Feb. 16, 1965 C. W. IRWIN ETAL 3,169,473

TYPE CARRIER FOR PRINTING MACHINE

Filed Sept. 10, 1962 3 Sheets-Sheet 1

FIG. 1.

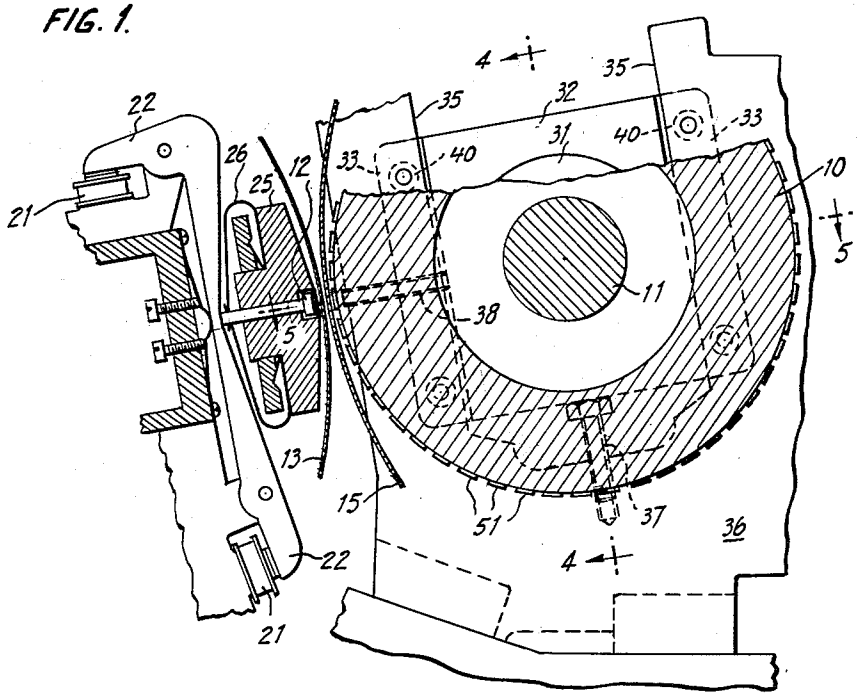


FIG. 2.

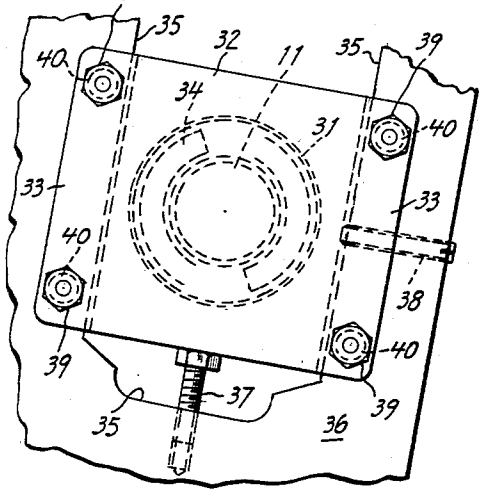
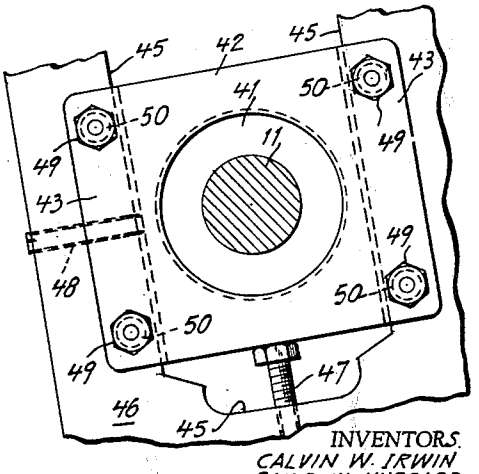


FIG. 3.



