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FLUID HAMMER IMPRESSION ACTUATING MEANS

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FIG. 1

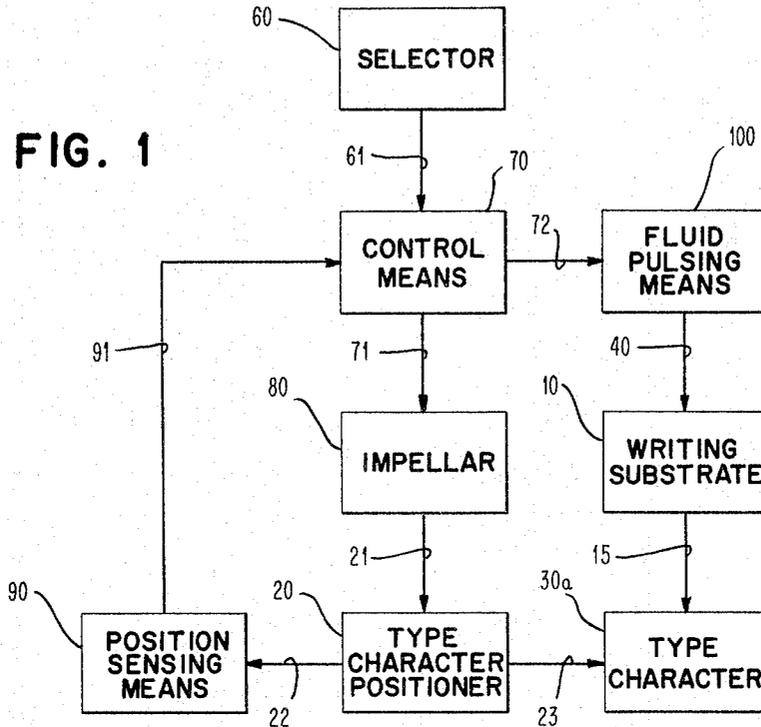


FIG. 2

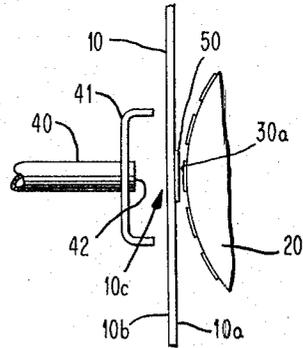
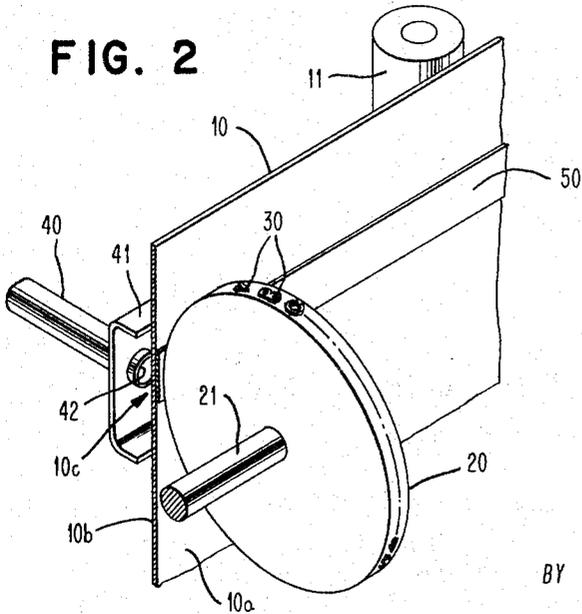


FIG. 3

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FLUID HAMMER IMPRESSION ACTUATING MEANS

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3 Claims. (Cl. 101-407)

This invention relates to printing devices, and more particularly relates to a serial-printing device employing a fluid hammer as the impression actuating means.

Systems for serially selecting and printing a plurality of characters on a paper or similar surface are known, the common typewriter being a typical example. Such devices impress their characters by the striking of a printable-substance-containing ribbon or sheet, the impact of the strike causing impression of the selected character on a printable substrate. In both manual and automatic printing devices of this type, hereinafter called serial-printers, speed has become in the present state of the art, of prime importance. One of the major deterrents to increased speed of application of a series of characters has been, in all prior art devices, the inertia of the equipment associated with the type face that has to move in order to impress the selected character upon the paper or other substrate. Early serial-printing devices moved each individual character with an individual striking device in order to make an impression, and the considerable inertia of such individual striking means eventually became an intolerable limitation upon speed.

Single striking devices upon which are arranged all the desired characters are known. Such devices typically depend for selection of an individual character upon angular rotation, and thus reduce the striking distance to a small fraction of that required when each individual character has its own individual striking device. In such systems the aforesaid shorter striking distance together with the compactness resulting from use of a single striking device, results in a large reduction in striking time during application of a series of characters. In effect, such devices increase possible speed by substituting rotational inertia for translational inertia, and by reducing the distance through which the single striking means must be moved to perform a strike.

