# United States Patent [19]

**McVey**

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[54] **SEQUENTIAL HAMMER IMPRINTER**


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[52] **U.S. Cl.** ..... **101/93 MN,** 197/98, 197/23, 197/56

[51] **Int. Cl.** ..... **B41g 47/46**

[58] **Field of Search** .. 101/93 MN, 93 R, 42, 57, 68, 101/69, 70, 78, 109, 287, 316, 368, 93 C, 3; 197/17, 23, 49, 98, 56



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,126,823 | 3/1964 | Benson | 101/93 C |
| 2,813,481 | 11/1957 | Hansen | 101/93 R |
| 3,670,647 | 6/1972 | Funk et al. | 197/49 |
| 3,444,975 | 5/1969 | Simshauser | 101/93 C X |
| 3,453,572 | 7/1969 | Masterson | 101/93 C |
| 3,459,976 | 8/1969 | Nyman | 101/93 C X |
| 3,614,486 | 10/1971 | Smiley | 101/93 C X |
| 3,482,772 | 12/1969 | Thayer | 197/49 X |
| 3,309,989 | 3/1967 | Solheim et al. | 197/49 X |
| 3,139,820 | 7/1964 | Kittler | 101/93 C |
| 2,328,861 | 9/1943 | Thomas | 101/109 X |
| 2,625,100 | 1/1953 | Williams et al. | 101/93 R |
| 3,151,544 | 10/1964 | Taylor et al. | 101/93 MN |
| 2,534,364 | 12/1950 | Moll | 101/93 R |
| 3,218,965 | 11/1965 | Simons et al. | 101/93 R |
| 1,981,519 | 11/1934 | MacDonald | 101/93 MN |
| 1,624,124 | 4/1927 | Von Pein | 101/93 R |



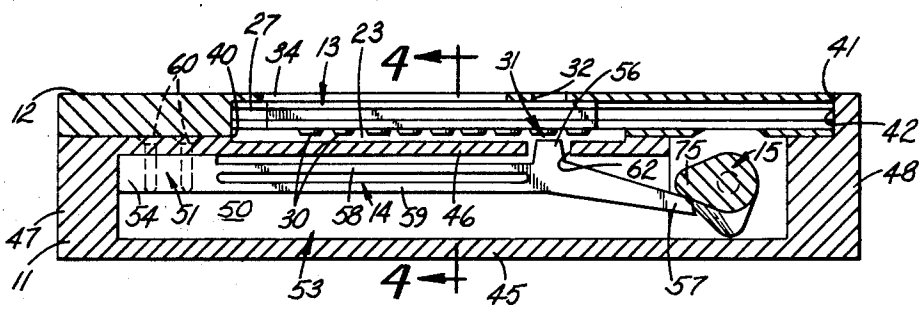
*Primary Examiner*—Robert E. Pulfrey
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[57] **ABSTRACT**

An impact printer with character carrying slides each selectively movable to position their characters one at a time in a printing station. A rotary cam sequentially deflects and releases a plurality of hammers to impact an imprintable form sequentially against the characters positioned in the printing stations. Substantially all of the components are formed of plastic to provide a compact and inexpensive structure.