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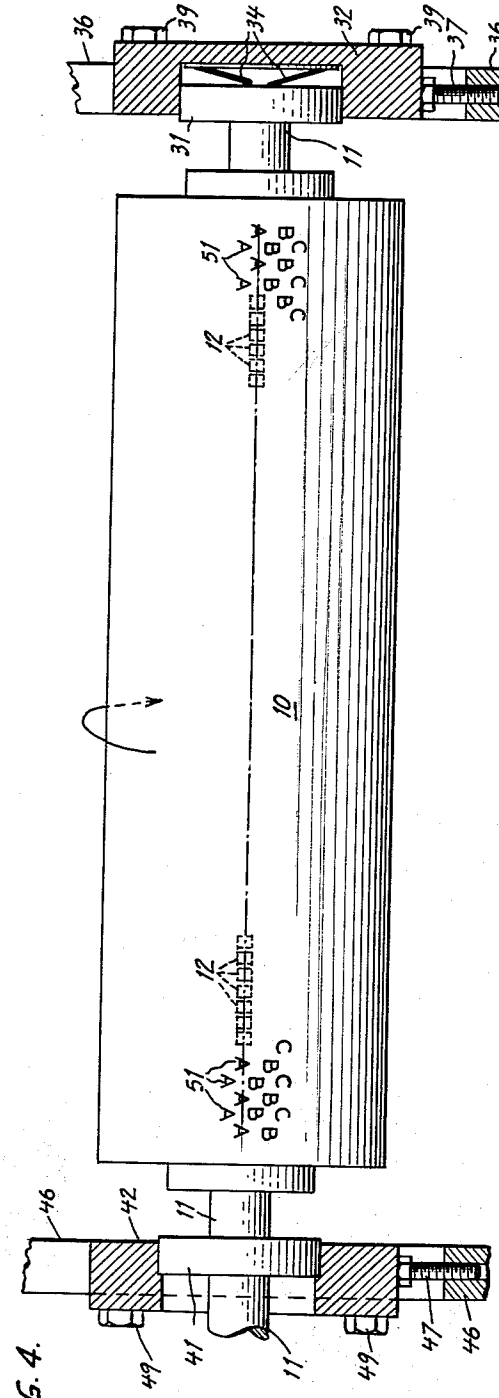

FIG. 4.

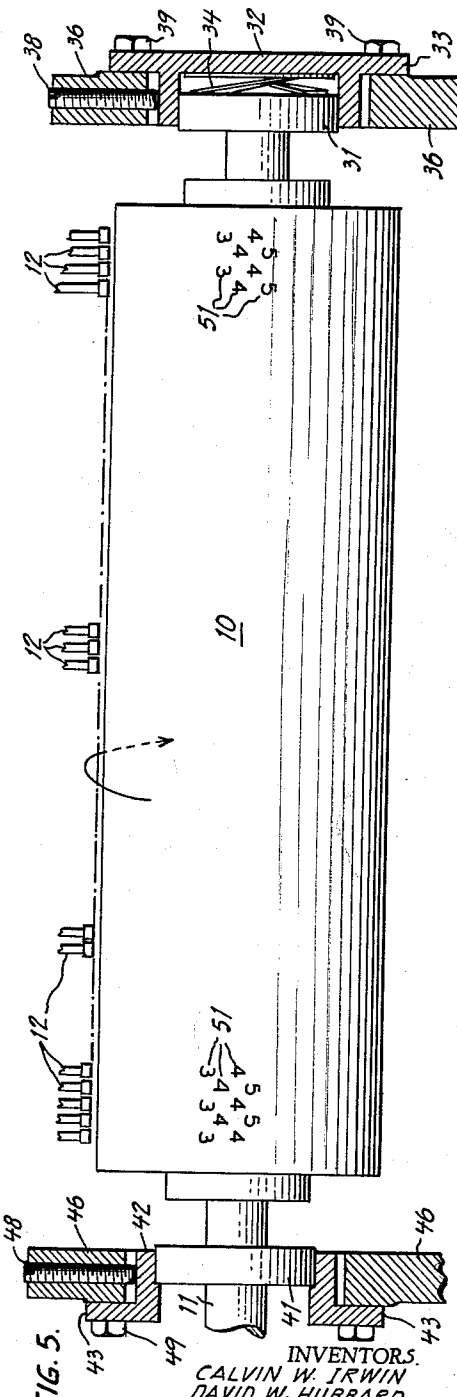

FIG. 5.

