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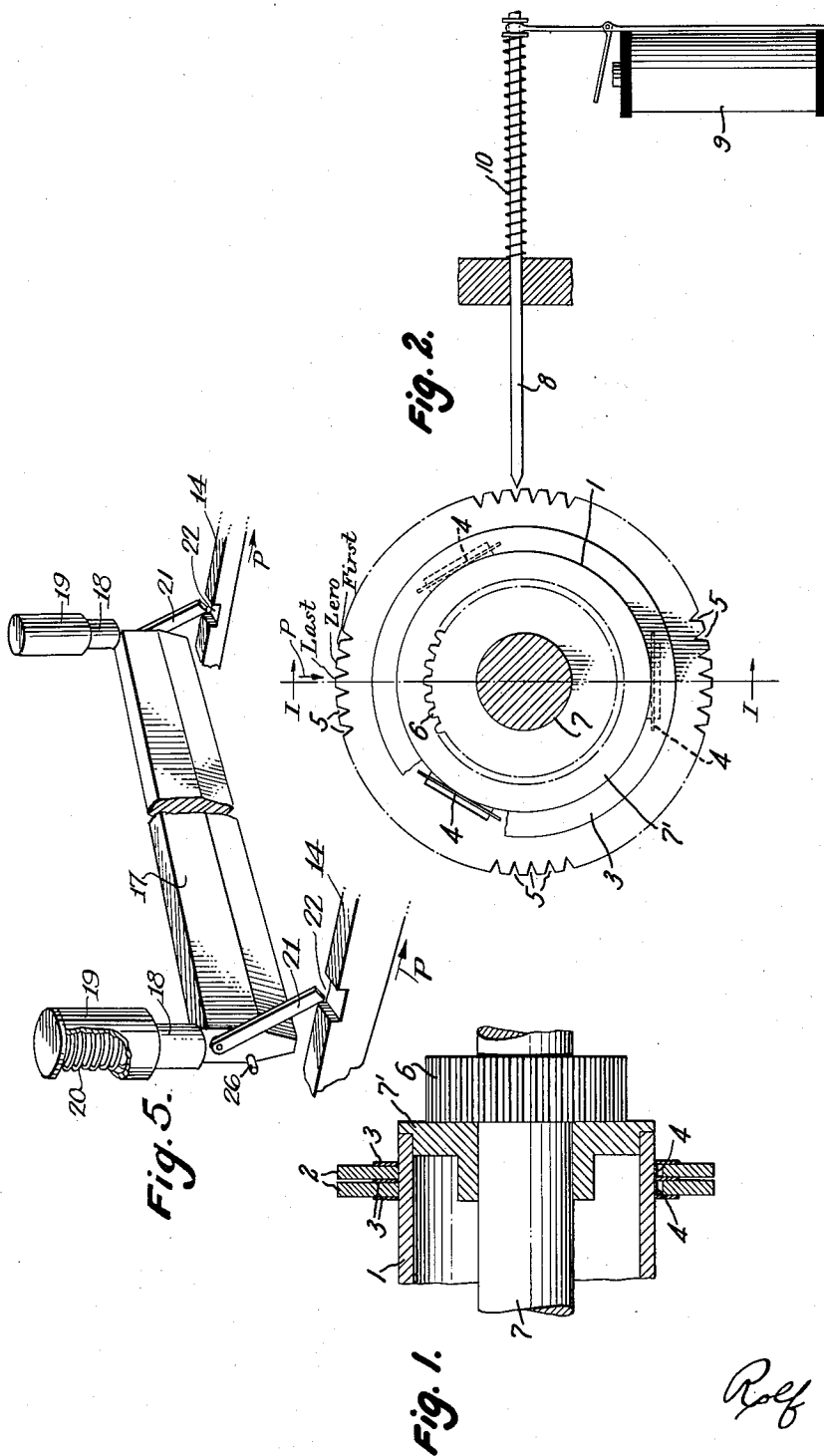
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PRINT WHEEL SETTING MECHANISM

