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Folkens et al.

[11] **3,788,214**

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[54] **PRINTING APPARATUS FOR BUSINESS MACHINES**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **101/96,** 101/95, 101/107, 101/110

[51] **Int. Cl.** **B41j 27/00**

[58] **Field of Search** .... 101/93 MN, 93 C, 93 R, 45, 101/47, 57, 94–96, 99, 100, 107, 109, 110, 65, 80, 269

[56] **References Cited**

UNITED STATES PATENTS

3,538,848	11/1970	Barbour	101/269
3,547,028	12/1970	Plumpe et al.	101/93 C
2,935,934	5/1960	Williams et al.	101/93 C
3,309,989	3/1967	Solheim et al.	101/93 C
3,373,682	3/1968	Angel	101/269 X
2,632,384	3/1953	Kerr et al.	101/94 X
3,143,063	8/1964	Stark	101/93 R
1,993,848	3/1935	Krell	101/47
3,351,007	11/1967	Poland	101/93 C
3,702,585	11/1972	Landis et al.	101/93 R
3,128,694	4/1964	Kittler	101/93 R

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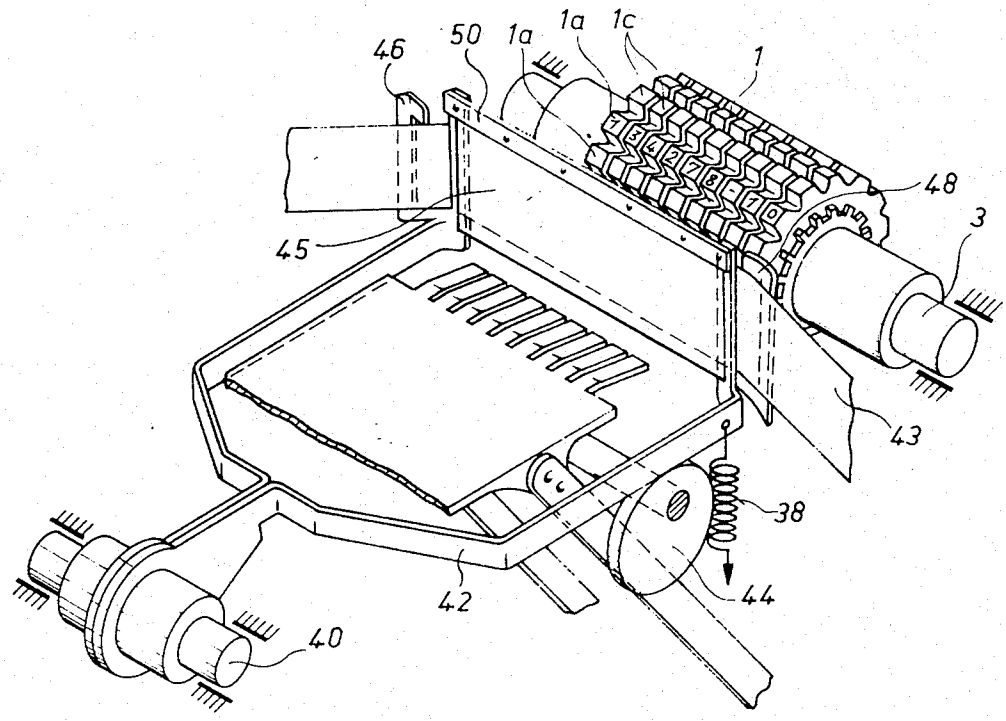
[57] **ABSTRACT**

A printing apparatus for typewriters, calculators, and like business machines in which the resilient prongs of a comb shaped printing plate are operated to slide in frictional contact in slightly resiliently deformed condition over areas of pressure responsive sheets covering printing type faces so that imprints are made. The sheet means may include an ink ribbon, a paper sheet, and a stationary foil on which the resilient prongs slide while holding the ink ribbon on the papers sheet, and the paper sheet on the type face, or other pressure responsive imprint forming sheets may be used.