**4 Claims, 6 Drawing Figures**



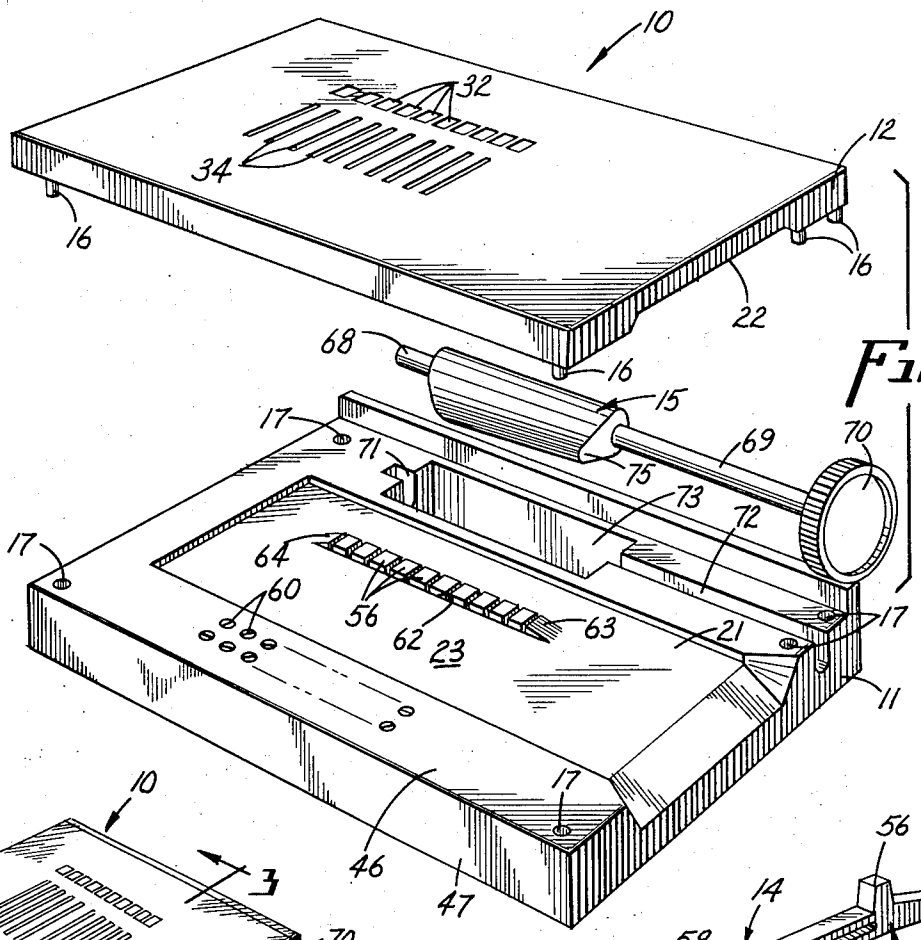



Fig. 1

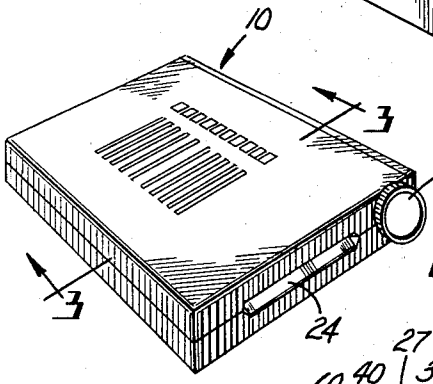



Fig. 2

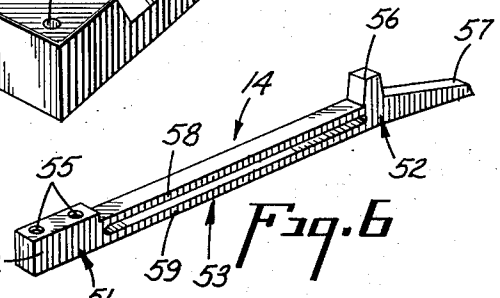



Fig. 6

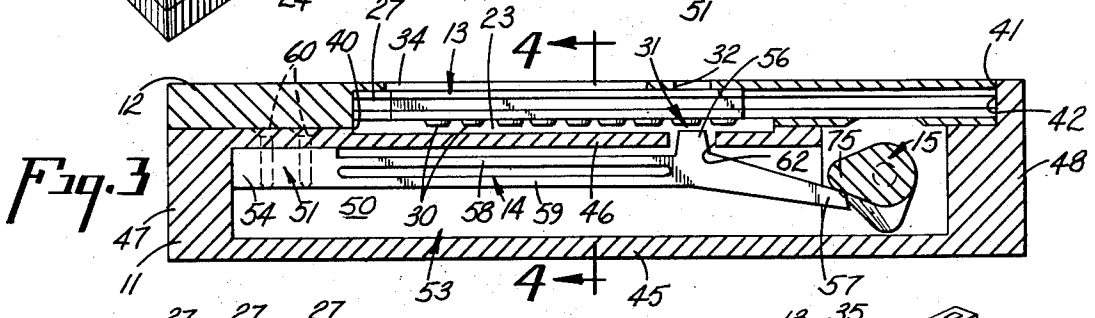



Fig. 3

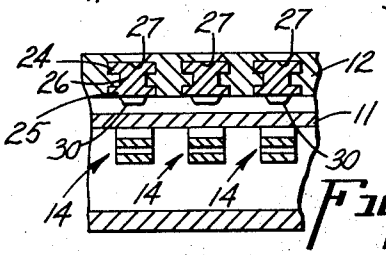



Fig. 4

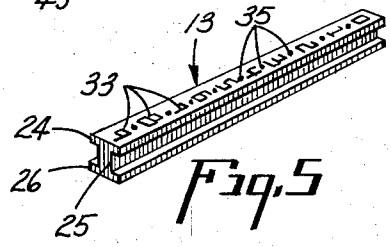



Fig. 5

# SEQUENTIAL HAMMER IMPRINTER

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to printing devices for imprinting a series of selected characters on a form, and more particularly to a simple and inexpensive printing device wherein printing is effected by sequentially releasing a series of hammers to sequentially impact an imprintable form with a series of raised characters.

2. Prior Art

Impact printing devices are well known which imprint selected characters on a form by impacting the form between a generally planar surface and a raised character. Most such impact printers, however, comprise relatively complex and expensive mechanisms which are inherently bulky and too heavy to be readily transportable in a pocket or purse.

Currency substitutes such as personal checks are increasingly being used both in the United States and in many foreign countries. The resulting flood of personal checks which pass daily through banks and interbank clearing houses has made it desirable to imprint each check with a series of optically scannable characters indicating the amount of the check so that the checks can be processed entirely automatically.

In order to facilitate the imprinting of personal checks with optically scannable characters indicating the amount of check, it is desirable to provide each depositor with a simple and inexpensive printing device with which he can imprint the desired information on each check he writes. In order for such printing devices to gain acceptance, it is important that they be light in weight and small in size so as to be readily transportable, as for instance in a pocket or purse. The printing device must also be of sufficiently inexpensive design as will permit its being issued to depositors either at no charge, or at only a nominal charge.

