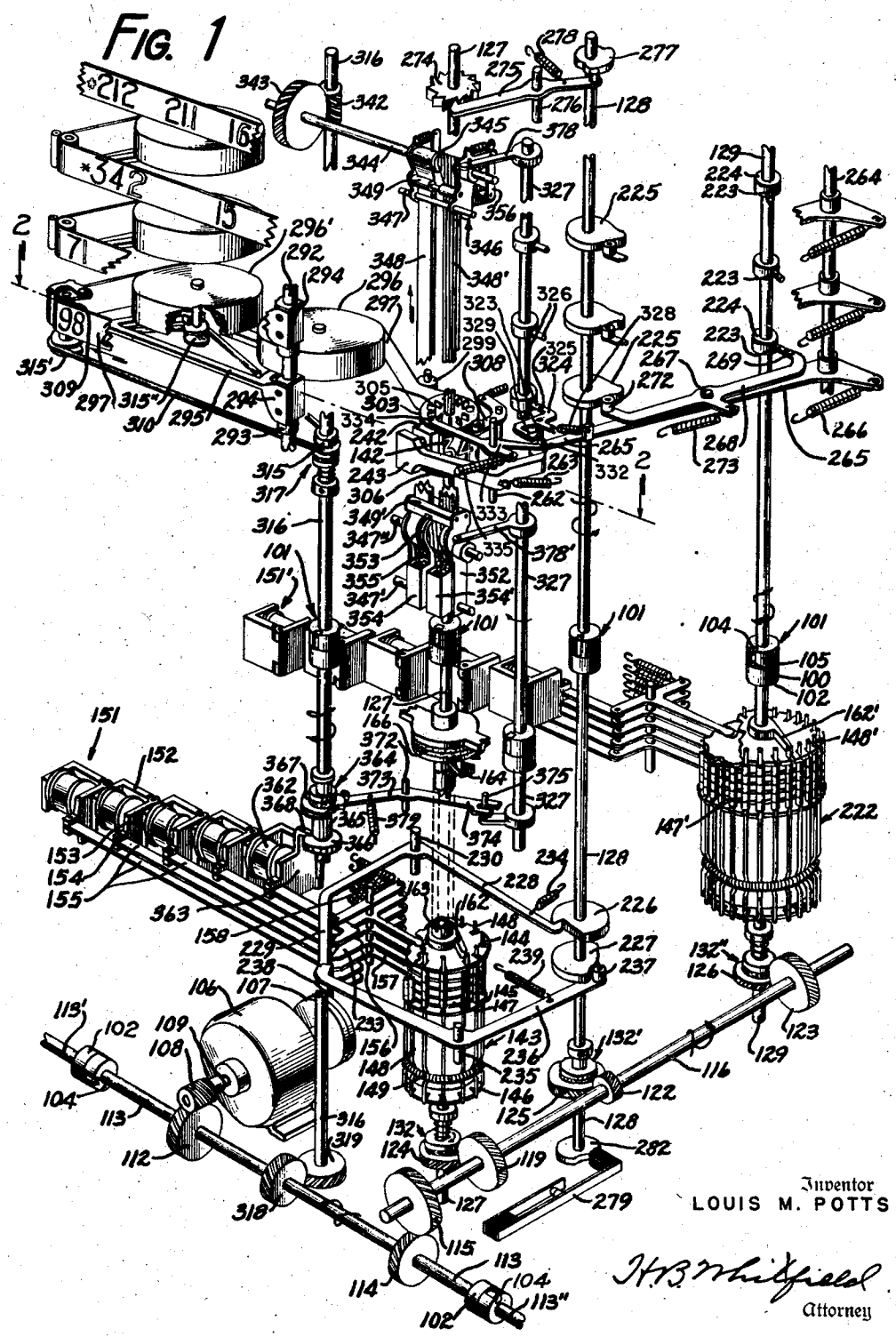
June 2, 1942. L. M. POTTS 2,284,681

RECORDING AND EXHIBITING MECHANISM

Filed May 15, 1939 8 Sheets-Sheet 1

FIG. 1



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RECORDING AND EXHIBITING MECHANISM

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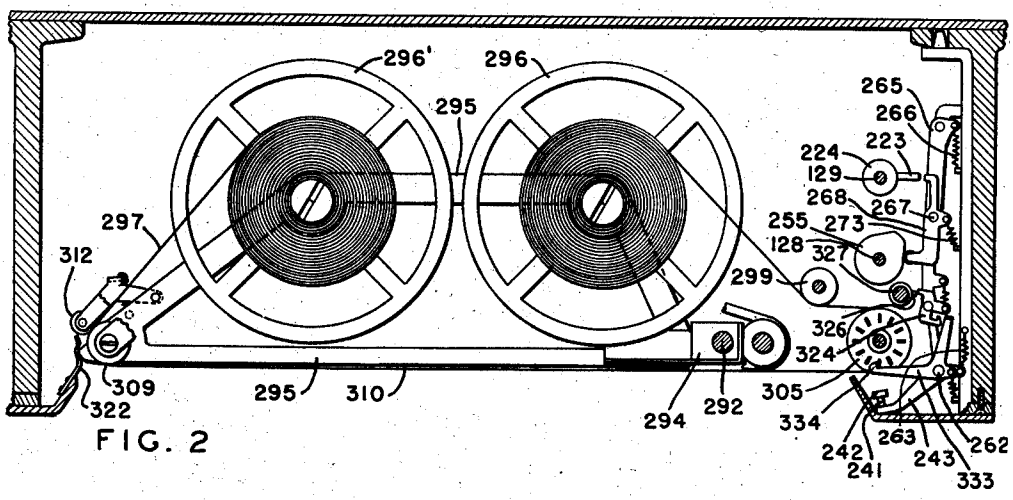


FIG. 2

FIG. 3

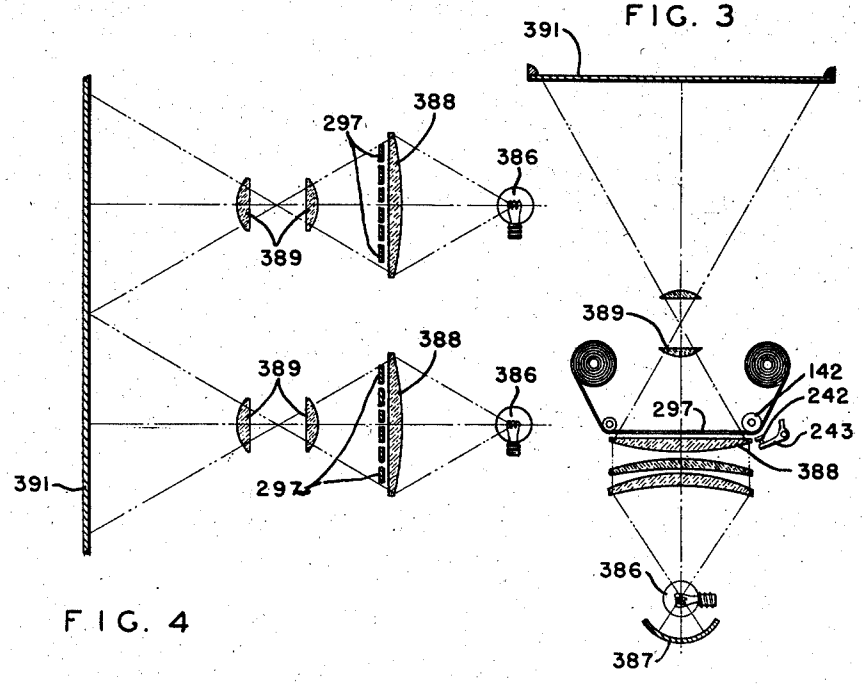


FIG. 4

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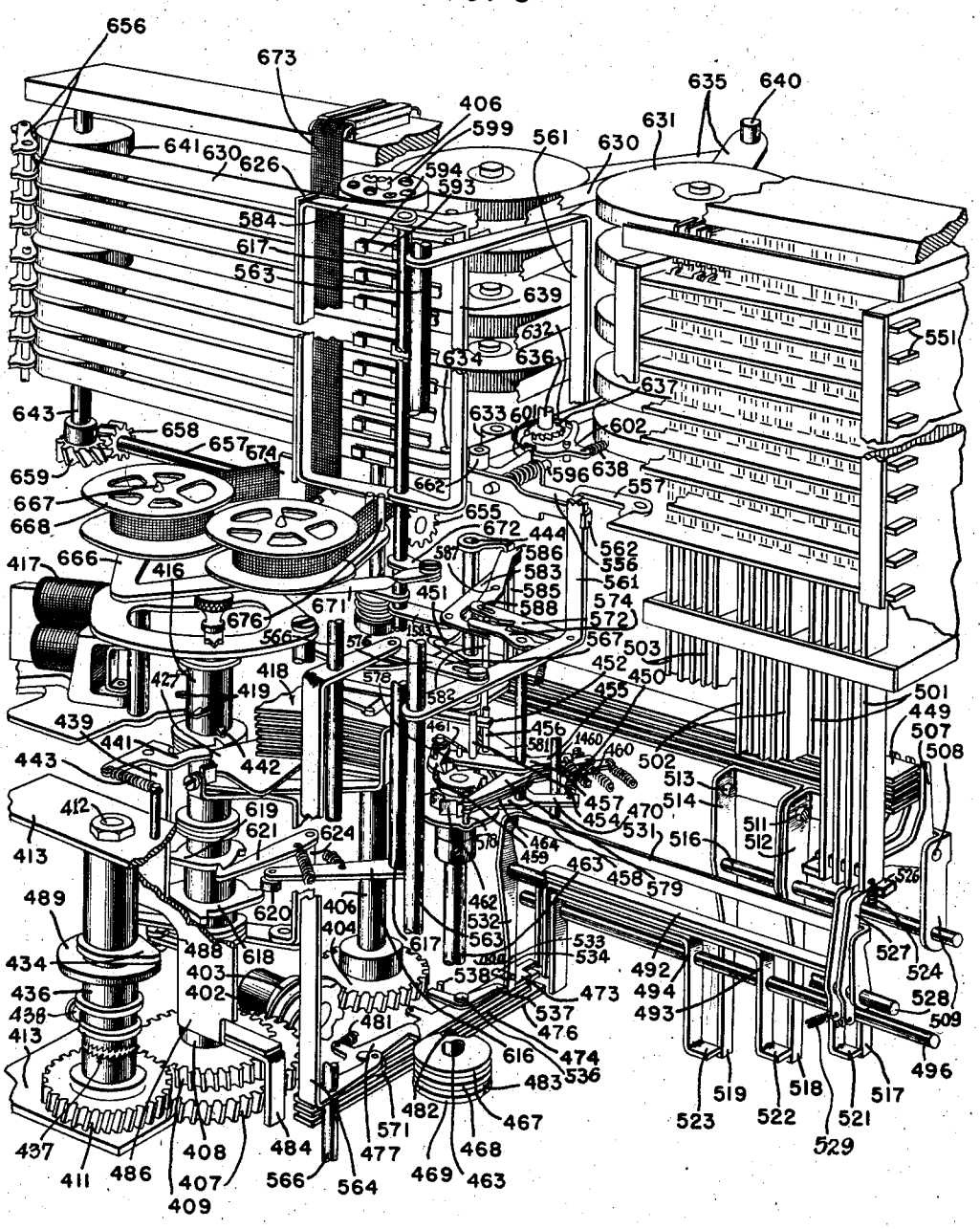
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June 2, 1942. L. M. POTTS 2,284,681

