

Description

The present invention relates to a printing device in which a type means is moved in a printing direction. Although it is not so restricted the invention relates more particularly to a small printing device which may be used in connection with a portable or pocket electronic computer.

Examples of known printing devices in which the selection of type elements used for printing is controlled by the use of a differential mechanism which provides first and second outputs are disclosed in United States Patents Nos. 3,548,993 and 4,043,439. In each of the known printing devices, however, the carriage is intricate in configuration and bulky because the type means, the printing mechanism and the selection mechanism are mounted on the carriage.

In general, a known printing device combined with a portable electronic computer prints symbols at two lowest positions and numerals at the remaining positions. In the printing device disclosed in United States Patent No. 4,043,439, symbol types and numeral types are arranged on the outer wall of a single type belt. Accordingly, the diameter of the type belt is necessarily large and hence it is impossible to miniaturize the printing device. In the case where symbols are printed at the two lowest positions and numerals are printed at the remaining positions, the desired type element must be selected from among all of the elements available, which takes a relatively long time and makes the printing speed slow. Furthermore, the conventional device suffers from a drawback in that, if it is intended to increase the number of type elements available for printing, the type head necessarily becomes larger.

At present there is a strong demand to reduce the size of pocket electronic computers provided with a printer. However, it is very difficult to miniaturize a pocket electronic computer using the above-described known printing device in which the carriage is large and intricate.

In the known printing device disclosed in United States Patent Nos. 3,548,993, electromagnets are provided for the first and second outputs of the differential mechanism. Therefore, the printing device is large in size and high in manufacturing cost. Furthermore, since current is continuously applied to the electromagnets during the printing operation, the power consumption is relatively large.

This drawback has been eliminated by the printing device disclosed in United States Patent No. 4,043,439 to some extent. In that printing device, only one electromagnet is used, and the application of current to the electromagnet is suspended relatively early in the printing operation. However, in addition to a switching mechanism for switching a type selecting operation and a printing operation, a positioning element for holding a selected type element during the printing operation must be employed by the printing device. Therefore the number of

components forming the printing device is necessarily large and the printing device is intricate in construction and large in size. Neither of the aforementioned patents provides a detailed description of place shifting, sheet feeding and carriage returning operations. Each of these operations needs a corresponding mechanism and power source. Accordingly, the known printing devices are not suitable for pocket electronic computers due to their intricate construction, bulky size and high manufacturing cost.

An example of a known serial printing device for a small portable electronic computer has been disclosed in United States Patent No. 4,051,942. This known serial printing device also has an intricate construction and large electromagnetic plungers are used for printing, place shifting, sheet feeding and carriage returning operations. Furthermore, the device uses a pulse motor to select type elements. Accordingly, the device is large in size and high in manufacturing cost. In addition, the device uses wire to shift the printing location. Since the wire is liable to stretch or move sidewardly, the printing position may not be accurate.

Another known printing device is disclosed in United States Patent No. 3,876,053 in which a rack and a shifting cam are used as a shifting mechanism. In that printing device, the type selecting mechanism is very intricate, and the printing mechanism is so designed that the type head is locked by a tab mounted between frames. Therefore, this printing device is also intricate in construction and large in size.

In British Patent Specification No. 2,056,918A there is disclosed a printing device comprising a motor; a drive mechanism for alternately transmitting drive from the motor to first and second output members; type means arranged to be driven by the first output member so that selected type can be brought to a printing position; a printing mechanism arranged to be driven by the said second output member to effect printing of the said selected type on a sheet, a locking member for alternately arresting and locking the first and second output members; an electromagnetically operated trigger member for causing the locking member to release the second output member and to arrest and lock the first output member; and a return drive member for causing the locking member to release the first output member and to arrest and lock the second output member.

In the construction shown in British Patent Specification No. 2,056,918A, however, the first and second output members are constituted by clutches having a large number of separate parts and this makes the printing device unduly bulky and complicated.

According, therefore, to the present invention, there is provided a printing device comprising a motor; a drive mechanism for alternately transmitting drive from the motor to first and second output members; type means arranged to be driven by the first output member so that selected

type can be brought to a printing position; a printing mechanism arranged to be driven by the said second output member to effect printing of the said selected type on a sheet; a locking member for alternately arresting and locking the first and second output members; an electromagnetically operated trigger member for causing the locking member to release the second output member and to arrest and lock the first output member; and a return drive member for causing the locking member to release the first output member and to arrest and lock the second output member, characterised in that the said drive mechanism comprises a differential mechanism whose second output member comprises a gear which is formed integrally with first and second cams, the second cam constituting the said return drive member, and the first and second cams being respectively engageable with integral first and second portions of the locking member.

As will be appreciated, in the case of the present invention the use of a differential mechanism enables complicated clutches to be dispensed with, while the provision of the second output member of the differential mechanism with integral cams engageable with respective portions of the locking member greatly simplifies the construction of both the second output member and of the locking member.

There may be a carriage which carries the type means and a shifting mechanism for moving said carriage in a printing direction, said type means and a sheet feeding mechanism being driven by said first output member; and said printing mechanism, the shifting mechanism and the carriage return mechanism being driven by said second output member.

Preferably, the operating time of said electromagnetically operated trigger member is varied to control engagement of said second output member and said switching member.

The said shifting mechanism preferably has a positioning member engaging with said carriage, said return mechanism has a return spring which places said carriage in a standby state and a connecting member for connecting said positioning member to said switching member, said positioning member being disengaged from said carriage by operating said connecting member with said switching member, and said positioning member being engaged with said carriage by operating said connecting member from said second output member.

Preferably type selecting, printing, shifting, sheet feeding and carriage returning operations are controlled by only one motor and only one trigger member.

Preferably, said printing mechanism and a shifting drive member of said shifting mechanism are held by said carriage, there being a frame on which is mounted said drive mechanism.

A shaft may be coupled to said second output

member, a printing drive member of said printing mechanism and said shifting drive member being both mounted movably but not rotatably on said shaft and coupled to said second output member.

The type means may comprise a plurality of type belts having type elements on the outer sides thereof and a cylindrical holder holding said type belts, said printing mechanism operating to selectively push said type belts outwardly to perform a printing operation.

The said type means may be adapted to engage a frame part when said printing device is in a standby state and to engage a carriage member after said carriage member has moved a predetermined distance in a line arrangement direction, a spring member being provided between the type means and the carriage member for urging said type means in said line arrangement direction.

There may be a hammer member which is adapted to engage a first type array when said printing device is in a standby state, and to engage successive type arrays as said carriage member moves in the line arrangement direction.

There may be an action member for acting on the locking member to arrest and lock the second output member when the locking member is in a standby condition and to arrest and lock the first output member when the locking member is in an operating position, the trigger member shifting the locking member from said standby condition to said operating condition, and the return drive member acting on the locking member to return the latter from the operating condition to the standby condition.

In its preferred form, the printing device of the present invention is such that the number of mechanisms mounted on the carriage is reduced, thereby to reduce the size and weight of the carriage and to reduce the size of the printing device itself. Moreover, the number of type elements can be increased without increasing the diameter of the type member thereof. Additionally, the printing device is simple in construction, and the number of symbol type elements may be increased without increasing the diameter of the type belt while still increasing the printing speed. An electromagnetic brake may, moreover, be employed as an electromagnetic unit to reduce the power consumption and to thereby increase the service life of a battery used therein.

In the preferred device, moreover, a type-element selecting operation, the printing operation and a print place shifting operation are carried out merely by a switching operation of a differential mechanism thereof.

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

Figure 1 is a section plan view of a first embodiment of a printing device constructed according to the invention,

Figure 2 is a side view of a selection mechanism forming part of the said first embodiment,

Figure 3 is a side view of a sheet feeding and carriage returning mechanism of the said first embodiment,

Figure 4 is a perspective view of the selection mechanism and the sheet feeding and carriage returning mechanism as viewed in the direction of the arrow A in Figure 1,

Figure 5 is a sectional plan view of the carriage returning mechanism of the said first embodiment,

Figure 6 is a sectional side view of a type member forming part of the said first embodiment,

Figure 7 is a timing chart of the first embodiment,

Figure 8 is a diagram showing a carriage of the first embodiment when a second line is selected,

Figure 9 is a diagram showing the said carriage when a third line is selected,

Figure 10 is a sectional side view of a shifting mechanism of the first embodiment,

Figure 11 is a horizontal cross-sectional view of a printing device according to a second embodiment of the present invention,

Figure 12 is a side elevational view of conversion and selection mechanisms of the said second embodiment,

Figure 13 is a side elevational view of sheet feeding and carriage returning mechanisms of the said second embodiment,

Figure 14 is an exploded perspective view of the conversion and selection mechanisms and the sheet feeding and carriage returning mechanisms as viewed in the direction of the arrow A' in Figure 11,

Figure 15 is a fragmentary horizontal cross-sectional view of the carriage returning mechanism of the said second embodiment,

Figure 16 is a vertical cross-sectional view of a type member of the said second embodiment,

Figure 17 is a timing chart illustrative of operation of parts of the said second embodiment,

Figure 18 is a fragmentary horizontal cross-sectional view showing a carriage of the second embodiment when selecting a second type position,

Figure 19 is a fragmentary horizontal cross-sectional view showing the said carriage when selecting a third type position, and

Figure 20 is a vertical cross-sectional view of a type position shifting mechanism of the said second embodiment.

A first embodiment of the invention will now be described with reference to Figures 1 to 10 of the accompanying drawings.

Figure 1 is a sectional plan view of a printing device according to the present invention showing a selection mechanism 1, a sheet feeding and carriage returning mechanism 2, and a carriage 3. Figure 2 is a side view of the selection mechanism 1. Figure 3 is a side view of the sheet feeding and carriage returning mechanism 2. Figure 4 is a perspective view showing the selection mechanism 1 and the sheet feeding and carriage

returning mechanism 2 as viewed in the direction of an arrow A in Figure 1.

These mechanisms will now each be described.