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TYPE CARRIER FOR PRINTING MACHINE

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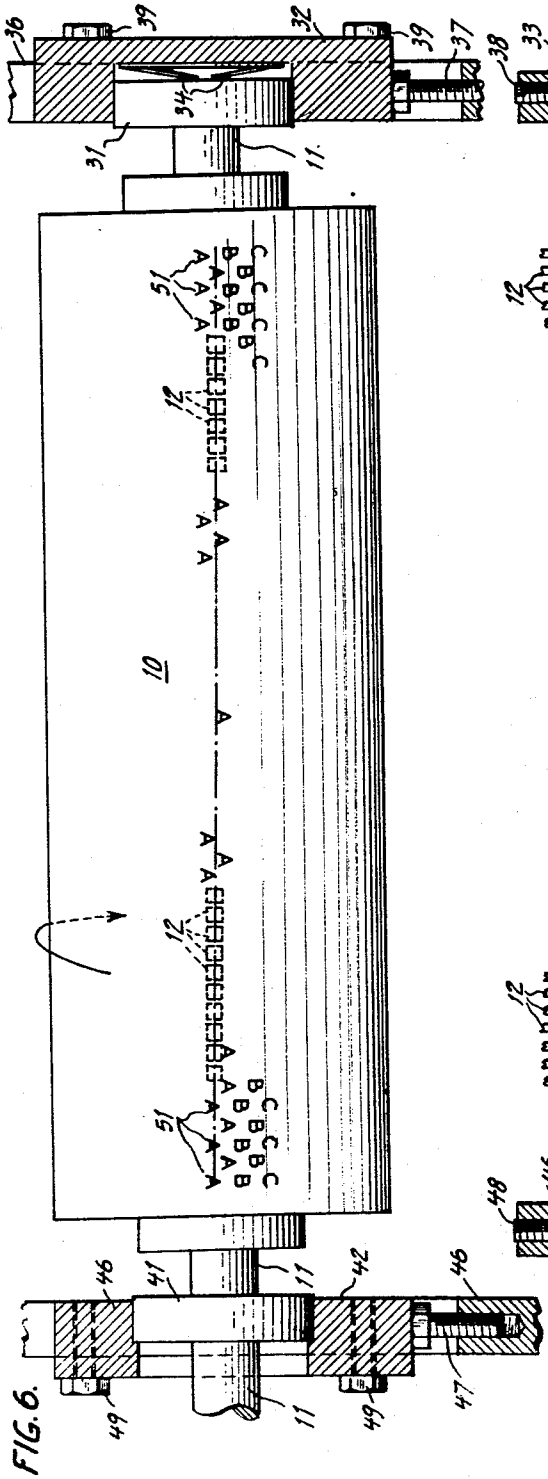

FIG. 6.

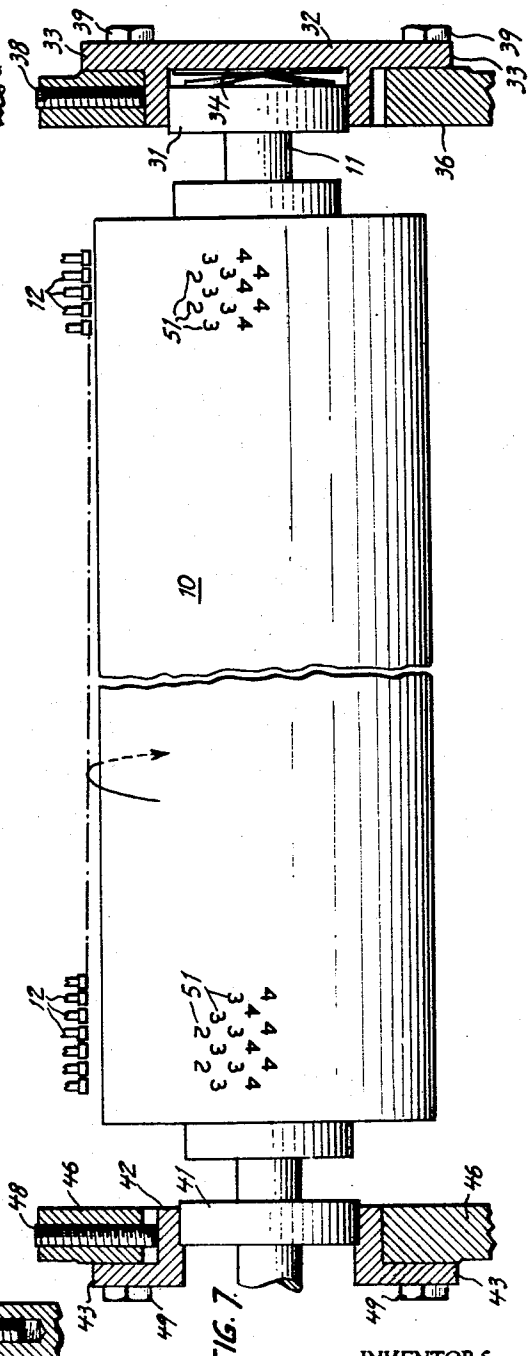

FIG. 7.