RECORDING AND EXHIBITING MECHANISM

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FIG. 5



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RECORDING AND EXHIBITING MECHANISM

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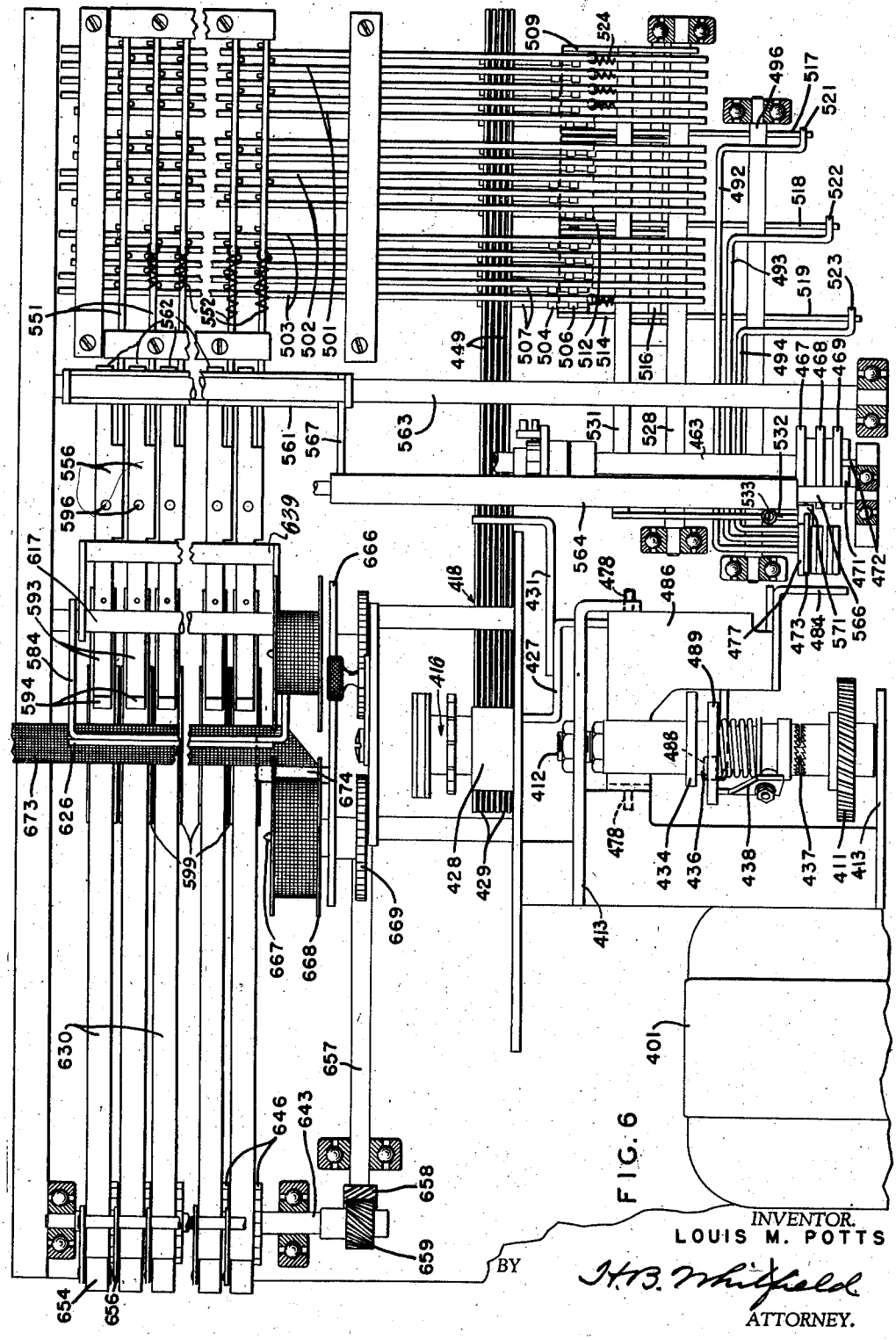


FIG. 6

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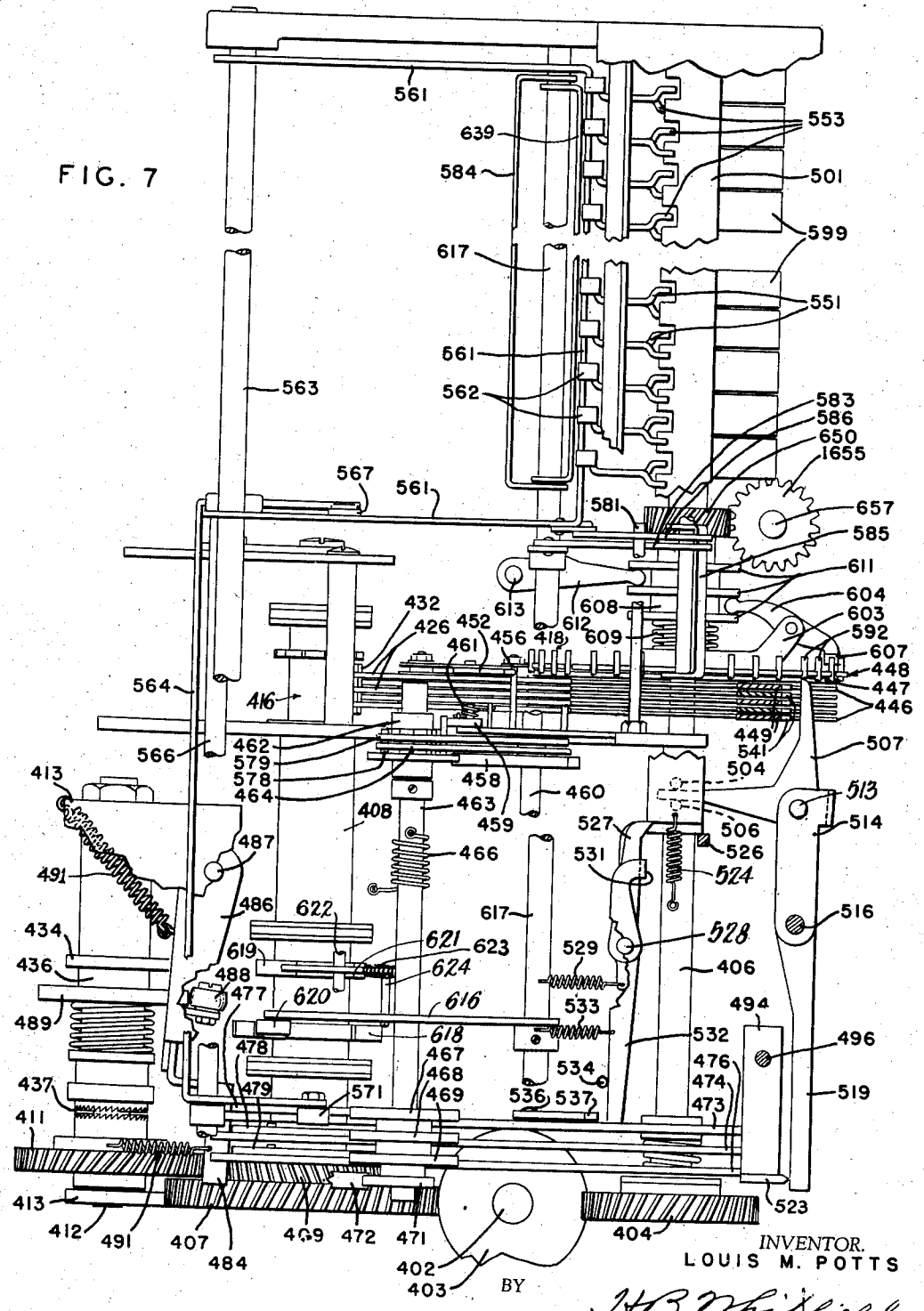
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June 2, 1942. L. M. POTTS 2,284,681

RECORDING AND EXHIBITING MECHANISM

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FIG. 7



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June 2, 1942. L. M. POTTS 2,284,681

RECORDING AND EXHIBITING MECHANISM

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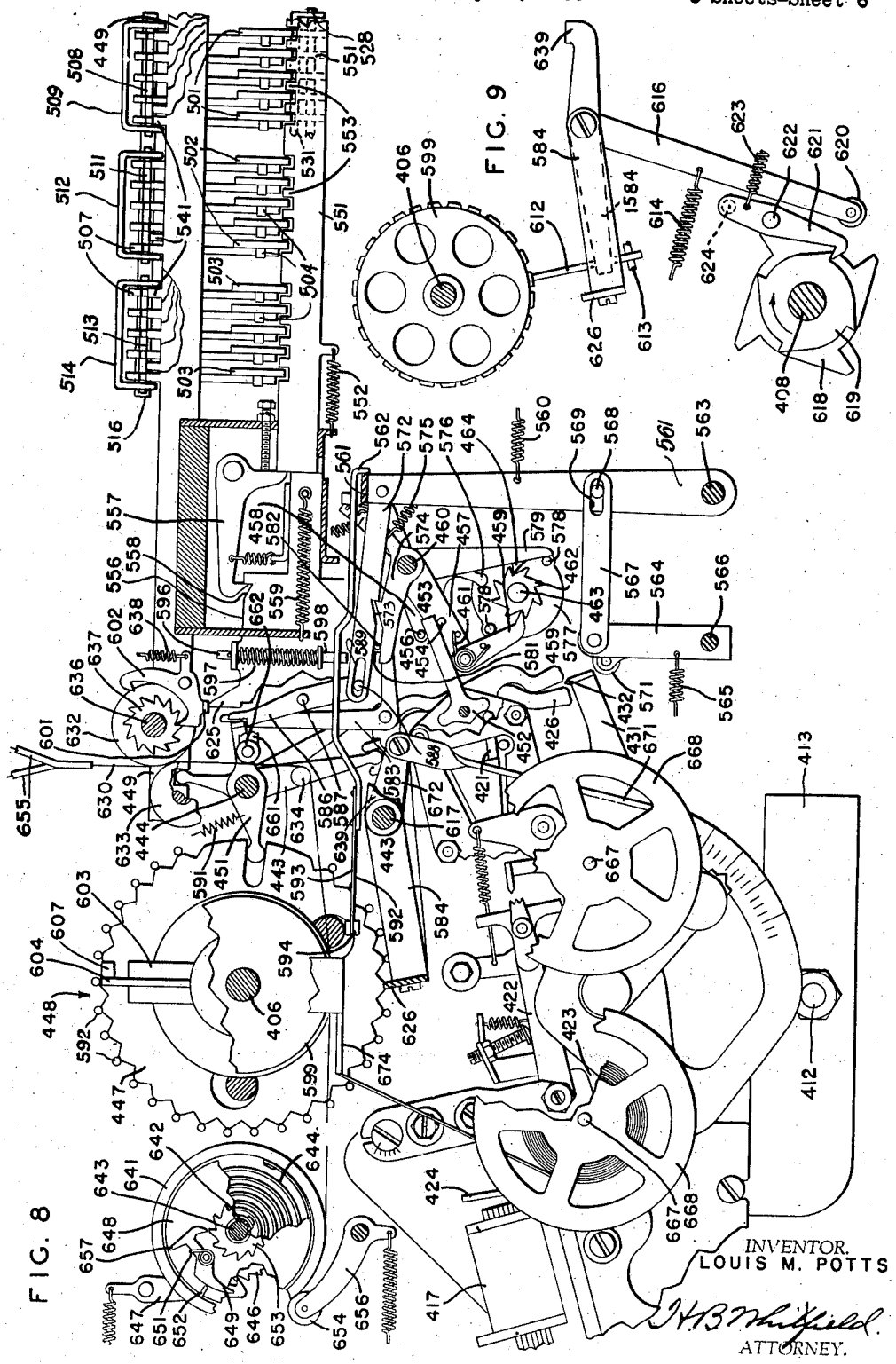


