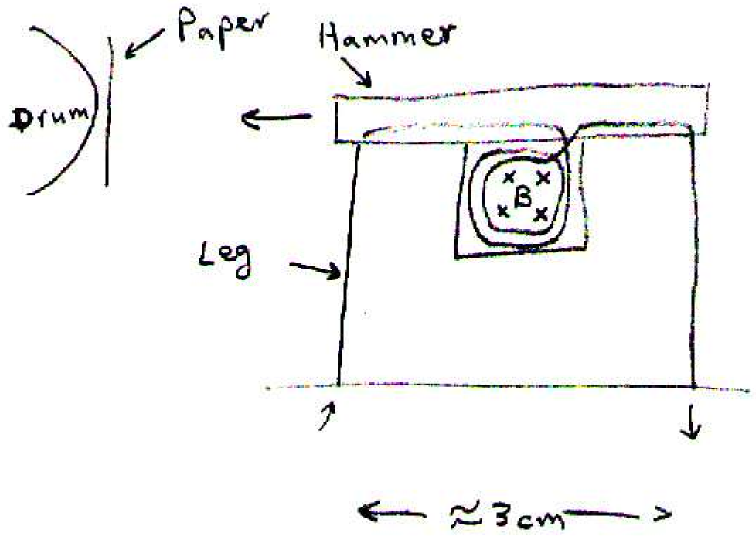
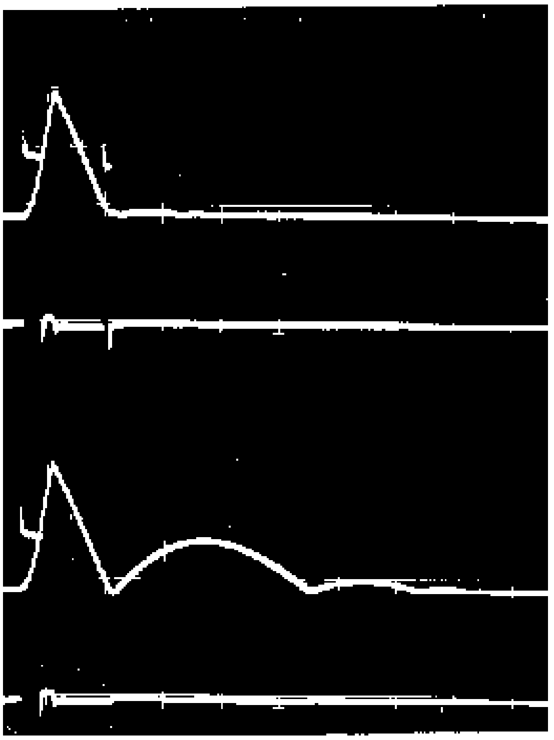
The Data Products Line Printer. 1964

A horizontal hammer is projected to the left and collides with paper ink, tape and drum, the rotating drum having a row of etched As, below them a row of Bs, and so on. The timing of the hammer is made to coincide with the time that letter is opposite the hammer. There is a row of 120 As, 120 Bs, and so on.