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TYPE CARRIER FOR PRINTING MACHINE

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This invention relates generally to high speed printing mechanisms employing rotary type carriers operating to produce a line of print within a cycle of rotation, the invention relating more particularly to the type carrier and means for mounting same in various orientations relative to a line of type hammers so as to render the mechanism adaptable for both parallel and serial read-out modes of operation.

Printing mechanisms of the sort hereinabove referred to have customarily been designed with hardware components, particularly the type carrier, designed for either one or the other of the two basic modes of operation, i.e. parallel read-out or serial read-out. The term parallel read-out is intended to denote that mode of operation wherein the control information is made available for all print columns simultaneously so that, for example, if the entire print line were to consist of the same character, all type hammers would be fired simultaneously. The term serial read-out is intended to denote that mode of operation wherein the control information is made available to the respective print columns serially so that, for the same example, the successively disposed type hammers arranged across the printing line will be controlled to fire one after the other with no two print hammers firing at exactly the same time. It will of course be evident that a basic distinction in the design of equipment for the respective modes of operation lies in the different orientation of a row of type faces extending across the type carrier in relation to the row of respective type hammers associated therewith.

Heretofore, it has been necessary to design type carriers for use solely in accordance with one or the other of these separate modes of operation. For parallel read-out systems, the type carriers are designed with rows of type faces extending across the carrier in a line parallel with the carrier axis. For serial read-out systems, type carriers have been designed with type faces extending in rows following a slightly spiralled configuration so as to provide the required delay, from one column of type faces to the next, in the time that the type faces of the respective columns are registered with their respective type hammers. It will of course be apparent that the necessity for designing the type carrier specifically for one form of operation or the other increases the cost of manufacturing equipment of this class over what would be the cost if the same type carrier could be utilized in both modes of read-out.

The present invention overcomes this difficulty by providing means whereby the same type carrier may, by simple adjusting procedures, be adapted to operate either in a parallel read-out or a serial read-out system. This adaptability is achieved by making provision for adjusting the type carrier supports at each end thereof so as to enable the orientation of the carrier axis to be varied relative to the line of type hammers depending upon which mode of operation is desired. The adjustable support for the type carrier enables the axis of the carrier to be tilted or skewed in either of two possible directions, i.e. perpendicular or parallel to the plane in which the type hammers are fired, either direction of adjustment serving to achieve the same result. By providing means for effecting such an adjustment, the cost

of manufacturing equipment which is capable of operation in both parallel and serial read-out systems is considerably reduced.

It is therefore the principal object of this invention to enable a printing mechanism of the sort herein described to be adaptable for operation in both parallel and serial read-out systems.

It is a further object of the invention to provide in a machine of the character described means for variably orienting the axis of the type carier relative to the associated type hammers so as to adapt the mechanism for either parallel or serial modes of operation.

Further objects of the invention together with the features contributing thereto and the advantages accruing therefrom will be apparent from the following description when read in conjunction with the drawing wherein:

FIG. 1 is a left hand sectional view of the type drum and associated type hammer mechanism of a high speed printer embodying the present invention.

FIG. 2 is a view of the type drum mounting means on the right hand side.

FIG. 3 is a view of the type drum mounting means on the left hand side.

FIG. 4 is a front view, taken along line 4—4 of FIG. 1, of the type drum shown as mounted for parallel read-out control of the type hammers.

FIG. 5 is a plan view, taken along line 5—5 of FIG. 1, of the drum shown as mounted for paralell read-out.

FIG. 6 is a front view, similar to FIG. 4, of the drum shown as mounted in accordance with one manner of adjustment for serial read-out control of the type hammers.

FIG. 7 is a plan view, similar to FIG. 5, of the drum shown as mounted in accordance with another manner of adjustment for serial read-out control of the type hammers.