FIG. 8

FIG. 9

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June 2, 1942. L. M. POTTS 2,284,681

RECORDING AND EXHIBITING MECHANISM

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FIG. 11

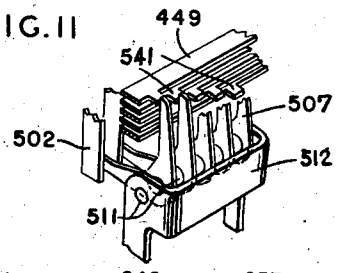


FIG. 10

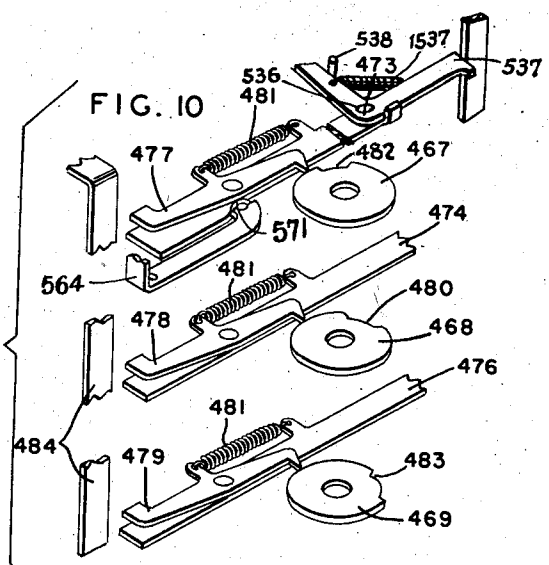
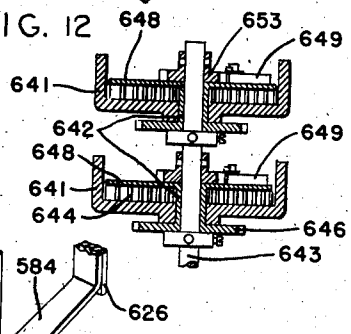


FIG. 12



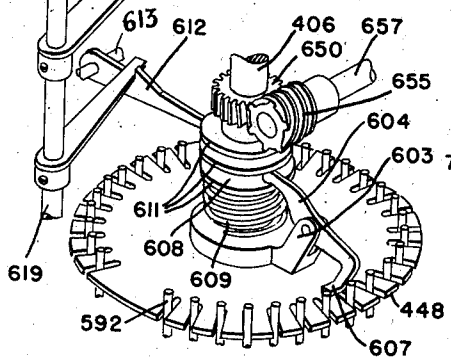


FIG. 14

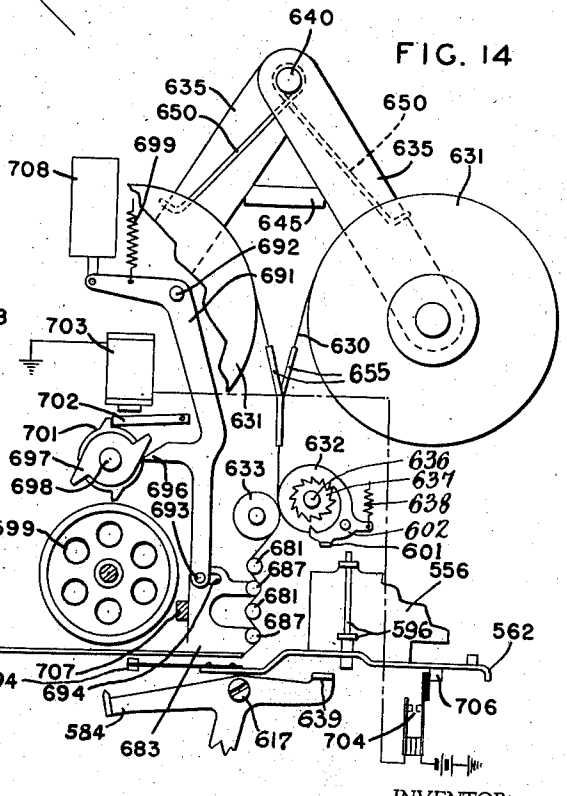


FIG. 13

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June 2, 1942. L. M. POTTS 2,284,681

RECORDING AND EXHIBITING MECHANISM

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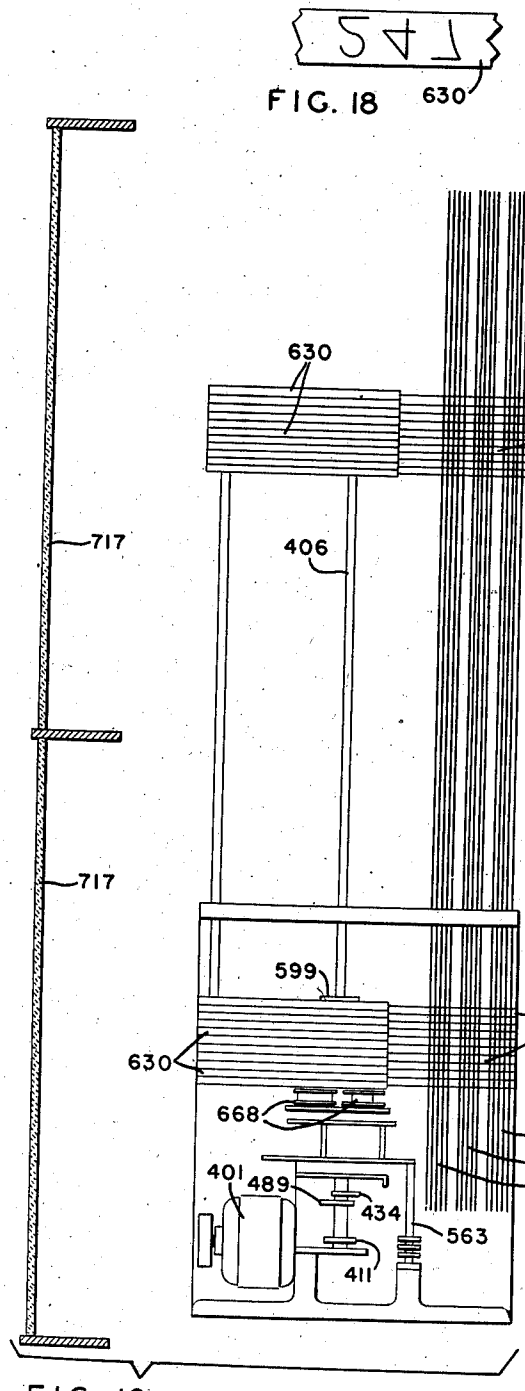


FIG. 16

FIG. 18

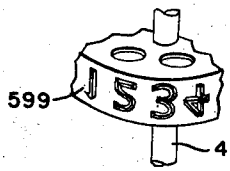


FIG. 17

FIG. 15

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Patented June 2, 1942 2,284,681

UNITED STATES PATENT OFFICE

2,284,681

RECORDING AND EXHIBITING MECHANISM

Louis M. Potts, Evanston, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Application May 15, 1939, Serial No. 273,672

6 Claims. (Cl. 88—24)

This invention relates to telegraphic printing and displaying apparatus and particularly to the recording of stock quotations and the projection of images of the quotations upon a viewing screen.

This application is a continuation in part of application Serial No. 525,189, filed March 25, 1931, renewed May 3, 1939.

An object of the invention is to record on a plurality of tapes in a printing telegraph apparatus all of the quotations pertaining to a selected group of stocks, each of the tapes being assigned to receive all of the quotations with reference to one of the stocks of the group, and to project on a screen quotations from corresponding portions of a group of tapes including the last quotation recorded on each of the tapes in the group.

Another object of the invention is to advance each tape across the field of the projecting apparatus only as an incident to the printing of quotations upon that tape so that the viewing screen shall at all times contain images of as many quotations on each tape in the field of its projecting apparatus as the dimensions of that field will accommodate, and those quotations shall be the latest with reference to the stock represented by that tape.

The invention features printing telegraph apparatus having a plurality of tapes movable in parallel paths and a plurality of type wheels carried by a single shaft and corresponding in number to the number of tapes for cooperation therewith individually, and in which the signals representing the stock designations preceding the price quotations condition individual printing mechanisms in preparation for the printing of the quotation upon the tape assigned to receive quotations from that stock. Quotations for stocks not included in the group to be recorded are discarded in the selector mechanism and have no effect upon any of the printing mechanisms.

The invention also features the division of the horizontally movable tapes in a printer into separated groups, each group having its own source of illumination and optical system, and having images projected therefrom upon its own viewing screen or upon an assigned portion of a large screen independently of the projection of images from other groups of tapes, the several groups of tapes being served by individual type wheels carried by a single type wheel shaft.

According to one embodiment of the invention, a plurality of type wheels is carried on a common rotatable shaft adapted to be stopped in various printing positions under the control of a code disc selecting device. Selector magnets individual to each of the discs in the code disc selector are provided for setting the discs to control the arrestment of the type wheels. A second similar selecting device also having its selecting discs individually controlled by selector magnets controls the arrestment of a second shaft carrying interference fingers, identified with the horizontally movable tapes, the function of the fingers being to co-act with the printing mechanism of the selected tape to print the selected character as determined by the first-mentioned selector mechanism on the selected tape. A third power operated shaft operates the printing mechanism for which an interference finger has been selected and an auxiliary shaft controls the tape feeding mechanism, the advancement of inking ribbon, and other functional operations.

In an alternative embodiment of the invention the type wheels are carried by a single continuously rotatable shaft which extends through and is controlled by a code disc selector mechanism. The code disc selector mechanism is controlled by a single magnet printing telegraph apparatus selector which also controls the setting of code bars. The code bars control the setting of storage code bars arranged in sets for storing selective conditions corresponding to the individual letters of the stock designation. The storage bars control the selection of printing interponents, there being one for each of the tapes, and when the sets of storage bars are positioned for a stock designation outside the group to which the printer is adjusted to respond, no printing interponent is selected.

The code disc selector device does not arrest the type wheel but merely trips off a printing mechanism which strikes the selected tape against the rotating type wheel, the selected character being printed while the type wheel is rotating at normal velocity. During the reception and printing of the stock price, the figure shift mechanism disables the storage code bar setting mechanism so that the signals for the price selection shall not interfere with the settings of those bars which have resulted in the selection of a printing interponent.

Tape feeding and ink ribbon feeding operations are performed as an incident to the printing operation. This embodiment of the invention features an arrangement for advancing blank tape past the printing position a sufficient distance to bring the last printed quotation into position for observation or projection, and for

drawing back toward the printing position the tape which had previously been permitted to advance from that position. With this arrangement a quotation is moved out from the printing position far enough to bring it into view or into the field of the projecting apparatus, and when the next quotation is to be printed upon the same tape the tape is retracted so as to print the new quotation closely adjacent to the one previously printed in order that as many quotations as possible may be contained in the length of tape that is within the field of observation or of the projecting apparatus.