Other uses for such printing devices are also under study. By way of example, the sorting and routing of mail could be entirely automated if each parcel of mail were inprinted by the sender with an optically or magnetically machine readable zip code. While a variety of mail sorting machines have already been designed which can read an optically or magnetically imprinted zip code and subsequently sort and route parcels according to their zip code, there still has been no acceptable solution to the problem of initially imprinting all mail parcels with a zip code in machine readable characters.

## SUMMARY OF THE INVENTION

The present invention overcomes the foregoing drawbacks of prior art devices and provides a simple and inexpensive printing device which sequentially impacts an imprintable form between selected characters and an opposing surface to imprint the form with machine readable characters.

The printing device includes a housing which houses a plurality of character carrying slides, a plurality of hammers, and a rotary cam. All of these elements are preferably formed of plastic and arranged to form a compact and light-weight structure which is readily transportable in a pocket or purse.



The housing includes a body and a cover which define a slot at one end into which an imprintable form may be inserted. A series of parallel ways are formed in the cover to slidably support the slides for movement across one face of the imprintable form.

The slides each carry a series of raised characters and each slide is operable to selectively position its characters one at a time in a printing station. Indicia carried on the slides register with openings formed through the cover to indicate which characters are positioned in the printing stations.

The hammers each have supporting portions secured to the housing at positions spaced from the printing stations. Each of the hammers also have an anvil portion which extends adjacent a separate one of the printing stations. The anvil portions are spaced from the slide-carried characters such that an imprintable form inserted into the housing extends between the slide-carried characters positioned in the printing stations and the anvil portions of the hammer.