With reference to FIG. 1, the mechanisms by which printing is effected includse a type carrier in the form of a drum **10** suitable keyed to a continuously rotating shaft **11**, the shaft rotating in a counter-clockwise direction in the present instance so as to serially advance type faces arranged columnarly around the periphery of the drum into print position in registration wih an associated type hammer **12**. A print receiving medium **13**, which may be paper or other suitable material, is disposed between the head of the type hammer and the type drum, the said medium being supported and fed line spacing direction by any suitable means, not shown. Disposed and suitably fed between the print receiving medium and the type drum is a marking transfer medium **15** in web form, which may be impregnated either with ink, carbon, or the like, for transferring the image of each character type face to the surface of the print receiving medium when a type hammer **12** is actuated to impact the print receiving medium and the marking transfer medium against the surface of a selected character type face on the type drum **10**.

The type hammers **12** are driven or fired at selected intervals in a cycle of drum rotation by electromagnetic actuators each of which includes a coil **21** and a pivotally mounted armature **22** which has an arm engaging the shank of an associated type hammer thereby causing the hammer to fire into impacting relation with a selected type face on the drum when the associated coil **21** is energized. This action causes the image of the selected character type face to be transferred through the marking medium **15** and reproduced on the print receiving medium **13**. The type hammers are slideably supported for firing movement by a transverse hammer guide bar **25** which extends across the machine from one side to another a distance at least the length of the drum and is

supported at its ends in the frame of the machine by suitable means, not shown. The bar 25 also supports springs 26 which act to yieldably retain the type hammers and associated armatures in their restored positions. Thus, it will be apparent that the several typehammers, of which there is one shown in FIG. 1, are supported by the bar 25 in a row extending horizontally across the machine with the heads of the type bars aligned along a horizontal line which will hereinafter be referred to as the firing line. It will also be seen that the firing stroke of all the type hammers from the firing line into printing impact with the type drum is guided along a substantially horizontal trajectory lying within a plane which is common to all the type hammers and which will hereinafter be referred to as the firing plane.

As can be seen by reference to FIGS. 2, 4 and 5, the right hand end of the type drum drive shaft 11 is rotatably mounted in bearings 31 which are of the self-aligning type to allow a limited amount of shaft deflection relative thereto. The bearings, along with a cooperating thrust absorbing spring 34, are fitted into a suitably recessed circular housing formed in a shaft support cap or block 32 which serves as a journal box for the shaft. The central main portion of block 32, which is formed with laterally projecting flanges 33 lies within a substantially U-shaped opening or seat 35 formed in a main support casting 36 of the machine. The opening 35 in said frame casting is wider than the central main portion of said block and constitutes an oversized seat for the block 32 enabling it to be placed in various settings within said seat as determined by set screws 37, 38, respectively, for reasons which will be hereinafter more fully explained. The set screw 37, which is threaded into the casting 36 at the bottom of the U-shaped opening or seat, supports the bottom edge of the block 32 and is effective for adjusting the block in a substantially vertical plane perpendicular to the type hammer firing plane heretofore defined. The set screw 38 is threaded into the frame casting at the side wall of the seat 35 so as to bear against the side of the block thereby being effective for adjusting the position of block 32 within said seat in a substantially horizontal plane parallel to the type hammer firing plane aforesaid.

The block 32 is secured in its adjusted position by means of bolts 39 fitted in oversized bores 40 formed in the side flanges 33 which overlap the side walls of the seat, said bolts being threaded into the frame casting to firmly retain the plate within the seat.

As shown in FIGS. 3, 4 and 5, the left hand end of the type drum drive shaft 11 is supported in a manner similar to that just described for the right hand end by means which includes self-aligning bearings 41 fitted into a circular recess in an open support block 42 formed with lateral flanges 43 and disposed within an oversized opening or seat 45 of U-shaped configuration formed in a main frame casting 46. A set screw 47 serves to adjust the position of block 42 in a plane perpendicular to the type hammer firing plane, and a set screw 48 adjusts the position of the block 42 in a plane parallel to the type hammer firing plane. Clamping bolts 49, engaging in oversized bores 50 formed in the outer overlapping flanges 43 of the block 42 and threaded into the frame casting 46, serve to securely retain the block in its adjusted position within the seat 45 formed in the frame casting 46.