Filed Jan. 27, 1953

2 Sheets-Sheet 1



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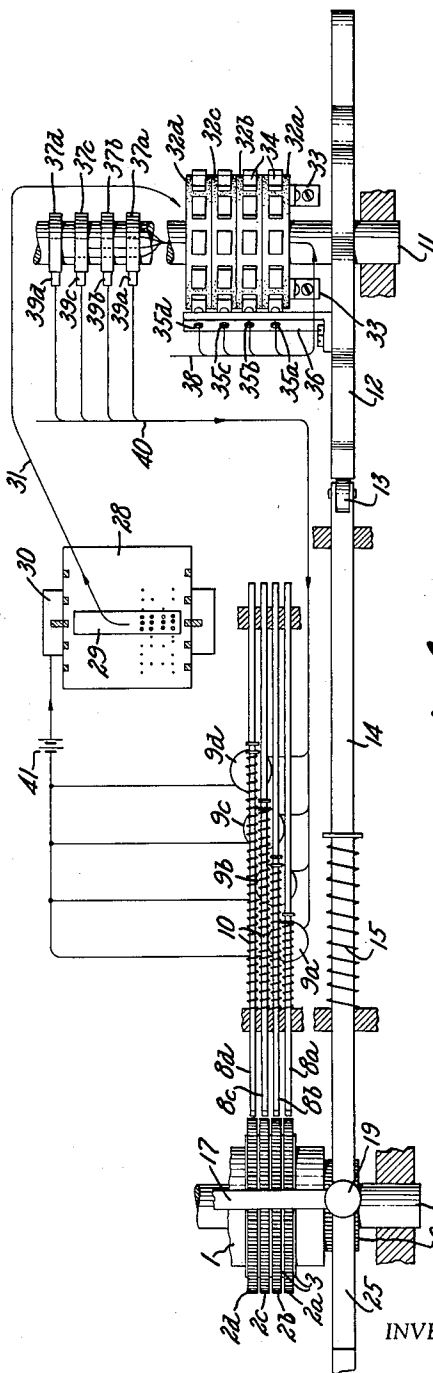
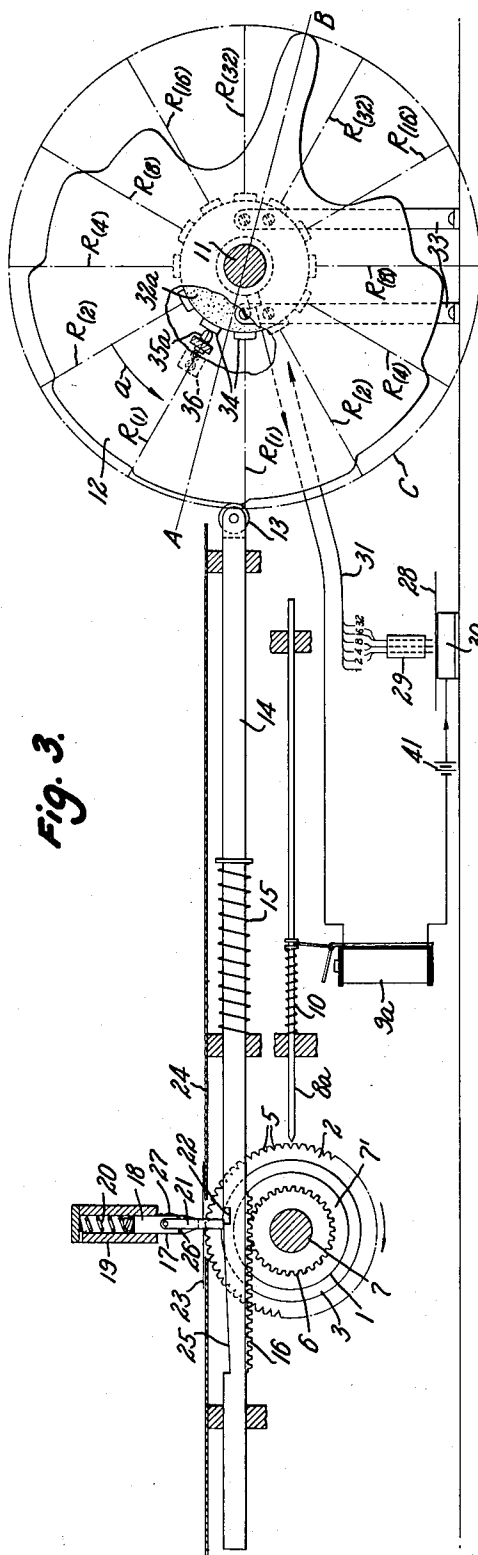
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1