(1) Selection Mechanism

An electric motor 6, having a motor shaft 6a, is fixedly secured to a frame 5. A motor gear 7 is fixedly secured to the motor shaft 6a. A reduction gear 8 is made up of a gear 8a which meshes with the motor gear 7, a bearing 8b which rotatably supports a selection drive gear 9, and a sun gear 8c engaged with a planet gear 10. The selection drive gear 9 has a bearing or shaft portion 9a which supports the planet gear 10. A printing switching cam 11, which constitutes a second output member of the motor 6, is made up of an inner gear 11a engaged with the planet gear 10; a cam 11c having a recess 11b in its periphery and which is engageable by a pawl 12a of a selection pawl 12 (Figures 2 and 4) serving as a locking member; a cam 11e having a protrusion 11d constituting a return drive member extending from its periphery and which is engageable by a pawl 12b of the selection pawl 12; a cam 11f, serving as a control member, which is engageable by a portion 13a of a positioning lever 13 (Figures 3 and 4) serving as a switching member; and a gear 11g which meshes with a gear ratio of 1:1, with a printing gear 15 which is fixedly secured to a printing shaft 14.

The reduction gear 8 and the printing switching cam 11 are supported on a shaft 17 which is rotatably supported between the frame 5 and a frame 16. A conversion mechanism utilizing a planet gear, i.e. a differential mechanism, is constituted by the sun gear 8c, the planet gear 10, the inner gear 11a and the selection drive gear 9. The selection pawl 12 is rotatably mounted on a shaft 19 which extends between the frame 16 and a frame 18 and is urged in the direction of an arrow B by a spring 20. A selection gear 21, which constitutes a first output member of the motor 6, is engaged with the selection drive gear 9, and has a selection ratchet 21b which has teeth 21a arranged regularly on its periphery. The ratchet 21b is engageable with the pawl 12c of the selection pawl 12. The selection gear 21 is fixedly mounted on a type shaft 22 which is rotatably supported between the frames 16 and 18. A trigger lever 23 is made up of a shaft 23a which rotatably supports a trigger planet gear 24, a portion 23b engaged with a portion 12d of the selection pawl 12, and a portion 23c engageable with a portion 13b of the positioning lever 13. The trigger lever 23 is pivotally mounted on the type shaft 22 and is urged in the direction of an arrow C by a spring 25.

A trigger sun gear 37, which is integral with a sheet feeding clutch ratchet 37a is fixedly mounted on the type shaft 22. A brake gear 26, engageable with the trigger planet gear 24, has a pin 26a which is engaged in a hole 27a which is cut in a brake disc 27 made of magnetic material. An electromagnetic brake yoke 28 made of magnetic material has an opening 28a which faces the

brake disc 27. A coil 29 is arranged in the brake yoke 28. The brake yoke 26, the brake disc 27 and the brake yoke 28 are mounted on a shaft 32 which extends between frames 30 and 31. The brake yoke 28 is mounted fixedly on the frame 31 so that it cannot rotate. Thus, an electromagnetic member, i.e. an electromagnetic brake, is constituted by the electromagnetic brake yoke 28, the brake disc 27 and the coil 29.

(2) Sheet Feeding and Carriage Returning Mechanism

The positioning lever 12, whose portion 13a is engageable with the cam 11f of the printing switching cam 11, and whose portion 13b is engageable with the portion 23c of the trigger lever 23, has a portion 13c which rotatably supports a sheet feeding trigger lever 33, a portion 13d engageable with a portion 33a of the sheet feeding trigger lever 33, and a protrusion 13e which is engaged with a protrusion 34a of a positioning transmission lever 34 which functions as a connecting member. The positioning lever 13 is rotatably mounted on the shaft 19 and is urged in the direction of an arrow D by a spring (not shown). The sheet feeding trigger lever 33, which has a portion 33b which is engaged by a portion 35a of a sheet feeding clutch pawl 35, is urged in the direction of an arrow E by a spring 36. The sheet feeding clutch pawl 35 is rotatably mounted on a shaft 38b of a sheet feeding drive gear 38. The drive gear 38 has a gear 38a engaged with a sheet feeding transmission gear 39 and is pivotally mounted on the type shaft 22. The sheet feeding clutch pawl 35 is urged in the direction of an arrow F by a spring 40, one end of which is fixedly secured to the sheet feeding drive gear 38. The sheet feeding clutch pawl 35 has a pawl 35b which is engageable with teeth 37b of a sheet feeding clutch ratchet 37a which teeth 37b are regularly arranged on the periphery of the ratchet 37a. A sheet feeding gear 47 is fixedly secured to a shaft 48 on which a sheet feeding roller 49 is fixedly mounted. The gear 47 is engaged with the sheet feeding transmission gear 39 which is pivotally mounted on a shaft 66 extending between frames 30 and 43. The positioning transmission lever 34 has a portion 34b, which is engaged with an end face cam 15a of a printing gear 15, and a portion 34c which is engaged with a portion 41b of a positioning plate 41. The positioning plate 41, which is pivotally mounted on a shaft 19, has a plurality of teeth 41a. The positioning transmission lever 34 is urged in the direction of an arrow G by a spring 42.

(3) Carriage

A type belt 50 (best seen in Figure 6) has type elements 50a on its outer side and protrusions 50b on its inner side. A type belt 51 (Figure 1) has type elements 51a and protrusions 51b, and a type belt 52 has type elements 52a and protrusions 52b. The type belts 50, 51, 52 are mounted on a type holder 53 which is mounted slidably and non-rotatably on the type shaft 22.

The type holder 53 is in the form of a cylinder, in the outer wall of which holes are formed into which are loosely fitted the protrusions 50b, 51b and 52b of the type belts 50, 51 and 52. The type belts 50, 51 and 52 are made of an elastic material such as rubber.

The type holder 53 is held on a carriage frame 54 in such a manner as to be movable a predetermined distance, and is urged in the direction of an arrow H by a type spring 65. The carriage frame 54, which is guided by the printing shaft 14 and by the type shaft 22, is movable in the direction of the arrow H. A hammer 55, which is rotatably mounted on a shaft 54a provided on the carriage frame 54, is urged in the direction of an arrow I by a spring 56. The hammer 55 has one end portion 55a which is engaged with an end face 57a of a printing cam 57. The printing cam 57 is held between portions 54b and 54c of the carriage frame 54 and is mounted on the printing shaft 14 in such a manner that it is slidable but not rotatable. The hammer 55 has another end portion 55b which is arranged so as to engage selectively with the protrusions 50b, 51b and 52b of the type belts 50, 51 and 52. A shifting cam 58 has a line cam 58a which is engageable with the teeth 41a of the positioning plate 41. The shifting cam 58 is held between portions 54d and 54e of the carriage frame 54 and is mounted on the printing shaft 14 in such a manner that it is slidable but not rotatable.

The operation of the printing device thus constructed will now be described.

(1) Initial Setting

Initial setting is carried out before selection and printing. The shifting cam 58 is disengaged from the teeth 41a of the positioning plate 41 by means described below (see the two-dot chain line in Figure 10), and the carriage 3 is moved by means of a return spring 63 in the direction opposite to the direction of the arrow H until a portion 54g of the carriage frame 54 abuts against a carriage stop 64 which is fixedly secured to the frame 18. The return spring 63 is directed by a guide roller 62 which is rotatably mounted on a shaft 61, the ends of the shaft 61 being fixedly secured to a portion 54f of the carriage frame 54 and to a frame bottom plate 60, respectively. The return spring 63 urges the carriage 3 in the direction opposite to the direction of the arrow H, one end of the return spring 63 being connected to a spring hook 59 on the frame bottom plate 60. When the portion 54g of the carriage frame 54 abuts against the carriage stop 64, a portion 53a of the type holder 53 simultaneously abuts against the carriage stop 64. Accordingly, the portion 53a moves inside the carriage frame 54 while compressing the type spring 65 and stops where the portion 55b of the hammer 55 faces the type belt 50. The type spring 65 is weaker than the return spring 63. By means of the spring 20, the pawl 12a of the selection pawl 12 is engaged in the recess 11b of the cam 11c, while the pawl 12c is disengaged from the corresponding tooth 21a of the selection ratchet

21, as shown by the solid line in Figure 2. The trigger lever 23 is in a standby position in which its portion 23c is held in abutment against the portion 13b of the positioning lever 13 by means of the spring 25 as shown by the solid line in Figures 2 and 3.

(2) First Place Selection

As the motor 6 rotates, the motor gear 7 is turned in the direction of an arrow J (Figure 4), and accordingly the reduction gear 8 and the planet gear 10 are turned in the directions of arrows K and L, respectively. In this operation, the printing switching cam 11 is maintained locked by the pawl 12a and therefore the inner gear 11a cannot be turned. As the inner gear 11a cannot be turned, the planet gear 10 revolves around the sun gear 8c while rotating around its axis to thus cause the selection drive gear 9 to turn in the direction of the arrow K via the planet shaft portion 9a. The rotation of the selection drive gear causes the selection gear 21 to turn in the direction of an arrow O (Figure 4) and causes the type shaft 22, the trigger drive gear 37, the trigger planet gear 24, the brake gear 26, the brake disc 27 and the type holder 53 to turn.

A desired type element is selected by controlling the application of current to the coil 29 with a type position signal which is provided by a detecting device (not shown) which is adapted to produce a type position signal in correspondence to a type element 50a in a conventional manner. The current is applied to the coil 29 slightly before a letter or numeral of a selected type element is in a printing position in which it faces a platen 44 which is mounted between the frames 18 and 43. Upon application of current to the coil 29, the brake disc 27 is attracted by the electromagnetic brake yoke 28. Since the brake yoke 28 is not rotatable, the rotation of the brake disc 27 is stopped, whereupon the rotation of the brake gear 26 locked with the pin 26a is also stopped. Even after the brake gear 26 has been stopped, however, the rotation of the trigger planet gear 24 continues. That is, the gear 24 revolves around the trigger drive gear 37 in the direction opposite to the direction of the arrow C while rotating around its axis in the direction of the arrow N to thus cause the trigger lever 23 to turn via the shaft 23a in the direction opposite to the direction of the arrow C against the elastic force of the spring 25. As the trigger lever 23 turns, its portion 23b turns the selection pawl 12 in the direction opposite to the direction of the arrow B so that the pawl 12c engages with a tooth 21a of the selection ratchet 21b to stop the rotation of the ratchet 21b as indicated by the chain line in Figure 2. When the selection ratchet 21b is locked, rotation of the type shaft 22 and the type holder 53 is stopped, as a result of which the desired type element 50a faces the platen 44. In this manner, type element selection is achieved (Figure 6).