9 Claims, 4 Drawing Figures



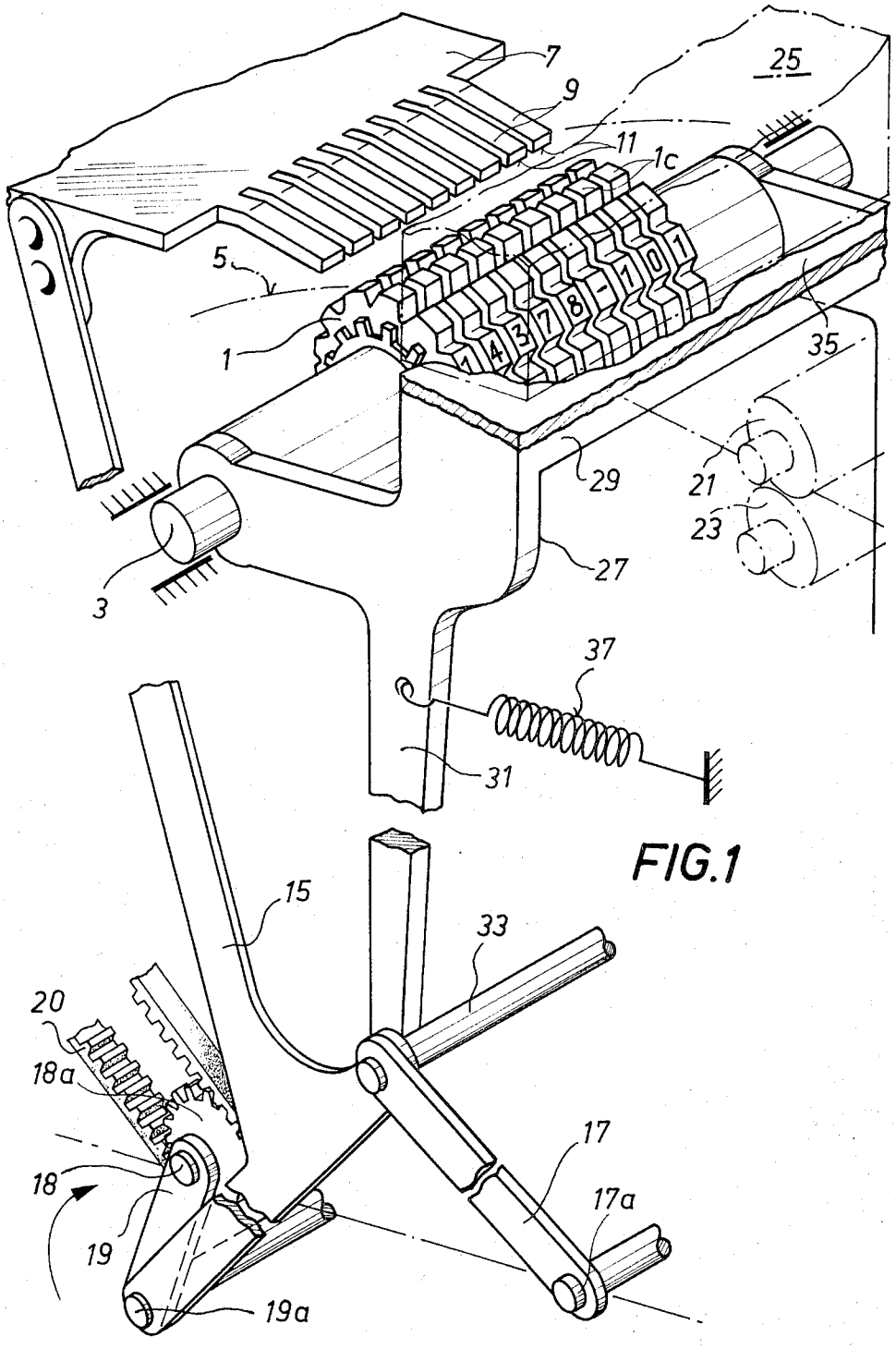
