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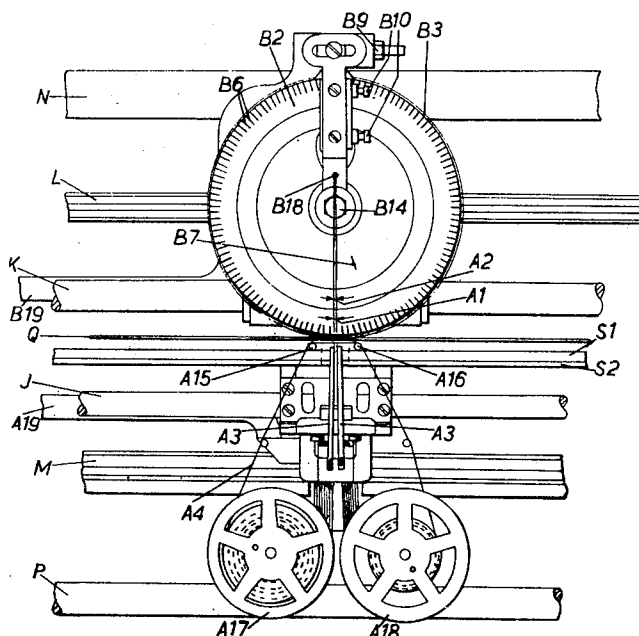
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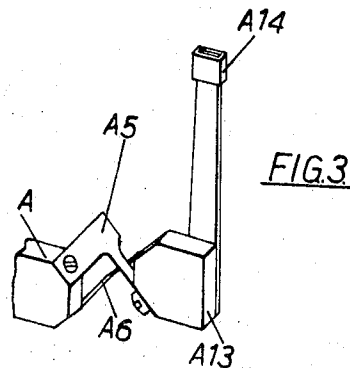
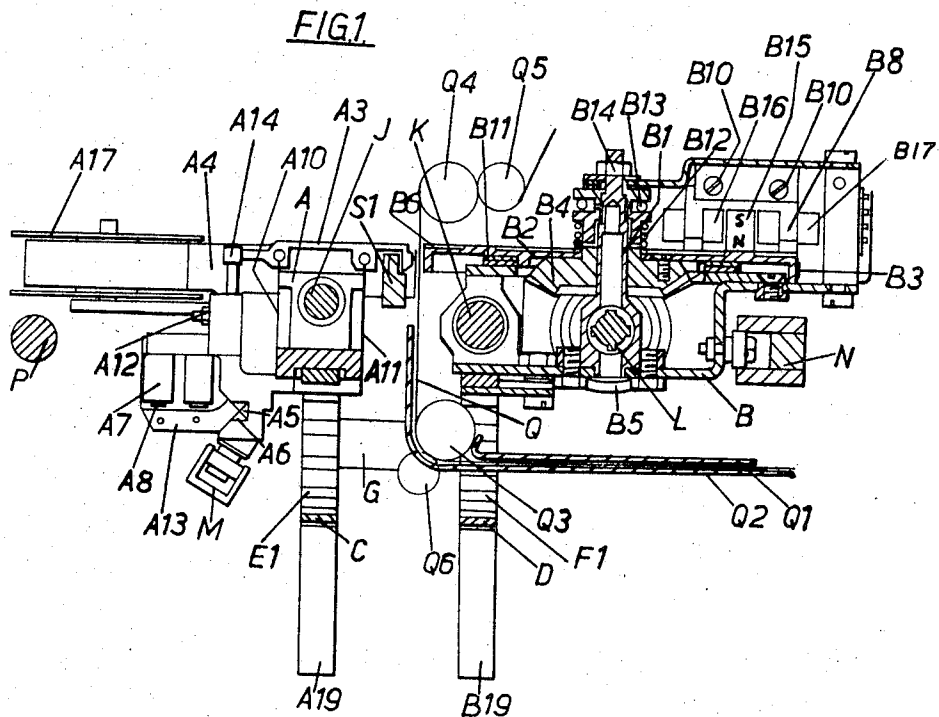
[54] **PRINTING MECHANISM WITH MOVABLE TYPE**
WHEEL AND HAMMER CARRIAGES
4 Claims, 6 Drawing Figs.