(3) First Place Printing and Place Shifting

Simultaneously when the selection pawl 12 is turned in the direction opposite to the direction of the arrow B by rotation of the trigger lever 23 to select a desired type element, the pawl 12a is disengaged from the recess 11b to allow free rotation of the printing switching cam 11. In this operation, rotation of the selection ratchet 21b is prevented by the pawl 12c, and therefore rotation of the selection gear 21 and the selection drive gear 9 is also stopped. Therefore, rotation of the planet gear 10 causes the inner gear 11a and accordingly the printing switching cam 11 to turn in the direction of the arrow P. The rotation of the printing switching cam 11 causes the printing gear 15, the printing shaft 14, the printing cam 57 and the shifting cam 58 to turn. As the printing cam 57 is turned, the hammer 55 is turned in the direction opposite to the direction of the arrow I by the cam lead of the cam end face 57a so that the portion 55b of the hammer 55 is engaged with the protrusion 50b of the type belt 50, thereby pushing the type belt 50 outwardly. As a result, the type element 50a is forced against the printing sheet 45 which is backed by the platen 44, thus achieving printing (as indicated by the two-dot chain line in Figure 6). An ink roll or the like (not shown) is used to coat the surface of the type element 50a with ink in the conventional manner.

Figure 7 is a timing chart showing the operations of the relevant elements with respect to one revolution of the printing switching cam 11 and accordingly the printing shaft 14. In Figure 7, reference numeral 71 indicates the application of current to the coil 29; 72 the operation of the trigger lever 23; 73 the operation of the selection pawl 12; 74 the rotation of the type shaft 22; 75 the rotation of the printing switching cam 11 and accordingly the printing shaft 14; 76 the cam lead of the printing cam 57; 77 the cam lead of the shifting cam 58; 78 the operation in the direction of the arrow G of the positioning transmission lever 34; 79 the operation of the positioning lever 13; 80 the operation of the sheet feeding trigger lever 33; and 81 the operation of the positioning plate 41.

The application of current to the coil 29 is suspended when the printing switching cam 11 starts rotating (indicated by the solid line in Figure 7). However, at this time the selection pawl 12 is in operation with the pawl 12a engaged with the periphery of the cam 11c. As the brake disc 27 is freely rotatable by suspending the application of current to the coil 29, the trigger lever 23 is turned in the direction of the arrow C returning to its standby position (the solid line in Figure 2) while turning the trigger planet gear 24, the brake gear 26 and the brake disc 27 with the aid of the spring 20.

Immediately upon the start of rotation of the printing gear 15, the positioning transmission lever 34 is moved in the direction opposite to the

direction of the arrow G by the end face cam 15a of the printing gear 15 to be disengaged from the protrusion 13e of the positioning lever 13, thus becoming freely rotatable. At the same time, the positioning plate 41 engaging the portion 34c, being urged in the direction of the arrow Q by the spring 46, is turned in the direction of the arrow Q to cause a tooth 41a to engage with the cam 58a of the shifting cam 58 (the solid line in Figure 10).

When the cam 11f of the printing switching cam 11 has turned through about 100°, the recess 11b faces the portion 13a of the positioning lever 13. However, since the trigger lever 23 has returned to its standby position, the portion 13b is locked by portion 23c so that the positioning lever 13 is not operated. Therefore, the protrusion 34a of the positioning transmission lever 34 is abutted against the protrusion 13c of the positioning lever 13. Even after the cam 15a of the printing gear 15 is moved away, the positioning transmission lever 34 is not moved in the direction of the arrow G. Thus, the tooth 41a of the positioning plate 41 is maintained engaged with the cam 58a of the shifting cam 58.

The printing operation is ended when the printing shaft 14 has turned through 180°. When the printing shaft 14 is further turned, the cam 58a of the shifting cam 58 is engaged with a tooth 41a of the positioning plate 41 and the shifting cam 58 is moved in the direction of the arrow H by the cam lead. When the shifting cam 58 is moved in this way, the carriage frame 54, the printing cam 57 and the hammer 55 are also moved simultaneously. Since a gap $\delta 1$ is provided between the type holder 53 and the carriage frame 54 as shown in Figure 1, while the carriage frame 54 is moved, the portion 53a of the type holder 53 is maintained abutted against the carriage stop 64 as shown in Figure 8. In this case, the portion 55b of the hammer 55 faces the type belt 51. When the printing switching cam 11 has turned through about 330°, the pawl 12a faces the recess 11b. Therefore, the selection pawl 12 is turned in the direction of the arrow B by the action of the spring 20 to lock the printing switching cam 11 once again. Thus, the place shifting operation has been completed. When the recess 11b is appropriately positioned, the return drive member constituted by the protrusion 11d of the cam 11e of the printing switching cam 11 engages with the pawl 12b to facilitate the action of the spring 20 and to thereby turn the selection pawl 12 in the direction of the arrow B.

(4) Second Place Selection

Simultaneously, when the selection pawl 12 turns in the direction of the arrow B to lock the printing switching cam 11, the pawl 12c is disengaged from the selection ratchet 21b. Thus, as was described with reference to the first place selection in detail, the selection gear 21 is turned again, to select a desired type element. The second place selection is different from the first place selection in that, while in the first place selection a desired type element is selected out of the font of

type elements on the type belt 50, for the second place selection a desired type element is selected out of the font of type elements on the type belt 51.

(5) Second Place Printing and Shifting

Second place printing is carried out in a manner similar to the above-described first place printing with the following exception. For the first place printing, printing is carried out by pushing the type belt 50 outwardly against the platen 44. However, for the second place printing, printing is carried out by pushing the type belt 51 outwardly against the platen 44. Similarly to the first place shifting, the second place shifting is achieved when the cam 58a of the shifting cam 58 is engaged with a tooth 41a of the positioning plate 41 so that the carriage 3 is moved in the direction of the arrow H by the cam lead. However, it should be noted that, as the gap $\delta 2$ (Figure 8) between the type holder 53 and the carriage frame 54 is slightly smaller than the shifting pitch, the type holder 53 is moved slightly in the direction of the arrow H and is abutted against the carriage frame 54 as a result of which the portion 55b of the hammer 55 faces the type belt 52 (Figure 9).

(6) Third Place Selection

Third place selection is carried out similarly to the second place selection except that for second place selection, a desired type element is selected from the font of type elements on the type belt 51, while for third place selection, a desired type element is selected from the font of type elements on the type belt 52 (Figure 9).

(7) Third Place Printing and Shifting

The printing is carried out similarly to the printing of the second place with the exception that type elements which are pushed outwardly against the platen 44 are selected from the font of type elements on the type belt 52. Shifting is also carried out similarly to the second place shifting except that the carriage 3 is moved by a distance corresponding to one column. However, in this case the type holder 53 has been abutted against the carriage frame 54 and therefore the carriage 3 is moved as shown in Figure 9 with the portion 55b of the hammer 55 facing the type belt 52.

(8) Selection, Printing and Shifting of Fourth Place and So Forth

These operations are carried out by repeating the procedures described in the above paragraphs (6) and (7).

(9) Highest Place Selection and Printing and Sheet Feeding and Carriage Return

The timing for these operations is as indicated by the two-dot chain lines in Figure 7.

Selection is carried out as described above although in the case of the highest place, the application of current to the coil 29 is not immediately suspended. That is, the application of current is maintained until the printing switching cam 11 has turned through about 145° as indicated by the two-dot chain line in the part 81 of Figure 7. When the printing switching cam 11 has turned through 100°, a cam surface 11h of the cam 11f faces the

portion 13a of the positioning lever 13. In this operation, as the application of current to the coil 29 is continued, the trigger lever 23 is in operation as indicated by the two-dot chain lines in Figures 2, 3 and 7. Therefore, the positioning lever 13 is turned in the direction of the arrow D by a spring (not shown) as indicated by the two-dot chain line in Figure 3. As the positioning lever 13 is turned in this way, the sheet feeding trigger lever 33 is turned in the direction opposite to the direction of the arrow E by the portion 13d of the positioning lever 13 so that the portion 33b is disengaged from the portion 35a of the sheet feeding clutch pawl 35. Upon disengagement, the sheet feeding clutch pawl 35 is turned in the direction of the arrow F by the action of the spring 40 so that the pawl 35b is engaged with the tooth 37b of the sheet feeding clutch ratchet 37a (indicated by the two-dot chain line in Figure 3).

In this operation, as the rotation of the type shaft 22 has been stopped, the rotation of the clutch ratchet 37a is also stopped. However, the tooth 37b is so arranged that it faces the type element 50a on the type belt 50 and engages the pawl 35b when stopped. Therefore the pawl 35b is engaged with the tooth 37b. When the printing switching cam 11 is turned further, the positioning lever 13 is returned to the standby position by being turned in the direction opposite to the direction of the arrow D by a cam lead 11i of the cam 11f. The sheet feeding trigger lever 33 is turned in the direction of the arrow E by the spring 36. However, as the sheet feeding clutch pawl 35 is operating, the trigger lever 33 is stopped with the portion 33b abutted against the portion 35c of the sheet feeding clutch pawl 35.

Carriage return is carried out as follows. When the positioning lever 13 is turned in the direction of the arrow D, the protrusions 13e and the recesses 13f of the positioning lever 13 face the recesses 34d and the protrusions 34a of the positioning transmission lever 34, respectively. When the printing switching lever 11 is turned through 145°, the lead of the end face cam 15a of the printing gear 15 moves away. Therefore, the positioning transmission lever 34 is moved in the direction of the arrow G by the action of the spring 42 and the protrusions 13e and the recesses 13f of the positioning lever 13 are engaged with the recesses 34d and the protrusion 34a of the positioning transmission lever 34, respectively, as indicated by the solid line in Figure 5. When the printing switching cam 11 turns through about 190°, the positioning lever 13 is returned to the standby position by being turned in the direction opposite to the direction of the arrow D by the cam lead 11i.