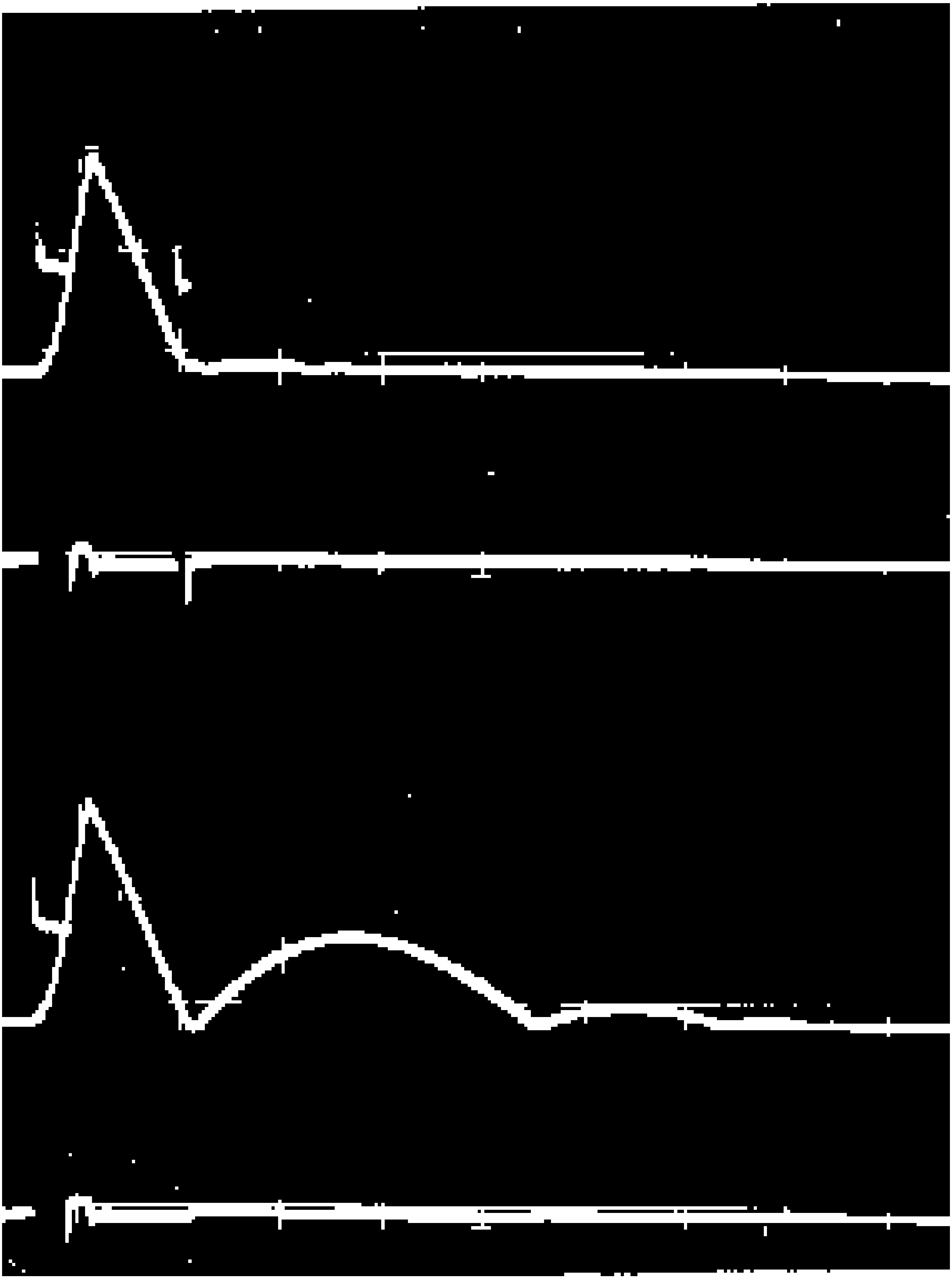
The source of energy is as follows. A “flag” attached to the hammer has a coil of wire within it in the presence of a permanent magnetic field. A pulse of electricity is delivered via the legs, two conducting bars which hold the hammer in position.