Two quotation projecting systems are disclosed. In one of these the optical system consists entirely of lenses, the light beam extending in a straight line from lamp to screen with the tapes being interposed between these two elements. Another projecting system which features compactness as one of its primary considerations involves the use of a plane reflector for turning the beam of light through 90 degrees whereby the optical system and the printer may be contained in a housing requiring less space from front to back than the first described projecting system.

A complete understanding of the invention may be obtained from the following detailed description, reference being had to the accompanying drawings wherein;

Fig. 1 is a diagrammatic perspective view of one embodiment of a multiple tape printer;

Fig. 2 is a plan view of the printer shown in Fig. 1;

Fig. 3 is a view showing diagrammatically a projecting system for use with the printer shown in Figs. 1 and 2;

Fig. 4 is a diagrammatic view representing a vertical section through the projecting system shown in Fig. 3;

Fig. 5 is a schematic perspective view of another embodiment of a multiple tape printer;

Fig. 6 is a front elevational view of the multiple tape printer shown in Fig. 5;

Fig. 7 is an elevational view taken at the right-hand end of Fig. 6;

Fig. 8 is a horizontal sectional view taken approximately on the line 8—8 of Fig. 6;

Fig. 9 is a detailed view showing the printing bail operating and restoring mechanism;

Fig. 10 is an exploded perspective view of the storage code bar bail selecting and operating mechanism;

Fig. 11 is a detailed perspective view of the letter code transferring mechanism;

Fig. 12 is a vertical sectional view of the tape puller mechanism;

Fig. 13 is a detailed perspective view of the print bail releasing mechanism;

Fig. 14 is a plan view showing schematically a modified tape advancing and retracting mechanism;

Fig. 15 is a horizontal sectional view, partly schematic, showing compactly arranged projecting systems;

Fig. 16 is a vertical sectional view taken approximately on the line 16—16 of Fig. 15 showing the division of tapes of one printer into groups and the provision of a viewing screen individual to each group;

Fig. 17 is a fragmentary view of a type wheel having the types so arranged thereon that upright, normal images of figures shall be observable on the viewing screen; and

Fig. 18 is a view of a fragment of a tape upon which characters have been printed by means of the type wheel shown in Fig. 17, the tape being viewed from the front.

Referring now to the drawings and particularly to Fig. 1, the reference numeral 101 designates shaft couplings by means of which the upper portions of the type wheel, tape selecting, printing, and other operating shafts may be disconnected from their lower driving portions, the purpose of the couplings being to permit the separation of the superstructure of the printer from its base. The couplings 101 comprise co-operating cylindrical elements 102 and 104 secured to the lower and upper shaft portions respectively, the coupling member 102 being provided with a pin 100 and the coupling member 104 being provided with a slot 105 in which pin 100 is disposed. The main driving motor 106, speed governed by governor 107, has a pinion 108 on the motor shaft 109. Pinion 108 meshes with gear 112 on cross shaft 113, carrying at its extremities coupling halves 102 and 104, the co-operating halves of the couplings, also numbered 102 and 104, being carried by shafts 113' and 113'' which may extend to adjacent printers, similar to that shown in Fig. 1, for driving all of them from the motor 106.

Also keyed to the shaft 113 is a gear 114 in mesh with a gear 115 secured to the intermediate shaft 116. Three gears 119, 122, and 123 are secured to shaft 116 and these gears are in mesh with gears 124, 125 and 126 respectively, carried by type wheel shaft 127, printing shaft 128, and tape selection shaft 129 respectively. The gears 124, 125, and 126 are arranged to turn independently of arrestment of their associated shafts, but the shafts when released for rotation may be driven by the gears through the medium of individual friction clutches 132, 132' and 132''. It will be understood that all of the shafts thus far referred to are journaled in bearings (not shown) upon the framework of the printer. As previously stated, couplings such as 101 enable the separation of the upper portions of the shafts from the lower portions, but the several portions of one shaft will be considered, for convenience in description, as one shaft which will be identified throughout its length by a single reference character.

Fixed to the upper portion of the type wheel shaft 127 at equally spaced intervals is a plurality of type wheels 142, there being a type wheel individual to each tape. The type wheels are very light in construction, comprising a hub by means of which a light web supports the drum upon which the characters are engraved. In the preferred embodiment the characters comprise numerals from 0 to 9, the asterisk and the blank portion. The characters of the same kind are in vertical alignment upon all type wheels. Upon bringing a selected character to the printing position the same character on all type wheels is selectively positioned.

Stationarily supported upon a frame portion (not shown) of the machine is a code disc selector mechanism 143 which is coaxial with type wheel shaft 127 and through which the shaft extends and rotates. The code disc selector 143 may be substantially identical with that shown in Patent 1,821,110, granted September 1, 1931, to S. Morton et al. This device comprises a central spool member (not shown) to which are fastened the upper and lower guide discs 144 and 145 respectively, and the fulcrum disc 146. Ro-

tatable upon the central spool through a small angular distance to one or the other of two selective positions are code discs 147. Spacers of appropriate form serve to maintain a definite axial spacing of said discs but allow free rotary movement thereof. Discs 147 are formed with V notches on their periphery and are limited in their angular movement by elongated slots therein within which there are contained the bolts serving to fasten the selector assemblies together. In operative relation with the code discs 147 are stop pins 148, there being a pin for each character position of the type wheel and one for the blank position. These pins are spaced equally about the periphery of the selector and are guided in radial slots in the guide discs 144 and 145. A notch in the lower end of each pin engages the edge of the disc 146 and permits the pin to pivot freely thereupon. A coil spring 149 encircles the pins 148 and is retained in position by a bowed portion in each pin wherein the spring rests. The spring 149 serves to move the selected pin centripetally, as will be described later, and also serves to prevent the pins from accidentally becoming displaced. The pins extend above the top face of the disc 144 for a short distance and between the discs 144 and 145 each pin is provided with four freely rotatable rollers to reduce the spring induced friction of the pins against the code discs 147 as the latter are shifted into selective combinations.

Selective setting of the discs 147 is brought about in response to received code combinations of impulse conditions transmitted from a local or remote source. For this purpose there is provided a group of four selecting electromagnets 151 adapted to be energized in selective combinations by current through a common switch 279, the relation of which to the complete communication circuit is shown in Fig. 34 of the application of which the present application has been identified as a continuation in part. The magnets 151 are supported upon the frame of the printer in any convenient manner by their yokes 152. According to the preferred embodiment of the invention the type wheels 142 have not more than twelve selective stop positions, for which four code discs 147 afford adequate selective combinations. Thus, only four selecting magnets are required to control the four code discs and the four left-hand magnets have been assigned to this function, the fifth or extreme right-hand magnet performing a special function to be described later.

Each yoke is provided with a pivoted armature 153 to which is pivotally connected at 154 the pull link 155. Carried upon a common pivot 156 affixed to the framework are the four T-levers 157, the leftwardly extending arm of each of which is pivotally articulated to its individual pull link 155. The intermediate arm of each T-lever 157 terminates in a rounded head disposed in a slot in the periphery of its associated code disc 147. The rightwardly extending arm of each key lever 157 is engaged by one end of a tension spring 158, the other end of which is affixed to the framework of the printer. Longitudinal or endwise movement of links 155 leftwardly, as viewed in Fig. 1, imparts a clockwise rotation to the levers 157 and thereby shift the code disc 147 counterclockwise against the tension of springs 158, this position of the discs being the selective marking position corresponding to the energization of the magnets 151. Upon de-energization of the magnets 151, the retractile springs 158 urge the discs 147 clockwise toward their alternate or selective spacing positions. It will be seen that the action of each magnet 151 upon its individual disc 147 is independent of the others and selective operation of the former results in selective settings of the latter. The selector magnets 151 need remain energized only for an interval of sufficient length to enable the locking in the selected settings of the disc 147, which will preferably remain locked until the resultant selective operation has been performed. The manner in which the locking of the code discs 147 may be accomplished will be described hereinafter.

The notches in the discs 147 are arranged so that selective permutational combinations of the rotative positions of the discs will establish single complete alignments of notches in various angular positions as fully disclosed in the previously identified patent to Morton et al. Upon the occurrence of an alignment of notches, a pin 148 will be forced by the spring 149 into the alignment of notches, thus moving the pin closer to the center of the code disc selector mechanism than is normal. When the discs are reset to establish a different alignment of notches, the previously selected pin is cammed out by the V notches and the new pin drops into the new selective alignment. The type wheel shaft 127 has secured thereto a stop arm 162 positioned below the upper ends of the pins 148. The length of the arm is such that it will pass unselected pins but will be stopped by a selected pin due to placement of the pin closer to the center of the code disc mechanism. Accordingly, the selection of various pins causes the arm 162 to stop in corresponding selected positions, depending upon the code received, each code being identified with a particular type wheel angular position.

As previously set forth, a power driven shaft which selects the tapes upon which printing is to be effected is identified by the reference numeral 129. Shaft 129 is located behind the shaft 127 and extends through a stationarily mounted code disc selector mechanism 222 which is similar to the code disc selector 143 previously described except that it has more stop pins 148' since a stop pin is required for each of the tapes and in the preferred embodiment of the invention thirty tapes are provided.

Whereas four code discs were sufficient to select individually the twelve stop pins associated with type wheel selector mechanism 143, five code discs are required in the tape selecting code disc mechanism 222 whereby a maximum of thirty-two selective possibilities is available. Accordingly, five selecting magnets are required and these magnets, identified by the reference numeral 151' are operatively coupled to the code discs 147' in the same manner as are the character selecting magnets 151 connected to the code discs 147. The stop arm 162' is secured to shaft 129 within the circle defined by the upper ends of stop pins 148', whereby it may be arrested, and with it shaft 129, by any one of the pins 148' which may be selected.

Fixed upon the upper part of shaft 129 are thirty interference fingers 223, of which but two are shown in Fig. 1 and each of which is carried by a collar 224 provided with a set screw for securing the collar to shaft 129 in the desired angular position. Collars 224 are clamped to shaft 129 so as to provide a spiral arrangement of the fingers 223, the spacing of which along shaft 129

corresponds to the spacing of type wheels 142 on shaft 127 and the angular positions of which correspond to the angular disposition of the pins 148', there being a finger 223 individual to each of the pins 148'. The fingers 223 need not necessarily be arranged spirally, the only requisite being that no two fingers 223 shall have the same angular position with respect to shaft 129. Thus, for each selective position of the stop arm 162' a finger 223 corresponding to one of the tapes is brought into a predetermined angular position with respect to code disc selector 222, the effective stop positions of all of the interference fingers 223 being the same although the stop position of shaft 129 varies for each. As a result thereof only one such finger 223 is permitted to become operatively effective as the printing mechanism is actuated, as will be later set forth, the selection of the particular effective finger being determined by the selection set upon on the code discs 147'.

Disposed between the shafts 127 and 129 is the printing shaft 128 normally held from rotation but adapted to be rotated by means of the friction clutch 132' and gears 122 and 125. In substantially horizontal alignment with and individual to each finger 223 is a printing cam 225, all of the thirty cams 225 being affixed in the same angular position upon the shaft 128.