In this operation, the positioning transmission lever 34 is turned in the direction opposite to the direction of the arrow D due to engagement with the positioning lever 13, while the positioning plate 41 is turned in the direction opposite to the direction of the arrow Q due to engagement with the portion 34c of the positioning transmission lever 34, as a result of which the cam 58a of the

shifting cam 58 is maintained disengaged from the tooth 41a of the positioning plate 41 (the two-dot chain line in Figure 10). Upon disengagement of the positioning plate 41 from the cam 58, the carriage 3 is returned to the standby position (the first place) by the action of the returning spring 63. Upon suspension of the application of current to the coil 29, the trigger lever 23 is returned to the standby position by action of the spring 25. When the type shaft 22 starts rotation again after the printing switching cam 11 has made one complete revolution, the sheet feeding clutch ratchet 37a is also turned. In this case, as the pawl 35b of the sheet feeding clutch pawl 35 is engaged with the tooth 37b, the sheet feeding drive gear 38, whose shaft 38b pivotally supports the sheet feeding clutch pawl 35, is turned in the direction of the arrow R.

As the sheet feeding drive gear 38 is turned this way, the portion 33b of the sheet feeding trigger lever 33 is abutted against the periphery 38c of the sheet feeding drive gear 38. When the sheet feeding drive gear 38 has made one complete revolution, the portion 33b of the sheet feeding trigger lever 33 is again engaged with the portion 35a of the sheet feeding clutch pawl 35, the sheet feeding clutch pawl 35 is disengaged from the sheet feeding clutch ratchet 37a, and rotation of the sheet feeding drive gear 38 is stopped. The rotation of the sheet feeding drive gear 38 is transmitted through the sheet feeding transmission gear 39 to turn the sheet feeding gear 47, the sheet feeding shaft 48 and the sheet feeding roller 49, so that the printing sheet 45 is fed by a distance of one line by the sheet feeding roller 49.

For printing the next line, the procedures described in paragraphs (2) and (3) above are carried out again.

If, in the case where the printing device is utilized for a portable electronic computer, symbols are provided on the type belts 50 and 51 and numerals on the type belt 52, then symbols can be printed at the first and second places and numerals at the third place and so forth.

The printing device described above has the following advantages.

(1) Selection, printing, shifting, sheet feeding and carriage return can be readily switched by a simple method in which one motor and one electromagnetic member are used to control the engagement of the electromagnetic trigger member and the switching member (the positioning lever 13). Accordingly, the number of components forming the printing device is greatly reduced compared with the prior art, and accordingly the number of steps needed for assembly of the device is reduced. Furthermore, the control circuit for controlling the printing device can be simplified. As only one electromagnetic member is employed for the driving operation, the number of drivers can be decreased. Therefore, the printing device has small size, small weight, and low manufacturing cost. Accordingly, when this printing device is combined with a portable electronic computer, the overall assembly is small and light,

and it can be manufactured at low cost.

(2) Only the type means and the printing mechanism is carried by the carriage, while the selection and drive mechanisms are mounted on the main frame of the printing device. Therefore, the carriage can be made small and light, and accordingly the printing device can easily be miniaturized. A very simple method is employed in which type belts are employed as the type means in such a manner that, for the first place, the type belt holder is abutted against the frame, and for the second place and so on, the holder is abutted against the carriage so that the hammer is selectively brought into position with respect to the type belts. Therefore, printing can be carried out without increasing the size of the type belts, and the number of type elements can readily be increased. As the planet gear mechanism and the electromagnetic brake are employed for the electromagnetic operating means for the selection mechanism, the power consumption of the electromagnetic device is reduced, and the electromagnetic device can be miniaturized. As a cam means is provided which operates in association with the spring member which returns the selection pawl from the operating position to the standby position, the load applied to the electromagnetic operating means when selection is carried out is reduced, and the size and power consumption of the electromagnetic operating means is further reduced.

(3) The selecting operation and the printing operation can be switched by a simple construction in which the locking member (the selection pawl 12) having a pair of locking pawls 12a, 12c for alternately arresting and locking two outputs of the differential mechanism 8c, 9, 10, 11a is provided in the selection mechanism, and the control member (the cam 11c of the printing switching cam 11), for holding the locking member 12 so that the latter is maintained operated by the electromagnetic trigger member 23 during printing operations and shifting operations, is provided at the second output side connected to the printing mechanism so that, after the printing and shifting operations, the locking member is returned to the standby position to arrest and lock the second output again. Therefore, the number of components forming the printing device is reduced and the size and weight of the printing device decreased. The printing device of the invention can be readily combined with a portable electronic computer. As the application of current to the electromagnetic trigger member can be suspended immediately upon the second output side starting rotation, the power consumption is reduced.

(4) Only the printing mechanism, the type members, and the shifting cam, which is the shifting drive member of the shifting mechanism, are mounted on the carriage. Therefore, the size of the carriage is very small, and accordingly its weight is very small thus contributing to a reduction of the size and the weight of the printing device. As the differential mechanism for switching the selecting

and printing operations is mounted on the frame, the construction thereof is very simple, which results in a reduction of the size and weight of the printing device. The type members are connected to one output of the differential mechanism, and the printing mechanism and the shifting mechanism are connected to the other output. Therefore, the printing device can be controlled by one electromagnetic device, thereby contributing to a simplification of the construction.

(5) The construction is simple since the type members are provided on the carriage in such a manner that they are movable through a predetermined distance and the hammer faces the type belts successively in such a manner that, in the stand-by state of the printing device, the type means is abutted against the frame and the hammer faces the first type belt. After the shifting operation is carried out for one line, the hammer faces the second type belt. The operation is continued in this manner. That is, the type belts are switched until the type means abuts against the carriage. Thus, the number of type elements can be increased without decreasing the printing speed and without increasing the size of the type means.

Reference will now be made to a second embodiment of the invention which is shown in Figures 11—20.

As shown in Figure 11, the second embodiment of a printing device of the present invention generally comprises an assembly 101 of conversion and selection mechanisms, an assembly 102 of sheet feeding and carriage returning mechanisms, and a carriage 103. These mechanisms will each be described below with reference to Figures 11 to 14.

(1) Conversion and Selection Mechanisms

A channel-shaped frame 105 includes a pair of frame members 105a, 105b spaced from each other. A motor 106 is affixed to the frame member 105a and has a motor shaft 106a to which there is secured a gear 107. A speed reduction gearing 108 includes a gear 108a meshing with the motor gear 107, a gear shaft 108b on which there is journaled a selection drive gear 109, and a sun gear 108c held in mesh with a planet gear 110. The selection drive gear 109 has a shaft 109a on which the planet gear 110 is journaled. A printing switching cam 111, which constitutes a second output member of the motor 106, is composed of an internal gear 111a meshing with the planet gear 110, a cam 111c having in its outer periphery a recess 111b in which there is engageable a pawl 112a of a selection pawl 112 (Figures 12 and 14) that serves as a locking member, a cam 111e serving as a return drive member and having on its outer periphery a protrusion 111d that is engageable with a pawl 112b of the selection pawl 112, a cam 111f serving as a first control member and engageable with a portion 113a of a return lever 113 (Figures 13 and 14) which serves as a switching member, and a gear 111g held in mesh with a printing gear 115 fixed to a printing shaft 114 at a gear ratio of 1:1.

The speed reduction gearing 108 and the printing switching cam 111 are rotatably mounted on a shaft 117 affixed to the frame members 105a. A conversion mechanism, for converting rotation of the motor 106 into first and second outputs is constituted by a differential mechanism which is in the form of a planetary gear composed of the sun gear 108c, the planet gear 110, the internal gear 111a, and the selection drive gear 109. A selection gear 121, which constitutes a first output member of the motor 106 and which is held in mesh with the selection drive gear 109, has a selection ratchet wheel 121a having teeth arranged at regular intervals around its outer periphery, the selection pawl 112 having a pawl 112c engageable with the teeth. The selection gear 121 is fixed to an end of a type shaft 122 projecting from the frame member 105a, the type shaft 122 being supported on and between the frame members 105a, 105b. An electromagnetic clutch yoke 128 of magnetic material is fitted in the selection gear 121. The yoke 128 has an opening 128a in which there is disposed a coil 129 with a member 129a thereof affixed to a shaft 132 secured to the frame member 105a, the opening 128a being directed to a trigger plate 127 of magnetic material.

A trigger lever 123 includes a portion 123a engageable with a portion 112d of the selection pawl 112, a portion 123b engageable with a portion 113b of the return lever 113, and pins 123c engaging in holes 127a in the trigger plate 127. The trigger lever 123 is fitted over the type shaft 122 and urged by a trigger lever spring 125 to turn in the direction of the arrow C' in Figure 14. An electromagnetic trigger member is constituted jointly by the electromagnetic clutch yoke 128, the coil 129, the trigger plate 127, the trigger lever 123, and the trigger lever spring 125. The selection pawl 112 is rotatably mounted on an end of a shaft 119 projecting from the frame member 105a, the shaft 119 extending through the frame members 105a, 105b. The selection pawl 112 has slanted surfaces 112e, 112f which are engageable with a selection pawl spring 120 which is in the form of a leaf spring affixed to the frame member 105a and serves as an action member. The slanted surfaces 112e, 112f are selectively engageable with the spring 120 to allow the selection pawl 112 to take one of the solid-line positions (the standby condition) and the two-dot-and-dash-line position (operating condition) as shown in Figure 12.

(2) Sheet Feeding and Carriage Returning Mechanism

The return lever 113 comprises a portion 113a engageable with the cam 111f of the printing switching cam 111, the portion 113b engageable with the portion 123b of the trigger lever 123, a portion 113c engageable with a portion 135a of a paper feeding clutch pawl 135, a projection 113d (Figure 14) engageable with a projection 141b of a positioning plate 141, and a portion 113e engageable with an end cam surface 115a of the printing

gear 115 which serves as a second control member. The return lever 113 is rotatably mounted on the shaft 119. A return lever spring 134 acts between a portion 113f of the return lever 113 and a projection 105d of the frame member 105a, as shown in Figure 13, to urge the return lever 113 in the directions of the arrows D' and E' as illustrated in Figure 14.

A sheet feeding clutch pawl 135 is swingably mounted on a pin 138b of a sheet feeding drive gear 138 which has a gear 138a meshing with a sheet feeding transmission gear 139 and which is rotatably mounted on the type shaft 122. The sheet feeding clutch pawl 135 is urged to turn in the direction of the arrow F' by a spring 140 having one end fixed to the sheet feeding drive gear 138. The sheet feeding clutch pawl 135 also has a pawl 135b (Figure 14) engageable with teeth 137a arranged at regular intervals around an outer periphery of a clutch ratchet wheel 137. A sheet feeding gear 147 is affixed to a shaft 148 on which a sheet feeding roller 149 is fixedly mounted, and is held in mesh with the sheet feeding transmission gear 139 which is rotatably mounted on a shaft 132.