[52] U.S. Cl. **197/49,**
197/18; 101/93
[51] Int. Cl. **B41j 1/50**
[50] Field of Search. **197/49, 55;**
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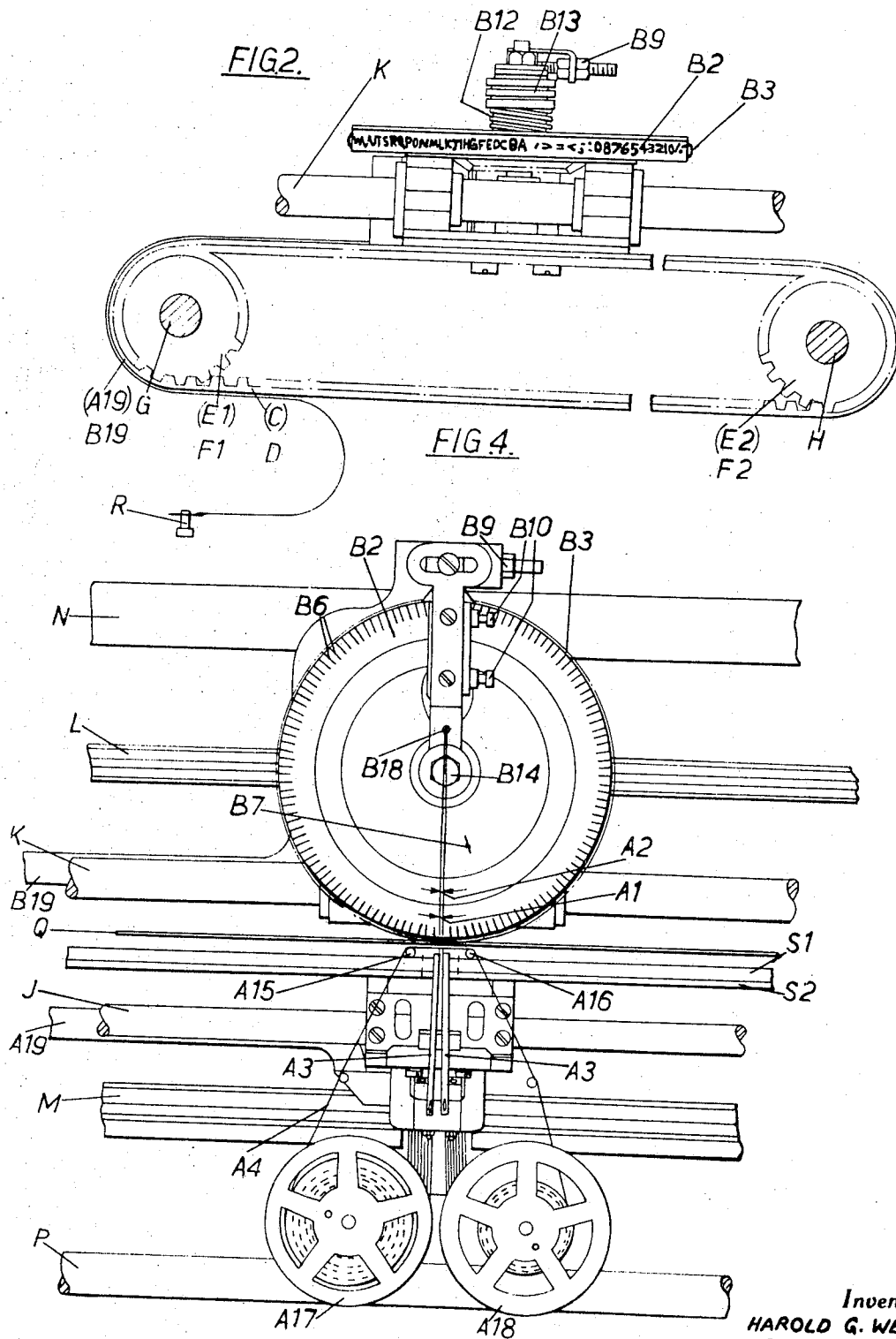
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ABSTRACT: A printing element in the form of a continuously rotating type wheel and an associated operating element in the form of a printing hammer are disposed on opposite sides of a record medium, means are provided for causing said hammer to cooperate with said type wheel to print a selected character on said medium, and said elements move synchronously in a direction parallel to the printing of successive characters.