Disposed toward the lower end of shaft 128 and fixed thereto is a stop disc 226 and selector locking cam 227. Pivoted upon the frame of the printer at 230, and in operative alignment with a notch in the periphery of disc 226, is a stop latch 228, the right-hand arm of which is hook-shaped for latching, and the left-hand arm of which is bent downwardly in an extension 229 adapted to span all of the leftwardly extending pointed projections 233 of the selector magnet links 155. The downwardly extending arm 229 of lever 228 is disposed in the path of the left-hand edges of all of the projections 233, so that upon leftward movement of any of the links 155, due to energization of its magnet 151, lever 228 will be rocked in clockwise direction and its latching end will be withdrawn from engagement with stop disc 226 whereby shaft 128 will be permitted to rotate in counterclockwise direction. Upon the return of all of the operated links 155 to normal position, spring 234 which biases lever 228 in counterclockwise direction will cause the lever to return to engagement with stop disc 226 and when the disc has completed one revolution, it will be brought to rest and with it shaft 128.

Pivoted upon the frame of the printer at 235 is a locking lever 236. Lever 236 is biased in counterclockwise direction by tension spring 239 and carries at its right-hand end a follower roller 237 which is maintained in engagement with the contour of the locking cam 227 by the spring. At its left-hand end, lever 236 is provided with a downwardly extending arm 238 which has a knife edge adapted to engage on one side or the other, all of the projections 233 of selector magnet links 155. When links 155 are in normal or extreme right-hand position, the pointed ends of their extensions 233 are disposed to the right of the knife edged arm 238 carried by lever 236. Upon movement of one or more links 155 to extreme left-hand position, the pointed ends of their projections 233 are moved to the left of the knife edge. When shaft 128 is at rest, spring 239 holds the knife edged arm 238 of lever 236 out of the path of the pointed ends of links 155, so that they are free to be moved by the magnets 151, but when shaft 128 is released for rotation, cam 227 rocks lever 236 clockwise, thereby moving its knife edged arm 238 inwardly past the ends of projections 233 of links 155, thereby locking any of the links which have been operated to their left-hand positions and preventing the movement of any others of the links 155 to their left-hand position. This constitutes the locking mechanism previously mentioned, whereby a magnet 151 need remain energized only long enough for shaft 128 to be set in rotation and links 155 to be locked.

In operative relation with the type wheels 142 are individual platens 242, each of which is provided with a curved working face corresponding with the contour of the type wheel. The platens are yieldably mounted upon studs carried by the printing hammers 243 and are normally maintained at a predetermined distance from the printer hammers by compression springs 241 (see Fig. 2). The amount of freedom afforded platens 242 is only sufficient to permit the platens to align themselves against the type wheels to obtain clear printing. The springs assist this alignment and also absorb the excess printing forces, thereby minimizing the wear upon the type wheels. The platen may be made of somewhat elastic material, such as any of the well-known phenolic condensation resins, for example, or it may be faced, upon its working side, with a lamina of rubber. Both types of structure have been found satisfactory in use.

Each printing hammer 243 is in the form of a bell crank and is pivotally supported at 262 upon the framework of the printer. The left-hand arm supports the platen 242 and the right-hand arm is engaged by an operating lever 265. A tension spring 263, connected to print hammer 243, biases the hammer in counterclockwise direction, whereby platen 242 is normally retracted from the type wheel.

A vertically disposed fixed rod 264 has journaled thereon, by means of collars, the print hammer operating arms 265, there being an arm individual to each hammer. The arms 265 terminate with blunt extremities for engagement with the rightwardly extending arms of printing hammers 243. Each arm 265 is biased in clockwise direction, which is the restorational direction, by a tension spring 266. Each of the arms 265 carries intermediate its ends a pivot pin 267 upon which is pivoted an interference lever 268 which is U shaped, having one leg 269 adapted to engage the associated printing interference finger 223 when the latter has been brought into effective position, and having the other leg provided with a roller 272 engageable by its associated printing cam 225. A tension spring 273 connected to a projecting arm of U shaped interference lever 268 biases the lever in clockwise direction to maintain roller 272 in engagement with its cam 225, and also to hold leg 269 of U shaped lever 268 clear of interference finger 223, to permit shaft 129 to rotate.

In addition to the printing cams 225, shaft 128 carries at its upper end a type wheel corrector and locking cam 277. In horizontal alignment with cam 277, type wheel shaft 127 has secured thereto a toothed correcting wheel 274. A stud shaft 276 pivotally supports a lever 275, the right-hand end of which, as viewed in Fig. 1, is provided with a cam follower roller and the left-hand end of which is provided with a pawl hook. A spring 278 biases lever 275 in counterclockwise direction to maintain the cam roller in engagement

with cam 277 and to withdraw the pawl hook from the path of the teeth of correcting wheel 274.

The printing shaft 128 is provided at its lower end with a cam 282 which controls the opening and closing of a pair of contacts 279, which are included in one side of the circuits to all of the selector magnets 151 for timing the operation of those magnets.

As previously set forth, shaft 129 determines the tape upon which a quotation is to be printed, shaft 127 determines the character to be printed and shaft 128 operates the selected print hammer. In detail, the code pertaining individually to the tape to be printed is set up in the magnets 151' by control fully disclosed in the application of which this application is a continuation in part. This code is set up in the form of current through certain of the magnets of the set 151', leaving other magnets de-energized, and corresponding discs 147' in the selector 222 are operated, camming out all index pins 148' except the one corresponding to the combination of selector magnets 151' energized. The shaft 129 is thus released for rotation and rotates until the stop arm 162' engages the newly selected pin 148', the shaft 129 then stopping with the interference pin 223 corresponding to the selected stop pin in position to interfere with the printing lever 268 pertaining to the tape upon which the quotation is to be printed. The selected magnets 151' are maintained energized by external control throughout the period of printing upon the selected tape.

After the tape selection has been established in selector mechanism 222, the code combination for the first of the characters to be printed is set up in the left-hand four of the five magnets 151, the current for the magnets being supplied simultaneously, if more than one magnet is to be energized, through the contacts 279 which, in the rest position of shaft 128, are closed. The links 155, associated with the energized magnets, are shifted to the left, thus rocking printing shaft stop lever 228 in clockwise direction, which releases shaft 128 for rotation, the direction of rotation being counterclockwise. As the links 155 are moved to the left, the code discs in selector mechanism 142 are set according to the code combination representing the character to be printed, the previously selected stop pin 148 is cammed to unselected position and a new stop pin is selected. Shaft 127 is not permitted to rotate immediately, however, as corrector lever 275 is held in extreme clockwise position by engagement of its follower roller with the high portion of cam 277, whereby the pawl hook of lever 275 holds corrector wheel 274 and therefore shaft 127 momentarily.

Two operations controlled by shaft 128 occur almost immediately after the shaft begins to rotate. One of these operations is the clockwise rocking of locking lever 236 by cam 227 to lock those of the selector magnet links 155, which have been moved to the left, in their selected position. The other operation is the counterclockwise rocking of corrector lever 275 by its spring 278, due to rotation of the high portion of cam 277 out of engagement with the follower on lever 275. Thus, the pawl hook of corrector lever 275 is withdrawn from corrector wheel 274 which is released for rotation and shaft 127 with it. The type wheels 142 are thus released for rotation and they continue to rotate until arrested in the new selective position under the control of stop arm 162. Shortly after the locking of selector bars 155 and the release of shaft 127, contacts 279 are opened by cam 282 to de-energize all of the selector magnets 151, the bars 155 remaining locked.

It will be noted that the cams 225 do not operate their follower rollers 272 until near the end of a cycle of rotation of shaft 128. During this time, shaft 127, which rotates at sufficient velocity to reach the next selective stop position before the operation of printing cam followers 272, finds the selected stop position and is brought to rest. Shortly before the printing cam followers are operated, spring 278 restores correcting lever 275 to extreme clockwise position, this operation occurring after shaft 127 has come to rest in a selected position. The pawl hook of correcting lever 275 is thus brought into the recess ahead of the tooth of corrector wheel 274 which pertains to the character selected for printing. The locking bell crank 236 is now restored to normal position (extreme counterclockwise) to unlatch selector bars 155, and contact 279 may be permitted to close, these operations being performed by cams 227 and 282 respectively, to prepare the selector mechanism to respond to the next character selection. The unlatching of selector bars 155 permits them to be drawn to extreme right-hand position by springs 158, whereby the setting of code discs 147 is changed and the pin 148 which had arrested shaft 127 is withdrawn. The shaft is thus permitted to respond to its driving torque and may rotate through the small angle by which the pawl hook of correcting lever 275 was ahead of the selected tooth, the shaft being rearrested by engagement of the tooth with the hook, this small angular movement constituting the correction.

Near the end of the printing shaft rotation, the cams 225 sharply rock all of the U shaped levers 268 in counterclockwise direction about their pivots 267. However, one of the levers 268 will find a finger 223 in juxtaposition with its right-hand leg 269 and hence further rotation of this particular lever 268 about its pivot 267 will be arrested. The interference pin 223 by which it is blocked will become its fulcrum instead of its pivot 267, and further movement of lever 268 will impart counterclockwise rotation to arm 265 about fixed shaft 264, which motion is communicated to the associated printing hammer 243 to rock said hammer clockwise to carry the platen thereon against the type character.

A sharp hammer blow is imparted for printing, resulting in a well-defined impression. This result is obtained owing to the fact that the counterclockwise motion of the arm 265 is very rapid and the hammer 243 is thrown against the type wheel as soon as the arm 265 reaches the limit of its outward motion. Upon striking the type wheel to make the impression, the hammer rebounds and is instantly away from the tape independently of the length of time arm 265 is held in its extreme position. In its extreme position, arm 265 holds the platen near the tape but not against the tape, the actual printing occurring because of overtravel of the printing hammer 243 due to its inertia.

It will be apparent that all of the U shaped levers 268 are operated simultaneously by their cams 225. All but one of the levers 268 will find no interference pin 223 blocking its rotation about its pivot 267. Accordingly, all of the U shaped levers 268, except one, will rock idly about their respective pivots 267 and will not impart any

movement to the arms 265 by which they are individually supported. It follows that only one of the printing hammers 243 will be operated.

In the foregoing description of the operation of the printing mechanism, no mention was made of the method for supplying ink for making a printing impression. The ink ribbon mechanism will now be described.

Affixed near the upper end of continuously rotating shaft 316, which is driven by a gear 319 meshing with a gear 318 fixed to shaft 113, is a worm 342 in mesh with gear 343 keyed to ribbon driving shaft 344 journaled in the framework of the printer. The opposite end of the shaft 344 is splined and is provided with a ribbon driving spool 345 rotatable therewith and slidable thereupon. The worm 342 and gear 343 are proportioned to impart an extremely slow linear feed to the ribbons. Hence, with the sharp printing blow effected, no smudging of the impression results despite the fact that the ribbons move continuously. Ribbon spool 345 is part of the carriage 346 transversely slidable with said spool upon shaft 344 and upon fixed guide rod 347.

The spool 345 is provided with flanges for guiding two endless ink saturated ribbons 348 and 348' of different colors. Idler rollers 349, carried by the carriage 346 in front of and behind the ribbons, guide them so that the upwardly and downwardly moving portions of the loop are in close proximity to permit the ribbon to move in the narrow space between the platens and the tapes. In normal operation, a particular ribbon 348, probably black, is in line for printing. However, mechanism is provided to shift the other ribbon which may, for example be red, into the printing position and the black ribbon out of printing position and vice versa.

