of grooves on the inner surface of said print head, and means responsive to the turning of said shaft for radially moving one of said pins at a time sequentially into complete driving engagement with its corresponding groove thereby rotating said print head.

4. An improved support and drive mechanism for a single element spherical printing head comprising a supporting shaft, means mounting the spherical center of said print head for universal movement relative to one end of said shaft, and means turning said print head about the axis of said shaft comprising a plurality of drive pins mounted in a plane including the spherical center of said print head, a plurality of longitudinal grooves equal in number to said pins on the inner surface of said print head, and means responsive to the turning of said shaft for radially moving one of said pins at a time sequentially into complete driving engagement with its corresponding groove thereby rotating said print head.

5. A mechanism in accordance with claim 3 wherein said radial moving means for said drive pins comprises a ring cam having a single high dwell at a predetermined point of engagement between said pins and said print head, and means interconnecting said pins and said ring cam.

6. A mechanism in accordance with claim 3 wherein said radial moving means for said drive pins comprises a ring cam having a single high dwell at a predetermined point of engagement between said pins and said print head, each of said pins having a notch engageable with said ring cam, and means for turning said pins about the axis of said shaft and thereby driving said pins radially into engagement with said print head to turn the latter about the axis of said shaft.

7. An improved support and drive mechanism for a single element print head comprising a supporting shaft, means mounting the spherical center of said print head for universal movement relative to one end of said shaft, and single point drive means for turning said print head about the axis of said shaft comprising a plurality of drive pins, means mounting said drive pins in a common plane including the spherical center of said element for movement about the axis of said shaft and for movement radially of said shaft, pin drive means comprising a fixedly mounted ring cam concentric with said drive pin mounting means, said ring cam having a single lobe proximate to a predetermined point of engagement with said type head, and means interconnecting said ring cam and said pins whereby the rotation of said pins drives said pins radially relative to said shaft in conformity with the shape of said ring cam.

8. An improved support and drive mechanism for a single element spherical print head comprising a support shaft, means mounting said print head for universal movement relative to one end of said shaft, additional means supporting said print head for tilting movement about a tilt axis perpendicular to the axis of said shaft and changing single point drive means for turning said print head relative to said shaft comprising means supporting a plurality of drive pins for rotation about the axis of and for radial movement relative to said shaft, a plurality of longitudinal grooves in the inner periphery of said spherical print head, and means providing for the inter-engagement of one of said drive pins and a corresponding longitudinal groove at a point lying in a plane perpendicular to the tilt axis of said spherical print head, comprising a ring cam fixedly mounted concentrically of said shaft for engagement with said drive pins, said ring cam having a high dwell point in a plane perpendicular to the tilt axis of said print head, and means moving said pins relative to said ring cam whereupon as said drive pins are turned relative to said ring cam they are moved radially outwardly into engagement with their corresponding groove by the high dwell point of said ring cam.

9. An improved support and drive mechanism for a single element spherical print head comprising a support shaft, means mounting the spherical center of said print head for universal movement relative to said support shaft, tilting means for tilting said print head about a fixed tilt axis, and varying turn means interconnecting said print head and said supporting shaft at a point lying in the plane perpendicular to said tilt axis, comprising a plurality of drive pins, means mounting the same in a plane including the spherical center of said print head, a number of longitudinal grooves in the inner wall of said print head corresponding in number to said pins, and means responsive to the turning of said shaft for turning said drive pins about the axis of said shaft and sequentially driving said pins radially into engagement with their corresponding grooves in said print head at a point lying in the plane perpendicular to said tilt axis.

10. A mechanism in accordance with claim 9 wherein said radial drive means comprises a ring cam fixed relative to said support shaft and having a single lobe located in a radial line through the center of said shaft and perpendicular to said tilt axis, and means interconnecting said drive pins and said ring cam so that the turning of said pins about the axis of said shaft drives them sequentially into engagement with their corresponding grooves proximate to the lobe of said ring cam.

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