To adapt the type drum for use in parallel readout systems, the set screws 37, 38 and 47, 48 are set so as to orient the axis of the carrier i.e. shaft 11, parallel to the type hammer firing line. The type drum may be adapted for use in serial read-out systems in either of two ways. One way of adapting the drum for serial read-out is by adjusting the set screws 37, 47 so as to elevate one end of the drum and lower the other end of the drum which has the effect of skewing the axis of the drum relative to the type hammer firing line within a plane perpendicular to the firing plane. Another way of adapting the type drum for a serial read-out system is by adjustment of the set screws 38, 48 so as to dispose one end of the drum closer to the firing line and the other end of the drum more removed from the firing line thereby, in effect, skewing the axis of the drum relative to the firing line within a plane parallel to the firing plane.

As indicated in FIGS. 4 and 5, character type faces 51 are disposed over the surface of the type drum in a pattern of intersecting rows and columns, each row containing a type face for the same character and extending longitudinally of the drum along a line parallel to the drum axis. Each column of type faces includes one for each of the several characters which may be printed by the mechanism and extends circumferentially around the drum along a line perpendicular to the drum axis. The arrangement shown is the checkerboard design wherein each row contains a type face for every other column with the type faces for each separate character being contained in two adjacent rows relatively offset one column from the other. It will be understood, however, that this checkerboard array of type faces is shown by way of an example and is not essential for carrying out the inventive concept herein disclosed. It will also be understood that a separate type hammer 12 is provided for each column of type faces 51 on the drum 10.

FIGS. 4 and 5 illustrate the orientation of the drum 10 relative to the type hammers 12 when the drum mounting means heretofore described are adjusted so as to adapt the drum for use with parallel read-out control of the type hammers 12. In this adjustment, the drum axis is disposed so as to be parallel with the type hammer firing line. When thus adjusted, the type drum as it rotates, as best seen in FIG. 4, operates to carry all type faces within a row simultaneously into registration, at print position, with the print hammers 12. When the axis of the type drum is disposed parallel to the firing line, the surface of the drum, as can be seen in the plan view of FIG. 5, along its entire length is equidistant from the several type hammers 12 so that the distance required for a type hammer to move from the firing line into printing impact, i.e. the length of the firing stroke, is the same for all type hammers. Thus, it will be apparent that, when the type drum axis is oriented parallel to the firing line, the simultaneous firing at uniform velocity of selected type hammers in accordance with parallel read-out techniques will drive the selected type hammers into printing impact at the same instant since they all travel the same distance from the firing line. It will of course be understood that the firing of the selected type hammers is timed to make allowance for the travel time of the type hammers into printing impact so as to cause the selected hammers to simultaneously impact their respective type faces at the instant the row of type faces is carried into printing position.

FIG. 6 is a front view similar to FIG. 4, but illustrating an adjusted orientation of the type drum, in accordance with one form of adjustment, for adapting the type drum for use in systems employing serial read-out control of the type hammers 12. In the position shown in FIG. 6, the set screws 47, 37 have been adjusted from the setting shown in FIG. 4 so as to lower the left hand end of the type drum and raise the right hand end of the type drum relative to the type hammers thereby in effect skewing the axis of the type drum relative to the type hammer firing line within a plane parallel to the firing plane of the type hammers 12. When in the position as shown in FIG. 6, it will be apparent that, as the type drum rotates, the type faces 51 of a row will be carried into registration, at print position, one after the other, serially, starting with the left hand columns. The degree of skewing depends upon the velocity of the type drum and the read-out rate and is calculated so as to synchronize the serial registration of type faces within a row at print position with the serial read-out rate controlling the type hammers so that the firing of any type hammer along the row will cause it to impact the type face at the instant the

type face is registered at print position. It will of course be understood that the sequential order in which the several type hammers are controlled during the serial read-out proceeds from left to right across the row of type hammers so as to thereby correspond to the order in which the type faces of a row are carried into printing position.