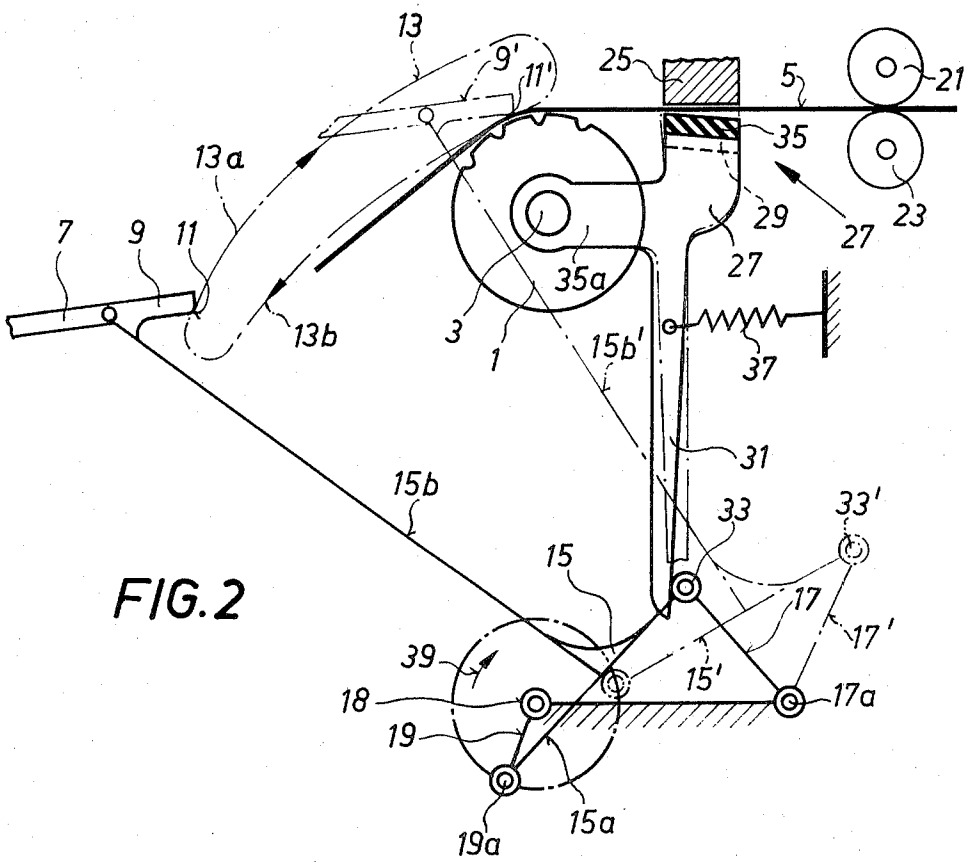


