

PATENT SPECIFICATION

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(54) PRINTING DEVICE

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA, a Japanese company of 3-4, 4-chome Ginza, Chuo-ku, Tokyo, Japan and SHINSHU SEIKI KABUSHIKI KAISHA, a Japanese company of 3-5, 3-chome, Owa, Suwa-shi, Nagano-ken, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to printing devices.

Conventional printing devices have a relatively large number of component parts for converting electrical print command signals into mechanical motion of print characters. These conventional printing devices are complicated to assemble, are of a relatively large size and are heavy.

According to the present invention there is provided a printing device comprising at least one character ring having print characters on its periphery; a pawl arranged to engage the or each character ring the arrangement being such that, when the or each print character ring is in motion, the respective pawl, when released, stops the print character ring so that a desired one of the print characters thereon is in a printing position; a spring member for urging the or each pawl for movement in a predetermined direction; and electromagnetic means for releasing the or each pawl for movement under the action of the respective spring member to engage the respective character ring on receipt of a print command signal; the or each electromagnetic means includes a restraining member and an electromagnetic device, the restraining member preventing movement of the or the respective pawl under the action of the or the respective spring member when the electromagnetic device is not energised and permitting movement of the or the respective pawl under the action of the or the respective

spring member when the electromagnetic device is energised by a print command signal.

In the preferred embodiment in which the at least one character ring is mounted on a shaft having an axially extending notch in the periphery thereof, a resilient member being provided having a first portion engaged in said notch and a second portion engaged with the or each character ring, the resilient member being so arranged that the or the respective character ring rotates with the shaft until prevented from doing so by the or the respective pawl.

The printing device may include reset means for disengaging the or each pawl from the or the respective character ring on completion of a printing operation.

The or each restraining member may be biased into engagement with the or the respective pawl by a compression spring, guide means being provided for guiding the movement of the or each restraining member.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:—

Figure 1 is a side elevation, partly cut-away, of a printing device according to the present invention;

Figure 2 illustrates an arrangement for guiding pawls of the printing device of Figure 1;

Figure 3 shows an arrangement for guiding upper portions of restraining members of the printing device of Figure 1;

Figure 4 shows an arrangement for guiding the lower portions of the restraining members shown in Figure 3; and

Figure 5 is a perspective view of first and second print base plates of the printing device of Figure 1.

Throughout the following description the terms "upper", "lower", etc. refer to the directions as seen in the drawings.

Referring to the drawings, and in par-

ticular to Figure 1, there is illustrated a printing device according to the present invention. The printing device has a plurality of print character rings 10 one of which is provided for each column to be printed. Each character ring 10 has a plurality of print characters 101, e.g. letters or symbols, provided around its periphery 104. A ratchet wheel 102 is mounted for rotation with each character ring and has a respective tooth for each print character 101. A spring member 11 is mounted within a slot 103 in each ratchet wheel 102, the spring member having a first portion 111 which engages within a recess 107 of the respective character ring 10 and a second portion 112 which engages in a notch 211 in a shaft 21 upon which the character rings 10 are mounted. A power source or motor (not shown) is provided to rotate the shaft 21 in either the counterclockwise direction as indicated by arrow B or in the clockwise direction as indicated by arrow C. The resiliency of each spring member 11 is such that it biases the first portion 112 thereof, towards the axis of the shaft 21 so that the first portion is urged into engagement with the notch 211. When the first portion 112 of each spring member 11 is engaged within the notch 211 in the shaft 21, the print characters 101 on the respective character ring 10 and the teeth on the respective ratchet wheel 102 have a predetermined relationship with respect to one another.

A pawl 12, provided for each character ring 10, is guided in slots 131, 132 of a pawl guide member 13. The pawls 12 are mounted for rotation about a support shaft 14 and each is biased to engage the teeth of the respective ratchet wheel 102. When the pawls 12 engages the teeth of the respective ratchet wheels 102 the latter are prevented from further rotation so that predetermined print characters 101 on the corresponding character ring 10 is stopped in a printing position.