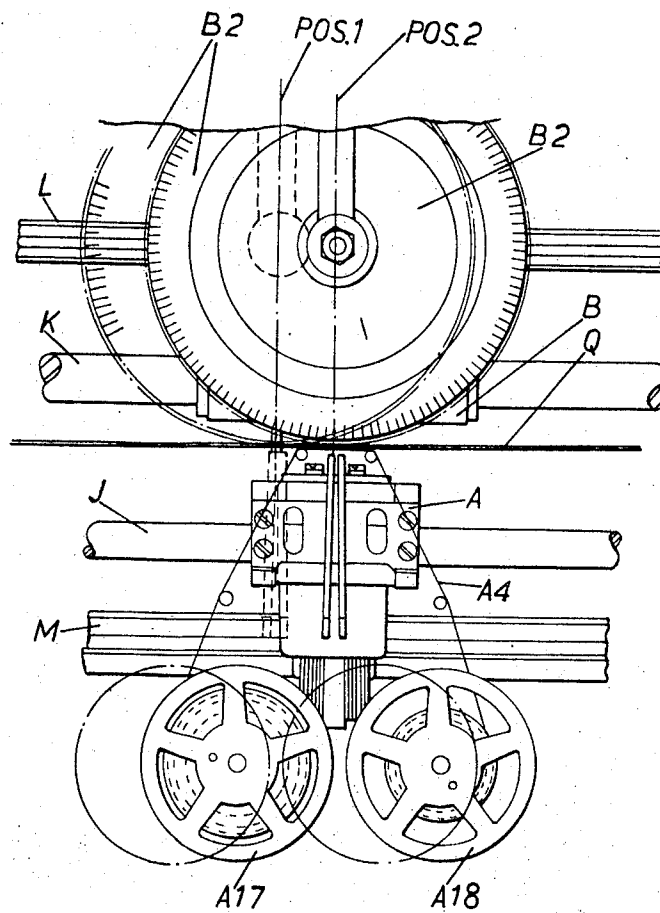


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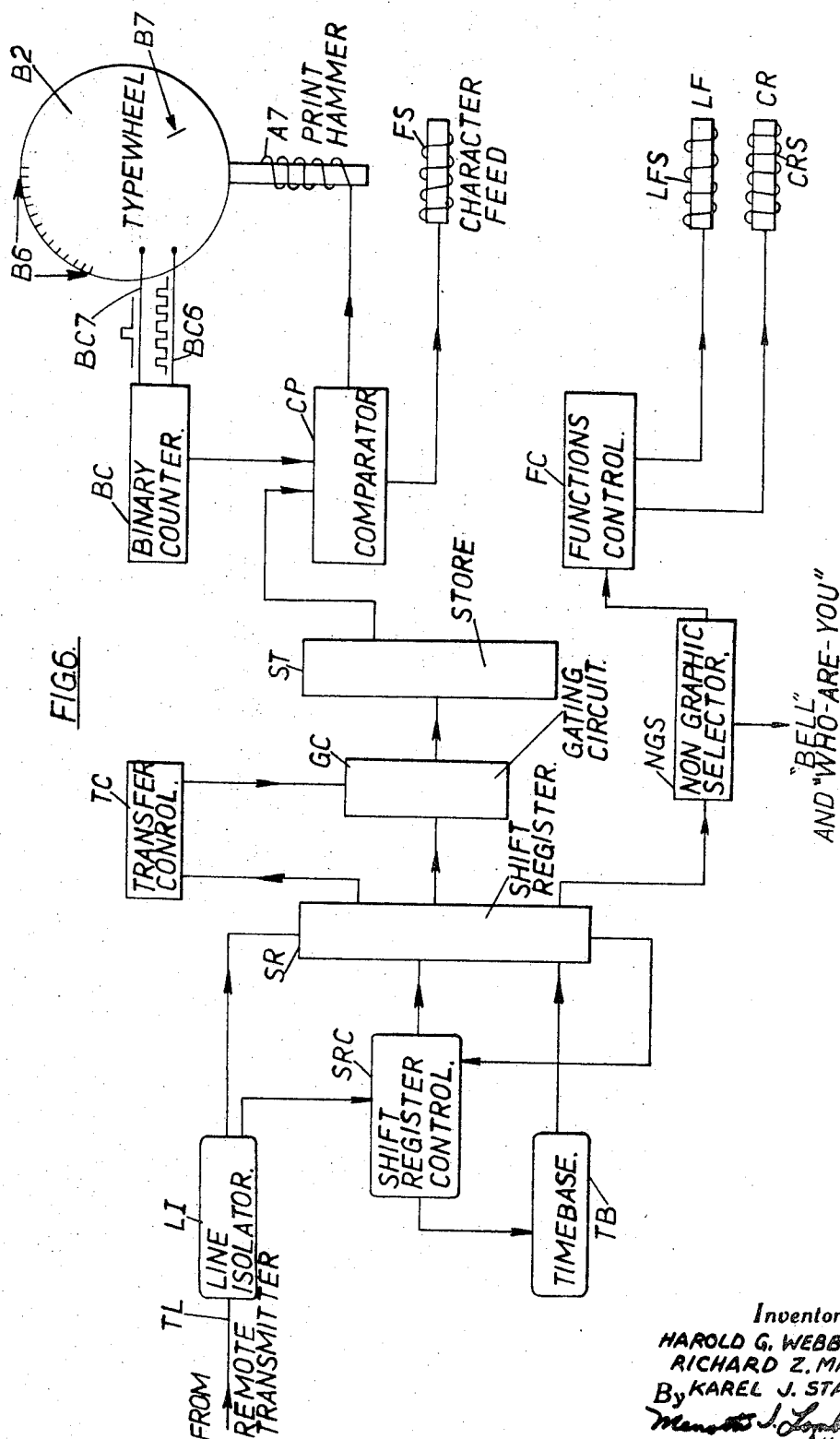