FIG.1


13
9'
11'
25
5
21
35
13a
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7
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11
27
35a
13b
3
1
15b'
37
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15b
33
33'
15
17
17'
39
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18
17a
19
19a
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FIG. 2

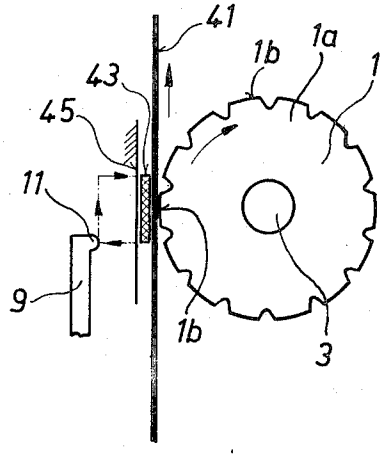
41
1b
1a
1
43
45
11
9
1b
3

FIG. 3

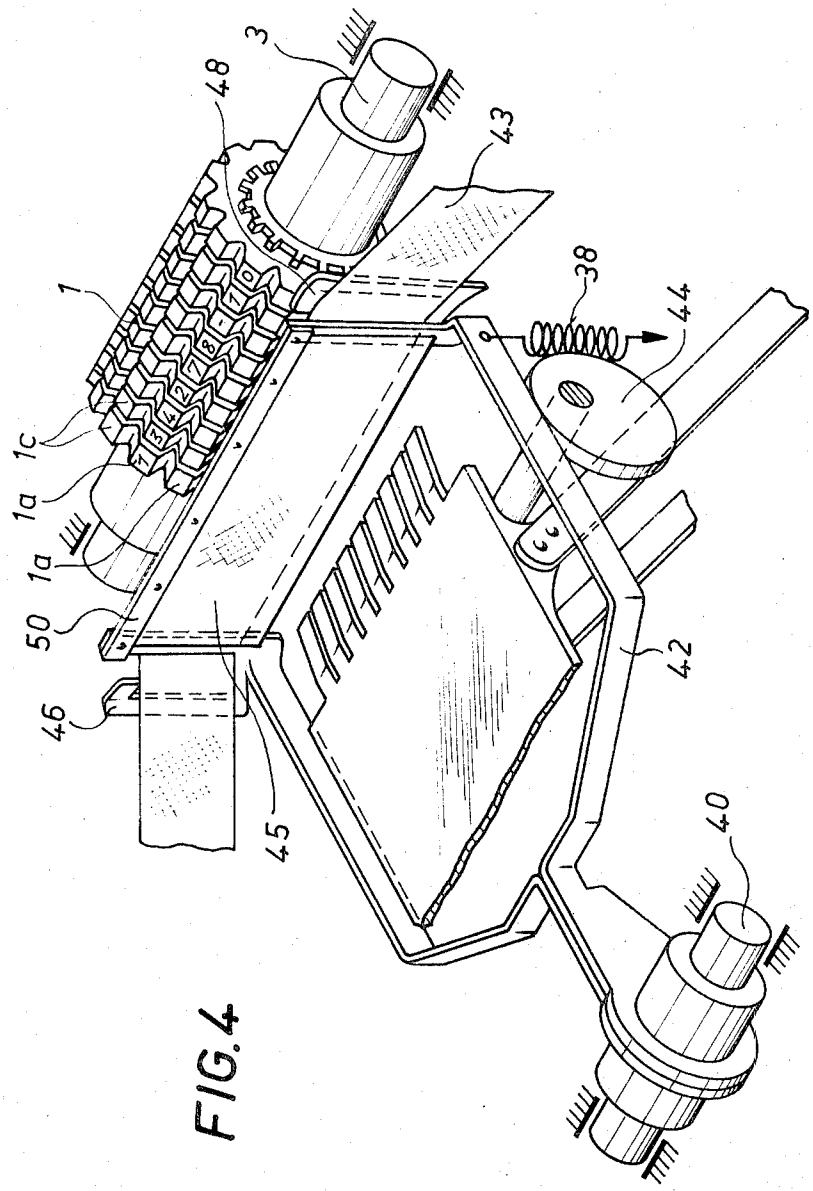

FIG. 4

PRINTING APPARATUS FOR BUSINESS MACHINES

BACKGROUND OF THE INVENTION

The present invention is concerned with a printing apparatus for business machines, which is particularly suited for printing entire lines formed by printing types. It is known to press a pressure member against a pressure responsive imprint forming sheet means covering a line of types, in perpendicular direction against the type faces of the line of types.

In a known printer of this type, the pressure member has a curved pressure edge which is rolled over a pressure responsive imprint forming sheet means from one end of a line of types to the other end. This apparatus makes uneven imprints, particularly when the line of types is formed by a plurality of printing wheels which are turnable between digital positions. Due to unavoidable tolerances between the diameters of the individual printing wheels, it is hardly possible to obtain a perfect imprint.

It has been proposed to use an elastic cover on the pressure edge of the pressure member so that the small differences between the diameters of the printing wheels are compensated, but nevertheless, an absolutely precise sharp imprint cannot be obtained.

If soft rubber is used for covering the pressure edge, the type of a projecting type wheel deforms the rubber and deeply enters into the same so that also the sheet and an ink ribbon are substantially deformed. A deformation of the paper sheet by a bulge cannot be avoided by the elastic rubber cover, and it is not possible to obtain a precisely uniform appearance of the printed characters. On the other hand, if a hard rubber is used for covering the pressure edge, the distance which is rubber will yield is substantially reduced so that the curved pressure edge is mainly supported on the projecting types, so that not so far projecting types of other printing wheels produce weaker imprints.

Another disadvantage of the prior art is that, irrespective of the fact that the moving masses are small, a high amount of energy is required for printing, particularly if a transfer magnet ink ribbon is used. Due to the fact that the pressure of the curved pressure edge is perpendicular to the type faces, the pressure must be sufficient to press the sheet means simultaneously against the entire character forming the type face of the types against which the sheet means is pressed.

In printing apparatus according to the prior art, the ink is transferred by a high pressure, and the ink ribbon, the paper, and other sheets have to be compressed by the types and deformed so that the ink is transferred. The quality of the imprint regarding blackness, sharpness of contour and width of lines, substantially depends on the deformation of the paper and of the pressure member.