Below the lowest type wheel, a second shiftable carriage 352 is provided, similar to the upper ribbon carriage but having a ribbon roller 353, serving merely as an idler. Carriage 352 is provided with idlers 349' identical in function with the idlers 349 above-described. Carriage 352 is shiftable transversely upon guide rods 347' and 347'' by means to be described later.

Carriage 352 is provided with ink wells 354 and 354' containing supplies of ink, such as black and red ink, for the two ribbons. Wicks 355, wiping against ribbons 348 and 348' convey ink to the ribbons.

To compensate for stretching or slack in the ribbon, there are provided tension rollers 356 carried by yieldable arms pivoted on the carriage 346 and over which a loop of the ribbon passes.

In the present embodiment of the invention, the movable printing platens 242 carry the ribbons 348 or 348' and the tape 297 against the engraved characters on the type wheels 142 for making type impressions, the ink ribbons being next to the platen 242, whereby the printing tape 297 is interposed between the ribbons 348 or 348' and the platen 242. It is evident that ink excess may not reach the type wheel to gum or clog the characters.

One of the reasons that ribbons of two different colors are provided is that the type wheels are not provided with fractions characters, but only with the integers figures from 0 to 9, inclusive. For those quotations which require fractions, which are usually expressed in eighths, the fractions may be represented by the figures 1 to 7, inclusive, printed in red; for example, the integers being printed in black. Also, the asterisk, the provision of which has been mentioned previously, may be employed for indicating new "high" or "low" quotations, black being used to indicate one of those conditions and red the other. Accordingly, there is provided a fifth selecting magnet 362 adapted to operate its armature 363 in response to a signaling current accompanying the code combination for the characters to be printed in red. Carried upon shaft 316 and adapted to be driven by friction clutch 364 is a sleeve member 365 comprising a stop disc 366 and a cam 367, the sleeve, cam, and disc being secured together for rotation as one element. Sleeve member 365 is normally restrained from rotation by the engagement of a projecting finger 368 of armature 363 with a notch in disc 366. The uppermost of the springs 158 serves to retract armature 363 and maintain its projecting finger in engagement with stop disc 366.

A ribbon shift controlling lever 373 is pivoted to the framework of the printer as at 372. Lever 373 carries at one end a roller which engages cam 367 and at the other end the lever is bifurcated to engage a pin 375 carried by an arm secured to ribbon shift shaft 327. Lever 373 is biased into engagement with cam 367 by tension spring 379. Ribbon shift control shaft 327 is journaled in the framework of the printer and is provided with arms 378 and 378' terminating adjacent to the ribbon shift carriages 346 and 352, respectively. At their free ends, the arms 378 and 378' are connected by pivots to the carriages 346 and 352, respectively, so that when shaft 327 is rocked in clockwise direction, the black ribbon 348 is moved out of the printing position and the red ribbon 348' is moved into that position. Conversely, when shaft 327 is restored to extreme counterclockwise position, the black ribbon is restored to printing alignment with the platens and type wheels. The shaft 327 is normally maintained in the last mentioned position by spring 379 operating through lever 373.

In operation, upon the reception of a code combination including a red inking ribbon selecting impulse, magnet 362 is energized simultaneously with the character selecting magnets 151, armature 363 is attracted and its projecting finger is withdrawn from engagement with stop disc 366, whereby cam 367 is released for a cycle of rotation. As the cam rotates, the follower carried by lever 373 drops into the recess in the cam as spring 379 rocks levers 373 in counterclockwise direction which, in turn, rocks shaft 327 in clockwise direction to shift the ribbon as previously described. Cam 367 is so shaped and timed that the red ribbon remains in its shifted position long enough for a printing operation to be accomplished with the co-operation of that ribbon, and thereafter, lever 373 is restored to extreme clockwise position by cam 367, thus restoring the ribbons to the normal positions. As cam sleeve 365 completes one cycle of revolution, it comes to rest unless the next code combination includes a condition for selecting color printing.

There remains to be described with reference to the embodiment of the invention shown in Fig. 1 the tape supporting and feeding mechanism. The foundational element of the tape supporting mechanism is a fixed rod 292 supported in the framework of the printer and having fixed thereto collars 293 spaced according to the spacing of the type wheels. A cylindrically bored block 294 is supported upon rod 292 by each of the collars 293 and attached to each block is a

light horizontally disposed frame member **295** (Figs. 1 and 2) which support tape spools **296** and **296'**. Spool **296** supports the supply roll of tape and spool **296'** is a take-up spool for receiving and storing printed tape.

Tape **297** is a narrow paper strip of width sufficient to record characters carried by the type wheel. The tape, after leaving the supply roll on spool **296** passes over a guiding idler roller **299** rotatably supported upon the framework of the printer and thence around the type wheel **142**.

Above each type wheel, a tape spacing disc **303** is sleeved on shaft **127**, and from the upper surface of the disc, radial lugs **305** project, the number of lugs equaling the number of selective stop positions of the type wheel. A similar disc **306** is sleeved on shaft **127** below each type wheel, the disc **306** differing from disc **303** in that it does not have lugs projecting from either of its surfaces. The peripheries of discs **303** and **306** are milled (as a coin). Against the peripheries of these discs, the tape **297** is held in non-slipping contact by means of two pressure rollers carried upon spring arms **308** pivoted in the framework of the printer. Discs **303** and **306** are of slightly greater diameter than the type wheel so that the tape neither interferes with the rotation of the type wheel nor tends to be advanced by the type wheel as the latter rotates. From the discs **303** and **306** the tape passes between the platen **242** and the type wheel and thence across the front of the spool supporting frame **295**, around a feed roller **309** journaled in the frame **295**, and to the take-up spool **296'**. The feed roller **309** is faced with gripping material, such as rubber, and a yieldably mounted pressure roller **312** (Fig. 2) presses the tape into engagement with the feed roller **309** and aids the roller in feeding the tape.

Individual to each of the tapes **297** is a grooved pulley **315** sleeved upon shaft **316** and arranged to receive rotation therefrom through the instrumentality of a friction clutch **317**. Similar grooved pulleys **315'** and **315''** are connected to the tape feed roller **309** and the take-up reel **296'** respectively. A belt **310** passes around the pulleys **315**, **315'** and **315''** for imparting rotation from shaft **316** to tape advancing roller **309** and take-up reel **296'**.

The frame **295** may be swiveled about the rod **292** in a forward direction to make readily accessible the tape spools so that a fresh roll of tape may be inserted and the used tape removed. A catch **322** (Fig. 2) of any preferred form is provided to maintain the frame **295** in its proper operative position. Shaft **316** is so located that swiveling of the frame **295** tends to shorten instead of lengthen the center distance between the pulleys **315** and **315'** so that no stretching of the belt **310** results.

Each of the printing arms **265** carries a stud **323** near the free end of the arm, upon which is pivoted a latch **324**. Normally, the latch is in the position shown in Figs. 1 and 2 with a projection **325** thereof abutting a stud **326** fixed to the ribbon shifting control shaft **327**, there being a stud **326** individual to each of the tape printing mechanisms. A tension spring **328** is connected between a spring bracket carried by arm **265** and the latch **324** to maintain the latch in abutment with the pin **326**. Latch **324** is provided with a hook portion **329** which is adapted to slide over and latch on the right of a lug **332** carried by a tape spacing lever **333**. Spacing lever **333** is in the form of a bell crank and is pivoted on shaft **262** which supports the printing hammers **243**, and is provided with a hook portion **334** adapted to engage individually the lugs **305** upon the disc **303** for restraining the disc from rotation. Hook **334** of the lever **333** is urged into engagement with lugs **305** by a spring **335**.

When a printing arm **265** is oscillated rightwardly, as viewed in Figs. 1 and 2, to effect the printing of a character, the spacing latch **324**, which it carries, is also moved rightwardly and its hook **329** passes across and engages the lug **332** on spacing lever **333**. As the printing arm **265** returns to normal position, the latch **324**, which it supports, rocks the spacing lever **333** counterclockwise to disengage hook **334** from lug **305** carried by upper tape spacing control disc **303**. At all times, the pulley **315'** is tending, by means of its belted connection with pulley **315**, to draw the tape to the left, pulley **315'** supplying a continuous torque to tape pulling roller **309**, but the tape is restrained from movement by its frictional engagement with the latched disc **303**, and pulleys **315** and **315'** are stationary. However, as the disc **303** is freed by the operation of lever **333**, the roller **309** pulls the tape leftwardly, the tape which passes roller **309** being accumulated upon take-up reel **296'**. The motion of the tape is limited to a distance of one character space because latch **324**, on its return movement, brings its projection **325** into abutment with the finger **326** and is rocked clockwise about its pivot **323** to release lever **333**, which is thereupon returned to normal engagement with the succeeding lug **305** by means of spring **335**. The speeds of operation of the various members are proportioned so that the disc **303** may rotate only the distance of one lug to move the type one character space before being stopped. The tape moves one character space after each character printed.

After printing a fraction, it is desired to have the tape step two character spaces in order that a blank space may be left between the fraction and the first character of the next succeeding quotation, for the reason that a fraction generally terminates a quotation and the extra space increases the legibility by separating one quotation from the next without the actual transmission of a spacing signal.

To this end, the spacing mechanism is operated in a different manner under the control of the ribbon shift shaft **327**. The spacing operation will proceed as previously described but there will be one condition different from that occurring in the printing of an integer; namely, the shaft **327** will have been rocked in clockwise direction to shift the ribbon characters for fraction color printing, and the interference pins **326**, carried by shaft **327**, will have been moved out of registry with the arms **325** of latches **324**. Upon the return of printing arm **265** to normal position, the lever **333** is rocked counterclockwise to release the disc **303** as before, and tape **297** is free to be moved by roller **309**. Latch **324** is then returned to normal position, but it does not engage its interference pin **326** and, therefore, the latch **324** is not tripped to release tape spacing lever **333** for engagement with the next lug **305**, so that the tape continues to move. However, an instant after the latch has returned to normal position, the shaft **327** is rocked back to normal to return the ribbon carriages to position for the printing of integers and, in so doing, the finger **326** strikes the projection **325**, of latch **324**, and

rocks the latch to disengage its hook 329 from the lug 332 carried by the spacing lever. The lever 333 is then free to re-engage the second succeeding lug 305 by action of spring 335.

The principle of this modified spacing operation is the delay in the tripping of latch 324 to permit disc 303 to rotate two spaces instead of one, and the movement of the shaft 327 is so timed as to permit the tape to move two spaces, but not more than that distance.

If a quotation does not have any fraction, an extra space may be provided by transmitting a signal combination which causes the blank portion of the type wheel to become aligned with the print hammer. The printing and spacing mechanisms then operate as if a character were being printed, but since the type wheel is not provided with a character no impression will be made upon the tape.

Under certain circumstances, it may be desirable when using a stock quotation printer, such as that described in the foregoing portions of this specification, to enlarge the printed characters so that they may be readable at a distance greater than the maximum possible with characters of the ordinary size. Accordingly, there is included in this invention a method of projecting the printed characters upon a screen to suitable magnified dimensions. Such an arrangement is shown in Figs. 3 and 4, both of which are in diagrammatic form.