A yoke 22 prevents magnetic flux leaking from an electromagnetic device 38. The yoke 22 is mounted adjacent to a mounting plate 20 which is made of non-magnetic material. The mounting plate 20 is fixed between two frames (not shown) to maintain a predetermined distance therebetween as well as to maintain rigidity of the printing device. The mounting plate 20 is provided with a bent portion 201 to which a resilient member 19 is fixed, for example, by adhesive. A female screw 221 is tapped into the yoke 22 so that it may be fixed to the mounting plate 20 by a screw 23. Furthermore, a female screw 222 is tapped in the yoke 22 and a resilient plate, having spring fingers 25, is mounted on the mounting plate 20 by a screw 24 which engages the female screw 222. Each of the spring fingers 25

engages with a hook portion 121 of a respective pawl 12 to bias the latter for rotation about the support shaft 14 in a direction indicated by an arrow D. A tail portion 122 of each pawl 12 is engaged with an end portion 261 of a restraining member 26. An end portion 271 of an attraction plate 27 is inserted in an aperture 262 of each restraining member 26. The upper part of each restraining member 26 is guided by a first guide member 30 having an elongate slot 303 (Figure 3) therein and a second guide member 31 which has a plurality of guide teeth 314 therein. The lower part of each restraining member 26 is guided by a third guide member 32 having an elongate slot 321 (Figure 4) therein. By virtue of the construction of these guide members the distance 33 between the mounting plate 20 and the restraining member 26 can be predetermined. A tail portion 263 (Figure 4) of each restraining member 26 is supported on a compression spring 34 contained in a support structure 35 and thus each restraining member 26 is biased upwardly.

When an electromagnetic coil 28 is energised, the respective attraction plate 27 is attracted towards an iron coil 29 within the electromagnetic coil 28 causing the restraining member 26 to begin to move downwardly. As the tail portion 122 of the respective pawl 12 is inclined to the direction of downward movement of the restraining member 26 the pawl 12 begins to rotate in a controlled manner in the direction of the arrow D under the action of the respective spring finger 25 immediately the restraining member 26 begins to move downwardly. If the tail portion 122 of the pawl 12 were to extend in a direction parallel to the direction of movement of the restraining member 26, the pawl 12 would not rotate until it had been released from engagement with the respective restraining member on downward movement thereof and when released the pawl would rotate in an uncontrolled manner.

On downward movement of each restraining member 26 the respective pawl 12 rotates from the position shown in solid lines in Figure 1 to the position shown by a broken line 123, and in this position the pawl 12 engages with one of the teeth of the respective ratchet wheel 102 so that a selected print character 101 is in a printing position. The rotation of the pawl 12 takes a longer time in the case where the tail portion 122 of the pawl 12 is parallel to the direction of movement of the respective restraining member 26 than the case where the tail portion 122 is inclined to the direction of movement of the respective restraining member. The actual angle of inclination of the tail portion 122 to the direction of move-

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ment of the restraining member 26 is arbitrary, and improves operative reliability of the pawl 12 in the direction of a print character to take part in a printing operation.

The restraining members 26 are accurately positioned and fixed in predetermined positions by means of the screw 23 which fixes the yoke 22 to the mounting plate 20, and the arrangement is such that the end portion 261 of each restraining member 26 just touches a projection 124 on the respective pawl 12. If the tail portion 122 of each pawl 12 and the end portion 261 of the respective restraining member 26 are too deeply engaged, the rotation of the pawl 12 takes a relatively long time and the reliability of the selection of a print character to be printed is reduced. On the other hand, if the tail portion 122 of each pawl 12 is too lightly engaged with the end portion 261 of the respective restraining member 26 they are liable to disengage if the printing device is subjected to an external shock. The projections 124 define a predetermined degree of engagement between the tail portion 122 of each pawl 12 and the end portion 261 of the respective restraining member 26.

Coil bobbins 36 are provided on a pair of first print base plate 37, with the cores 29 thereof fixed to the yoke 22. The coil bobbins and the first print base plates 37 are also fixed to the yoke 22. Two rows of cores 29 are arranged in a regular zigzag on the yoke 22. A second print base plate 40 is fixed to the yoke 22. The second print base plate 40 is provided with electronic circuitry 41 whose lead terminals 411 are connected to projections 371 on the first print base plate 37. Each of the coils 28 is energized through the second print base plate 40 and the first print base plate 37.