SUMMARY OF THE INVENTION

It is one object of the invention to overcome the disadvantages of prior printing apparatus for business machines, and to provide a printing apparatus for a serial printer or parallel printer which is of simple construction and inexpensive to manufacture, while suitable for high printing frequencies, and operating at a low noise level.

Another object of the invention is to reduce the force required for pressing a printing member against sheets located on type faces for obtaining a clear imprint.

With these objects in view, an embodiment of the invention comprises a type carrier having at least one type, and preferably a line of types having type faces; positioning means for positioning pressure responsive imprint forming sheet means on the type face or faces so that an area of the sheet means covers each type face; printing means including at least one printing element, and preferably a line of resilient printing elements formed by the prongs of a comb-shaped plate; and operating means for sliding the printing elements substantially parallel to the type faces over the areas of the sheet means in frictional contact with the areas, respectively, so that the areas abut the type faces and imprints are made on the respective areas by the respective type faces.

The resilient prongs of the printing means have friction faces which, during the printing operation slide under low pressure over the intermediate sheet means and thereby over the type faces of the types of the type carrier which are to be printed. In contrast to the prior art, where the printing pressure is exerted in a direction perpendicularly to the type faces, in the present invention, the elastic prongs are moved substantially parallel to the type faces over the respective areas of the sheet means so that very little energy is required for the imprints since the resilient prongs slide on the type face of the types, and are not moved against the type faces in perpendicular direction. For transmitting ink to papers sheets, and for producing visible imprints, frictional contact with a minimal pressure is sufficient, and the high pressure required by apparatus of the prior art is avoided.

It is a particular advantage of the invention that the intermediate sheet means are hardly deformed by the resilient prongs, and that the transfer of ink takes place almost exclusively due to the friction exerted by the moving resilient prongs.

In the preferred embodiment of the invention the printing plate and the resilient prongs thereof are moved along an elongated endless path so that the prongs pass the sheet means at a distance during movement in one direction, and resiliently slide on the sheet means during movement in opposite direction along the endless elongated path. The prongs move in tangential direction over the respective type faces of the type carrier, and every line is immediately visible after the printing operation since the printing plate and prongs move away from the imprinted types in a direction parallel to the type faces.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG 1 is a framentary perspective view illustrating an embodiment of the invention;

FIG. 2 is a schematic side view illustrating particularly the operating means for moving the printing plate along an endless path;

FIG 3 is a side view illustrating a modified apparatus in which instead of pressure sensitive paper, standard paper and an ink ribbon are used; and

FIG. 4 is a fragmentary perspective view illustrating the mounting of the ink ribbon in the embodiment of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The printing apparatus of the invention can be used for a parallel printer settable over the entire length of a line, as well as for serial printers.

In the embodiment illustrated in the drawing, a parallel printer is shown which includes a type carrier 1 composed of a series of type wheels or printing wheels 1c each of which has a predetermined number of types 1a with type faces 1b on which digits and characters are formed. Evidently, instead of printing wheels 1, printing bars with types along the length thereof may be used. All type wheels 1 are coaxially arranged on a shaft 3, and can be set by apparatus of the type disclosed in the copending U. S. Pat. application Ser. No. 46,198, or in any other conventional way. When the type wheels 1c have been set, a line of types 1a is formed which is to be printed. An imprint forming sheet means 5, which may be a pressure sensitive paper sheet, passes over the type faces 1b, as best seen in FIG. 2. The pressure sensitive sheet means 5 is imprinted, if a comb-shaped printing plate 7, which has resilient prongs 9, is moved along the endless path 13 so that during the return stroke of the printing means 7, 9, the engaging faces 11 of the printing elements or prongs 9 slide over the areas of the pressure sensitive sheet means 5 which respectively cover the type faces 1b of the respective operative line of types 1b.

Due to the fact that the prongs 9 with engaging faces 11 move along a flat endless path 13, the printed line becomes immediately visible since the printing plate 7 with prongs 11 moves away from the type carrier 1. Particularly during the return movement of the prongs 9 with engaging faces 11 when which the printing takes place, the engaging faces 11 move substantially parallel to the line of type faces 1b formed by the line of types 1a whose characters or digits are to be printed. However, the engaging faces 11 engage the sheet means 5 at a slight pressure causing a slight resilient deformation of the prongs 9.

