United States Patent

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[54] **HIGH SPEED PRINT HAMMER CONSTRUCTION**
3 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **101/93**
[51] **Int. Cl.** **B41j 9/28**
[50] **Field of Search** ..... 101/93 (RC); 197/14, 17

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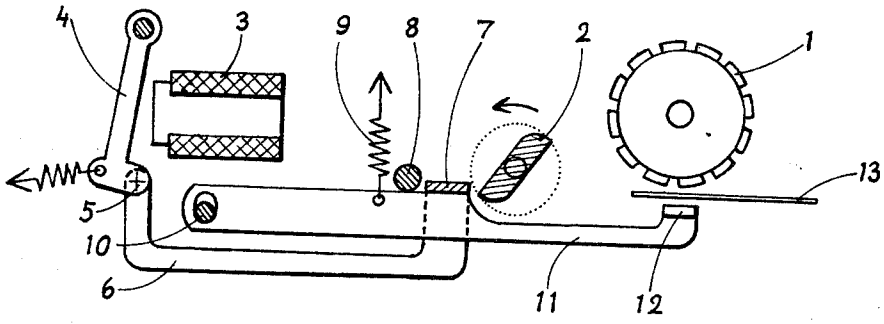
ABSTRACT: The present invention relates to an apparatus for numerically printing the results of computers, or measuring instruments with digital electrical output.



