

[54] **PRINTING HAMMER ARRANGEMENT**

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[58] Field of Search 101/93 C, 426; 197/1; 346/74 MP

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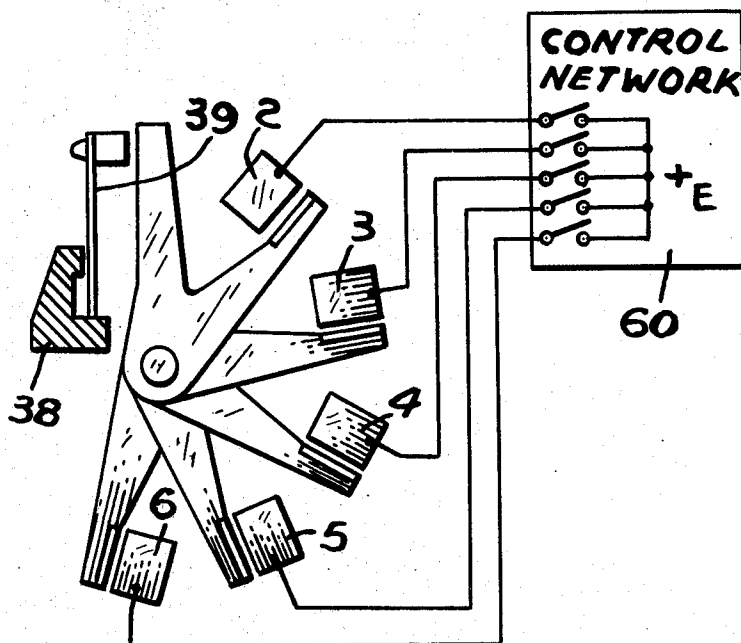
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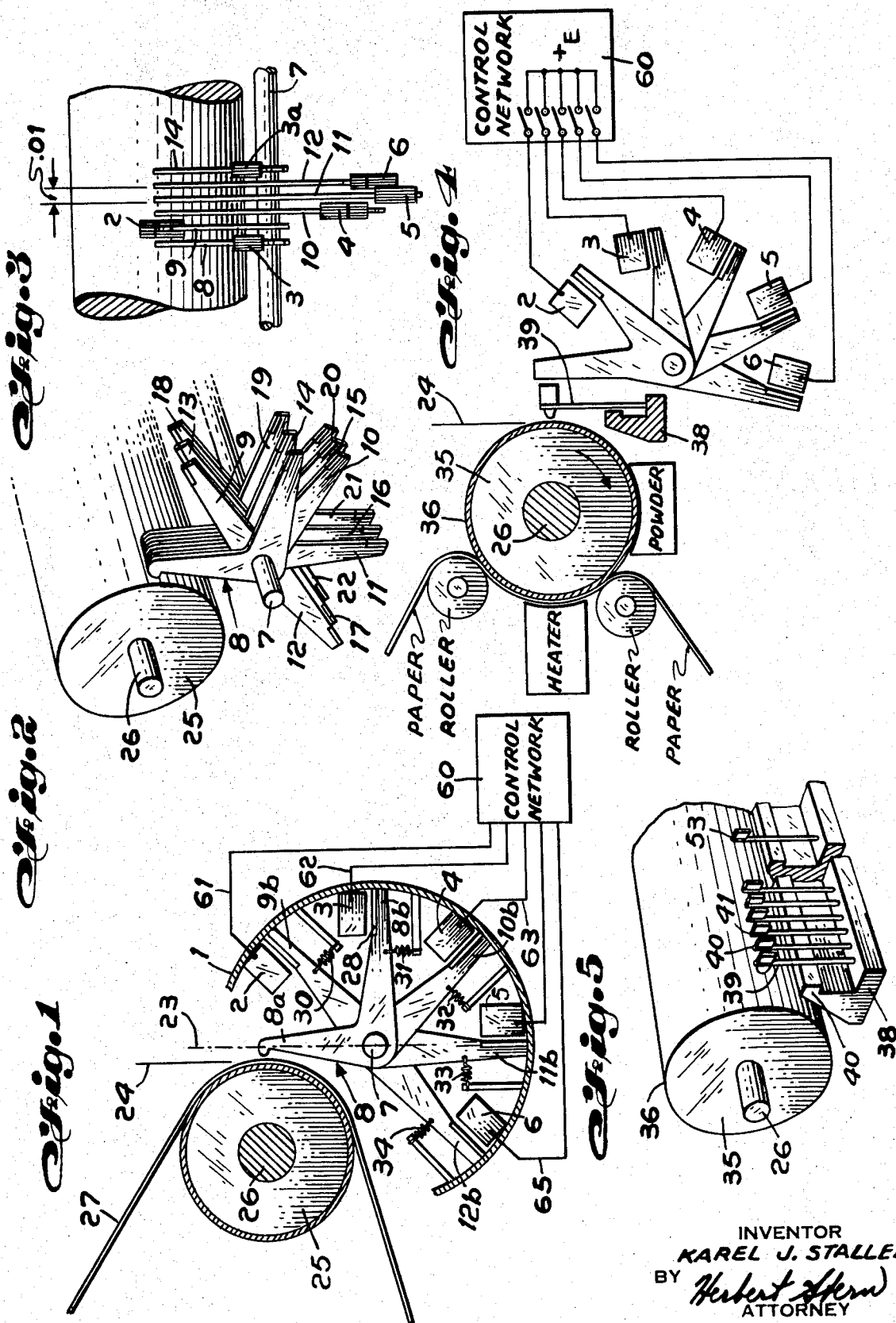
[57] **ABSTRACT**