Operating means are shown in FIGS. 1 and 2 for moving the printing means 7, 9, 11 along the endless path 13.

The operating means include drive means in the form of a toothed pulley 18a driven by an endless toothed belt 20, and driving a shaft 18 to which a crank arm 19 is secured which has a pivot 19a at its outer end connected with one end of a link 15a whose other end is connected by a pivot 33a of a rod 33 to a lever 17 which is turnable about a stationary pivot 17a. Link 15a is part of a rigid linkage 15 which includes bar means 15b which fixedly carry the printing plate 7 with prongs 9.

In the position shown in solid lines in FIG. 2, the rigid linkage 15 holds the printing plate 7 with prongs 11 near the reversal point of the endless path 13, and during movement of crank arm 19 to the position shown in chain lines, the linkage assumes the position 15', while lever 17 moves to position 17', shaft 33 moves to position 33', and the bar means 15b moves to the position 15b'. In this position shown in chain lines, the engaging faces 11 cooperate with the areas of the pressure sensitive sheet means 5 which cover the respective selected line of types 1a.

It is important that the resilient prongs 9 move first along the path portion 13a spaced a distance from the sheet means 5, and then move in substantially the opposite direction along the path portion 13b to slidingly and resiliently engage the respective areas of the sheet means 5 which cover the respective type faces 1b of the selected line of types 1a. Any operating means for moving the printing plate 7 with prongs 11 along an endless path may be used instead of the operating means illustrated in FIGS. 1 and 2, and described above.

Positioning means including transporting rollers 21 and 23 transport the pressure sensitive sheet means 5 after the imprint of a line has been made so that the next line of free areas is placed on the newly set type faces 1b of a line of newly selected types 1a. The sheet means 5 producing the imprints may be like the sheets disclosed in the U.S. Pat. 2,059,537, issued May 16, 1960 to Watkins.

Since the sliding of the engagement faces 11 of resilient prongs 9 over the free areas of the sheet means exerts a pull to the left, as viewed in FIG. 2, on sheet means 5 due to the frictional engagement between the prongs 9 and the respective areas of the sheet means 5, it is advantageous to provide holding means including a fixed clamping member 25 and a movable clamping member 35 forming a gap through which the sheet means 5 is transported by the transporting rollers 21, 23. The movable clamping member 35 has an arm 35a mounted on shaft 3 for angular movement between the illustrated position in which clamping members 25, 35 are spaced, and a clamping position pressing sheet means 5 against the clamping bar 25. An arm 31 is connected with clamping bar 35, and cooperates with the shaft 33 which is part of the operating means which move the printing plate 7 with prongs 9 along the endless path 13. A spring 37 connects a fixed frame point with arm 31 to press the same against shaft 33, as also shown in FIG. 1. When the engaging faces 11 of the prongs 9 are about to engage the areas of sheet means 5 covering the respective line of type faces 1b, shaft 33 is in such a position that it permits spring 37 to move the clamping bar 35 to a position clamping and holding the sheet means 5 to prevent a slipping of the same on the type faces due to the movement of the engaging faces 11 over the respective areas. When the imprint has been completed and engaging faces 11 have moved off the respective areas of sheet means 5, shaft 33 assumes a position for displacing arm 31 and for moving clamping bar 35 to the position shown in FIG. 2 in which sheet means 5 can be transported through the gap between clamping bars 25 and 35 by the transporting rollers 21, 23 which properly position the next free line of areas of sheet means 5 over the respective line of type faces 1b.

The apparatus illustrated in FIGS. 1, 2 and 3 operates as follows:

In the initial position of rest of the apparatus, the comb-shaped printing plate 7 with elastic prongs 9 is in the position illustrated in solid lines in FIG. 2, and spaced from the type carrier 1 in tangential direction so that the previously printed line on sheet means 5 is freely visible.