Referring to Fig. 3, the parts of the tape printer of Fig. 1 are identified by the same reference numerals as before. Only minor structural variations from the previously described printer are required; such as, providing a type wheel with reverse characters and adapted to print characters in inverted position; providing transparent tape instead of the ordinarily used opaque tape; moving the tape supply and the take-up reels to different locations and supporting them upon different mountings to prevent the projected image from being obscured thereby. In order that the image may be accommodated on the screen, it is found desirable to arrange the tapes in groups, the number of tapes in each group being governed by the size of the lenses economically usable. Fig. 4 shows the arrangement for groupings of tapes, each group having its own optical system. Since it is desirable to have the projected tape images move from right to left, as do the tapes when viewed directly, as in Fig. 1, it is necessary to reverse the printing mechanism back to front in order that the projected image shall move in the desired direction, taking into consideration the reversal of the image by the projector.

The optical system is clearly disclosed in Figs. 3 and 4. A source of light 386, one individual to each optical system, is arranged in front of a concave reflector 387, and the light transmitted directly from the lamp 386 and reflected from mirror 387 is transmitted through the condenser lens system 388, through the tape 297 upon which quotations have been printed and through the objective lens system 389. From this point, the image is magnified and is projected upon the rear of the translucent screen 391 where it is visible to the observer from the opposite side thereof.

In Fig. 5, the division of the tapes 297 into groups is shown, each group having its own lamp 386, condensing lens 388, and objective lens system 389, these optical systems being aligned one above the other in registry with the groups of tapes. A single screen may be provided onto which the images of the groups of tapes are projected, but the groups of tapes should be sufficiently separated that the images of adjacent vertically aligned groups shall not overlap on the screen 391.

An alternative embodiment of a multiple tape stock quotation printer is shown in Figs. 5 to 14, inclusive. This printer is also adapted for the projection of enlarged images of the printed tapes upon screens, as shown in Figs. 15 to 18, inclusive. Referring to Figs. 5, 6, and 7, the reference numeral 401 designates a motor, the rotor shaft 402 of which carries a pinion 403. Pinion 403 has direct driving engagement with a gear 404 secured to type wheel shaft 406 and with a gear 407 secured to a combined selector and printing shaft 408. Shafts 406 and 408 are rotatably supported by stationary frame portions of the printer. Gear 407 has secured thereto a gear 409 with which meshes a gear 411 carried by a transfer shaft 412 rotatably supported in brackets 413. The arrangement of shafts and gears is similar to that disclosed in copending application Serial No. 193,642, filed March 3, 1938, by Albert H. Reiber.

Shaft 408 has sleeved thereon at its upper end a selector cam sleeve 416 to which rotation is imparted from shaft 408 by means of cooperating driving and driven discs at the end of sleeve 416, felt, or other resilient discs being interposed between the driving and driven discs. Selector cam sleeve 416, in cooperation with selector magnet 417, controls the setting of sword levers in a sword and T-lever selector mechanism indicated generally by the reference numeral 418. Selector cam sleeve 416 has a plurality of cam projections 419 (Fig. 5) which individually and successively bring sword levers 421 (Fig. 8) into cooperation with a selector lever 422, the selective positions of which are controlled by an armature lever 423 which carries an armature 424 for the selector magnet 417. The single magnet sword and T-lever selector mechanism is well known in the art of printing telegraphy, and the specific embodiment shown herein is disclosed in the hereinbefore mentioned copending application of Albert H. Reiber, so that it is not considered necessary to describe in detail the operation of such a selector mechanism other than to say that by means of that mechanism, the sword levers 421 are selectively positioned in extreme clockwise or counterclockwise positions and are thereafter moved endwise to establish corresponding selective positions of transfer levers 426 under the control of a transfer mechanism.

The transfer mechanism comprises a bail 427, Fig. 6, at the upper end of which is secured a bracket 428 which retains a plurality of transfer springs 429. Springs 429 are effective upon the individual sword levers 421 when bail 427 is operated to move the sword levers to their extreme right-hand positions, as viewed in Fig. 8. Bail 427 has secured thereto an arm 431 which is provided with a locking blade 432 which normally locks projecting ends of transfer levers 426 and which is withdrawn due to clockwise rotation of arm 431 when bail 427 is operated to permit the selective resetting of transfer levers 426.

Transfer bail 427 carries a cam follower roller (not shown) which engages a cam 434 secured to a cam sleeve 436, sleeved on the transfer shaft 412. Rotation is imparted to cam sleeve 436

through a spring loaded jaw clutch 437 which is normally held disengaged by a clutch throwout lever 438. Lever 438 is carried at the lower end of a bail 439 which carries at its upper end an operating arm 441 disposed in the path of a cam projection 442 (Fig. 5) included in selector cam assembly 416. A tension spring 443 biases clutch throwout lever 438 into engagement with clutch 437 and the end of operating arm 441 in the path of cam projection 442. Upon each operation of clutch tripping bail 439, cam 434 is released for a single revolution and operates its follower which through arms 431 and 427 unlocks transfer levers 426 and repositions them in accordance with a new signal combination under the control of sword levers 421.

Stock quotation printers are usually operated under the control of a 6-unit code, one impulse of which determines whether figures or letters shall be printed and the remaining five of which select the particular letter or figure to be printed. In conformity with this practice, the printer now being described is provided with five of the transfer levers 426, each of which has disc and slot articulation with an intermediate three-armed lever 443 (Fig. 8) of which there are five disposed one above the other upon pivot 444. Each of the intermediate three-armed levers 443 has one of its arms disposed in a slot in a code disc 446, of which there are five permutation code discs (Fig. 7) and a special blocking disc 447 (Fig. 8) included in a code disc selector mechanism indicated generally by the reference numeral 448 (Figs. 7 and 8). The third arm of each of the three-armed intermediate levers 443 terminates in a disc portion which is disposed in a slot near the end of a code bar 449 of which there are five (Figs. 5 to 8, inclusive). Pivot 444 also supports a lever 451 which is operatively in engagement with special blocking disc 447. The function and control of lever 451 will be described later.

It will be apparent from the foregoing that when transfer levers 426 are set permutatively according to a new signal combination the intermediate levers 443 will be actuated correspondingly to impart corresponding settings to the five code discs 446 and to the five code bars 449.

The sword lever selector mechanism 418 includes the five sword levers 421 which control the setting of the five transfer levers 426, and a sixth sword lever which is controlled according to that impulse of the code combination which identifies the code combination as pertaining to letters or figures. The sixth sword lever is aligned with and controls a T-shaped lever 452 which is pivoted coaxially with the transfer levers 426. The T-shaped lever 452 has its principal arm 453 disposed between pins 454 and 456 carried by lever 457 and bell crank 458 respectively. Lever 457 is pivoted at 460 and carries at its free end a pawl 459 which is biased counterclockwise, as viewed in Fig. 8, by a spring 461, into engagement with a ratchet wheel 462 secured at the upper end of shaft 463. Lever 457 is biased in clockwise direction by spring 450 (Fig. 5) engaging an arm 455 of lever 457 and urging the arm into engagement with a stop post 1460. Bell crank 458 is biased in counterclockwise direction by spring 465 engaging arm 470 of bell crank 458 and urging the arm into engagement with post 1460 on the opposite side from arm 455 of lever 457. Stop post 1460 is so positioned that T-shaped lever 452 is normally retained by the lever 457 and bell crank 458 in a position intermediate the positions to which it may be rocked by its associated sword lever 421. The rocking of T-shaped lever 452 to either of its extreme positions is effected by the transfer bail 427 which moves sword levers 421 endwise rightwardly, as viewed in Fig. 8, and thus momentarily rocks T-shaped lever 452 to extreme clockwise or counterclockwise position while at the same time setting transfer levers 426 permutatively. As the transfer bail 427 returns to normal position, it ceases to exert any effect upon the sword levers 421 and T-shaped lever 452 returns to its normal or intermediate position, being restored by lever 457 in the event that it had rocked that lever counterclockwise or by bell crank 458 in the event that it had rocked that lever clockwise.

The relation of T-lever 452 to incoming signal combinations is such that when the combination pertains to the letters of a stock quotation designation, T-shaped lever 452 is rocked in clockwise direction and, in turn, rocks pawl supporting lever 457 counterclockwise to effect counterclockwise rotation of rock shaft 463 one ratchet step. A holding pawl 464 is urged into engagement with ratchet 462 by a spring (not shown) to hold ratchet wheel 462 in its normal position or in any advanced position to which it may be rotated by pawl 459.

Shaft 463 is biased in clockwise direction, as viewed in Fig. 8, by means of a torsion spring 466 (Fig. 7) and is provided at its lower end with cams 467, 468, and 469 and with a stop disc 471. Stop disc 471 is provided with a shoulder which is engageable with a fixed bracket 472 of the frame of the machine to arrest shaft 463 when ratchet wheel 462 is engaged by neither of the pawls 459 and 464 to determine the rest position thereof.

Cams 467 to 469, inclusive, are provided for controlling the setting of three sets of storage code bars according to permutational settings of the code bars 449. As shown in Figs. 5, 7, and 10, a series of endwise movable bars 473, 474, and 476 is disposed adjacent to the cams 467 to 469, inclusive. Bars 473, 474, and 476 are disposed one above the other corresponding to the spacing of cams 467 to 469, inclusive, and each of the bars pivotally supports an interponent lever 477, 478, and 479, respectively, which levers are aligned horizontally with cams 467, 468, and 469 respectively and are urged into engagement with the cams by springs, such as 481 (Figs. 5 and 10). Cams 467 to 469, inclusive, are provided with recesses as at 482, 480, and 483, respectively (Figs. 5 and 10) which may be entered by the cam engaging ends of interponent levers 477 to 479 respectively when cams 467 to 469 respectively have been rotated into position to present their recesses. The angular disposition of cams 467 to 469, with reference to their individual interponent levers 477 to 479 respectively, is such that when shaft 463 is in normal position with the shoulder of stop disc 471 engaging fixed stop 472, none of the recesses 482, 480, and 483 is presented to an interponent lever. When ratchet 462 has been advanced one step in counterclockwise direction cam 467 is rotated sufficiently to bring its recess 482 into alignment with the cam engaging end of its interponent lever 477, which responds to its spring 481 and enters the recess 482, the interponent 477 thus rotating in clockwise direction, as viewed in Fig. 5. When ratchet 462 is rotated another step in counterclockwise direction by pawl 459, the recess

482 in cam 467 is moved out of registry with the cam engaging end of interponent 477 and the recess 480 in cam 468 is presented to the cam engaging end of interponent 478. Similarly, when shaft 463 is rotated another ratchet step in counterclockwise direction, interponent 478 is restored to its normal position by the movement of the recess 480 in cam 468 out of registry with the interponent, and recess 483 in cam 469 is presented to the cam engaging end of the lowermost interponent 479.

Adjacent to the left-hand end of the bars 473, 474, and 476, as viewed in Fig. 7, is the depending arm 484 of a bail 486 pivoted at 487. Bail 486 is provided with a cam follower roller 488 which engages a cam 489 included on cam sleeve 436 carried by transfer shaft 412 and driven by clutch mechanism 437. When cam 489 is rotated, bail 486 is rocked counterclockwise, as viewed in Fig. 7, and its depending arm 484 is moved rightwardly a predetermined distance and is then restored to normal position, which is that shown in Fig. 7, by tension spring 491. Bail arm 484 clears the left-hand ends of bars 473, 474, and 476 as it moves rightwardly, but the left-hand end of any of the interponent levers 477, 478, and 479, which is rocked in clockwise direction due to entrance of its cam follower portion into a recess in its corresponding cams 467, 468, or 469, moves into the path of bail arm 484, and as the arm is moved rightwardly, rightward motion is imparted to the bar 473, 474, or 476 by which such interponent is carried. The right-hand ends of bars 473, 474, and 476 are step cut so that they may individually engage depending operating arms of nested bails 492, 493, and 494 respectively pivoted upon shaft 496.