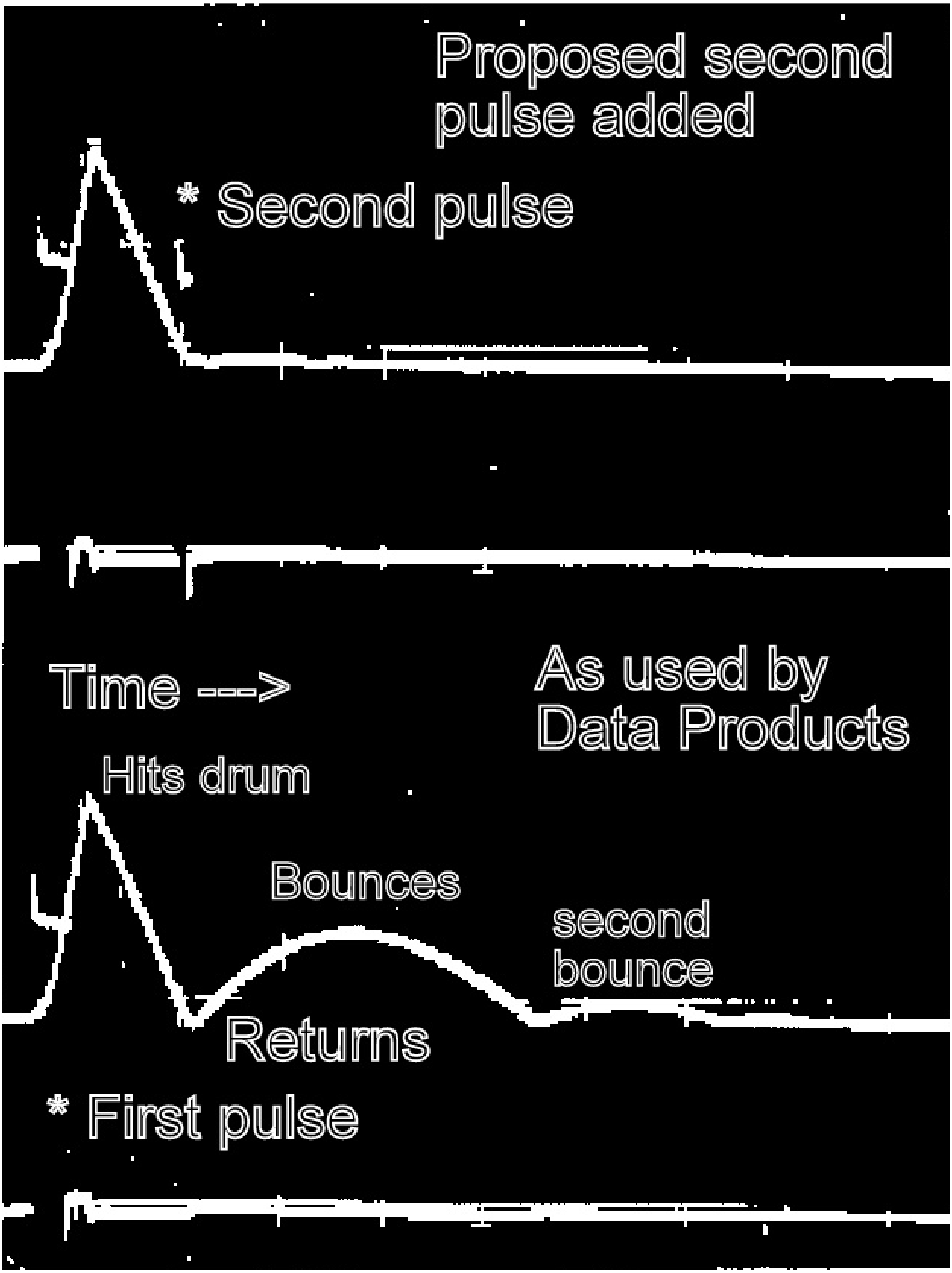


On the right is plotted distance towards the left, shown vertically, and time, shown horizontally. Data Products used the single electric pulse with the result shown in the bottom half of the oscilloscope picture. The hammer took 10msec to travel to the drum and back, but then took 25 more msec to recover, bouncing off the back stop twice. However, a second, narrow pulse causes the whole exercise to fall from 25msec to 10msec, as shown in the top traces. Admittedly paper feed to the next line, after a line was printed, took about another 20msec, so the improvement was not by a factor 25/10, or 2½, but still a big improvement, about 45/35 or 29%. Also, the back stop will last longer because it is not pounded.

Unfortunately the one or two pulses overlap on the other oscilloscope trace.