A shaft is rotatable in a predetermined direction through a given angle by a cam member (not shown), to cause the pawls 12 to rotate in the clockwise direction. Between the character rings 10 and a platen 44 print paper 45 and an inked ribbon 46 are disposed.

Figure 2 illustrates an arrangement for guiding the pawls 12. The pawl guide member 13 is substantially U-shaped and has a first portion 137 and a second portion 138. The guide member 13 also has a pair of ears 133 by means of which it is mounted on the support shaft 14. The pawls 12 are mounted for rotation about the support shaft 14 and are guided in the slots 131 provided in the first portion 137 of the pawl guide member and the slots 132 provided in the second portion 138 of the pawl guide member 13. Abutment rings 15 are fitted on the support shaft 14 to prevent the guide member 13 from moving axially relative thereto.

The unit consisting of the support shaft

14, the pawls 12 and the pawl guide member 13, may be handled easily and may be mounted relatively simply between spaced-apart frames 16, 17. The second portion 138 of the pawl guide member 13 has a pair of parallel faces 134 which are spaced apart by substantially the same distance as the frames 16, 17. When the support shaft 14 is fixed in a groove 161 of the frame 16 and a groove 171 of the frame 17 by means of nuts 18, the faces 134 of the pawl guide member 13 engage respective surfaces of the frames 16, 17 so that axial movement of the pawl guide member 13 relative to the frames 16, 17 is limited. Thus the pawls 12 are disposed in predetermined positions relative to the frames 16, 17. Abutment portions 135 on the second portion 138 of the guide member 13 engage an edge 162 of the frame 16 and an edge 172 of the frame 17. A projection 136 on the first portion 137 of the pawl guide member 13 is engaged by the resilient member 19 and compresses the same. Thus the elasticity of the resilient member 19 urges the abutment portions 135 to engage with the edge 162 of the frame 16 and the edge 172 of the frame 17 so that no rotational play exists between the pawl guide member 13 and the support shaft 14.

Each of the character rings 10 is mounted for pivotal movement on the shaft 21 and is guided by the pawls 12 on each side except in the case of the endmost character ring adjacent the frame 16 which is guided by one of the pawls 12 and a projection 138 on the second portion 138 of the pawl guide member 13 so that its movement in the direction of the axis of the shaft 21 is limited. Accordingly, the position and spacing of the character rings 10 is determined merely by the pawls 12 and the pawl guide member 13.

Figure 3 illustrates in greater detail the first guide member 30 and the second guide member 31. The yoke 22 is bent into a substantial U-shape so that it has a first portion 226 and a second portion 227. The first portion 226 of the yoke 22 is fixed to the mounting plate 20 by the screw 221 shown in Figure 1. The first portion 226 and the second portion 227 of the yoke 22 are provided with a plurality of grooves 225 in which the attraction plates 27 are mounted. The attraction plates 27 are disposed in positions corresponding to the respective cores 29. The first portion 226 of the yoke 22 has a pair of parallel edge faces 224 which extend in a direction which is perpendicular to the plane containing the restraining members 26. Furthermore the first portion 226 and the second portion 227 of the yoke 22 has four support portions 223 which are in the same plane as the edge faces 224.