The plan view of FIG. 7 illustrates another manner of orienting the type drum relative to the type hammers 12 for adapting the type drum to serial read-out systems. In this case the set screws 38, 48 are adjusted so as to deflect or skew the axis of the type drum within a plane parallel to the firing plane of the type hammers. This has the effect, as shown in FIG. 7, of disposing the right hand end of the type drum closer to the row of type hammers and the left hand of the drum farther away from the row of type hammers. This adjustment results in varying the length of the firing stroke for the several type hammers in the row with the firing stroke for the hammers on the left hand side being increased in length and gradually diminishing in length in left to right order along the row of type hammers. It will of course be evident that if the several type hammers are fired with uniform velocity, which is the case, those which are required to travel the greater distance from the firing line into printing impact, i.e. have the longer firing stroke, will take a correspondingly longer time interval from the moment of firing until they reach printing impact. This time differential between the firing stroke time of the several type hammers compensates for the time lag in the read-out rate so that as a row of type faces is carried simultaneously into print position all of the type hammers which are sequentially fired to print the corresponding character will impact the respective type faces of the row simultaneously. The degree of skew of the carrier axis is calculated so to to provide a time differential between the firing stroke time of adjacent type hammers which is equal to the time lag between successive columnar control intervals in the read-out cycle.

From the foregoing it will be apparent that the invention provides means which by simple adjustment procedures enables a type carrier to be adapted for both parallel and serial read-out systems. While the invention has been shown and described in what is considered to be a preferred embodiment, it will of course be understood that changes in form could be made without departing from the spirit of the invention, and it is therefore intended that the invention be not limited to the exact form herein shown and described nor to anything less than the whole of the invention as hereinabove set forth and as hereinafter claimed.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an impact form of high speed printing mechanism including a row of type hammer means arranged along a firing line, and actuator means for firing said hammer means along a common firing plane into printing impact, a continuously rotating drum-like carrier formed with a plurality of type faces each adapted to register with said hammer means at printing position within the firing plane of said hammer means at a predetermined instant during the rotation of said carrier, said type faces being arranged in perpendicularly arrayed rows and columns with each row extending along a line parallel to the carrier axis, and adjustable mounting means for supporting said carrier in operative relation to said hammer means, said mounting means in one adjusted setting supporting said carrier with its axis parallel to said firing line whereby each row of type faces is registered at print position for simultaneous firing of said hammer means, and in another adjusted setting supporting the carrier with its axis skewed relative to said firing line whereby each row of type faces is registered at print position for sequential firing of said hammer means.

2. The invention according to claim 1 wherein said another setting of said adjustable means supports said carrier with its axis skewed within a plane perpendicular to the firing plane of said hammer means, whereby the type faces within a row are sequentially carried into print position.

3. The invention according to claim 1 wherein said another setting of said adjustable means supports said carrier with its axis skewed within a plane parallel to the firing plane of said hammer means, whereby the type faces within a row are simultaneously carried into print position at different respective distances from said firing line.

4. The invention according to claim 1 including a frame for supporting said hammer means and said carrier, and wherein said carrier is mounted at each end in bearings carried by bearing support members, said carrier frame being formed with oversized seats for said support members enabling the support members to be selectably oriented within said seats to effect the skewing of said carrier axis relative to said firing line.

5. The invention according to claim 4 including settable members threaded into said seats for adjusting the position of said support members, and clamping means for securing said support members in the adjusted position.

6. The invention according to claim 5 wherein separate threaded members are provided for each said seat including one for adjusting the orientation of said carrier axis in a plane perpendicular to said firing plane and one for adjusting the orientation of said carrier axis in a plane parallel to said firing plane.

7. In an impact form of high speed printing mechanism including a row of type hammers arranged along a firing line, and actuators for firing said hammers along a common firing plane into printing impact, a continuously rotating drum-like carrier formed with a plurality of type faces each adapted to register with said hammers at print positions within the firing plane of said hammers at a predetermined instant during the rotation of said carrier, said type faces being arranged in perpendicularly arrayed rows and columns with each row extending along a line parallel to the carrier axis, a frame for supporting said carrier in operative position relative to said hammers wherein the type faces of each column are carried successively into print position in register with an associated type hammer, and a bearing member at each end of said carrier for rotatably mounting said carrier, said bearing members being seated in said frame and set in positions which support the axis of said carrier in skewed relation to said firing line, whereby each row of type faces is registered in print position for sequential firing of said type hammers.

8. The invention according to claim 7 wherein the axis of said carrier is skewed along a direction lying in a plane perpendicular to said firing plane, whereby the type faces of a row are carried sequentially into print position.

9. The invention according to claim 7 wherein the axis of said carrier is skewed in a direction lying in a plane parallel to the said firing plane, whereby the type faces of a row when carried into printing position are disposed different distances from said firing line.

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