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FIG. 5



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PRINTING MECHANISM WITH MOVABLE TYPE WHEEL AND HAMMER CARRIAGES

BACKGROUND OF THE INVENTION

This invention relates to data-printing apparatus and is particularly, though not exclusively, applicable to printing mechanisms for high speed teleprinters.

It is generally recognized that conventional printers operating on intermittent methods of selection are limited to printing speeds of fifteen characters per second. Higher speeds require an unconditional continuous mode of operation.

SUMMARY OF THE INVENTION

According to the present invention in its broadest aspect there is provided a printing mechanism comprising a continuously movable printing element and an associated operating element, said elements being disposed on opposite sides of a record medium, means being provided for causing said elements to cooperate to print a selected character on said medium, and further means being provided for moving said elements synchronously in a direction parallel to the printing medium to permit the printing of successive characters.

More especially, there is provided a printing mechanism comprising a printing element in the form of a continuously rotating type wheel, and an associated operating element in the form of a printing hammer, said elements being disposed on opposite sides of a record medium, means being provided for causing said hammer to cooperate with said type wheel to print a selected character on said medium, and further means being provided for moving said elements synchronously in a direction parallel to the printing of successive characters.

The term "character" as used above and in the ensuing claims is to be interpreted broadly to cover any form of printed data.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention as applied to a teleprinter will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is an end elevation of the printing mechanism;

FIG. 2 is a front elevation of the printing mechanism with certain parts omitted;

FIG. 3 is a sketch to show a detail;

FIG. 4 is a plan view of the printing mechanism;

FIG. 5 is a view similar to FIG. 4 but showing more than one operating position of the mechanism; and

FIG. 6 is a logic diagram of the printing mechanism and its associated circuits.

DESCRIPTION OF PREFERRED EMBODIMENT

The printing mechanism according to the invention employs a printing element in the form of a continuously rotating type wheel B2 with characters B3 arranged around its periphery as shown in FIG. 2. The wheel rotates on one side of the paper Q (in this case behind it) and an associated operating element in the form of a hammer unit lies on the other side of the paper, in front, so that printing is effected by striking from the front with a hammer member A3, which in turn is operated by an armature lever A13 of a pulsed solenoid A7. A plurality of hammers can be used and in the printer system shown in the accompanying drawings two hammers are indicated. The hammer unit A and type wheel carriage unit B advance simultaneously in steps, which are multiples of the pitch of the characters or graphics and the number of the hammer members.

The spacing or pitch of the graphics on the wheel B2 does not need to be identical with the pitch of the graphics printed on the paper. The distribution of the graphics and the ratio of the transmission driving wheels can be such that a uniform motion of the wheel carriage is achieved.

Referring particularly to FIG. 1, the two carriage units A and B slide on rails J and K set parallel to each other and angu-

larly positioned with channelways M and N such that type wheel B2 lies parallel with hammer member A3.

Carriage units or assemblies A and B are connected rigidly to endless toothed belts C and D, driven by toothed wheels E2 and F2 (FIG. 2) and guided on wheels E1 and F1 (FIG. 2). E1 and F1 are connected to a shaft G (FIG. 1 and 2) and E2 and F2 are connected to a shaft H, (FIG. 2). The belts C and D could, of course, be replaced by chains.