(3) Carriage

A type belt 150 having type elements 150a on its outer side and protrusions 150b on its inner side, a type belt 151 having type elements 151a and protrusions 151b, and a type belt 152 having type elements 152a and protrusions 152b are mounted on a type holder 153 which is mounted slidably and non-rotatably on the type shaft 122. The type holder 153 is in the form of a cylinder having in an outer wall thereof holes in which are loosely fitted the protrusions 150b, 151b and 152b of the type belts 150, 151 and 152. The type belts 150, 151 and 152 are elastic bodies and are made of, for example, rubber. The type holder 153 is held on a carriage frame 154 in such a manner as to be movable a predetermined distance and is urged by a spring 165 in the direction which is opposite to that of the arrow H' as shown in Figure 11. The carriage frame 154 is guided by the type shaft 122 and the printing shaft 114, and is movable in the direction of the arrow H'.

A hammer 155 is rotatably mounted on a shaft 154a mounted on the carriage frame 154 and is urged by a spring 156 in the direction of the arrow I'. The hammer 155 has one end 155a engageable with the protrusions 150b, 151b or 152b of the type belts 150, 151 or 152. The hammer 155 has another end 155b held in engagement with a portion 160b of a transmission lever 160 rotatably supported on a shaft 154d mounted on the carriage frame 154, there being a limiter spring 161 having one end 161a fixed and the other end 161b movably held by a portion 160a. As shown in Figure 16, the hammer 155 is limited by portions 155c, 155d thereof and a portion 153b of the type holder 153 in its movement in the direction of the arrow M'. The limiter spring 161 has a portion 161c held in engagement with an end cam surface 157a of a type position shifting cam 157

sandwiched between portions 154b, 154c of the carriage frame 154 and slidably and non-rotatably mounted on the printing shaft 114. The type position shifting cam 157 also has an elongate cam 157b extending peripherally therearound and held in engagement with a tooth 141a of the positioning plate 141.

Operation of the printing device thus assembled will now be described.

(1) Initial Setting

Initial setting is carried out before selection and printing are started. The cam 157b of the type position shifting cam 157 is disengaged from the respective tooth 141a of the positioning plate 141 as shown by the two-dot-and-dash lines in Figure 20 in a manner described later. The carriage 103 is caused to move in the direction which is opposite to that of the arrow H' as shown in Figure 11 under the resiliency of a return spring 163 which extends around a spring guide roller 159 rotatably mounted on a shaft 158 and which has one end affixed to a portion 154f of the carriage frame 154 and the other end secured to a portion 105c of the frame 105. The carriage 103 is resiliently urged by the spring 163 until a portion 154g of the carriage frame 154 abuts against a carriage stopper 164 fixed to the frame member 105b as shown in Figure 11. When the portion 154g is held against the carriage stopper 164, the type holder 153 has its portion 153a held against the carriage stopper 164 under the force of the type spring 165. In this position, the end 155a of the hammer 155 is located opposite to the type belt 150 as illustrated in Figure 11. With the slanted surface 112f of the selection pawl 112 being held in engagement with the selection pawl spring 120, the pawl 112a of the selection pawl 112 engages in the recess 111b in the cam 111c and the pawl 112c held out of engagement with a tooth 121a of the selection ratchet wheel 121, as shown by the solid lines in Figure 12. The trigger lever 123 has its portion 123b held against the portion 113b of the return lever 113 under the resiliency of the trigger spring 125 as illustrated by the solid lines in Figures 12 and 13.

(2) Selection of First Type Position

When the motor 106 rotates, the motor gear 107 is caused to rotate in the direction of the arrow J', whereupon the speed reduction gear 108 and the planet gear 110 are caused to rotate respectively in the directions of the arrows K' and L', as shown in Figure 14. At this time, the printing switching cam 111 remains locked by the pawl 112a, and the internal gear 111a is prevented from rotating. Thus, the planet gear 110 rotates about its own axis as it revolves around the sun gear 108c, causing the selection drive gear 109 to rotate in the direction of the arrow K' through the planet gear shaft 109a. Rotation of the selection drive gear 109 causes the selection gear 121 to rotate in the direction opposite to that of the arrow C', whereupon the electromagnetic clutch yoke 128, the type shaft 122, and the type holder 153 are rotated.

A desired type element is selected by controlling energization of the coil 129 with a type position signal which is generated by a detector 167 (Figure 11) that comprises a detection plate 166 affixed to the type shaft 122 and a brush 167a secured to the frame 105 for producing a type position signal in response to a type element 150a. The coil 129 is energised just before a desired type element reaches a printing position which faces a platen 144 supported on and extending between the frame members 105a, 105b. When the coil 129 is energised, the trigger plate 127 is attracted to the electromagnetic clutch yoke 128 and co-rotates therewith. As the trigger plate 127 starts rotating, the trigger lever 123 which is locked therewith by the pins 123c is caused to rotate in the direction that is opposite to the direction of the arrow C' against the force of the trigger lever spring 125. Rotation of the trigger lever 123 causes its portion 123a to rotate the selection pawl 112 in the direction of the arrow B' until the pawl 112c engages a tooth of the selection ratchet wheel 121b, whereupon the selection ratchet wheel 121b stops rotating as shown by the two-dot-and-dash lines in Figure 12. When the selection ratchet wheel 121b is locked, the type shaft 122 and the type holder 153 stop rotating. A desired type element 150a is thus stopped opposite to the platen 144. The first type position is thus selected as illustrated in Figure 16.

(3) Printing at First Type Position and Shifting to Next Position

Concurrent with selection of the desired type element in response to rotation of the selection pawl 112 in the direction of the arrow B' when the trigger lever 123 rotates, the pawl 112a is released from engagement with recess 111b, allowing the printing switching cam 111 to rotate freely. At this time, the selection ratchet wheel 121b is prevented by the pawl 112c from rotating, the selection gear 121 and the selection drive gear 109 stop rotating. Rotation of the planet gear 110 then causes the internal gear 111a and hence the printing switching cam 111 to rotate in the direction of the arrow P' as shown in Figures 11 and 12. When the printing switching cam 111 rotates, the printing gear 115, the printing shaft 114, and the type position shifting cam 157 are caused to rotate. When the type position shifting cam 157 rotates, a cam lead of the end cam surface 157a causes the hammer 155 to turn in the direction that is opposite to that of the arrow I' through the limiter spring 161 and the transmission lever 160. The end 155a of the hammer 155 is brought into engagement with one of the protrusions 150b on the type belt 150 to push the latter from inside until the type element 150a is pressed against the platen 144 with a sheet 145 of printing paper as illustrated by the two-dot-and-dash lines in Figure 16. Although not shown, the type element 150a has its type surface coated with ink by an ink roll or the like in a known manner. At this time, the limiter spring 161 serves to press the type element 150a with a constant force even when the

distance between the end 155a of the hammer 155 and the platen 144 changes due to variations in dimensional precision of parts. Furthermore, varying positions in which the type element 150a stops in its rotation can be corrected by the portions 155c, 155d of the hammer 155 and the portion 153b of the type holder 153, with the result that type elements are aligned with each other in the direction of a line.

Figure 17 is a timing chart for operations of various parts while the printing switching cam 111 or the printing shaft 114 makes one revolution. Designated at 201 is energization of the coil 129, 202 operation of the trigger lever 123, 203 operation of the selection pawl 112, 204 rotation of the type shaft 122, 205 rotation of the printing switching cam 111 and the printing shaft 114, 206 the cam lead of the cam surface 157a of the type position shifting cam 157, 207 the cam lead of the cam surface 157b of the type position shifting cam 157, 208 movement of the return lever 113 in the direction of the arrow D', 209 angular movement of the return lever 113 in the direction of the arrow E', and 210 movement of the positioning plate 141. The coil 129 is de-energized (as shown by the solid line in Figure 17) when the selection pawl 112 is brought into an operating condition (as shown by the two-dot-and-dash line), whereas the selection pawl 112 remains actuated by engagement between the slanted surface 112e and the selection pawl spring 120. Since the coil 129 is de-energized and the trigger plate 127 is rendered rotatable freely, the trigger lever 123 is caused by the trigger lever spring 125 to rotate in the direction of the arrow C' into its standby condition as shown by the solid-line position in Figure 12.

Immediately when the printing gear 115 starts rotating, the return lever 113 is caused by the end cam surface 115a on the printing gear 115 to move in the direction opposite to that of the arrow D', whereupon the projection 113d is moved out of engagement with a projection 141b of the positioning plate 141, which is then rotatable freely. The positioning plate 141 is now caused by the leaf spring 146 secured to the frame 105 to rotate in the direction of the arrow Q' until the tooth 141a is brought into engagement with the cam surface 157b of the type position shifting cam 157 as shown by the solid-line position in Figure 20. When the cam 111f of the printing switching cam 111 angularly moves through an angle of 100 degrees, the recess 111h faces the portion 113a of the return lever 113, which is, however, prevented from rotating with the portion 113b locked by the portion 123b of the trigger lever 123 which has already been in the standby position. The return lever 113 is allowed to move in the direction of the arrow D' since it is displaced out of engagement with the cam lead of the cam surface 115a of the printing gear 115. Since the positioning plate 141 has already rotated, the return lever 113 is stopped in a position in which an end surface of the projection 113d of the return lever 113 is held in abutting engage-

ment with an end surface of the projection 141b of the positioning plate 141. When the printing shaft 114 angularly moves through an angle of 180 degrees to finish the printing operation and further angularly moves, the type position shifting cam 157 moves in the direction of the arrow H' since the cam 157a of the type position shifting cam 157 engages the tooth 141a of the positioning plate 141. Movement of the type position shifting cam 157 causes the carriage frame 154 supporting the cam 157 to move therewith. With the type holder 153 having a portion spaced from the portion 154g of the carriage frame 154 by a clearance δ (Figure 11), the carriage frame 154 is allowed to move, but the type holder 153 has its portion 153a held against the carriage stopper 164 under the force of the type spring 165 as shown in Figure 18. At this time, the end 155a of the hammer 155 faces the type belt 151. When the printing switching cam 111 rotates substantially through an angle of 330 degrees, the projection 111d of the cam 111e engages the pawl 112b, and the selection pawl 112 is caused to rotate in the direction opposite to that of the arrow B', locking the printing switching cam 111 again. Printing and shifting to a next type position are thus completed. At this time, the selection pawl 112 remains in the standby position (the solid-line position) due to engagement between the slanted surface 112f and the selection pawl spring 120.