After setting of the type wheels 1c on shaft 3, a line of types 1a is newly selected for printing. A clutch, not shown, or a motor, not shown, is operated to start the belt 20 to rotate pulley 18a and to drive crank arm 19 in a rotary motion so that the operating means including the rigid linkage 15 and lever 17 are driven to move printing plate 7 with prongs 11 along the endless flat path 13 first along the path portion 13a spaced from the selected type faces and the sheet means 5, and then back in a return stroke along the path portion 13b, which is so disposed that the engaging faces 11 of the prongs 9 slide over the areas of the sheet means 5 covering the type faces 1b of the line of selected types 1a. Prongs 9 are slightly deformed and resiliently yield to the small pressure between the engagement faces 11 and types 1a. Since the printing plate 7 and prongs 9 immediately move away from the imprinted areas of sheet means 5, the new line imprint is immediately visible, in contrast to a prior art arrangement in which printing means are moved in a radial direction into engagement and out of engagement with areas of a sheet covering the type faces of the selected types.

Since the engaging faces move in tangential direction over the type faces, only a small amount of energy is required.

During the actual engagement between the engaging faces 11 with the respective areas of sheet means 5, arm 35 was released by shaft 33 in the position 33', so that spring 37 could place the movable clamping bar 35 in the clamping position pressing sheet means 5 against the stationary clamping bar 25 for fixedly holding sheet means 5 against any displacement due to the friction between engaging faces 11 and areas of the sheet means 5.

When transporting rollers 21 and 23 are operated to shift the sheet means 5 to position a new line of free areas on the selected line of types, shaft 33 is operative to displace arm 31 to move clamping bar 35 to a position increasing the width of the gap between clamping bars 35 and 25 so that sheet means 5 can be properly positioned.

In the above described embodiment of FIGS. 1 and 2, a pressure responsive sheet means 5 is used which produces a legible imprint when engaging faces 11 slide with friction over the respective areas of the sheet means 5 which are supported by the characters of the type faces 1b.

In the modified embodiment illustrated in FIGS. 3 and 4, the sheet means include a paper sheet 41, and an ink ribbon 43. Since it would not be suitable to slide the engaging faces 11 of the prongs 9 over the ink ribbon 43, the ink ribbon is covered by a stationary foil 45 on which the engaging faces 11 slide while being resiliently deformed to exert pressure on ink ribbon 43, sheet 41, and the type faces 1b of the types of the respective line of types. The stationarily held foil 45 does not transmit the sliding motion of the engaging faces 11 to the ink ribbon 43 and to the paper sheet 41, so that a clear imprint is made. During the printing operation, the ink ribbon 43 is raised by conventional mechanism to a position located at the height of the respective line of types 1a to be printed. In order to review the printed line, foil 45 must also be retracted when the ink ribbon 43 is lowered. An apparatus serving this purpose is shown in FIG. 4.

The ink ribbon 45 passes through, and is guided by, arms 46 and 48 which are mounted on a frame 42 supported for angular movement about a shaft 40. After a line of types has been printed, frame 42 with arms 46, 48 is turned by a rotary cam 44 to a position in which the printed line is visible. Spring 38 holds frame 42 in engagement with cam 44.

The foil 45, which may consist of a synthetic material, a thin metal sheet, or the like, is secured to a frame 50 which is mounted on the arms 46 and 48 of the movable ink ribbon frame 42 so that the foil moves with the ink ribbon 43 to a position spaced from the line imprinted on the sheet 41, not shown in FIG. 4, so that the line is visible for inspection.

A modification is possible, in which the engaging face 11 of a prong 9 is adjusted only in a direction perpendicular to the type face, while the sheet means 5 and the type carrier 1 move at the same speed during the printing operation. The engaging face 11 of the prong 9 slides over the sheet means 5 and the type faces of the selected types so that a relative motion in tangential direction is maintained. In order to obtain a high printing speed, the printing on the sheet means should take place during the line shifting of the sheet means.

It is also possible to use a printing plate with a row of elastic prongs extending over the entire length of the line, and to effect cooperation of only one prong with a serial printer during each cycle of operation of the machine.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of printing apparatus for a business machine differing from the types described above.

While the invention has been illustrated and described as embodied in a printing apparatus in which the resilient prongs of a comb-shaped printing plate slide over a pressure sensitive sheet in tangential direction of type faces under the sheet, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations sould and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent as set forth in the appended claims.