The rotary cam is supported on a shaft journaled by the housing. One end of the shaft projects through the housing and carries a knob to facilitate manual rotation of the cam. The cam has portions configured to sequentially engage each of the hammers during a portion of each cycle of rotation of the cam. By this arrangement, the cam serves to sequentially deflect each anvil portion away from its respective printing station and to sequentially release each deflected anvil portion to impact the imprintable form against the raised characters positioned in the printing stations.

The sequential impaction feature of the present invention minimizes the amount of force which is needed to rotate the cam and likewise minimizes the amount of stress which is placed on the various printer components. As will be apparent, if all the hammers were simultaneously deflected and released, the cam would be difficult to rotate during hammer deflection and would rotate freely at all other times. Accordingly, the sequential impaction feature provides the cam with a smooth and easily effected movement during the printing operation. Moreover, the sequential impaction feature similarly minimizes the jarring of the printing device during printing as only one hammer at a time impacts the form.

Several other features of the present invention deserve emphasis. First, by virtue of the fact that the printer essentially comprises only a housing, a set of slides, a set of hammers and a rotary cam, all of which may be formed from plastic, the printer is inherentily simple in design and inexpensive to produce. This feature will permit its being distributed on a large scale without charge or at only a nominal charge. Secondly, the device is designed to form a compact, light-weight structure which is readily transportable. Thirdly, since the device operates by impacting an imprintable form sequentially against a series of raised characters, the slides and their characters need not be formed to such close tolerances as will assure an exactly aligned positioning of all the characters positioned in the printing stations. Unlike roller actuated printers wherein it is necessary for all of the imprintable characters to extend to a uniform height to assure a uniform printing action as a roller presses an imprintable form simultaneously against several or all of the characters, the hammers of the present impact printer will impact the form against the characters whatever their height. Ac-

cordingly, manufacturing tolerances may be relaxed, and the cost of the printer is likewise decreased.

The above-described embodiment of an impact printer is intended for use in conjunction with such forms as are coated or provided with carbon paper or the like to form an impression upon impact without the need for any auxiliary ink source. Where forms without this characteristic are to be imprinted, the printer may be provided with an inked ribbon between the form and the raised characters so that hammers will impact the form against the ribbon which, in turn, is impacted against the characters in the printing stations to imprint the form with ink from the ribbon.

Accordingly, it is a general object of the present invention to provide a novel and improved, simple and inexpensive impact printer of the type which is compact and light in weight so as to be readily transportable.

Other objects and a fuller understanding of the present invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of the impact printer of the present invention;

FIG. 2 is a perspective view of the printer of FIG. 1 on a reduced scale with the components of the printer assembled for operation;

FIG. 3 is an enlarged sectional view of the printer as seen from the plane indicated by the line 3—3 in FIG. 2;

FIG. 4 is a partial sectional view of the printer on the same scale as FIG. 3 as seen from the plane indicated by the line 4—4;

FIG. 5 is an enlarged perspective view of one of the several slides carried by the housing of the printer; and

FIG. 6 is an enlarged perspective view on the same scale as FIG. 5 showing one of the several hammers supported within the housing of the printer.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, and initially to FIGS. 1 and 2, an impact printing device is shown generally at 10. The printer 10 includes a housing structure comprising a body 11 and a cover 12. A plurality of slides 13, as shown in FIG. 5, are slidably carried by the cover 12. A plurality of hammers 14, as shown in FIG. 6 are mounted within the body 11. A rotary cam 15 is provided to deflect portions of the hammers and to sequentially release the deflected hammers to propel them toward the slides 13. As will be explained in greater detail, an imprintable form is positioned between the slides 13 and the hammers 14 whereby the hammers serve to impact the imprintable form against character carrying portions of the slides to effect imprinting of the form.

The base 11 and cover 12, when assembled as shown in FIG. 2, define a compact generally rectangular housing structure into which an imprintable form may be inserted. The base 11 and cover 12 are provided with mating depending projections and recesses 16, 17 to which adhesive is applied during assembly to hold the cover and base together. Mating recesses 21, 22 are provided in the base 11 and cover 12 to define a chamber 23 adapted to receive and hold an imprintable form. Access to the chamber 23 is provided through a tapered access slot 24 at one end of the housing structure.