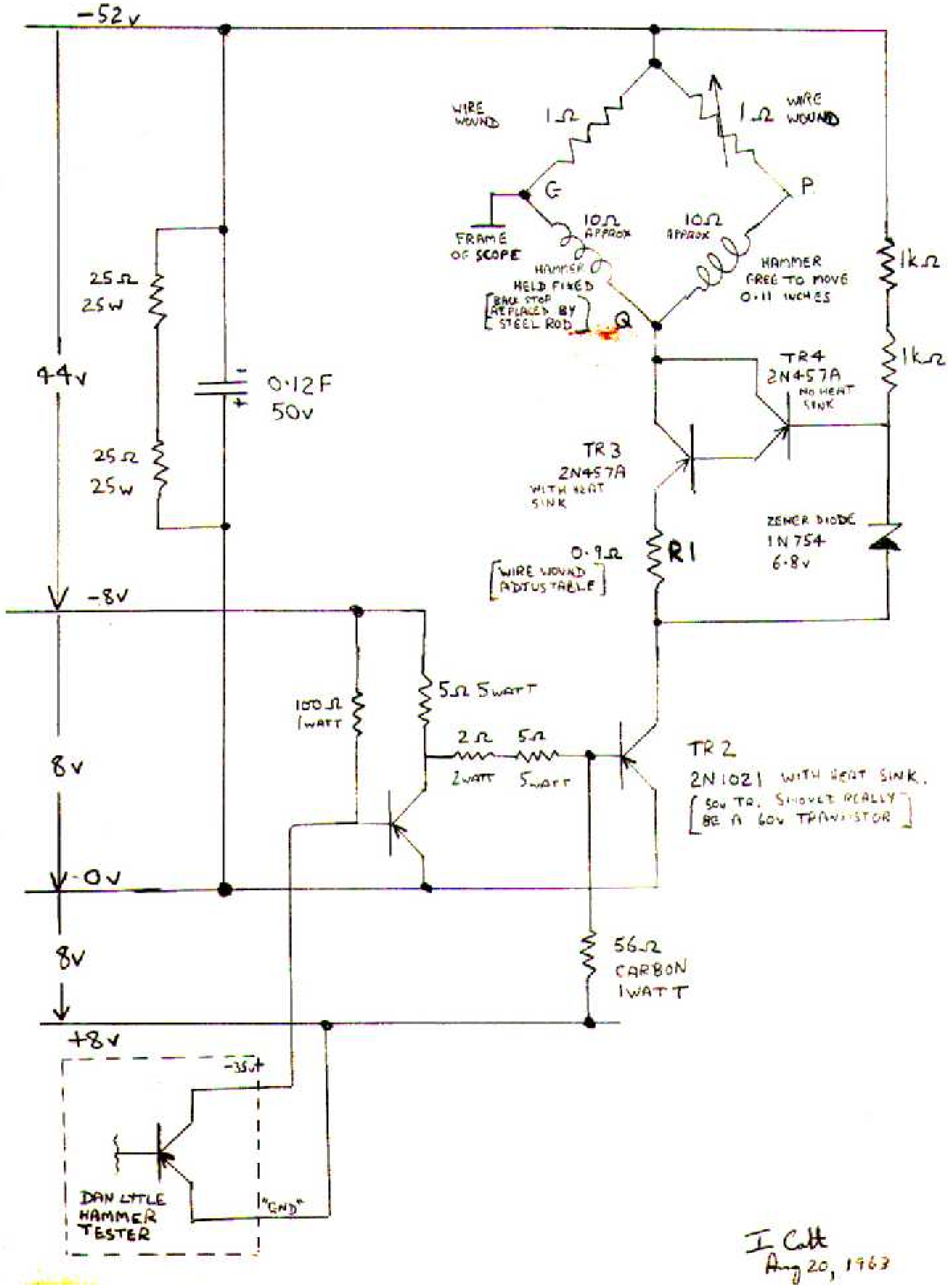


Note that the first pulse causes an acceleration, so the movement is acceleration, creating a curve. After the pulse it becomes a straight line for constant velocity. The return is a straight line, indicating (slower) constant velocity.



Proposed second pulse added
* Second pulse
Time --->
As used by Data Products
Hits drum
Bounces
second bounce
Returns
* First pulse

CIRCUIT USED TO GET DISPLACEMENT – TIME CURVE FOR A LINE PRINTER HAMMER.

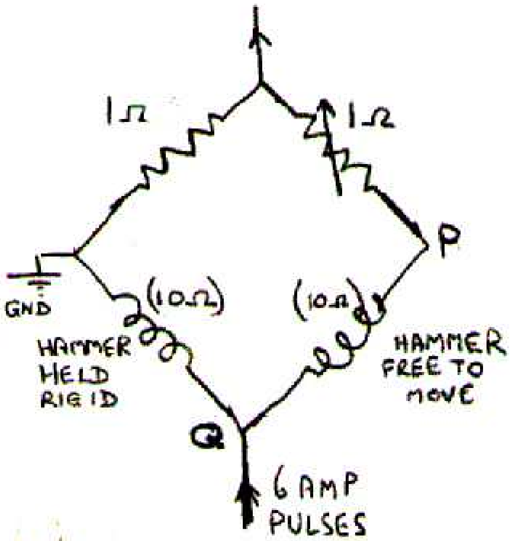


I. Catt
Aug 20, 1963

August 20, 1963

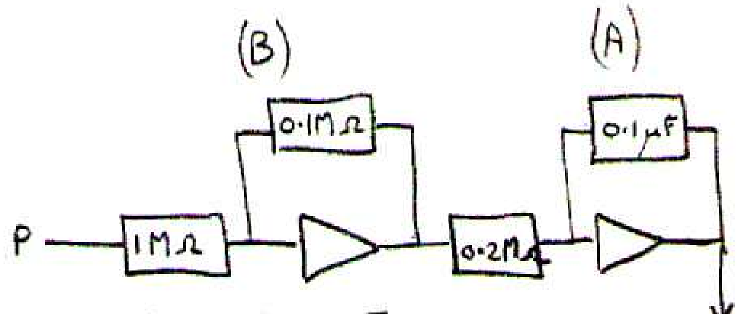
April 20, 1963
I Catt.