The second guide member 31, having the guide teeth 314 therein, is positioned at

central portion thereof, has a pair of columnar projections 318 which are arranged in a line which is parallel to the guide teeth 314. The second guide member 31 has a first mounting foot 311, a second mounting foot 312 and bent portions 317 all of which extend in a line which is parallel to the guide teeth 314. The width 47 of the first mounting foot 311 is greater than the width 48 of the second mounting foot 312. The first mounting foot and the second mounting foot are each provided with a mounting aperture 315. The second guide member 31 also has a pair of abutment faces 316 which again are disposed parallel to the line of the guide teeth 314 and a pair of parallel edge faces 313. The second guide member 31 is mounted on the four support portions 223 of the yoke 22, the pair of edge faces 313 being inserted between the edge faces 224 of the yoke 22. The restraining members 26 are then inserted between guide teeth 314. The edge faces 224 of the yoke 22 limit movement of the second guide member 31 in the direction of the plane containing the restraining members 26. The guide teeth 314 in the second guide member 31 determine the positioning of the restraining members 26. When the abutment faces 316 engage with the first portion 226 of the yoke 22, there is a gap between the first mounting foot 311 and the second portion 227 of the yoke 22 and there is a gap between the second mounting 312 and the first portion 226 of the yoke 22. The first mounting foot 311 is fixed to the second portion 227 of the yoke 22, with bending occurring, by a screw (not shown) which is screwed through the mounting aperture 315. The second mounting foot 312 is similarly fixed to the first portion 226 of the yoke 22. As the width 47 of the first mounting foot 311 is greater than the width 48 of the second mounting foot 312 there occurs a difference in resiliency and thus the second guide member 31 is biased in the direction of an arrow A so that its abutment faces 316 are urged into contact with the first portion 226 of the yoke 22. Thus the surface of the first portion 226 of the yoke 22, in contact with the mounting plate 20 and the columnar projections 318 are correctly aligned.

The first guide member 30 has a circular aperture 301 and an elliptic aperture 302 therein. Furthermore the first guide member 30 has a bent portion 304 which extends in a direction parallel to that of the elongated slit 303. The bent portion 304 is provided with comb-shaped guide grooves 305. The columnar projections 318 in the second guide member 31 are engaged within the apertures 301, 302 of the first guide member 30 so that the latter is mounted on the second guide member 31. The slit 303, which is parallel to the first portion

226 of the yoke 22 guides the restraining members 26. The guide grooves 305, provided in the bent portion 304 are aligned with the guide teeth 314 of the second guide member 31. Each groove 305 prevents the respective pawl 12 from being disengaged from the respective restraining member 26, a part of the pawl 12 adjacent to the tail portion 122 being inserted into the guide groove 305.

The abutment faces 316 of the second guide member 31 are fixed adjacent to the first portion 226 of the yoke 22 so that the distance 33 (Figure 1) may be determined accurately. If the distance 33 is incorrect, the tail portion 122 of each pawl 12 and the end portion 261 of the respective restraining member 26 will engage in an undesired position. If the distance 33 is too large, the pawl 12 will rotate by a larger angle than is desired to select one of the print characters 101 and it therefore takes longer for the pawl 12 to engage with the respective tooth the respective ratchet wheel 102. On the other hand, if the distance 33 is too small an engaging portion 125 (Figure 1) of the pawl 12 will intrude into the path of the teeth of the ratchet wheel 102 when the tail portion 122 of the pawl 12 and the end portion 261 of the respective restraining member 26 engage each other and thus preventing correct operation of the printing device.

As shown in Figure 4 a part of each restraining member 26 adjacent to the tail portion 263 thereof is guided by the slit 321 of the third guide member 32. The third guide member 32 is provided on the support structure 35 in such a way that recesses 322 in the former engage in corresponding T-shaped shoulders 352 of the latter. The compression springs 34 are provided in respective cylindrical holes 351 in the support structure 35. As the third guide member 32 is flexible, it is bent as both ends are inserted under the shoulders 352 of the support structure 35 and subsequently becomes planar. Projections 323 on the third guide member 32 bridge both sides 354 of the support structure 35 so that, even if the central width 324 of the slit 321 is reduced during mounting of the third guide member 32 on the support structure this reduction is subsequently corrected by means of the projections 323 engaging the sides 354 of the support structure. The support structure 35 is fixed to the yoke 22 in such a way that columnar projections 353 are inserted into holes (not shown) in the yoke 22.

As shown in Figure 5, a flange 361 is provided at each opposite end of each bobbin 36. Each flange 361 has a mounting aperture 362 and notches 363 therein. Coil terminal leads 281 of the coil 28 disposed about the respective bobbin 36 are spaced 130

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apart from the flange 361 by means of tapes 39.