The slides 13 are movably supported by the cover 12 for movement across one face of an imprintable form positioned within the chamber 23. As is best seen in FIGS. 4 and 5, the slides 13 have an I-shaped cross section with upper and lower flanges 24, 25 separated by a web 26 of reduced cross section. The cover 12 is provided with a series of parallel ways 27, each having a mating cross section to that of the slides 13 to support the slides for movement along parallel paths.

Movement of the slides 13 along the ways 27 serves to selectively position a series of raised characters in printing stations for an imprinting operation. The lower flanges 25 of the slides 13 each carry a series of raised, depending characters 30. Typically such characters may well include the Arabic numerals 0 through 9. A printing station, indicated generally in FIG. 3 by the numeral 31, is defined at a location along each of the ways 27. As will be explained in greater detail, such ones of the raised characters 30 are positioned in the printing stations 31 can be imprinted on a form.

The slides 13 carry indicia readable through openings in the cover 12 to indicate which of the characters 30 are positioned in the printing stations 31. A series of openings 32 are provided through the cover 12 immediately above the printing stations 31. The upper flanges 24 of the slides 13 carry indicia 33 which correspond to the characters 30 carried on the lower flanges 25. By this arrangement, an operator can ascertain which of the characters 30 are positioned in the printing stations 31 by reading the indicia 33 which are aligned with the openings 32.

Movement of the slides 13 is effected by inserting a pointed instrument through slots in the cover 12 to engage the slides. A series of slots 34 extend through the cover 12 in communication with the ways 27 to provide access to portions of the upper flanges 24 of the slides 13. A series of cylindrical recesses 35 are provided along the upper flanges 24. By this arrangement, a sharpened instrument such as the point of a pencil can be inserted through the slots 34 and into the recesses 35 so as to engage the slides 13. With the slides so engaged by a pointed instrument, the instrument can be moved along the slots 34 to effect movement of the slides 13 to position selected ones of the characters 30 in the printing stations 31.

The extent of movement of the slides 13 is limited by stop structures formed at each end of the ways 27. Referring to FIG. 3, the ways 27 are seen to extend only partway across the cover 12. The left ends of the ways 27, as viewed in FIG. 3, abuts a stop structure 40 formed integrally in the cover 12. The right ends of the ways 27 extend fully to the rightmost edge 41 of the cover 12 to permit assembly of the slides 13 into the ways 27. The rightmost edge 41, in assembly, abuts a stop structure 42 formed integrally with the body 11. Accordingly the slides 13 are movable along the ways 27 between the stop structures 40, 42. The length of the ways 27 is, of course, selected to permit the selective positioning of all of the characters 30 in the printing stations 31.

The body 11 is hollowed out to form a chamber within which the hammers 14 are mounted. As best illustrated in FIG. 3, the body 11 includes a bottom wall

45, a top wall 46, and a pair of sidewalls 47, 48. The recess 21 is formed in the top wall 46, while the stop structure 42 comprises an integral extension of the side wall 48. The walls 45–48 surround and define a central chamber 50 within which the hammers 14 are mounted.

The hammers 14 each have mounting and anvil portions 51, 52 spaced from each other by an integrally formed, relatively flexible supporting portion 53. The mounting portions 51 comprise generally rectangular mounting blocks 54 provided with a pair of upwardly opening threaded mounting apertures 55. The anvil portions 52 comprise upwardly extending anvil blocks 56 having integrally formed cam follower projections 57. The supporting portion 53 comprises a pair of relatively thin members 58, 59 extending between the mounting and anvil blocks 54, 56 and formed integrally therewith.

The hammers 14 are mounted in cantiliver fashion within the body chamber 50. Screws 60 extend through apertures in the top wall 46 and into the threaded apertures 55 to securely clamp the mounting blocks 54 to the body 11. Such a mounting arrangement serves to cantilever mount the anvil blocks 56 such that the anvil blocks can be moved up and down within the chamber 50 by transversely deflecting the supporting members 58, 59.