However, despite such refinements, inertia problems and consequently speed problems nevertheless exist in any system wherein the type-characters and their striking means or supports must move toward and strike the paper or other printing substrate. What is next needed for optimum speed serial-printing is a system wherein there is virtually no mass to overcome during the impressing step itself. This would necessitate elimination of nearly all the mass of the striking device, as well as in some way eliminating the inertia effect of the type-character itself.

It is accordingly a principle object of the present invention to provide a serial-printing device capable of extremely high speeds of serial impression of selected type-characters.

Another object of the invention is to provide such a serial-printing device wherein virtually all the mass of the striking device is eliminated and the inertia effect of the type-characters themselves is avoided.

Another object of the invention is to provide a simplified and more reliable serial-printing device.

Another object of the invention is to provide a serial-printing device capable of improved quietness and gentleness of operation as regards the impression striking of the type-characters and the paper or other writing substrate.

These and other objects and advantages of the inven-

tion will be more fully appreciated upon examination of the description of the invention contained hereinbelow, when taken with the accompanying figures, wherein like reference characters denote like parts in all views thereof, and wherein:

FIGURE 1 is a block diagram of a system of components adapted to form an image on a printable substrate by the principles of the present invention,

FIGURE 2 is a portion of a specific means for effectuating a printing operation in accordance with the system of FIGURE 1, and

FIGURE 3 is an end view of the apparatus of FIGURE 2 showing further details of the arrangement of the parts thereof.

Referring now to the figures, the invention contemplates utilizing a virtually inertialess column of air and a virtually inertialess local printing area of the substrate itself to effectuate striking and thereby to form the image of the type-character on the substrate. Specifically a substrate 10 is positioned by a frame of reference positioning means 11 which may be one or more rollers or other appropriate means for holding substrate 10 in a relatively oriented position in space. Substrate 10, it will be recognized, may be paper, fine cloth, printable plastic, or any other appropriate printable substrate. On one side 10a of substrate 10 is located type-positioning means indicated generally at 20 carrying a plurality of raised type-characters 30, and having a shaft 21. A portion of substrate 10 occupies a position 10c. The portion occupying that position changes as hereinafter described, but the position remains at 10c, defined as follows. The portion occupying position 10c defines the local printing location. On a first side 10a of substrate 10, facing position 10c, is one of the type-characters 30 on means 20, being designated 30a to indicate that any character 30 may occupy that position. When character 30a so faces position 10c, it is in the printing position, wherein the face of character 30a lies in a plane adjacent to the portion of substrate 10 then occupying position 10c and approximately parallel to the plane thereof at that position.

At a second side 10b of substrate 10, the second side being the opposite side of side 10a as is shown in FIGURE 3, is located fluid orifice means 40. In general fluid orifice means 40 points at the area of substrate 10 which at any given moment occupies the said local printing location 10c, that is to say, the fluid orifice means 40 points through substrate 10 and at the raised type-character 30a when it is in the printing position, already described. It will be recognized that the portion of substrate 10 shown in FIGURE 2 has been sectioned in the area immediately adjacent to the printing location so as to show the relationship of the opposed means 30a and 40. Normally, of course, the substrate 10 may extend appreciably toward the left in FIGURE 2, as for example where a strip is unrolled from the right and passed toward the left for strip printing. Where area printing (that is, a column of lines) is practiced instead of strip printing, the substrate 10 may also extend appreciably upward and downward from that portion shown in FIGURE 2.

The invention is not limited to a specific form of substrate 10 or a specific direction of movement of the substrate relative to the aforesaid printing location, and the entire substrate 10 need not be held in a planar position by positioning means 11 or any similar device. The only essential feature regarding substrate 10 is that the membrane thereof be held in such a way that when it passes between reference character 30a and fluid orifice means 40 (that is, at the printing location 10c) the substrate portion immediately thereat be properly spaced with regard to means 30a and 40, and be approximately

planar in that immediate local area and approximately parallel to the face of type-character 30a. Many alternative positioning means may be employed to achieve such a result, and means 11 is to be regarded as merely one example.