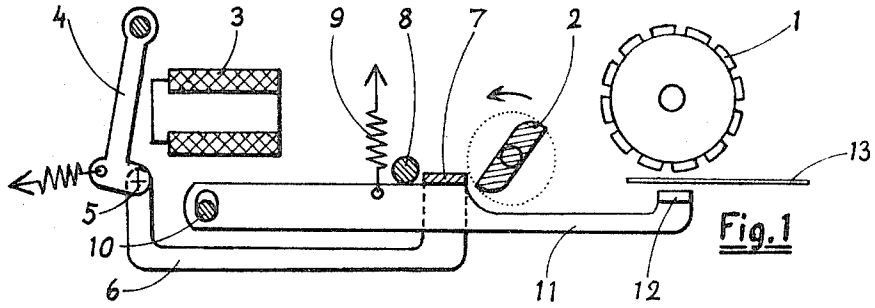


Fig.1

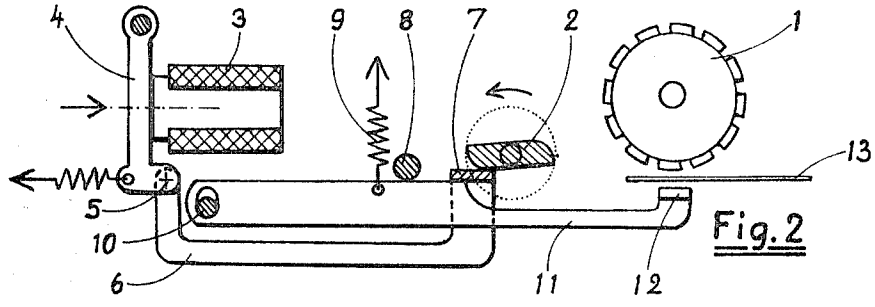


Fig.2

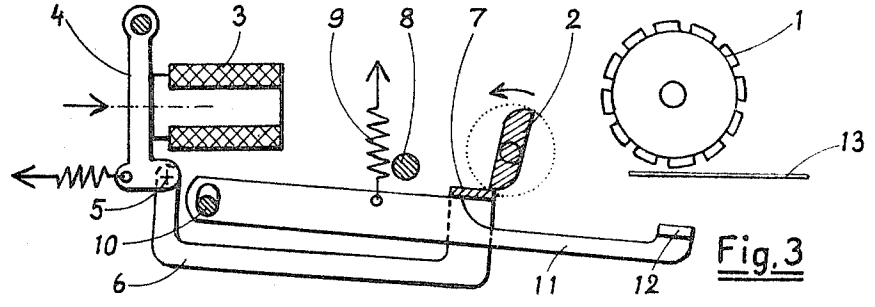


Fig.3

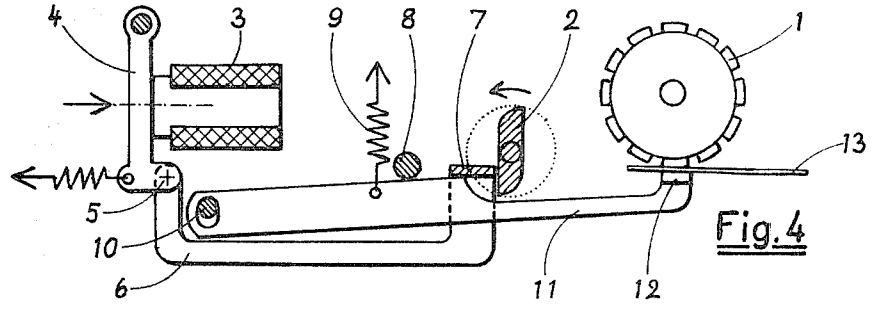


Fig.4

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HIGH SPEED PRINT HAMMER CONSTRUCTION

SUMMARY OF THE INVENTION

Basically, the apparatus operates on the known and commonly used principle of "printing on the fly." This means, a print wheel having printing characters on its circumference 15 rotating continuously. By assembling several print wheels of this kind on a common shaft, an entire line can be printed simultaneously. A print hammer assigned to each print wheel strikes the paper against the wheel at the instant the desired character on the rotating print wheel is opposite the hammer face.

It is a principal object of the present invention to provide a new and improved method and arrangement for powering and synchronizing the movement of the print hammers.

Heretofore, one commonly used method was to drive the print hammer against the paper directly by means of the power of an electromagnet, or solenoid. A disadvantage of this method is the relatively large size of electromagnet, or solenoid required to provide sufficient striking power for the print hammer.

Another disadvantage is the relatively high electrical energy required to operate the electromagnet for this purpose. Yet another disadvantage is that the mechanical force supplied by the electromagnet varies with the supply voltage as well as with the temperature of the coil. Variation of this force in turn results in varying speed of the hammer motion, which shows up as a misalignment of the print.

It is an object of this invention to provide a new and improved method and arrangement to drive the print hammer by mechanical energy stored in a spring.

Another object of the invention is to provide a new and improved method and arrangement to store the mechanical energy in said spring, and to release it at a certain instant for driving the print hammer by means of a cam rotating synchronously with the print wheel.

Another object of the invention is to provide a new and improved method and arrangement to mechanically connect said cam to the print hammer with its energy storing spring by means of a coupling link which is operated by an electromagnet. The insertion of this coupling link between the cam and the print hammer allows the hammer to be operated selectively controlled by the electromagnet, only when the desired character is in the position to be printed.

Another object of the invention is to provide a new and improved method and arrangement for aiding the electromagnet in operating the coupling link by mechanical force supplied by the cam. For this purpose, the cam is arranged to slide on the contact section of the coupling link in the same basic direction, in which the electromagnet moves the coupling link. In this way, the frictional force resulting from the cam sliding on the contact secton aids the electromagnet in moving the coupling link toward its fully engaged position. Moreover, the same frictional force retains the coupling link in this position as long as the cam is sliding on the contact section of the coupling link, even after the electromagnet has been disengaged. In this way, a greater tolerance is permissible for the operating time of the electromagnet.

Yet another object of the invention is to provide a new and improved method and arrangement for driving the hammer head by means of inertial force at the instant of striking the paper farther towards the print wheel than in its normal position.

Another object of the invention is to provide a new improved form of the cam employed in the printing mechanism. The two edges of a thin, flat camshaft serve as a cam each, while the camshaft rotates around a centerline halfway between the two edges. In this form, the camshaft is the easiest to be manufactured.

For describing the invention, reference may be had to the accompanying FIGS. which are schematic illustrations of an embodiment of the invention, showing the hammer mechanism in different phases of operation.

In these drawings, 1 is a print wheel having printing characters on its circumference, which are inked by conventional means not shown.

12 is a printing hammer disposed to strike the paper 13 against one of the printing characters of the print wheel 1, which phase of operation is shown in FIG. 4.

The printing hammer 12 is fixed on the free end of the hammer lever 11. The other end of the hammer lever is hinged to a fixed pin 10 providing lost motion.

The spring 9 attached to the hammer level 11 pulls the printing hammer 12 towards the print wheel 1 as far as the stop pin 8 allows, leaving sufficient space between the printing hammer and the print wheel for passing the paper 13.

Of the coupling link 6, one end is hinged at point 5 to the armature 4 of electromagnet 3. The other end is bent into the plane of hammer lever 11, as shown hatched in a cross section, and designated contact section 7. This contact section is adapted to slide along the hammer lever 11 as the coupling link 6 is moved by the armature of the electromagnet.