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PRINT WHEEL SETTING MECHANISM

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6 Claims. (Cl. 101—93)

This invention relates to printing mechanisms, and more particularly to printing mechanisms including a plurality of type wheels frictionally mounted upon a rotatable cylinder and each selectively movable with the cylinder during a part or all of a cycle of its movement to effect relative angular adjustments of the several type wheels so as to obtain the sequence of type characters (letters, numbers, symbols or the like) which it is desired to print.

This application is a continuation-in-part of my copending application Serial No. 714,068, filed December 4, 1946, now abandoned.

Objects of the invention are to provide printing mechanisms in which a plurality of type wheels are mounted upon and frictionally coupled to a rotatable cylinder, each type wheel having a notch associated with each character thereon, and locking pins which may be selectively engaged in or withdrawn from notches of the several wheels during part or all of a wheel-setting movement of the cylinder, thereby to obtain the desired sequence of type characters for printing. Objects are to provide printing mechanisms of the characteristics stated in which the cylinder is advanced by steps of different magnitude according to a desired code, for example a unit step and multi-unit steps varying as successive powers of "2," whereby each type wheel may be adjusted to a large number of successive unit positions by appropriate choice of the step movements of the cylinder during which the type wheel moves with, or alternatively is locked against movement with, the cylinder. More specifically, an object is to provide a printing mechanism of the characteristics stated in which the locking pins are controlled by solenoids selectively energized in synchronism with the rotation of a cam which effects the step-by-step advance of the cylinder carrying the type wheels, and in which the particular solenoid circuits to be energized for a given printing are determined by a coded record and an electrical scanning mechanism.

These and other objects and the advantages of the invention will be apparent from the following specification when taken with the accompanying drawings in which:

Fig. 1 is a fragmentary vertical section through a plurality of type wheels and their supporting cylinder, as taken substantially on section line I—I of Fig. 2;

Fig. 2 is an end elevation of the supporting cylinder and type wheels, and showing only a single control solenoid;

Fig. 3 is a schematic view of the mechanical elements and the electrical circuits for determining the setting of a type wheel for printing; a type wheel and the associated mechanical elements being shown in end elevation;

Fig. 4 is a schematic plan view of a portion of the printing mechanism showing a plurality of type wheels and the associated mechanisms, electrical and mechanical, for controlling the settings of the type wheels; and

Fig. 5 is a view in perspective of the printing bar and related components.

In the drawings, the reference numeral 1 identifies a cylinder on which a number N of type wheels 2 are supported between a series of spacing washers or annular

2

members 3 which are secured to the cylinder. The type wheels 2 have a slight clearance between adjacent spacing washers and are each frictionally connected to the cylinder 1 by a plurality of leaf springs 4 supported in notches 5 in the type wheels 2 and bearing against the surface of the cylinder 1. Radially extending notches 6 are provided in the type wheels between adjacent type characters, not shown, which may be letters, numbers or arbitrary symbols. The cylinder 1 is journaled on the machine frame, and is twice rocked or oscillated through one-half turn in a printing cycle. The support and driving mechanism is preferably duplicated at opposite ends of the cylinder and comprises a gear or pinion 6 fixed to a shaft 7 having an annular flange 7' which is telescoped into or otherwise secured to the end of the cylinder 1. The extent to which each type wheel 2 moves with the cylinder 1 is determined by a locking pin 8 which is controlled as to position by a solenoid 9 and a spring 10, the pin having alternative positions in which it is seated in or withdrawn from a notch 5 of the type wheel.