As is shown in FIGURE 3 an auxiliary substrate positioning frame 41 is associated with the orifice end of fluid orifice means 40, for the purpose of spacing substrate 10 slightly from the rim of orifice 42, primarily to standardize the striking as hereinafter described. Other means for preventing contact between the rim of orifice 42 and substrate 10 may be employed. Another reason for keeping apart the rim of orifice 42 and the portion of substrate 10 immediately adjacent thereto, is that located adjacent to the side 10a of substrate 10 is a ribbon 50 which may be thought of as a typewriter ribbon, or a portion of a ribbon deposit paper (so-called carbon paper), or any other appropriate image transfer layer which when struck has the property of transmitting the image of the striking surface to the portion of substrate 10 immediately therebehind. When a strip 50 is employed as is shown in the figures, the portions of positioning means 41 that contact substrate 10 will lie above and below strip 50 so that no image is inadvertently transferred onto substrate 10 by pressure of means 41. In turn, means 41, in keeping the rim of orifice 42 from contacting substrate 10 prevents inadvertent transfer of an image or smudge or the like to substrate 10 by pressure from the rim of orifice 42 on substrate 10. When area printing is practiced strip 50 will constitute a broad area carbon paper or the like as already mentioned, and means 41 may then be dispensed with entirely in favor of more generalized positioning means such as 11.

As is best shown in FIGURE 1, a selector 60 sets a control means 70 by signal 61. Selector 60 may be a keyboard or other coding means, local or distant. Signal 61 may be electrical, mechanical, or pneumatic. Control means 70 may for example constitute a plurality of relay contacts, one set for each character 30, so arranged that selector 60 closes one set corresponding to the character 30 coded thereby in a given selection operation. As will be hereinafter described, that one set of contacts is then capable of transmitting a signal originating in means 90.

Control means 70 directs impeller 80, which may be any suitable motive means, such as a motor, to turn if it has been theretofore idle, by means of signal 71. If impeller 80 is arranged so as to be continuously turning, then signal 71 is not employed. In either event, impeller 80 drives type-character positioner 20 by means of its shaft 21, indicated in signal fashion as the arrow from impeller 80 to positioner 20. Positioner 20 carries characters 30 successively into position 30a, as is indicated schematically by signal 23. When positioner 20 is a wheel as is illustrated in the figures, position sensing means 90 will sense via signal 22 which one of characters 30 is in the position of 30a at each instant, and report that fact via signal 91 to control means 70. Position sensing means 90 may be, for example, a series of contacts circumferentially arranged to rotate with means 20 against a fixed contact representing position 30a. Each contact would correspond to the angular position of one character 30, and the moving contact touching the fixed contact at a given instant would send a signal via 91 relating the fact of that position of that contact and character 30. Other position sensing means 90 are of course possible.

When a contact in means 90 corresponding to the same character as was coded into control means 70 is energized, that signal 91 will pass through a closed set of contacts in means 70. All other signals will meet open relay contacts therein. The aforesaid signal 91 will thus pass through control means 70 as signal 72, and will energize fluid pulsing means 100, which may be a valvable source of pressurized fluid. In that case, signal 72 may, for example, momentarily valve fluid which emerges as a

pulse indicated at 40, that is, as a pulse fed into fluid orifice means 40, shown as an arrow 40 in FIGURE 1. The pulse of fluid in means 40 causes substrate 10 at position 10c to strike type-character 30a, as shown in signal form in FIGURE 1 by signal 15. Since the same type-character 30 as was specified at selector 60 to start the sequence of events must be at position 30a (otherwise signal 91 would meet open relay contacts in means 70), the proper character is printed on substrate 10.

Variations on this arrangement are of course possible. In many valuable variations the arrival of the proper character 30 at position 30a will cause the fluid pulse to be emitted from means 100, just as already described. It is also of course possible to use other forms of positioner 20, for example stepping motors or other arrangements. Where position sensing means 90 constitutes means that emits a fluid pulse upon attainment of the proper character 30 at position 30a, that pulse can be used directly instead of the pulse of means 100. These and other variations will be apparent now that the principle has been pointed out.

As is best shown in FIGURE 3, the aforesaid fluid pulse is emitted from orifice 42 directly toward the adjacent portion 10c of side 10b of substrate 10. The immediately local portion of substrate 10 subjected to this pulse is driven toward the right-hand side in FIGURE 3, so that the opposite side of that portion, that is to say the portion 10c of side 10a immediately adjacent character 30a, is driven into impact contact with character 30a, with ribbon 50 therebetween. Since ribbon 50 is adapted to transfer an image forming substance to side 10a of substrate 10 under the influence of impact, the impression of character 30a is transferred thereby to side 10a of substrate 10.