(4) Selection of Second Type Position

When the selection pawl 112 rotates in the direction that is opposite to that of the arrow B' to lock the printing switching cam 111, the pawl 112c is simultaneously disengaged from the selection ratchet wheel 121b, and the selection gear 121 starts rotating again to select a desired type element in a manner similar to that described above in detail with respect to selection of the first type position. The selection of the second type position is different from the selection of the first type position in that, while in the first type position selection a desired type element is selected out of the font of type elements on the type belt 150, a desired type element is picked out of the font of type elements on the type belt 151 in the selection of the second type position (Figure 18).

(5) Printing at Second Type Position and Shifting to Next Type Position

The printing at the second type position is carried out in the same manner as that for the printing at the first type position. For the printing at the first type position, the type belt 150 is pushed outwardly against the platen 144. However, for the printing at the second type position, the type belt 151 is pressed outwardly against the platen 144 as shown in Figure 18. Shifting to a next type position from the second type position is effected, as with the shifting from the first type position, by movement of the carriage frame 154 in the direction of the arrow H' while the cam lead of the cam surface 157b of the type position

shifting cam 157 is held in engagement with the tooth 141a of the positioning plate 141. At this time, the type holder 153 has its portion spaced from the carriage frame portion 154g by a clearance δ_2' which is slightly smaller than a shifting pitch. Therefore, the type holder 153 is pushed by the carriage frame 154 and caused thereby to move for a small distance in the direction of the arrow H', whereupon the end 155a of the hammer 155 is located opposite to the type belt 152 as illustrated in Figure 19. The printing gear 115 starts rotating to enable the cam 115a to move the return lever 113 in the direction opposite to the type belt 152 as illustrated in Figure 19. The printing gear 115 starts rotating to enable the cam 115a to move the return lever 113 in the direction opposite to that of the arrow D'. However, such movement does not result in operation of the positioning plate 141 since the return lever 113 has already been released of engagement with the positioning plate 141.

(6) Selection of Third Type Position

The third type position is selected substantially in the same manner as that for the selection of the second type position, except that, although a desired type element is selected out of the font on the type belt 151 in the second type position, a type element is picked out of the font on the type belt 152 in the third type position as shown in Figure 19.

(7) Printing at Third Type Position and Shifting to Next Type Position

The printing at the third type position is performed in a manner similar to that for the printing at the second type position. However, a type element which is to be pressed against the platen 144 is selected out of the font on the type belt 152. The shifting to a next type position from the third type position is substantially the same as that from the second type position, except that the carriage frame 154 is caused to move to the next type position together with the type holder 153 held in abutting engagement therewith with the parts arranged as shown in Figure 19 and hence the end 155a of the hammer 155 facing the type belt 152.

(8) Selection of and Printing at Fourth Type Position and Shifting to Next Type Position and to Higher Type Positions

These operations can be effected by repeating the procedures (6) and (7).

(9) Selection of and Printing at Highest Type Position, and Sheet Feeding and Carriage Return

These operations are effected in the patterns as shown by the two-dot-and-dash lines in the timing chart of Figure 17. The selection of the highest type position is carried out in the same manner as before. However, in the highest type position, the coil 129 is not de-energized immediately, but remains energized as shown by the two-dot-and-

dash line at 201 in Figure 17 until the printing switching cam 111 angularly moves through an angle of 145 degrees. When the printing switching cam 111 turns through an angle of 100 degrees, the portion 113a of the return lever 113 faces the recess 111h in the cam 111f, and the return lever 113 is released from engagement with the cam 115a of the printing gear 115. At this time, the trigger lever 123 is kept actuated (as shown by the two-dot-and-dash lines in Figures 12, 13 and 17) since the coil 129 remains energized. Thus, the return lever 113 is caused by the return lever spring 134 to rotate in the direction of the arrow E' as illustrated by the two-dot-and-dash lines in Figure 13, and at the same time to move in the direction of the arrow D'. Rotation of the return lever 113 disengages the portion 113c from the portion 135a of the sheet feeding clutch pawl 135. Upon being unlocked, the sheet feeding clutch pawl 135 is caused by the spring 140 to rotate in the direction of the arrow F' until the pawl 135b engages a tooth 137a of the sheet feeding clutch ratchet wheel 137 as shown by the two-dot-and-dash lines in Figure 13. At this time, the sheet feeding clutch ratchet wheel 137 is prevented from rotating since the type shaft 122 stops rotating. Since the tooth 137a is positioned so as to correspond to the type element 150a on the type belt 150 and to mesh with the pawl 135b in the stopped position, the tooth 137a and the pawl 135b are held in mesh with each other. When the printing switching cam 111 angularly moves through an angle of 190 degrees, the return lever 113 is caused by the cam lead 111i of the cam 111f to rotate in the direction opposite to that of the arrow E' into the standby condition. Since the sheet feeding clutch pawl 135 has been actuated, the portion 113c returns toward the portion 135d of the sheet feeding clutch pawl 135, keeping the latter actuated.

Carriage return is effected as follows: When the return lever 113 angularly moves in the direction of the arrow E' and moves in the direction of the arrow D', the projection 113d and the recess 113f of the return lever 113 are brought respectively into engagement with the recess 141c and the projection 141b of the positioning plate 141. When the printing switching cam 111 angularly moves through an angle of 190 degrees, the return lever 113 is caused by the cam lead 111j to turn in the direction opposite to that of the arrow E' and to return into the standby position. At this time, the positioning plate 141 which engages the return lever 113 is rotated in the direction opposite to that of the arrow Q', and then is maintained in a position in which the cam 157b of the type position shifting cam 157 is disengaged from the tooth 141a of the positioning plate 141 as shown by the two-dot-and-dash lines in Figure 20. When the positioning plate 141 is brought out of engagement with the type position shifting cam 157, the carriage 103 is caused by the return spring 163 to move back to the standby condition at the first type position. When the coil 129 is de-energized, the trigger lever 123 is returned to the

standby position under the resiliency of the trigger lever spring 125. When the printing switching cam 111 makes one revolution starting rotation of the type shaft 122 again, the sheet feeding clutch ratchet wheel 137 is also rotated. Since the pawl 135b of the sheet feeding clutch pawl 135 engages the tooth 137a at this time, the sheet feeding clutch pawl 135 and the sheet feeding drive gear 138 with the sheet feeding clutch pawl 135 swingably supported on the pin 138b are caused to rotate in the direction of the arrow R'. When the sheet feeding drive gear 138 makes one revolution, the portion 113c of the return lever 113 engages the portion 135a of the sheet feeding clutch pawl 135 again, whereupon the sheet feeding clutch pawl 135 is disengaged from the sheet feeding clutch ratchet wheel 137, stopping rotation of the sheet feeding drive gear 138. Rotation of the sheet feeding drive gear 138 enables the sheet feeding transmission gear 139 to rotate the sheet feeding gear 147, the sheet feeding shaft 148, and the sheet feeding roller 149, thereby feeding the sheet 145 of printing paper by a distance corresponding to one line.

Printing along a next line can be performed by repeating the procedures (2)—(9).

Where the printing device of Figures 11—20 is incorporated in an electronic desktop calculator or the like, the type belts 150, 151 may have symbol types and the type belt 152 may have numerical types to print symbols at first and second type positions and numbers at a third type position on a sheet of printing paper.

With the arrangement shown in Figures 11—20, as described above, the selection mechanism has the locking member (selection pawl 112) for alternately arresting and locking two outputs from the conversion mechanism. The action member (selection pawl spring 120) maintains the locking member 112 in either one of two states, that is, a standby condition and an operating condition. When the locking member 112 is shifted from the standby condition to the operating condition by the electromagnetically operated trigger member 123, 125, 127—9, the locking member 112 is kept in the operating condition by the action member 120. When printing and shifting are completed, the locking member 112 is returned from the operating condition to the standby condition by the return drive member (protrusion 111d of the printing switching cam 111) supplied with the second output from the motor 106 which is fed to the printing mechanism, whereupon the second output is arrested and locked again, and the locking member is maintained in the standby position by the action member.

The printing device of Figures 11—20 is of highly simple construction to effect selection and switching between types. The printing device of Figures 11—20 is composed of a reduced number of parts, small in size, lightweight, and applicable to pocket electronic calculators and the like. Since the electromagnetically operated trigger member can be de-energized immediately after the locking member 112 has been shifted from the standby

condition to the operating condition, the printing device of Figures 11—20 consumes a reduced amount of electric power.

Claims

1. A printing device comprising a motor (6); a drive mechanism (8c, 9, 10, 11a) for alternately transmitting drive from the motor (6) to first and second output members (21, 11); type means (50—53) arranged to be driven by the first output member (21) so that selected type (50a, 51a, 52a) can be brought to a printing position; a printing mechanism (55) arranged to be driven by the said second output member (11) to effect printing of the said selected type on a sheet (45); a locking member (12) for alternately arresting and locking the first and second output members (21, 11); an electromagnetically operated trigger member (23) for causing the locking member (12) to release the second output member (11) and to arrest and lock the first output member (21); and a return drive member (11d, 11e) for causing the locking member (12) to release the first output member (21) and to arrest and lock the second output member (11), characterised in that the said drive mechanism (8c, 9, 10, 11a) comprises a differential mechanism whose second output member (11) comprises a gear (11a) which is formed integrally with first (11c) and second (11d, 11e) cams, the second cam (11d, 11e) constituting the said return drive member, and the first and second cams (11c, 11d, 11e) being respectively engageable with integral first and second portions (12a, 12b) of the locking member (12).

2. A printing device as claimed in claim 1 in which the second output member (11) is provided with a third cam (11f) which is engageable with a switching member (13) which controls operation of a carriage return mechanism (63).