Each of the first print base plates 37 has intervals, mounting grooves 372 each of first projections 371 disposed at regular intervals, mounting grooves 372 each of which corresponds to each of the first projections 371, and a second projection 374 adjacent to the plane containing the first projections. The first projections 371 and the second projection 374 are provided with grooves 378 at one end. A groove 373 is provided adjacent to each first projection 371 and each mounting grooves 372. First copper foil portions 375 and a second copper foil portion 376 are provided on the first projections 371 and the second projection 374 respectively and these copper foil portions 375 extend to the respective groove 378.

Each bobbin 36 is fixed to the respective first print base plate 37 in such a way that a respective one of the first projection 371 is engaged in the flange 361 of the bobbin 36 and the notches 363 are engaged with the mounting groove 372. The two leads 281 are connected by soldering between the first copper foil portion 375 and the common second copper foil portion 376 the leads 381 extending through the grooves 373. The two opposed first print base plates 37, equipped with the bobbins 36, are mounted to the yoke 22 in such a way that the first projections 371 and the second projection 374 of each penetrate through apertures 229 of the yoke 22 into electrical contact with the second print base plate 40 and in such a way that the cores 29 inserted in respective apertures 364 in the bobbins 36 are fixed to the yoke 22.

The second print base plate 40 is provided with first copper foil portions 401 and second copper foil portions 402. Spark reducing lead terminals 411, 412 of the electronic circuitry 41, as well as both ends of conductive wires 42 on each side, are soldered to the first copper foil portions 401 and the second copper foil portions 402. The second print base plate further comprises apertures 403 and mounting apertures 404.

The first projections 371 and the second projections 374 enter the apertures 403 so that the grooves 378 of the first projections 371 engage the terminals 411 of the electronic circuitry 41 and so that the grooves 378 of the second projections 374 hold the conductive wires 42. The terminals 411 are soldered to the first copper foil portions 375 of the first print base plates 37 and the conductive wires 42 are soldered to the second copper foil portions 376.

The second print base plate 40 is fixed to the yoke 22 by, for example, screws extending through the amounting apertures

402. When a voltage is applied across a respective one of the conductive wire 42 and the first copper foil portions 401 of the second print base plate 40, the corresponding coil 28 is energised.

The operation of the above described printing device will now be described with reference to Figure 1.

The shaft 21 is provided with a torsion coil spring (not shown) which biases the shaft 21 for rotation in the direction of the arrow B. A part of the shaft 21, (not shown) is engaged with an abutment (not shown) so that the shaft 21 has a stable position which is that illustrated in Figure 1. On application of a print command signal, the shaft 21 is rotated in the direction of the arrow C by the power source and this rotation of the shaft 21 increases the torsion within the torsion coil. Since the second portion 112 of each spring member 11 is engaged in the notch 211 of the shaft 21, the second portion 112 presses against the groove due to resiliency of the spring member 11. Thus the character rings 10 rotate with the shaft 21. Just before the print character 101 to be printed on each character ring arrives at the printing position facing the platen 4, the respective coil 28 is energised through the second print base plate 40 and the first print base plate 37 so that the respective attraction plate 27 is attracted towards to the respective core 29. The corresponding restraining member 26 begins to move downwardly compressing the respective compression spring 34. The respective pawl 12 begins to rotate in the direction of the arrow D under the action of the spring finger 25 as the tail portion 122 is released from the restraining member 26 as the latter moves downwardly. When the tail portion 122 of the pawl 12 is disengaged from the end portion 261 of the respective restraining member 26, the pawl 12 rotates freely to the position shown by the broken line 123 in Figure 1 so that the pawl 12 engages with a tooth of the ratchet wheel 102 corresponding to the print character 101 to be printed so that further rotation of the character ring 10 is prevented and the desired print character 101 is in the printing position. The end portion 261 of the restraining member 26 now engages a bottom surface 126 of the pawl 12. Further rotation of the shaft 21 causes the second portion 112 of the spring 11 to disengage from the notch 211 so that this second portion 112 rides over the circumference of the shaft 21. During rotation of the shaft 21 in the direction of the arrow C each of the character rings 10 is stopped as the desired print characters thereon come to the printing position. After the shaft 21 has rotated through a predetermined angle its rotation is stopped by an arresting member (not

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shown) and the platen 44 is pressed against the aligned print characters 101 so that a printing operation is performed.