We claim:

1. Printing apparatus for business machines, comprising support means; a type carrier mounted on said support means and including a line of types having type faces; positioning means movably mounted on said support means for positioning pressure-sensitive imprint-forming sheet means on said type faces, said sheet means having a row of areas covering said type faces, respectively, of said line of types; printing means including a comb-shaped means having a row of resilient prongs forming a line of printing elements; and driven operating means movably mounted on said support means and connected with said printing means for slidingly moving said printing elements over said areas, respectively, and over the covered type faces substan-

tially parallel to said type faces so that said prongs are resiliently deformed while in sliding contact with said areas, respectively, whereby imprints are made by said type faces on said areas.

2. Printing apparatus as claimed in claim 1 wherein said operating means are connected with said printing means for moving said printing elements along parallel endless paths so that each printing element moves in one direction along a first portion of an endless path spaced from said sheet means and said type faces, and then moves in the opposite direction along a second portion of said endless path in sliding frictional contact with the respective area of said sheet means.

3. Printing apparatus as claimed in claim 2 wherein said operating means includes a crank arm rotatable about a first axis, a rigid linkage including a link having one end pivotally connected with the outer end of said crank arm and bar means rigidly connected with said link and said comb-shaped plate, a lever supported for angular movement about a second axis and having a free end pivotally connected with the other end of said link, and drive means for rotating said crank arm whereby said comb-shaped plate moves about an elongated endless path during rotation of said crank arm.

4. Printing apparatus as claimed in claim 1 wherein the material of said comb-shaped plate and of said prongs is a synthetic plastic material.

5. Printing apparatus for business machines, comprising support means; a type carrier mounted on said support means and including a line of type faces; positioning means movably mounted on said support means for positioning pressure-sensitive imprint-forming sheet means on said type faces, said sheet means having rows of areas for covering said type faces, respectively, of said line of types, said positioning means including driven transporting means movably mounted on said support means in driving connection with said sheet means for moving successive rows of areas of said sheet means into printing positions covering said line of type faces, respectively; printing means including a line of resilient printing elements movable along paths, respectively, passing over said areas, respectively; driven operating means movably mounted on said support means and connected with said printing means for slidingly moving said printing elements along said paths over said areas, respectively, and over the covered type faces substantially parallel to said type faces so that said printing elements are resiliently deformed while in sliding contact with said areas, respectively, whereby imprints are made by said type faces on said areas, respectively; and movable holding means connected with and operated by said operating means for holding said sheet means immovably in said printing positions during the sliding of said printing elements over said areas.

6. Printing apparatus as claimed in claim 5 wherein said holding means include a stationary clamping means and a movable clamping means forming a gap through which said sheet means is moved by said transporting means; and wherein said movable clamping means is connected to, and operated by said operating means to press said sheet means against said first clamping means so as to clamp and immovably hold said sheet means during the sliding movement of said printing elements over said areas.

7. Printing apparatus as claimed in claim 6 wherein said movable clamping means is mounted for angular movement and has an arm and wherein said operating means includes a spring connected with said arm, a rotary crank, and means driven by said rotary crank during movement of said sheet means by said transporting means to engage said arm for moving said movable clamping means against the action of said spring away from said sheet means and said fixed clamping means.

8. Printing apparatus as claimed in claim 6 wherein said movable clamping means includes a clamping bar, and a resilient cover for said clamping bar engaging said sheet means when said movable clamping means is moved toward said fixed clamping means.

9. Printing apparatus for business machines comprising support means; a type carrier mounted on said support means and including a line of type faces; positioning means mounted on said support means for positioning a sheet means including a paper sheet having one side confronting said type faces, and an ink ribbon on the other side of said paper sheet, said sheet means having rows of areas for covering said type faces, respectively, of said line of type faces; printing means including a line of resilient printing elements movable along paths passing over said areas, respectively; a frame located in the proximity of said line of types of said type carrier; a foil supported on said frame between said ink ribbon and said printing elements; and driven operating means movably mounted on said support means and connected with said printing means for slidingly moving said printing elements along said paths on said foil so that said printing elements slide over said foil and are resiliently deformed while holding said foil on said ink ribbon, and said ink ribbon on said paper sheet whereby imprints are made by said type faces on said areas.

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