The control basis may be such that the locking pins normally prevent movement of the type wheels or, as shown in Figs. 2, 3 and 4, may be such that the type wheels are normally free to move with the cylinder 1. With this arrangement, and assuming that the initial movement of the cylinder 1 in a printing cycle is clockwise, as seen in Figs. 2 and 3, the normal position of the type wheels 2 will be with the "Zero" type at one step to the right or clockwise from the plane of movement P of the printing bar; the "First" type which is brought into printing position by one-step relative movement of the type wheel 2 on cylinder 1 is to the right of the "Zero" position type, and the "Last" type on the type wheel is at the left of the "Zero" type; as indicated by the legends of Fig. 2. The type wheels 2 are provided with 64 type positions when the solenoids 9 may be energized, as will be described later, for one or more of the intervals during which the cylinder 1 is moved progressively through angular increments corresponding respectively to "1," "2," "4," "8," "16" and "32" type spaces. The several type wheels are set in desired positions during the first clockwise and counter-clockwise oscillation of cylinder 1 through one-half turn, the hammer then drops to effect the printing, and the type wheels are reset to normal positions during the second clockwise and counter-clockwise oscillation of the cylinder.

Apparatus and electrical control circuits for effecting these operations are illustrated schematically in Figs. 3 and 4 in which the same reference numerals are applied to the same elements, except that the letters a—d have been added to certain reference numerals of Figs. 3 and 4 to distinguish between different type wheels 2 and their respective associated elements. The main shaft 11 of the machine which includes the printing mechanism is preferably motor-driven and it carries a cam 12 engaged by a cam follower roller 13 mounted in the end of a rod 14 which is urged towards the cam by a spring 15 and has a rack 16 in mesh with the pinion 6 on the shaft 7 of the cylinder 1. The edge or working surface of the cam 12 is divided into twelve segments by changes in radius at or centered on the twelve uniformly spaced radii indicated by light broken lines R superposed upon the cam in Fig. 3. The movement imparted to the cylinder 1 as the several cam segments move in succession into engagement with the cam follower 13 is indicated, in terms of type spaces, by the numerals in parentheses adjacent each radial line R.

In the reset position of the apparatus as shown in Fig. 3, the cam follower 13 has been moved towards the left by the final radial rise of the cam and the type wheels are each in the position shown in Fig. 2. The contour of the cam 12 is symmetrical about a diametrical plane A—B

through the center of the cam segment in engagement with the follower 13 at the reset position of the printing mechanism. The first five radial slopes of the cam are inwardly directed and correspond to type step values of "1," "2," . . . "16" of the selected code, whereas the sixth radial slope is outwardly directed and has the step value "32." On rotation of shaft 11 and cam 12 counterclockwise, as indicated by the arrow *a* of Fig. 3, the rod 14 moves to the right for a total of thirty-one type steps as the cam follower 13 rides down the first five radial slopes, thereby turning the cylinder 1 clockwise for a total of thirty-one steps. The cam follower 13 rides up the sixth radial slope on further rotation of the cam 12, and the rod 14 is thereby returned toward the left and rocks the cylinder 1 counterclockwise by thirty-two type steps. The setting of the type wheels is completed by this oscillation of the cylinder 1 during approximately a half-turn of the shaft 11 and cam 12, and the one-step displacement of the rod 14 beyond its initial position by the "32" step lobe of cam 12 trips the printing bar 17 by mechanism to be described later. The continued rotation of the cam 12 back to initial position effects a further oscillation of the cylinder 1, but in this resetting operation the clockwise motion is through one type step more than the counterclockwise motion. This differential in the displacements of the cam follower 13 and rod 14 on each reciprocation by the cam 12 is indicated graphically in Fig. 3 by the light line circle C which is drawn tangent to the projecting lobe and lies outside of the circular surface of the starting segment by a radial distance corresponding to one type step.