On completion of the printing operation the shaft 43 is rotated in the direction of an arrow F to rotate the pawls 12 in the direction of the arrow E out of the path of movement of the ratchet wheels 102. When the shaft 43 has rotated to the position shown by a broken line 431, the pawls 12 rotate further in the direction of the arrow E from the position shown by the solid line in Figure 1 to enable the end portions 261 of the restraining members 26 to engage with the tail portions 122 of the respective pawls 12, the restraining members 26 being biased for upward movement by means of the compression springs 34. Thus the pawls 12 have been reset.

When the pawls 12 have been reset, the shaft 21, which during this time has remained stationary, is released from the arresting member and begins to rotate in the direction of the arrow B due to the energy stored in the torsion coil spring. The character rings 10 which have not taken part in the printing operation rotate with the shaft 21 as the second portions 112 of the respective spring member 11 still remain in the notch 211. The character rings 10 which did take part in the printing operation begin to rotate with the shaft 12 as soon as the second portions 112 thereof engage within the notch 211 of the shaft 21.

When the shaft 21 has rotated in the direction of the arrow B to the position shown in Figure 1 the shaft 21 is stopped by an abutment (not shown). As each character ring 10 has kinetic energy due to its inertia the character rings continue to rotate even though the shaft 21 is stopped so that an abutment 105 provided on each character ring 10 engages with a first engaging portion 127 of the respective pawl 12 and then slides up the first engaging portion 127 to rotate the pawl 12 in the direction of the arrow E to the position shown by the broken line 129. The connecting energy of the character rings 10 is thereby absorbed by the resilient member 19 by virtue of engagement by second engaging portions 128 of the pawls 12. The abutment 105 is inclined to the radial direction of the respective character ring 10 by an angle θ for the purpose of limiting wear of the abutment 105 and by providing a relatively long sliding path for the abutment 105 along the first engaging portion 127. The abutment 105 is further protected from wear by the elastic member 19 which absorbs the kinetic energy of the character ring 10. Though the character ring 10 which has just rotated the pawl 12 to the position shown by the broken line 129 is positioned in such a way that the second portion 112 of the spring member 11 is half

disengaged from the notch 211, the character ring 10 returns to the illustrated position due to the resiliency of the spring member 11 so that the second portion 112 correctly engages the notch 211 once more.

The shaft 43 rotates in the direction of the arrow G from the position shown by the broken line 413 to the position shown by the solid line. Thus the printing device is ready to carry out a further printing operation.

The printing device described above has a relatively small number of component parts and occupies a relatively small space. Assembly of the printing device is facilitated and it has a relatively long operational life.

WHAT WE CLAIM IS:—

1. A printing device comprising: at least one print character ring having print characters on its periphery; a pawl arranged to engage the or each character ring the arrangement being such that, when the or each print character ring is in motion, the respective pawl, when released, stops the print character ring so that a desired one of the print characters thereon is in a printing position; a spring member for urging the or each pawl for movement in a predetermined direction; and electromagnetic means for releasing the or each pawl for movement under the action of the respective spring member to engage the respective character ring on receipt of a print command signal; the or each electromagnetic means includes a restraining member and an electromagnetic device, the restraining member preventing movement of the or the respective pawl under the action of the or the respective spring member when the electromagnetic device is not energised and permitting movement of the or the respective pawl under the action of the or the respective spring member when the electromagnetic device is energised by a print command signal.

2. A printing device as claimed in claim 1 in which the at least one character ring is mounted on a shaft having an axially extending notch in the periphery thereof, a resilient member being provided having a first portion engaged in said notch and a second portion engaged with the or each character ring, the resilient member being so arranged that the or the respective character ring rotates with the shaft until prevented from doing so by the or the respective pawl.

3. A printing device as claimed in claim 1 or 2 including reset means for disengaging the or each pawl from the or the respective character ring on completion of a printing operation.

4. A printing device as claimed in any preceding claim in which the or each restraining member is biased into engagement with the or the respective pawl by a com-

shown) and the platen 44 is pressed against the aligned print characters 101 so that a printing operation is performed.