The anvil blocks 56 project through the top wall 46 and into the chamber 23. Referring to FIGS. 1 and 3, the top wall is provided with a slot 62 through which the anvil blocks 56 project. In order to maximize the permissible manufacturing tolerances on the hammers 14 and the body 11, the top wall 46 is provided with a pair of ramp-like projections 63, 64 adjacent opposite ends of the slot 62. By this arrangement, if one or more of the anvil blocks 56 extends to a position above the recess 21 in the top surface 46, the ramp-like projections 63, 64 will guide forms being inserted or withdrawn from the chamber 23 over the anvil blocks 56. This prevents the anvil blocks 56 from catching the form to prevent its movement within the chamber 23.

The rotary cam 15 is mounted on a shaft journaled for rotation by the body 11. Referring to FIG. 1, the cam 15 is seen to be formed integrally with shaft portions 68, 69. A knob 70 is formed integrally with the shaft portion 69. The body 11 is provided with aligned slots 71, 72 which journal the shaft portions 68, 69. A rectangular through aperture 73 located intermediate the slots 71, 72 provides an opening through which the cam 15 can be inserted into the chamber 50.

The rotary cam has camming portions configured to sequentially deflect and release each of the hammers 14 during a portion of each cycle of rotation of the cam 15. The cam is provided with a single lobe 75 which does not parallel the common axis of the shaft portions 68, 69, but rather is helical about this axis. Accordingly, the lobe 75 will extend into engagement with each of the various hammers 14 during different portions of each cycle of rotation of the cam 15. When the cam 15 is rotated counterclockwise, as viewed in FIG. 3, it will initially cause downward deflection of only the rightmost of the anvil blocks 56 as viewed in FIG. 1. Subsequent counterclockwise motion will bring the cam lobe 75 sequentially into engagement with the next and the next of the hammers.

The cam lobe 75 and the cam follower portions 57 of the hammers 14 are configured so that deflected ones of the hammers will be suddenly released by the cam lobe permitting a rapid acceleration of the anvil blocks 56 through the slot 62 toward the slides 13. The present invention utilizes the rapid movement of the released anvil blocks 56 to impact an imprintable form against the characters 30 positioned in the printing stations. Just as the deflection of the hammers 14 is accomplished sequentially by rotation of the cam 15, the release of the hammers is likewise sequential. Accordingly since not all of the hammers are deflected and released simultaneously, the force required to rotate the knob 70 is minimized and made more uniform than would be the case if all of the hammers were simultaneously deflected. Moreover, since no two hammers are released for impact at exactly the same instant, the amount of jar transmitted to the printer during a printing operation is minimized.

In operation an impact imprintable form is inserted through the slot 24 into the chamber 23 so as to position a portion of the form between the slides 13 and the anvil blocks 56. A sharpened instrument such as a pencil is then inserted through the slots 34 and into the slide recesses 35 to effect movement of the slides. The slides are moved in such a fashion along the ways 27 as to bring the desired characters 30 into the printing stations 31. Confirmation of the proper positioning of the selected characters 30 is had by reading the indicia 33 which appear through the cover openings 32. The knob 70 is then rotated manually to rotate the cam 15 counterclockwise as viewed in FIG. 3. Such cam rotation sequentially deflects and releases the hammers 14 to impact the form against the characters 30 which are positioned in the printing stations 31.

Where it is desirable to provide a printer which is operable in conjunction with forms which are not imprintable by impact alone but rather require the use of an inked ribbon, such a ribbon can be suspended beneath the characters 30 positioned in the printing stations 31. Various ribbon positioning and feed mechanisms of a type suitable for use with the impact printer of the present invention are well known and will not acccordingly be described here in greater detail.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. An impact printer comprising:

a. housing means defining a region into which an imprintable form can be inserted for printing;

b. a plurality of slides movably carried by said housing means for movement along one side of said region in parallel directions, each of said slides carrying a plurality of raised characters along a surface facing said region and being adapted to selectively position said characters in side-by-side printing stations;

c. said slides being provided with indicia viewable through apertures in said housing means to indicate which of said characters are positioned in said printing stations;