An arrangement for printing hammers wherein a plurality of pivotably mounted hammers are provided, the hammers being divided into a plurality of sets, each hammer of a set having first and second legs which are angularly displaced from one another by a fixed amount, this fixed amount being different for each set. The first leg of each hammer is positioned adjacent a recording device and the second leg of each hammer is positioned adjacent a selectively actuatable electromagnet. The actuation of an electromagnet causes the movement of the associated hammer thereby causing the recording of information. In one embodiment the recording device includes a platen, paper and an inked ribbon provided adjacent the first legs of the hammers, the first legs striking the ribbon thereby imprinting a mark on the paper.

In another embodiment the recording device includes a magnetizable drum and the first leg of each hammer is aligned with a magnetic actuator, the movement of the first leg causing movement of the magnetic actuator, thereby providing a magnetic mark on the magnetizable drum.

7 Claims, 5 Drawing Figures





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PRINTING HAMMER ARRANGEMENT

BACKGROUND OF THE INVENTION

This invention relates to a printing hammer arrangement, and more particularly to such an arrangement for use with hammers which mark a point, a number of point marks forming a character.

Printing hammer arrangements known in the prior art are usually actuated by pneumatic or magnetic means. A deficiency in the prior art is that the driven legs of the hammers have been placed as closely together as the legs of the hammers containing the mark which is to be imprinted. Since it is necessary for visual acceptability that the marks be placed closely together, especially if the hammers make point marks approximately 0.01 inches apart, a number of these point marks forming a desired character, the spacing between the driven legs has also been extremely small. This spacing causes great difficulty, if not impossibility, in locating the driving mechanism, be it pneumatic means or magnetic means, especially since, where magnetic means are utilized as actuators, extreme care and expense has to be taken to properly space the magnets near their associated legs, since selective actuation of a particular magnet may not be allowed to have any effect on any nearby hammer other than the one with which the actuator is associated.

SUMMARY OF THE INVENTION

Therefore, the main object of this invention is to provide a printing hammer arrangement wherein sufficient space is provided between the actuated portions of the hammers to facilitate the placement of actuators.

According to the present invention, there is provided printing apparatus comprising a printing plane, a multiplicity of pivotably mounted hammers positioned to strike said printing plane, said multiplicity of hammers divided into a plurality of sets of movable hammers, each hammer of a set having first and second legs which are angularly displaced from one another by a predetermined amount, said predetermined amount being different for each set, the first leg of each hammer of each set being located in a plane adjacent said printing plane, and means positioned adjacent the second leg of each of said hammers causing the first leg thereof to impinge upon said printing plane.

A feature of the present invention is to provide a printing apparatus having a plurality of sets of hammers wherein each hammer of a set is separated from other hammers of the same set by at least one hammer of another set.