- On completion of the printing operation the shaft 43 is rotated in the direction of an arrow F to rotate the pawls 12 in the direction of the arrow E out of the path of movement of the ratchet wheels 102. When the shaft 43 has rotated to the position shown by a broken line 431, the pawls 12 rotate further in the direction of the arrow E from the position shown by the solid line in Figure 1 to enable the end portions 261 of the restraining members 26 to engage with the tail portions 122 of the respective pawls 12, the restraining members 26 being biased for upward movement by means of the compression springs 34. Thus the pawls 12 have been reset.
- When the pawls 12 have been reset, the shaft 21, which during this time has remained stationery, is released from the arresting member and begins to rotate in the direction of the arrow B due to the energy stored in the torsion coil spring. The character rings 10 which have not taken part in the printing operation rotate with the shaft 21 as the second portions 112 of the respective spring member 11 still remain in the notch 211. The character rings 10 which did take part in the printing operation begin to rotate with the shaft 12 as soon as the second portions 112 thereof engage within the notch 211 of the shaft 21.
- When the shaft 21 has rotated in the direction of the arrow B to the position shown in Figure 1 the shaft 21 is stopped by an abutment (not shown). As each character ring 10 has kinetic energy due to its inertia the character rings continue to rotate even though the shaft 21 is stopped so that an abutment 105 provided on each character ring 10 engages with a first engaging portion 127 of the respective pawl 12 and then slides up the first engaging portion 127 to rotate the pawl 12 in the direction of the arrow E to the position shown by the broken line 129. The connecting energy of the character rings 10 is thereby absorbed by the resilient member 19 by virtue of engagement by second engaging portions 128 of the pawls 12. The abutment 105 is inclined to the radial direction of the respective character ring 10 by an angle θ for the purpose of limiting wear of the abutment 105 and by providing a relatively long sliding path for the abutment 105 along the first engaging portion 127. The abutment 105 is further protected from wear by the elastic member 19 which absorbs the kinetic energy of the character ring 10. Though the character ring 10 which has just rotated the pawl 12 to the position shown by the broken line 129 is positioned in such a way that the second portion 112 of the spring member 11 is half

disengaged from the notch 211, the character ring 10 returns to the illustrated position due to the resiliency of the spring member 11 so that the second portion 112 correctly engages the notch 211 once more.

The shaft 43 rotates in the direction of the arrow G from the position shown by the broken line 413 to the position shown by the solid line. Thus the printing device is ready to carry out a further printing operation.

The printing device described above has a relatively small number of component parts and occupies a relatively small space. Assembly of the printing device is facilitated and it has a relatively long operational life.

WHAT WE CLAIM IS:—

1. A printing device comprising: at least one print character ring having print characters on its periphery; a pawl arranged to engage the or each character ring the arrangement being such that, when the or each print character ring is in motion, the respective pawl, when released, stops the print character ring so that a desired one of the print characters thereon is in a printing position; a spring member for urging the or each pawl for movement in a predetermined direction; and electromagnetic means for releasing the or each pawl for movement under the action of the respective spring member to engage the respective character ring on receipt of a print command signal; the or each electromagnetic means includes a restraining member and an electromagnetic device, the restraining member preventing movement of the or the respective pawl under the action of the or the respective spring member when the electromagnetic device is not energised and permitting movement of the or the respective pawl under the action of the or the respective spring member when the electromagnetic device is energised by a print command signal.
2. A printing device as claimed in claim 1 in which the at least one character ring is mounted on a shaft having an axially extending notch in the periphery thereof, a resilient member being provided having a first portion engaged in said notch and a second portion engaged with the or each character ring, the resilient member being so arranged that the or the respective character ring rotates with the shaft until prevented from doing so by the or the respective pawl.
3. A printing device as claimed in claim 1 or 2 including reset means for disengaging the or each pawl from the or the respective character ring on completion of a printing operation.
4. A printing device as claimed in any preceding claim in which the or each restraining member is biased into engagement with the or the respective pawl by a com-



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pression spring, guide means being provided for guiding the movement of the or each restraining member.

5. A printing device substantially as here-
5 in described with reference to and as shown
in the accompanying drawings.

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