3. A printing device as claimed in claim 2 characterised by a carriage (3) which carries the type means (50—53) and a shifting mechanism (58) for moving said carriage (3) in a printing direction, said type means (50—53) and a sheet feeding mechanism (49) being driven by said first output member (21); and said printing mechanism (55), the shifting mechanism (57) and the carriage return mechanism (63) being driven by said second output member (11).

4. A printing device as claimed in claim 3, characterised in that the operating time of said electromagnetically operated trigger member (23) is varied to control engagement of said second output member (11) and said switching member (13).

5. A printing device as claimed in claim 3 or 4 characterised in that said shifting mechanism has a positioning member (41) engaging with said carriage (3), said return mechanism has a return spring (63) which places said carriage (3) in a standby state and a connecting member (34) for connecting said positioning member (41) to said switching member (13), said positioning member (41) being disengaged from said carriage (3) by

standby position under the resiliency of the trigger lever spring 125. When the printing switching cam 111 makes one revolution starting rotation of the type shaft 122 again, the sheet feeding clutch ratchet wheel 137 is also rotated. Since the pawl 135b of the sheet feeding clutch pawl 135 engages the tooth 137a at this time, the sheet feeding clutch pawl 135 and the sheet feeding drive gear 138 with the sheet feeding clutch pawl 135 swingably supported on the pin 138b are caused to rotate in the direction of the arrow R'. When the sheet feeding drive gear 138 makes one revolution, the portion 113c of the return lever 113 engages the portion 135a of the sheet feeding clutch pawl 135 again, whereupon the sheet feeding clutch pawl 135 is disengaged from the sheet feeding clutch ratchet wheel 137, stopping rotation of the sheet feeding drive gear 138. Rotation of the sheet feeding drive gear 138 enables the sheet feeding transmission gear 139 to rotate the sheet feeding gear 147, the sheet feeding shaft 148, and the sheet feeding roller 149, thereby feeding the sheet 145 of printing paper by a distance corresponding to one line.

Printing along a next line can be performed by repeating the procedures (2)—(9).

Where the printing device of Figures 11—20 is incorporated in an electronic desktop calculator or the like, the type belts 150, 151 may have symbol types and the type belt 152 may have numerical types to print symbols at first and second type positions and numbers at a third type position on a sheet of printing paper.

With the arrangement shown in Figures 11—20, as described above, the selection mechanism has the locking member (selection pawl 112) for alternately arresting and locking two outputs from the conversion mechanism. The action member (selection pawl spring 120) maintains the locking member 112 in either one of two states, that is, a standby condition and an operating condition. When the locking member 112 is shifted from the standby condition to the operating condition by the electromagnetically operated trigger member 123, 125, 127—9, the locking member 112 is kept in the operating condition by the action member 120. When printing and shifting are completed, the locking member 112 is returned from the operating condition to the standby condition by the return drive member (protrusion 111d of the printing switching cam 111) supplied with the second output from the motor 106 which is fed to the printing mechanism, whereupon the second output is arrested and locked again, and the locking member is maintained in the standby position by the action member.

The printing device of Figures 11—20 is of highly simple construction to effect selection and switching between types. The printing device of Figures 11—20 is composed of a reduced number of parts, small in size, lightweight, and applicable to pocket electronic calculators and the like. Since the electromagnetically operated trigger member can be de-energized immediately after the locking member 112 has been shifted from the standby

condition to the operating condition, the printing device of Figures 11—20 consumes a reduced amount of electric power.

Claims

1. A printing device comprising a motor (6); a drive mechanism (8c, 9, 10, 11a) for alternately transmitting drive from the motor (6) to first and second output members (21, 11); type means (50—53) arranged to be driven by the first output member (21) so that selected type (50a, 51a, 52a) can be brought to a printing position; a printing mechanism (55) arranged to be driven by the said second output member (11) to effect printing of the said selected type on a sheet (45); a locking member (12) for alternately arresting and locking the first and second output members (21, 11); an electromagnetically operated trigger member (23) for causing the locking member (12) to release the second output member (11) and to arrest and lock the first output member (21); and a return drive member (11d, 11e) for causing the locking member (12) to release the first output member (21) and to arrest and lock the second output member (11), characterised in that the said drive mechanism (8c, 9, 10, 11a) comprises a differential mechanism whose second output member (11) comprises a gear (11a) which is formed integrally with first (11c) and second (11d, 11e) cams, the second cam (11d, 11e) constituting the said return drive member, and the first and second cams (11c, 11d, 11e) being respectively engageable with integral first and second portions (12a, 12b) of the locking member (12).

2. A printing device as claimed in claim 1 in which the second output member (11) is provided with a third cam (11f) which is engageable with a switching member (13) which controls operation of a carriage return mechanism (63).

3. A printing device as claimed in claim 2 characterised by a carriage (3) which carries the type means (50—53) and a shifting mechanism (58) for moving said carriage (3) in a printing direction, said type means (50—53) and a sheet feeding mechanism (49) being driven by said first output member (21); and said printing mechanism (55), the shifting mechanism (57) and the carriage return mechanism (63) being driven by said second output member (11).

4. A printing device as claimed in claim 3, characterised in that the operating time of said electromagnetically operated trigger member (23) is varied to control engagement of said second output member (11) and said switching member (13).

5. A printing device as claimed in claim 3 or 4 characterised in that said shifting mechanism has a positioning member (41) engaging with said carriage (3), said return mechanism has a return spring (63) which places said carriage (3) in a standby state and a connecting member (34) for connecting said positioning member (41) to said switching member (13), said positioning member (41) being disengaged from said carriage (3) by



operating said connecting member (34) with said switching member (13), and said positioning member (41) being engaged with said carriage (3) by operating said connecting member (34) from said second output member (11).

6. A printing device as claimed in any of claims 3—5 characterised in that type selecting, printing, shifting, sheet feeding and carriage returning operations are controlled by only one motor (6) and only one trigger member (23).

7. A printing device as claimed in any preceding claim characterised in that said printing mechanism (55) and a shifting drive member (58) of said shifting mechanism are held by said carriage (3), there being a frame (16, 18) on which is mounted said drive mechanism (8c, 9, 10, 11a).

8. A printing device as claimed in claim 7 characterised by a shaft (14) coupled to said second output member (11), a printing drive member (57) of said printing mechanism (55) and said shifting drive member (58) being both mounted movably but not rotatably on said shaft (14) and coupled to said second output member (11).

9. A printing device as claimed in any preceding claim characterised in that the type means comprises a plurality of type belts (50—52) having type elements (50a, 51a, 52a) on the outer sides thereof and a cylindrical holder (53) holding said type belts (50—52), said printing mechanism (55) operating to selectively push said type belts (50—52) outwardly to perform a printing operation.

10. A printing device as claimed in any preceding claim characterised in that said type means (50—53) is adapted to engage a frame part (64) when said printing device (55) is in a standby state and to engage a carriage member (54) after said carriage member (54) has moved a predetermined distance in a line arrangement direction, a spring member (65) being provided between the type means (50—53) and the carriage member (54) for urging said type means (50—53) in said line arrangement direction.

11. A printing device as claimed in claim 10 characterised by a hammer member (55) which is adapted to engage a first type array (50) when said printing device is in a standby state, and to engage successive type arrays (51, 52) as said carriage member (54) moves in the line arrangement direction.

12. A printing device as claimed in any preceding claim characterised by an action member (120) for acting on the locking member (112) to arrest and lock the second output member (111) when the locking member (112) is in a standby condition and to arrest and lock the first output member (121) when the locking member (112) is in an operating position, the trigger member (123) shifting the locking member (112) from said standby condition to said operating condition, and the return drive member (111d) acting on the locking member (112) to return the latter from the operating condition to the standby condition.

Patentansprüche

1. Druckvorrichtung mit einem Motor (6), einem Antriebsmechanismus (8c, 9, 10, 11a) zum wechselseitigen Übertragen der Antriebskraft vom Motor (6) zu einem ersten und einem zweiten Ausgangselement (21, 11), einer Typeneinrichtung (50—53), die von dem ersten Ausgangselement (21) derart angetrieben wird, daß eine ausgewählte Type (50a, 51a, 52a) in eine Druckstellung gebracht werden kann, einem Druckmechanismus (55), der zum Drucken des ausgewählten Typen auf ein Blatt (45) von dem zweiten Ausgangselement antreiben wird, einem Sperrelement (12) zum wechselseitigen Anhalten und Verriegeln des ersten und zweiten Ausgangselements (21, 11), einem elektromagnetisch betätigten Auslöseelement (23), wodurch das Sperrerelement (12) das zweite Ausgangselement (11) freigibt und das erste Ausgangselement (21) anhält und verriegelt, und einem Rückkehrantriebs-element (11d, 11e), wodurch das Sperrelement (12) das erste Ausgangselement (21) freigibt und das zweite Ausgangselement (11) anhält und verriegelt, dadurch gekennzeichnet, daß der Antriebsmechanismus (8c, 9, 10, 11a) ein Differentialgetriebe aufweist, dessen zweites Ausgangselement (11) ein Zahnrad (11a) aufweist, das einstückig mit ersten (11c) und zweiten Nocken (11d, 11e) ausgebildet ist, wobei der zweite Nocken (11d, 11e) das Rückkehrantriebs-element bildet und die ersten und zweiten Nocken (11c, 11d, 11e) entsprechend mit integralen ersten und zweiten Teilen (12a, 12b) des Sperrelements (12) in Eingriff bringbar sind.

2. Druckvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das zweite Ausgangselement (11) mit einem dritten Nocken (11f) versehen ist, der mit einem Schaltelement (13) in Eingriff bringbar ist, das den Betrieb eines Wagenrückkehrmechanismus (63) steuert.

3. Druckvorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß ein Wagen (3) vorgesehen ist, der die Typeneinrichtung (50—53) sowie einen Schiebemechanismus (58) zum Bewegen des Wagens (3) in einer Druckrichtung trägt, daß die Typeneinrichtung (50—53) und ein Blattzufuhrmechanismus (49) von dem ersten Ausgangselement (21) angetrieben werden, und daß der Druckmechanismus (55), der Schiebemechanismus (58) und der Wagenrückkehrmechanismus (63e) vom zweiten Ausgangselement (11) angetrieben werden.

4. Druckvorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Betriebszeit des elektromagnetisch betätigten Auslöseelements (23) zur Steuerung des Eingriffs des zweiten Ausgangselements (11) mit dem Schaltelement (13) variiert wird.