As shown in Fig. 5 which illustrates the position of the parts immediately after a printing operation and the rods 14 start to move in a direction toward the right, the printing bar 17 extends across the entire assembly of type wheels 2 with cams 12 and rods 14 at opposite ends of the bar 17. The bar 17 is carried at each end by a piston 18 which is vertically slidable in a cylinder 19. A spring 20 is seated between and with its ends connected respectively to the top of the piston and to the upper end of the cylinder, and the length of the spring in unstressed condition is such that the lower face of the printing bar 17 is spaced somewhat above the type wheel 2. The printing bar is normally held at a higher level, and spring 20 therefore is compressed, by a link 21 which is pivoted on the piston 18 and has its lower end seated upon the bar 14 at the left upper edge of a notch 22 into which the link drops upon movement of the rod 14 into its extreme left position by the lobe of the cam 12. When this occurs, the compressed spring 20 throws the printing bar 17 downward upon a paper sheet or card 23 placed upon the top panel 24 of the machine above the type wheels. The panel 24 has an opening of sufficient size to clear the type wheels, and a plurality of sheets 23 with carbon coatings, or with inserted sheets of carbon paper, may be employed when a plurality of records are to be printed. The spring 20 momentarily expands beyond its normal unstressed condition when the compression is suddenly released by the dropping of the link 21 into the notch 22, and then contracts to normal unstressed condition to lift the printing bar 17 from the paper 23.

On movement of the rod 14 towards the right on the continued rotation of the cam 12, the link 21 turns counterclockwise on its pivot and rides out of the notch 22 and down the inclined upper surface 25 of rod 14 to the left of the notch 22. The link 21 is turned clockwise by its engagement with this inclined surface during movement of the rod towards the left in the final stage of the resetting operation, and is arrested in alignment with the piston 18 by a stop pin 26 on the piston. The lower end of the link again rides down the inclined surface of the rod 14 in the initial stage of the next printing operation but a breaking of the toggle formed by the link 21 and piston 18 is prevented by a leaf spring 27 secured to the piston 18 and

bearing upon the link 21 to oppose a counterclockwise tilting of the link.

The electrical network and apparatus for setting the individual type wheels to a selected one of sixty-four possible positions is controlled or energized by a card or tape having, for each line to be printed and for each type wheel, a code group of six spots which are each effectively and selectively conductive or non-conductive according to the desired step adjustment of the type wheels. The six code spots correspond, respectively, to the above specified step values of "1," "2," . . . "32," and, for convenience and simplicity of explanation, it is assumed that the code card or tape 28 is of insulating material and selectively perforated at each unit code area of six spots for the selective engagement of probe contacts of a scanning unit 29 with a conductive plate 30 upon which the record card 28 is placed. There are six contact pins for each code unit and, for a number N of type wheels, a cable 31 of 6N wires extends from the scanning unit 29 to the stationary bank of N commutator disks 32a, 32b, etc., which are coaxial with the main shaft 11 and anchored to the machine base or frame by brackets 33. There are twelve contacts 34 on each commutator disk, each code wire of the cable 31 being connected to two contacts symmetrically disposed with respect to line AB of Fig. 3, the several contacts having the step values indicated in parentheses adjacent the radial lines R which extend through the contacts in Fig. 3. A bank of contact brushes 35a, 35b, etc., is mounted on a bracket 36 which is secured to and rotates with the cam 12, the brushes being individually connected to slip rings 37a, 37b, etc., on shaft 11 by the wires of a cable 38. Brushes 39a, 39b, etc. engage the slip rings and are individually connected by wires of cable 40 to the solenoids 9a, 9b, etc. which control the locking pins 8a, 8b, etc. of the several type wheels. While only four type wheels have been shown in the fragmentary views, it is to be understood that any number N may be provided. The other terminals of all solenoids are connected through a current source, which is shown schematically as a battery 41, to the base plate 30, thereby completing the scanning circuits.