The type wheel B2 is located on a spindle B1 fixed to carriage B. Underneath the wheel and attached to it there is a bevel gear B4 in mesh with a pinion gear B5. The pinion gear which is located in bearings fixed to the carriage transmits the drive to the wheel. The drive is applied by a splined shaft L through the pinion gear B5, thus allowing the carriage to slide and at the same time rotating the wheel continuously. On the vertical peripheral edge of wheel B2 are projecting graphics B3. Wheel B2 rides on a low-friction annular bearing B11 and is held onto this by a spring B12, B12 being held in compression under a thrust bearing B13. The upper part of thrust bearing B13 is clamped and fixed in position on spindle B1 via a nut B14. The lower part of thrust bearing B13 is driven by a dog clutch attached to the wheel.

It should be noted that this way of mounting the printing wheel ensures its stability during carriage return, and when stopping. Furthermore, the bearing is preferably a plain bearing which introduces friction in the gear drive and this eliminates backlash and the slowing down of the wheel whenever one of the printing hammers has operated. In this way it is possible to operate one hammer after another without errors due to speed variations of the wheel. It shall further be observed that since the printing or type wheel B2 is slidable on the fixed spindle B1 and is permanently fixed to its driving bevel gear B4, it is a comparatively simple and quick matter to replace or interchange printing wheels. Also, on wheel B2 near its edge are projections B6 equal in number to graphic positions B3 and at another radius, a projection B7 (FIG. 4) to indicate revolutions of the wheel B2. Mounted above these projections is a compound inductor unit B8 in the form of a set of majuscule letter E laminations with a permanent magnet B15 secured to the center limb and coils B16 and B17 on each of the outer limbs. Alternatively of course, only half the number of projections B6 need be provided to cooperate with two offset coils. In this way, there are produced pulse signals corresponding respectively to the number of graphics and the number of revolutions.

A small air gap is provided between the projections B6, B7 and wheel B2 and the three limbs on B8. Adjustment of this gap is made via screws B10. A angular adjustment B9 (FIG. 4) is provided for advancing or retarding the electrical timing as to when member A3 commences to move in relation to the required graphic B3.

Mounted on carriage A are two identical hammer systems each inclined generally towards the rotation axis of the wheel B2 at angles A1 and A2 to, say, a position B18. (FIG. 4). When members A3 are in close proximity to graphics B3 they will be square to the face of graphics immediately in front of the contact face of member A3.

If a larger number of printing hammers are used, their angle of inclination must be a compromise between the tangent of the printing wheel and the plane of the paper.

Between member A3 and graphics B3 passes an ink ribbon A4 and between ink ribbon A4 and graphics B3, passes the strip or sheet of paper Q.

Energization of solenoid A7 attracts armature lever A13 which is pivotally suspended on cross blades A5 and A6 (FIGS. 1 and 3). The extreme end of armature lever A13 at A14 pushes member A3 towards graphics B3 on wheel B2. Member A3 is supported on two flexible supports A10 and A11 which allows A3 to move generally in a horizontal direction.

After the armature lever A13 has moved its full angular movement up to laminations A8, member A3 leaves the tip A14 of armature A13 and moves in free flight to a resilient

stop S2 (FIG. 4) on a shaped bar S1. (FIGS. 1 and 4). Stop S2 is thereby compressed to such an extent as to allow the member A3 to push the ink ribbon A4 and paper Q onto the graphic B3, thereby making an impression of the graphic B3 on the surface of paper Q.

After impact, member A3 is returned initially by the energy stored in the stop S2 and then also by the spring force of supports A10 and A11 to the rest position as determined by stop A12. The presence of the resilient stop S2 reduces the dwell time of the hammer member A3 with paper and graphics B3.

Electrical connections are made between solenoid A7 and the electronic circuitry of FIG. 6 via flexible printed circuit connectors supported upon carriage A, the on toothed belt C and thereafter making a free part loop to a termination on frame R (FIG. 2). Furthermore, electrical connections are made between inductor unit B8 and the electronic circuitry of FIG. 6 in a similar way via flexible connectors supported on carriage B, then on toothed belt D, and thereafter making a free part loop to a termination on frame R. Interconnection of the electronic circuitry is made at R.

The ink ribbon A4 moves continually and slowly in front of the face of member A3, guided by pins A15 and A16 (FIG. 4) but not touching the faces of the graphics, from ribbon spools A17 to A18 (FIG. 4). Just before the ribbon A4 reaches the end of its length, a projection within the ribbon trips a common type of reversing system to change the direction of motion. This system of driving the ribbon A4 is actuated from an eccentric shaft P (FIGS. 1 and 4).