5. Druckvorrichtung nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß der Schiebemechanismus ein mit dem Wagen (3) in Eingriff stehendes Positionierelement (41) aufweist und daß der Rückkehrmechanismus eine dem Wagen (3) in einen Wartezustand stellende Rückkehrfeder (63)



sowie ein Verbindungselement (34) zum Verbinden des Positionierelements (41) mit dem Schaltelement (13) aufweist, wobei das Positionierelement (41) außer Eingriff mit dem Wagen (3) gelangt, indem das Verbindungselement (34) mit dem Schaltelement (13) betätigt wird und wobei das Positionierelement (41) mit dem Wagen (3) in Eingriff gelangt, indem das Verbindungselement (34) von dem zweiten Ausgangselement (11) aus betätigt wird.

6. Druckvorrichtung nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß die Typenauswahl-, Druck-, Schiebe-, Blattzufuhr- und die Wagenrückkehr-Operationen lediglich durch einen Motor (6) und lediglich durch ein Auslöseelement (23) gesteuert werden.

7. Druckvorrichtung nach irgendeinem vorangehenden Anspruch, dadurch gekennzeichnet, daß der Druckmechanismus (55) und ein Schiebeantriebselement (58) des Schiebemechanismus von dem Wagen (3) gehalten werden und daß ein Rahmen (16, 18) vorgesehen ist, auf dem der Antriebsmechanismus (8c, 9, 10, 11a) befestigt ist.

8. Druckvorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß eine Welle (14) vorgesehen ist, die mit dem zweiten Ausgangselement (11) gekoppelt ist, wobei ein Druckantriebselement (57) des Druckmechanismus (55) und das Schiebeantriebselement (58) zusammen beweglich, jedoch nicht drehbar, auf der Welle befestigt und mit dem zweiten Ausgangselement (11) gekoppelt sind.

9. Druckvorrichtung nach irgendeinem vorangehenden Anspruch, dadurch gekennzeichnet, daß die Typeneinrichtung eine Vielzahl von Typenriemen (50—52) mit Typenelementen (50a, 51a, 52a) auf deren Außenseite sowie einen die Typenriemen (50—52) haltenden zylindrischen Halter (53) aufweist, wobei beim Betrieb des Druckmechanismus (55) die Typenriemen (50—52) selektiv zur Ausführung eines Druckvorganges nach außen gestoßen werden.

10. Druckvorrichtung nach irgendeinem vorangehenden Anspruch, dadurch gekennzeichnet, daß die Typeneinrichtung (50—53) mit einem Rahmenteil (64) in Eingriff steht, falls sich der Druckmechanismus (55) in einem Wartezustand befindet, und mit einem Wagenteil (54) in Eingriff steht, nachdem der Wagenteil (54) sich um einen vorbestimmten Weg in einer Zeilenanordnungsrichtung bewegt hat, wobei ein Federelement (65) zwischen der Typeneinrichtung (50—53) und dem Wagenteil (54) vorgesehen ist, um die Typeneinrichtung (50—53) in die Zeilenanordnungsrichtung zu treiben.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß ein Hammerselement (55) vorgesehen ist, das im Wartezustand der Druckvorrichtung mit einer ersten Typenreihe (50) und bei der Bewegung des Wagenteils (54) in Zeilenanordnungsrichtung mit folgenden Typenreihen (51, 52) in Eingriff steht.

12. Druckvorrichtung nach irgendeinem vorangehenden Anspruch, dadurch gekennzeichnet,

daß ein Funktionselement (120) vorgesehen ist, das auf das Sperrelement (112) einwirkt und das zweite Ausgangselement (111) anhält und verriegelt, falls sich das Sperrelement (112) in einem Wartezustand befindet, und das erste Ausgangselement (121) anhält und verriegelt, falls sich das Sperrelement (112) in einem Betriebszustand befindet, wobei das Auslöseelement (123) das Sperrelement (112) vom Wartezustand zum Betriebszustand schiebt und das Rückkehrantriebselement (111d) auf das Sperrelement (112) einwirkt, um das letztgenannte vom Betriebszustand in den Wartezustand zurückzuführen.

Revendications

1. Imprimante comprenant un moteur (6); un mécanisme d'entraînement (8c, 9, 10, 11a) pour transmettre alternativement l'entraînement du moteur (6) à un premier et à un deuxième organes de sortie (21, 11); des agencements de caractères (50 à 53) conçus pour être entraînés par le premier organe de sortie (21) de sorte qu'un caractère choisi (50a, 51a, 52a) peut être amené à une position d'impression; un mécanisme d'impression (55) conçu pour être entraîné par le deuxième organe de sortie (11) pour effectuer l'impression du caractère choisi sur une feuille (45); un organe de blocage (12) pour arrêter et bloquer alternativement les premier et deuxième organes de sortie (21, 11); un organe de déclenchement (23) actionné électromagnétiquement pour faire en sorte que l'organe de blocage (12) libère le deuxième organe de sortie (11) et qu'il arrête et bloque le premier organe de sortie (21); et un organe d'entraînement de retour (11d, 11e) pour faire en sorte que l'organe de blocage (12) libère le premier organe de sortie (21) et qu'il arrête et bloque le deuxième organe de sortie (11), caractérisée par le fait que le mécanisme d'entraînement (8c, 9, 10, 11a) comprend un mécanisme différentiel dont le deuxième organe de sortie (11) comprend une roue dentée (11a) qui est formée d'une seule pièce avec une première (11c) et une deuxième (11d, 11e) cames, la deuxième came (11d, 11e) constituant l'organe d'entraînement de retour et les première et deuxième cames pouvant être respectivement mises en coopération avec une première et une deuxième parties solidaires (12a, 12b) de l'organe de blocage (12).

2. Imprimante selon la revendication 1, caractérisée en ce que le deuxième organe de sortie (11) est muni d'une troisième came (11f) qui peut être mise en coopération avec un organe de commutation (13) qui commande le fonctionnement d'un mécanisme de retour de chariot (63).

3. Imprimante selon la revendication 2, caractérisée par un chariot (3) qui porte les agencements de caractères (50 à 53) et un mécanisme de déplacement (58) pour mouvoir le chariot (3) dans un sens d'impression, les agencements de caractères (50 à 53) et un mécanisme d'avancement de feuille (49) étant entraînés par le premier organe



de sortie (21); et le mécanisme d'impression (55), le mécanisme de déplacement (57) et le mécanisme de retour de chariot (63) étant entraînés par le deuxième organe de sortie.

4. Imprimante selon la revendication 3, caractérisée en ce que l'on fait varier le temps de fonctionnement de l'organe de déclenchement actionné électromagnétiquement (23) pour commander la coopération du deuxième organe de sortie (11) et de l'organe de commutation (13).

5. Imprimante selon l'une des revendications 3 et 4, caractérisée par le fait que le mécanisme de déplacement présente un ressort de rappel (63) qui place le chariot (3) dans un état d'attente et un organe de liaison (34) pour relier l'organe de positionnement (41) à l'organe de commutation (13), l'organe de positionnement (41) étant dégagé du chariot (3) par actionnement de l'organe de liaison (34) avec l'organe de commutation (13), et l'organe de positionnement (41) étant mis en coopération avec le chariot (3) par actionnement de l'organe de liaison (34) depuis le deuxième organe de sortie (11).

6. Imprimante selon l'une quelconque des revendications 3 à 5, caractérisée par le fait que les opérations de sélection, d'impression, de déplacement, d'avancement de la feuille et de retour du chariot sont commandées par un seul moteur (6) et un seul organe de déclenchement (23).

7. Imprimante selon l'une quelconque des revendications précédentes, caractérisée par le fait que le mécanisme d'impression (55) et un organe d'entraînement de déplacement (58) du mécanisme de déplacement sont retenus par le chariot (3), un bâti (16, 18) étant prévu, sur lequel est monté le mécanisme d'entraînement (8c, 9, 10, 11a).

8. Imprimante selon la revendication 7, caractérisée par un arbre (14) accouplé au deuxième organe de sortie (11), un organe d'entraînement d'impression (55) et l'organe d'entraînement de déplacement (58) étant tous deux montés de façon mobile mais non tournante sur cet arbre (14) et accouplés au deuxième organe de sortie (11).

9. Imprimante selon l'une quelconque des

revendications précédentes, caractérisée par le fait que les agencements de caractères comprennent plusieurs courroies de caractères (50 à 52) présentant des éléments de caractère (50a, 51a, 52a) sur leurs côtés extérieurs et un organe de retenue cylindrique (53) retenant les courroies de caractères (50 à 52), le mécanisme d'impression (55) agissant de manière à pousser sélectivement les courroies de caractères (50 à 52) vers l'extérieur pour exécuter une opération d'impression.

10. Imprimante selon l'une quelconque des revendications précédentes, caractérisée par le fait que les agencements de caractères (50 à 53) sont conçus pour coopérer avec une partie de bâti (64) quand l'imprimante est dans un état d'attente et pour coopérer avec un élément de chariot (54) une fois que cet élément de chariot (54) s'est déplacé d'une distance prédéterminée dans un sens d'arrangement de ligne, un élément de ressort (65) étant prévu entre les agencements de caractères (50 à 53) et l'élément de chariot (54) pour solliciter les agencements de caractères (50 à 53) dans le sens d'arrangement de ligne.

11. Imprimante selon la revendication 10, caractérisée par un marteau (55) qui est conçu pour s'appliquer à une première disposition de caractères (50) quand l'imprimante est dans un état d'attente et pour s'appliquer à des dispositions successives de caractères (51, 52) lorsque l'élément de chariot (54) se meut dans le sens d'arrangement de ligne.

12. Imprimante selon l'une quelconque des revendications précédentes, caractérisée par un organe d'action (120) servant à agir sur l'organe de blocage (112) pour arrêter et bloquer le deuxième organe de sortie (111) quand l'organe de blocage (112) est dans un état d'attente et pour arrêter et bloquer le premier organe de sortie (121) quand l'organe de blocage (112) est dans une position de fonctionnement, l'organe de déclenchement (123) déplaçant l'organe de blocage (112) de l'état d'attente à l'état de fonctionnement et l'organe d'entraînement de retour (111d) agissant sur l'organe de blocage (112) pour ramener ce dernier de l'état de fonctionnement à l'état d'attente.