The cam 2 rotating in synchronism with the print wheel 1 covers the operating range shown in the FIGS. as a dotted circle. Consequently, with the armature 4 of the electromagnet released, as shown in FIG. 1, the contact section 7 is in the position in which it cannot be contacted and moved by the cam 2. Otherwise, with the armature pulled toward the electromagnet and thus the contact section being in the opposite position, as shown in FIG. 2 thru FIG. 4, the cam contacts and moves the contact section in the course of its revolution.

As the contact section 7 is moved by the cam 2, hammer lever 11 is moved in conformity.

FIG. 1 shows the mechanism in the nonprint position, characterized by the magnet 3 not being operated. The armature 4 is released and thus keeps the contact section 7 of the coupling link 6 out of the operating range of the cam 2. In this placement, the hammer lever 11 cannot be operated by the cam 2.

FIGS. 2 thru 4 show three different consecutive phases of preparing the printing as well as the final phase of printing itself. In these cases the electromagnet 3 is operated, and thus the armature 4 is attracted, which in turn has the coupling link 6 with its contact section 7 pushed into the operating range of the cam 2.

In the phase shown in FIG. 2, the rotating cam 2 is just beginning to push down the hammer lever 11 thru the contact section 7 of the coupling link.

In the following phase shown in FIG. 3, the rotating cam has pushed down the hammer lever 11 thru the contact section 7 of the coupling link almost to the lowest position, by this loading the spring 9.

In the following phase shown in FIG. 4, the rotating cam has just left the contact section 7 of the coupling link. By this, the thrust applied thru the contact section to the hammer lever 11 has been suddenly released, and consequently the hammer lever has been pulled up by means of the loaded spring 9.

In the course of this latter motion, the hammer head 12 at the free end of the hammer lever 11 has attained a high speed. Due to inertia, it continues flying towards the print wheel 1, even after the hammer lever has reached the stop pin 8. From then on, the stop pin serves as the fulcrum for the hammer lever while the lost motion at the fixed pin 10 is taken up. This part of the motion ends with the actual printing. The hammer head comes to a stop striking the paper against the print wheel, by this consuming the inertial energy of the hammer head.

After that, the spring 9 pulls the hammer lever back to the position of FIG. 2, or to the normal position of FIG. 1 respectively, if at this time the electromagnet has already released its armature.

I claim:

1. In a digital printing apparatus having a continuously rotating print wheel, a printing hammer arrangement having a hammer lever with a printing hammer on its free end, said printing hammer disposed adjacent to said print wheel, the

other end of said hammer lever hinged to a fixed pin by lost motion means, a spring attached to said hammer lever for pulling said printing hammer towards said print wheel, a fixed stop pin disposed adjacent to said hammer lever between said printing hammer and the point of attachment of said spring in a position to keep said printing hammer separated from said print wheel against the pull of said spring; a coupling link operatively connected by a hinge with the movable armature of an electromagnet, said coupling link having a contact section, said contact section adapted to slide along on said hammer lever between said printing hammer and said stop pin; a cam rotating in synchronism with said print wheel, said cam being adapted to strike said contact section when said contact section is moved to the print position by the actuation of said armature of said electromagnet, thereby moving said hammer lever in such a way that said printing hammer withdraws from said print wheel and said spring becomes loaded, said cam being also adapted to release said contact section at that phase of its revolution at which it has caused said printing hammer withdraw the farthest from said print wheel, thereby freeing said hammer lever to be pulled by said

loaded spring; whereby said printing hammer at the free end of said hammer lever is moved and accelerated toward said print wheel, said stop pin serving as fulcrum for said hammer lever in the last phase of this motion, and by taking up said lost motion at said hinged end of said hammer lever, propelling said printing hammer at the free end of said hammer lever by means of inertia further toward said print wheel than in the normal position.

2. A printing hammer arrangement according to claim 1, wherein the direction of rotation of said cam is such, that said cam while striking said contact section of said coupling link, moves in the same direction in which said coupling link is moved by said armature due to operation of said electromagnet.

3. A printing hammer arrangement according to claim 1, wherein said cam, serving a plurality of said printing hammer arrangements, is formed as one edge of a thin, flat camshaft, said camshaft having two of said edges arranged symmetrically to both sides of the rotating axis of said camshaft.