In the reset position of the apparatus, the brushes 35a, 35b, etc. are positioned to bear upon the upper one-step contacts 34 of the commutator disks, and the brushes engage the lower set of contacts "1" to "32" in sequence during the first half-rotation of shaft 11 and cam 12. The contact engagements are made just prior to the corresponding step displacements of cam follower 13 and rod 14 by the cam 12, thus setting up a sequence of circuits which will be completed at the scanning unit 29 for each punched code or conductive position. The number wheels 2 are normally free to move with the cylinder 1 in the embodiment illustrated in Figs. 3 and 4, but the locking pins 8 are projected into notches 5 of the wheels 2 to block such movement when the solenoids 9 are energized during one or more of the step-by-step displacements of the follower 13 and rod 14 by the cam 12. The relative positions of the type wheels on the cylinder 1 at the end of a half-rotation of the cam 12 therefore vary with the energizations of the solenoids by the code punching of the record sheet 28. The printing hammer 17 drops, as above explained, when the bar 14 is moved into its extreme left position by the projecting lobe of the cam 12. On continued rotation of cam 12 back to reset position, the rod 14 is moved toward the right by the spring 15 and thereby the direction of angular displacement of the cylinder 1 is reversed with respect to the previous or "setting" step of the same magnitude and, since the control solenoids 9 are again energized for the same step advances as in the setting half-cycle, all type wheels are restored or reset to their initial positions.

It is to be noted that the cam 12 is of relatively small diameter since it provides a selective control of N type wheel positions but has an effective "throw" of only N/2 type positions. As above explained with reference to

5

Fig. 2, if no control is imposed upon a type wheel 2 and it moves clockwise with the cylinder 1 through thirty-one steps and then counterclockwise through thirty-two steps to the printing position, the printed character will be the "Zero" character or type at one space to the right of the type in the printing plane P at the reset position of the type wheel 2. The desired one of the first thirty-one types to the right of the "Zero" is printed when the type wheel is locked against clockwise movement with the cylinder 1 for one or more of the first five of the step-by-step advances of the cylinder. If the type wheel is not locked during the clockwise rotation of the cylinder 1, the thirty-second type will be in the printing position and will be printed if the wheel is then locked in that position by energization of the "32 step" solenoid 9 to prevent movement of the type wheel during the following counterclockwise movement of the cylinder 1 through thirty-two type steps. If the type wheel is locked for one or more of the clockwise steps of "1" to "16" and for the counterclockwise step "32" of the cylinder 1, the printed type will be in the range between the thirty-second and the last type of the wheel.

The invention is not limited to the particular embodiment herein described and illustrated as it is possible and entirely practical to reverse the described control and have the type wheels normally locked against movement with the cylinder 1.

I claim:

1. In a printing mechanism, a rotatably supported cylinder, means for twice rocking said cylinder back and forth by sequences of angular step movements, each back and forth movement constituting a half-cycle of operation of said cylinder and the respective angular step movements being of different values, with each sequence totaling substantially a half-revolution of said cylinder a plurality of type wheels frictionally mounted on said cylinder and having notches between adjacent types, a printing hammer movable in a substantially radial plane of said cylinder, a locking pin for each type wheel and movable between positions of engagement in a wheel notch or alternatively in spaced relation thereto, a solenoid for actuating each locking pin, and means for actu-

6

ating said printing hammer upon completion of the first half-cycle of operation of said cylinder.

2. In a printing mechanism, the invention as recited in claim 1, wherein said means for rocking the cylinder comprises a cam; and switch means operable in synchronism with said cam for opening or closing circuits to said solenoids in intervals between step movements of said cylinder.

3. In a printing mechanism, the invention as recited in claim 2, wherein the steps of said cam are of progressively different magnitude and symmetrically arranged with respect to a diametrical plane through the cam, and said switch mechanism establishes the same circuit condition for each solenoid for cam steps of the same magnitude at opposite sides of said diametrical plane.

4. In a printing mechanism, the invention as recited in claim 3, wherein the steps of said cam have magnitudes, in succession of 1, 2 and a series of powers of 2; the steps except for the last being radially inward and the last step being radially outward, thereby providing a projecting lobe constituting a part of said means for actuating said printing mechanism.

5. In a printing mechanism, the invention as recited in claim 4, wherein said type wheels are provided with 64 types, and the maximum magnitude step of said cam has the value 32.

6. In a printing mechanism, the invention as recited in claim 5, in combination with an electrical scanning apparatus in series with said switch means and solenoids, said scanning apparatus including six contact pins for each solenoid.

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