Further objects and features of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially sectioned plan view of an arrangement according to the invention;

FIG. 2 is a partial perspective view of the arrangement shown in FIG. 1;

FIG. 3 is an end view of the hammer arrangement illustrated in FIG. 1 illustrating the spatial relationship between actuating means;

FIG. 4 is a partially sectioned plan view of another arrangement according to the invention; and

FIG. 5 is a partial perspective view illustrating the magnetic actuating means shown in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2 which show a partially sectioned plan view and a partial perspective view of the instant invention there is shown a non-magnetic frame 1 having mounted thereon electromagnetics 2 through 6. Mounted on an axle or pivot 7 are hammers 8 through 22, each hammer having two legs, 8a-22a respectively, and 8b-22b respectively. The hammers 8 through 22 are broken into sets, hammers 8, 14, and 19 comprising one set, hammers 9, 13, and 18 comprising a second set, hammers 10, 15, and 20 comprising a third set, hammers 11, 16, and 21 comprising a fourth set and hammers 12, 17, and 22 comprising a fifth set. By referring to FIG. 2 it can be seen that the first and second, or a and b legs respectively of each set form the same predetermined angle, this angle being different for each set. The first or a legs of all hammers of all sets are disposed in plane 23 which is located adjacent printing plane 24, and a rotating platen 25, mounted on an axle 26, is also disposed adjacent printing plane 24. A sheet 27, for example paper on which matter is to be printed, is disposed in the printing plane 24 and an inked sheet or ribbon, not shown, will also be disposed in said plane 24 between the hammers and paper 27.

The hammers 8-22 may be constructed of magnetic or non-magnetic material. If, however, they are primarily constructed of non-magnetic material, at least part of the hammers must be formed as magnetic armatures so that the hammers will be attracted to their associated electromagnets. Further, each leg 8a-22a of hammers 8-22 is formed with a head, 8c through 22c, which is brought to a point so as to enable the impressing of point marks on paper 27.

The operation of the device of FIGS. 1 and 2 will now be described. Signals from a source of control signals 60, of a kind well known in the art, are transmitted on cables 61 through 65 to their respective electromagnets 2 through 6; for example, to electromagnet 3. Actuation of electromagnet 3 will draw leg 8b of hammer 8 which may be as shown at 28, in a direction shown by arrow 29. This in turn will drive leg 8a of hammer 8 toward printing plane 24 where it will make a mark, for example, a point mark, on paper 27. The signal which actuates electromagnet 3 is a brief pulse and cessation of the pulse restores magnet 3 to its original unmagnetized condition, thereby releasing hammer 8 and allowing it to return to its original position. To aid in returning the hammers to their original position, springs 30 through 44 are provided, springs 30-34 being shown, each spring coupled between one hammer and frame 1.

Referring now to FIG. 3, there is illustrated an end view of the arrangement illustrated in FIG. 1, which more clearly discloses the advantage of "staggering" the hammers so as to provide additional space for placement of the electromagnets. The embodiment illustrated utilizes five sets of hammers, each set containing three hammers, for a total of 15 hammers disposed longitudinally along platen 25. Since for most application, the points, comprising a character 0.08 inches square, are approximately 0.01 inches apart, so as to provide a visually satisfactory appearance, it is clear

that in a hammer arrangement constructed in accordance with the prior art the activating electromagnets would also have to be placed approximately 0.01 inches apart. In the instant invention, however, hammers 8 and 14 are part of one set, and these hammers are located five times 0.01 inches apart or 0.05 inches apart. It is thus seen that electromagnets 3 and 3a have five times as much placement space as they would have if hammers 8 and 14 were adjacent one another. Hammers 9, 10, 11, and 12, which are all parts of different sets of hammers are interleaved between the two hammers of the same set, hammers 8 and 14 in the illustrated case. Further, it will now be clear that additional space for the magnets may be provided by providing additional sets of hammers, these sets of hammers also forming a predetermined angle between their first and second legs, the angle formed by the legs of each set being different than the angle formed by the first and second legs of the hammers of any other set.