When another command is issued by selector 60 either by pushing a key on a keyboard when such is employed, or by other coding means, the sequence already related is repeated. That is, impeller 80 either starts or continues to move the characters 30 into and out of position 30a, the printing position. As soon as the proper character 30 is in the position shown for character 30a, position sensing means 90 causes another fluid pulse to be sent via fluid orifice means 40 to strike the image of this latter character onto side 10a of substrate 10, by the same process already described for the first character. It will be usual practice of course to move substrate 10 in some direction in order that the sequence of printed characters do not superimpose, but rather follow some predetermined spatial sequence. Clearly when a strip printing is performed it will be usual to move substrate 10 toward the left in FIGURE 2, but other movements are of course possible and may be used where appropriate. The means for moving substrate 10 form no part of the present invention but for example roller 11 may perform such task.

The example impeller 80 described has been in continuous motion, or in continuous motion after start-up by selector 60. In either event the striking of character 30a occurs on the fly. It is also possible of course, and when variations of means 20 are employed it can easily be carried out, to directly select a position to be attained by a standing means 20. The only difference between this mode and that just described, is the existence of signal 71. In the flying strike mode, impeller 80 needs no signal 71. In the dwelling strike mode, the signal 71 starts and stops means 20. Thus in the dwelling strike mode, signal 71 starts impeller 80 when selector 60 is worked, and position sensing means 90 sends a signal 91 to control means 70 when the proper character 30 reaches 30a that causes a fluid pulse from means 100 as aforesaid, but that also terminates signal 71, that is, that stops means 20 at the proper character 30. Striking is thus done while character 30 is dwelling.

One significant advantage of using a pulse of fluid to impact substrate 10 into type-character 30a as is shown in FIGURE 3, is that an extremely quiet and gentle opera-

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tion is thereby effected. The quietness results of course from the lack of moving mechanical parts or the lack of impact between hard parts. In other words the fluid impacting upon substrate 10a produces virtually no sound, while the impact of substrate 10 upon type-character 30a with ribbon 50 interposed therebetween produces very little sound because of the relatively soft nature of substrate 10 and ribbon 50. The gentleness of impact also results from the absence of hard parts directly contacting substrate 10, so that less etching or embossment of substrate 10 occurs, and consequently a more uniform typed appearance and less likelihood of tearing of substrate 10 results.

Now that the invention has been described, it will be appreciated that a relatively inertialess column of gaseous fluid, such as air, is employed as the striking means, and that therefore the prior art limitation upon speed due to the inertia of the type-character and its supporting means is eliminated. The operation in addition to being relatively inertialess as already described, with the attendant advantages, is also extremely quiet and extremely unlikely to cause embossment or tearing of substrate 10.

Although the invention has been described with reference to a specific arrangement for effecting its principles, other arrangements may be substituted without departing from those principles. The specific means shown are illustrative, not limiting.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A printing device useful for forming an image on a printable substrate comprising means provided with an image-forming character thereon, means for positioning said substrate closely adjacent but spaced from said image-forming character, said substrate being positioned substantially parallel to and substantially planar with respect to said image-forming character, means having an orifice at one end for directing an impulse of fluid toward the side of said substrate opposite from said image-forming character effective to impact the other side of said substrate against said image-forming character to form said image on said substrate and spacing means fixed to said fluid impulse directing means in close adjacency to the end having the orifice to maintain the substrate out of contact

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with said end of said fluid impulse directing means at all times during and between pulses.

2. A printing device useful for forming an image on a printable substrate comprising means provided with an image-forming character thereon, means for positioning said substrate and image-transfer material closely adjacent but spaced from said image-forming character, said image-transfer material being positioned intermediate said substrate and said image-forming character, said substrate and said image-transfer material being positioned substantially parallel to and substantially planar with respect to said image-forming character, means having an orifice at one end for directing an impulse of fluid toward the side of said substrate opposite from said image-transfer material and said image-forming character effective to bring said substrate into direct contact with said image-transfer material and to impact said image-transfer material against said image-forming character to form an image on said substrate and spacing means fixed to said fluid impulse directing means in close adjacency to the end having the orifice to maintain the substrate out of contact with said end of said fluid impulse directing means at all times during and between impulses.

3. A printing device in accordance with claim 2 wherein said spacing means is positioned and adapted such that upon contact with said substrate contact therewith is made above and below relative to said image-transfer material.

References Cited by the Examiner

UNITED STATES PATENTS

1,855,525	4/1932	MacArthur	101-407
2,405,714	8/1946	Ryan	101-4 X
2,467,034	4/1949	Hutt	101-4 X
2,737,882	3/1956	Early et al.	101-3
2,762,297	9/1956	Baer	101-111 X
2,844,094	7/1958	Lang	101-93
2,869,454	1/1959	Gruver	101-134.5
3,015,263	1/1962	Lounsberry et al.	101-19
3,122,039	2/1964	Sowers et al.	101-3 X
3,149,562	9/1964	Wilkins et al.	101-93
3,159,099	12/1964	Wadey	101-1

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