DISPLACEMENT - TIME GRAPH FOR A LINE PRINTER HAMMER WHEN DOUBLE - PULSED.



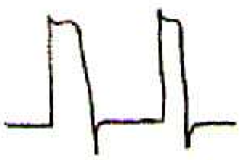
535
OR 551 TEKTRONIX SCOPE USED
FRAME FLOATING.

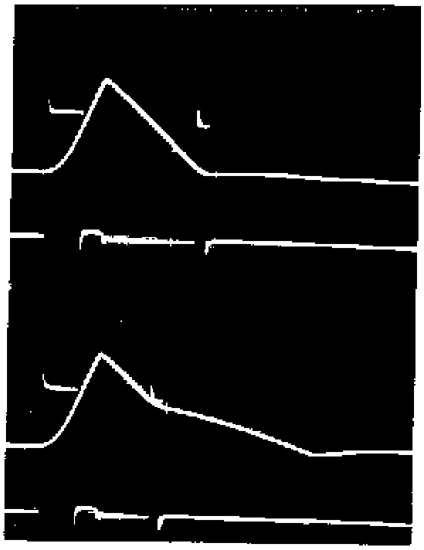
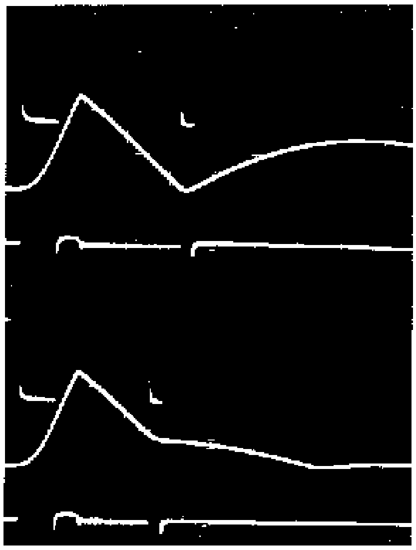

:



TYPE O PLUG - IN UNIT

0·1 v/cm
2 msec/cm
[UNLESS OTHERWISE STATED]


: Q — 10 X attenuation probe 2 volt/cm.

Top left shows the ideal. Bottom left and bottom right show an early second pulse. Top right shows a second pulse too late, which is disastrous. Note that there is a big margin of error for timing of the second pulse. The second pulse has to be shorter. Its correct width will relate to the amount of momentum after collision with the drum compared with the initial momentum.

Ivor Catt 24 September 2012

This project had a major influence on me. First, the political dimension is very interesting. Although my company Data Products Corp. Had fewer than one hundred employees, turf wars obviously played an important role. Stopping the long bounces was the territory of the mechanical engineers. And I saw them busy adding gunge to the two legs. While it was true that each happer had a dedicated hammer driver board, which defiuned the length of the single pulse with an RC time constant, so that major redesign would be necessary, the benefits would be very great indeed, as you will agree. However, I am sure the ideas of two pulses was never adopted. Sice I was fired onlyh a few months later, after being put okn another job, I cannot be absolutely sure of this, that the second pulse was never adopted.

The second factor is technical. The time that the hammer dwelt on the paper, ink tape and rotating (etched) drum was the time it took a sound message to travel from left hand end of the hammer to right hand end, to tell the right hand end to reverse its travel. Then a sound signal had to travel form right end to left end telling the left hand end that it was now O.K. for the left hand end to reverse and leave paper, ink and drum. Thus, the dwell time, which would smear out the characters because of the moving drum, was twice the time it took for sound to travel from one end of the hammer to the other. With this in mind, the hammers were made shorter. Many decades later this led me to ruminate on the behaviour of a violin string, see http://www.electromagnetism.demon.co.uk/21172.htm , http://www.electromagnetism.demon.co.uk/01052.htm . The transient behaviour of a violin string is along the string, not a sine wave at right angles to the string. Sideways movement by the string is a secondary effect.

Ivor Catt 24 September 2012