Referring now to FIG. 4, there is shown another arrangement according to the instant invention which is provided for use with a recording means having a magnetizable surface, for example a magnetized drum or magnetic tape. In the embodiment illustrated in FIG. 4, a drum 35 having a magnetizable surface 36 is disposed in the printing plane 24.

This embodiment may be utilized with a recording medium, for example paper, magnetically attracted powder and fixing means, for example a heater, all of which are well-known in the art and are therefor not further described. The arrangement of the hammers, electromagnetics, springs, etc., are as shown in FIG. 1, excepting that the hammers are now flat rather than pointed, and therefore will not be described with regard to FIG. 4. An elongated magnet 38 is disposed along the length of the magnetizable surface 36, a predetermined distance separating the surface 36 and magnet 38, and has extending therefrom a plurality of magnetic rods 39 through 53, one associated with each of the first legs 8a through 22a. Each magnetic rod 39-53 is formed with a head 39a through 53a which is brought to a point for forming a magnetized point on magnetizable surface 36. As each electromagnet is selectively actuated by control network 60 as discussed above with regard to FIG. 1, its corresponding hammer is moved in such a manner that the first leg of the moved hammer strikes one of the flexible magnetic rods 39 through 53, moving the head of the magnetic rod very close to a point on the magnetizable surface 36, but not requiring the striking of the surface 36 by the head of the rod, since the magnetic intensity of the operative rod head is sufficient to magnetize a point on the surface without actual contact, thereby providing a magnetized mark or point on the surface. It will be noted that in providing the magnetized point on surface 36 a flux path exists between elongated magnet 38 and surface 36.

The hammers shown in FIG. 4 are returned to their original position after actuation of their corresponding magnets by springs as illustrated in FIG. 1. The flexible magnetic rods, 39-53, after magnetizing a point on surface 36, are returned to their original position by the flexing action of the rods themselves. In addition, elongated magnet 38 is formed in an L-shape, leg 40 of the L extending along the longitudinal axis of the rods 39

through 53. This extension of leg 40 along the axis of rods 39 through 53 aids in effecting the return of the rods to their original position, after being struck by a hammer.

While I have described above the principle of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in objects thereof and in the accompanying claims.

I claim:

1. Printing apparatus comprising:

a printing plane;

a multiplicity of pivotably mounted hammers positioned to strike said printing plane,

said multiplicity of hammers divided into a plurality of sets of movable hammers, each hammer of a set having first and second legs which are angularly displaced one from another by a predetermined amount, said predetermined amount being different for each set, the first leg of each hammer of each set being located in a plane adjacent said printing plane;

means positioned adjacent the second leg of each of said hammers for causing the first leg thereof to impinge upon said printing plane;

recording means having a magnetizable surface disposed in said printing plane; and

a plurality of magnetic activating means, one associated with each hammer, located between said magnetizable surface and said hammers, the movement of a hammer moving the associated activating means to provide a magnetized point on said surface,

said plurality of activating means comprising:

an elongated magnet extending the length of said magnetizable surface; and

a plurality of magnetic rods disposed along the length of said elongated magnet, each of said rods connected at one end to said elongated magnet, the other end of each of said rods located between its associated hammer and said magnetizable surface so that said other end of each of said rods moves towards said surface in response to the movement of its associated hammer.

2. Printing apparatus, according to claim 1, wherein said means positioned adjacent each second leg comprises a plurality of electromagnets.

3. Printing apparatus, according to claim 1, wherein each of said rods is flexible, returning to its original position after it has been moved by said hammer.

4. Printing apparatus, according to claim 1, wherein said elongated magnet is L-shaped, one leg of the L extending along the longitudinal axis of each of said rods, thereby effecting the return of the rod to its original position.

5. Printing apparatus, according to claim 1, wherein each hammer of a set is separated from other hammers of the same set by at least one hammer of a different set.

6. Printing apparatus, according to claim 1, further comprising:

a fixed frame to which said multiplicity of hammers are mounted and to which said means positioned adjacent each second leg are mounted; and

return means coupled between said frame and each hammer for returning each hammer to its original position after it has been moved by said means positioned adjacent each second leg.

7. Printing apparatus, according to claim 6, wherein said return means comprises a plurality of springs, each spring coupled between said frame and one hammer.

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