d. said slides additionally being provided with recesses adapted to be engaged by a pointed instrument inserted through slots in said housing means to facilitate movement of said slides to selectively position said characters in said printing stations;

e. a plurality of hammers each having supporting portions secured to said housing means and having anvil portions at locations spaced from said supporting portions, each of said anvil portions extending to a position generally adjacent a separate one of said printing stations on the opposite side of said region from said one side; and

f. rotary cam means journaled by said housing means and having cam portions configured to deflect said hammers to sequentially move each of said anvil portions away from its associated printing station and to sequentially release said deflected anvil portions;

g. whereby the deflection of said hammers will bias said anvil portions toward their respective printing stations with sufficient force to assure the rapid movement of said released anvil portions toward their respective printing stations thereby serving to sequentially impact an imprintable form positioned between said slides and said anvil portions against said characters positioned in said printing stations.

**2.** An impact printer comprising:

a. housing means including a body structure and a cover defining therebetween a region into which an imprintable form can be inserted for printing;

b. a plurality of parallel extending ways being provided in said cover structure;

c. a plurality of substantially identical slides slidably mounted in said ways movably for movement along one side of said region in parallel directions, each of said slides carrying a plurality of raised characters along a surface facing said region and being adapted to selectively position said characters in side-by-side printing stations;

d. said body structure defining a chamber therein and having an opening communicating said chamber and said region.

e. a plurality of substantially identical hammers mounted in said chamber, each of said hammers having supporting portions secured to said body structure and having anvil portions at locations spaced from said supporting portions, each of said anvil portions extending to a position generally adjacent a separate one of said printing stations on the opposite side of said region from said one side and being extensible through said opening to engage an imprintable positioned within said region;

f. said hammers each additionally having cam follower portions formed integrally therewith;

g. rotary cam means journalled by said housing means and having cam lobe portions adapted to engage each of said cam follower portions during different portions of each cycle of rotation of said cam means to sequentially deflect each of said anvil portions away from its associated printing station and to sequentially release said deflected anvil portions;

h. said cam lobe portions being disposed generally helically about the axis of rotation of said cam means;

i. whereby the deflection of said hammers will bias said anvil portions toward their respective printing stations with sufficient force to assure the rapid movement of said released anvil portions toward their respective printing stations thereby serving to sequentially impact an imprintable form positioned between said slides and said anvil portions against said characters positioned in said printing stations.

**3.** Portable data imprinting apparatus for mechanically imprinting characters and like variable data on a print receiving sheet, comprising:

a case having a printing station including a laterally extending line of character printing positions transversely spanning a portion of the case;

a plurality of elongated imprinting bars within said case slidably supported for axial movement along parallel adjustment axes along the case through said printing station;

each of said type bars having a columnarily disposed series of character type faces, means accessible from the exterior of said case manually engagable for shifting any selected one of said character type faces on the type bars in registry with said character printing positions;

means for visibly indicating the character type faces disposed in registry with said character printing;

a plurality of hammers, each being a cantilevered beam arm with one end secured to said case and a second end projecting into a drive array, each hammer having an anvil spaced from said one end, one hammer and one anvil for each said character printing position, each anvil having a normal condition positioned adjacent to the printing area; and

a composite drive member composed of a rotary cam portion for each hammer, each portion mounted to contact the end of a hammer in the drive array and to lift said hammer against its inherent resiliency to a flexed distance from said normal condition, and to release the hammer for a rebound flight toward said normal condition, each cam section being in a rotary relationship to each other section and the whole defining a rotary helical cam;

Whereby, rotation of said cam will lift the several hammers in said drive array sequentially and allow the hammers to rebound sequentially.

**4.** The impact printer of claim **3** wherein said cam portions serve both to sequentially deflect said portions of said hammer means and to sequentially release said deflected anvil portions whereby no two of said anvil portions are in exactly the same stage of deflection at the same time nor are any two of said deflected anvil portions released to effect a printing impaction at the same time, thereby minimizing the force required to turn said rotary cam means and likewise minimizing stress on the various printer components as well as the resulting jarring action to which the printer is subjected.

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