Paper Q is guided between two plates Q1 and Q2, then between rollers Q3 and Q6, over Q4 and then between Q4 and Q5. The peripheral speed of roller Q3 is slower than that of roller Q4.

After a graphic has been printed on the paper Q, a signal is then transferred to the function control system (to be described) whereby a one-step-at-a-time stepping system moves the connected carriage A and B synchronously to the next printing position say from position 1 to position 2 (as shown in FIG. 5). The function control system actuates a stepping motor driving the toothed belts C and D via the shaft G or H. All this time, the printing wheel B2 is rotating at constant speed.

Reference will now be made to the logic diagram shown in FIG. 6.

Signal combinations coming in from the telegraph line TL pass through a line isolator L1 to a shift register SR and a shift register control SRC. Receipt of a start element is effective via control SRC to start a local time base TB. This times the storage of the succeeding permutable elements in the shift register.

Assuming the code combination received represents a character, then as soon as it is completely stored in SR, a transfer control TC energized a gating circuit GC to transfer the contents of the shift register into a store ST feeding a comparator, the signal combination being in the form of a binary number.

As already mentioned, the typewheel B2 is arranged via projections B6 and B7 to generate pulse signals, one for each character and one for each revolution respectively. These are fed over lines BC6 and BC7 respectively, to a binary counter BC which counts the number of pulses on BC6 since the last pulse on BC7. This total is also fed into the comparator CP and when it agrees with the stored number representing the received code combination, the print hammer solenoid A7 is energized, followed by a feed solenoid FS which forms part of the stepping motor for moving the belts C and D.

Alternatively, the binary counter BC could be replaced by a further shift register which is arranged firstly to receive the number representative of the received code combination, and then the output of the binary counter BC. Thus, the printing hammer solenoid A7 would be actuated when a predetermined total had been reached in the further shift register.

Reverting to FIG. 6 in the case of a receive code combina-

tion which does not represent a graphic, this passes from the shift register SR to a nongraphic selector NGS. Except in the case of "Bell" or "Who are You?" combinations, this selector causes the operation of a functions control FC which in turn effects the operation of an appropriate function solenoid such as LFS for "line feed" of CRS for "carriage return".

While we have described above the principles of our 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 our invention as set forth in the accompanying claims.

We claim:

1. A high speed printing arrangement for serially recording selected characters along the print line of a recording medium in response to input signal code combinations comprising:

a. a movable type wheel carriage assembly positioned to one side of the recording medium, said type wheel carriage assembly including a continuously rotating type wheel having the character types arranged circumferentially thereon and having on a flat surface thereof a revolution indicating projection and a plurality of type position indicating projections, means for rotating said type wheel adjacent to the recording medium, and adjustable sensing means, which include a compound inductor unit having a set of letter E laminations with a permanent magnet secured to the center limb and individual coils on each of the outer limbs, and positioned proximate to said flat surface and stationarily arranged with respect to the rotation of said type wheel, said adjustable sensing means being arranged to generate a pulse each time either a type indicating projection or the revolution indicating projection passes relative thereto, said sensing means having an adjustment for altering the timing of projection sensing by changing the relative position of said sensing means with respect to the type wheel projections;

b. a movable hammer carriage assembly positioned on the other side of the recording medium, said hammer carriage assembly including hammer means responsive to an activation signal for impacting a selected type on said type wheel with the recording medium;

c. means for supporting and moving said carriage assemblies simultaneously along a path parallel to the print line and spacing the travel thereof in accordance with the character spacing along the print line; and

d. function control circuitry, responsive to the pulses generated by said adjustable sensing means and to said input coded signals, for controlling the movement of said carriage assemblies along the print line and for controlling the motion of said hammer means via said activation signal to effect the printing of a selected character on the recording medium.

2. The printing arrangement according to claim 1 wherein said means for supporting and moving said carriage assemblies include a pair of toothed belt drive means, each associated with a respective one of said carriage assemblies and both responsive to a common drive source, for moving said carriage assemblies simultaneously along the print line.

3. The printing arrangement according to claim 1 wherein said function control circuitry includes a binary counting unit for counting the number of type indicating pulses received from said adjustable sensing means after receipt therefrom of the last revolution indicating pulse and a comparator unit coupled to said binary counting unit for providing activation signals in response to an agreement between a signal from said binary counting unit and a signal input representative of a received coded character.

4. The printing arrangement according to claim 3 wherein separate and succeeding signals from said comparator unit, upon agreement of signals applied thereto, are applied respectively to said hammer means and to said means for moving said carriage assemblies along the print line.