Previous reference has been made to sets of storage code bars. There are three such sets, the first set being designated 501, the second 502, and the third 503. Storage code bars 501, 502, and 503 are individually supported near their lower ends by being provided with two pins 504 and 506, Fig. 7, between which extend horizontal arms of transfer bell cranks 507, there being a transfer bell crank individual to each of the storage code bars. As the storage code bars are arranged in sets, so also are the transfer bell cranks 507, those individual to the code bars 501 being pivotally supported as at 508 in a transfer bail 509, those individual to code bars 502 being pivoted at 511 in a transfer bail 512 and those individual to the code bars 503 being pivoted at 513 in a transfer bail 514. Bails 509, 512, and 514 are pivoted upon pivot rod 516, and each has a depending operating arm, the arms being designated 517, 518, and 519 for the bails 509, 512, and 514 respectively. Adjacent to the lower ends of the bail arms 517, 518, and 519, bails 492, 493, and 494 are provided with laterally extending projections 521, 522, and 523 respectively in the operative path of which the lower ends of bail arms 517, 518, and 519 are disposed. As viewed in Fig. 7 upon the rightward reciprocation of any of the bars 473, 474, and 476, its corresponding bail 492, 493, or 494 will be rocked counterclockwise and will, in turn, impart counterclockwise rocking movement to the corresponding bail 509, 512, or 514 through its depending arm 517, 518, or 519 respectively.

Storage code bars 501, 502, and 503 are individually urged downwardly by means of tension springs 524 (Fig. 7) to seek engagement with a stop rail 526. These bars are movable under the control of transfer bell cranks 507, as will presently be described, from their lowermost positions engaging the stop rail 526, which is one of their selective positions, to an upper and therefore alternative selective position, in which position they are held by individual latches 527 pivoted on a pivot rod 528 and biased in clockwise direction, as viewed in Fig. 7, by individual tension springs 529. The clockwise movement of latches 527 when their individual bars 501, 502, and 503 have been lifted free of those latches is limited by a bail 531 which is also pivoted upon rod 528 and which spans all of the latches 527. When any of the bars 501, 502, and 503 is lifted to its upper selective position, it rests upon its associated latch 527, which has been moved in clockwise direction by its spring 529 and which remains in that position until retracted to permit the storage code bars 501, 502, and 503 to return to normal position.

The retraction of latches 527 is accomplished by bail 531 which has at its left-hand end, as viewed in Fig. 5, a depending arm 532 which terminates close to the upper surface of reciprocable bar 473. Bail 531 is biased clockwise by tension spring 533 (Fig. 7) to engage, in the normal condition, a fixed stop 534. Reciprocable bar 473 has pivoted upon the upper surface thereof as at 536 (Figs. 5 and 7) a trip-off lever 537 which consists of two arms, one extending along bar 473 and terminating adjacent the lower end of latch tripping bail arm 532 which is disposed in its path, and the other extending transversed from bar 473 and having in its path a fixed pin 538 (Fig. 5). A spring 1537, Fig. 10, maintains lever 537 in its extreme clockwise position resting against a stop lug integrally formed with the bar 473. Upon rightward reciprocation of bar 473, as viewed in Fig. 7, the end of the arm of trip-off lever 537 which extends along bar 473 engages latch restoring bail arm 532 and rocks the bail counterclockwise to withdraw latches 527 from supporting engagement with any of the storage code bars 501, 502, or 503, that may be in their uppermost selective position. As trip-off lever 537 continues to be carried rightwardly by bar 473, its laterally extending arm engages pin 538 and the trip-off lever is rocked counterclockwise, as viewed in Fig. 5. The counterclockwise rocking of trip-off lever 537 causes it to be withdrawn from engagement with the lower end of latch restoring bail arm 532, and spring 533 restores bail 531 to extreme clockwise position, as viewed in Fig. 7, in engagement with stop 534. Upon retraction of bar 473 to normal position, the trip-off lever 537, after being withdrawn from engagement with bail arm 532, returns to extreme clockwise position, as viewed in Fig. 5, in readiness to rock unlatching bail 531 upon the next operation of reciprocable bar 473.

As shown in Figs. 8 and 11, each of the bars 449 is provided with three lugs projecting from the rear edge thereof, the lugs on a bar being spaced and arranged to block simultaneously or to unblock a corresponding one of the transfer bell cranks 507 in each set 501, 502, or 503. Thus, the uppermost of the bars 449 has projections 541 which will block the first transfer bell crank in each group, counting from the left, as viewed in Fig. 8, and these lugs will be moved out of blocking relation to the particular bell cranks 507 when the uppermost bar 449 is moved to its other selective position. Similarly, the bar 449 next below the top has three lugs 541 which will block the second transfer bell crank 507 in each group counting from the left when the bar is

in one selective position and which will not be in the path of those bell cranks when the bar is moved to its other selective position. Fig. 11 shows in detail the relation of the lugs **541** to one set of transfer bell cranks **507**. It should be noted that none of the lugs **541** carried by the bars **449** can block one transfer bell crank **507** when in one selective position and another of the bell cranks when in another selective position. The movement of bars **449** from one to another of their selective positions is sufficient only to move its lugs into or out of locking relation with respect to particular transfer bell cranks.

It will be apparent that when latches **527** are withdrawn to their extreme counterclockwise positions, as viewed in Fig. 7, and all of the storage bars **501**, **502**, and **503** are permitted to rest upon the fixed stop **526**, the transfer bell cranks **507** associated with those of the bars **501**, **502**, and **503** that had been previously elevated will be rocked in counterclockwise direction. Stop **526** is so positioned that the upwardly extending arms of transfer bell cranks **507** cannot thereby rock into engagement with the lugs **541** carried by bars **449**, and thus there will be no interference with the setting of these bars by the three-armed intermediate levers **443**. As the reciprocable bar **473** moves to its extreme rightward position (Fig. 7), it rocks transfer bail **509** to extreme counterclockwise position, thus carrying the five transfer bell cranks **507** supported thereby to the left. Those of the transfer bell cranks **507** carried by bail **509** that do not encounter lugs **541** are merely moved leftwardly idly, their horizontally extending arms moving between the pins **504** and **506** of storage bars **501** without in any way affecting the storage bars. However, those that encounter lugs **541** have their upwardly extending arms arrested by the lugs and as bail **509** continues to rock in counterclockwise direction, the blocked transfer levers **507** are rocked in clockwise direction to lift their associated storage bars **501** against the tendencies of their individual springs **524**. The bars that are lifted, clear their latches **527** which respond to their springs **529** and move into position to support the lifted storage bars. In this manner, the storage bars **501** are set in positions corresponding to the selective positions of the bars **449**.

Storage bars **502** and **503** may be set according to the next two signal combinations in the same manner, the setting of the bars being accomplished by reciprocable bars **474** and **476** under the control of cams **468** and **469**. In this manner, there may be stored in the storage bars **501**, **502**, and **503**, code combinations representing three successively received letter codes.

The sets of storage code bars **501**, **502**, and **503** control the selection of any one of a plurality of selectable slide bars **551** in a manner similar to a selecting system disclosed in copending application Serial No. 333,161, filed January 17, 1929, by L. M. Potts. Referring now particularly to Fig. 7, it will be observed that the bar **501** seen in elevation is provided with a uniform distribution of notches and lugs. The space occupied by one lug and an adjacent notch corresponds to that required to any one of the plurality of tapes upon which printing is to be effected. In this space is accommodated one of the selectable slide bars **551**, there being one such bar for each tape upon which characters are to be printed. All of the bars **501**, **502**, and **503** are identical with the bar **501** shown in elevation in Fig. 7 in that they are provided with a uniform distribution of notches and lugs. Thus, there is no permutational or other coding inherent in the notching of the several bars **501**, **502**, and **503**. Slide bars **551** are shown in their extreme right-hand position in Fig. 8, and these bars are slidable leftwardly under circumstances about to be described, the leftward movement being imparted by tension springs **552** individual to each bar **551**. Each of the bars **551** is provided with three sets of notches, each set consisting of five notches. The slide bars **551** are so positioned with reference to storage bars **501**, **502**, and **503** that the front edges of the storage bars are disposed in the notches in bars **551**, the front edges of the storage bars being the edges provided with the uniform distribution of notches and lugs. There are thus provided upon bars **551** a plurality of lugs or ears **553**. With reference to any of the storage bars **501**, **502**, and **503**, the lugs **553** disposed at the right of individual storage bars, as viewed in Fig. 8, are the ones which may prevent leftward movement of a slide bar **551**.

As shown in Fig. 7, the lugs **553** of slide bars **551** are bent upwardly or downwardly according to a permutation code system whereby a bar **501**, **502** or **503** may have certain of its lugs interposed in the path of lugs **553** of certain of the slide bars **551** when the storage bar is in its upper selective position and may have others of its lugs interposed in the path of lugs **53** carried by the remainder of the slide bars **551** when the storage bar is in its lower selective position. From this, it will be apparent that for a given permutational setting of the storage bars **501**, **502**, and **503** in upper and lower selective positions one, and according to the preferred embodiment of the invention only one, of the slide bars **551** will have all of its lugs **553** in alignment with notches in the storage bars whereby the slide bar will have been selected and will be free to move leftwardly, as viewed in Fig. 8. With a different permutational setting of the storage bars **501**, **502**, and **503**, another one or none of the slide bars **551** may be selected for leftward movement.

As is well known in printing telegraph systems operable in accordance with permutation codes, five selecting bars will afford thirty-two usable selective possibilities. This is true of any of the sets of five storage bars **501**, **502** and **503**. With three such sets jointly controlling the slide bars **551**, the number of selective possibilities is very much higher than can possibly be employed in a single printer. This arrangement will permit the coding of the slide bars **551** according to the actual letters of the stock designation. Thus, the bars **501** may be set according to the code combination for the first letter of the stock, bars **502** may be set in accordance with the code combination for the second letter of the stock, and bars **503** may be set according to the combination of the third letter of the stock designation. Some stock designations are customarily represented by two letters and some by a single letter. For quotations relating to such stocks, it will be necessary to set permutationally only the storage bars **501** and **502** or only the storage bars **501**. Since prior to the setting of the bars **501** all of the latches **527** are retracted to permit all of the storage bars to return to their lowermost positions, those quotations which contain no second, or second and third letters will not involve permutational settings of the storage bars **501** or **502** and **503**, and those

bars will remain in their lowermost positions. For such stocks, the slide bars **501** will necessarily be coded to be selectable when the storage bars **502** and **503** are in their lowermost positions and such slide bars will be blocked when a storage bar from a set for which the stock designation has no identifying letter is raised to the upper selected position. For settings of the storage bars corresponding to designations of stocks other than those for which tapes have been provided in a particular printer, no slide bar **551** will be coded to be selected, and as the printing of a stock price occurs only as a consequence of selection of a slide bar **551**, the unwanted quotation will be rejected, as will presently appear.

At the left of each of the slide bars **551**, as viewed in Fig. 8, is a combination print hammer and tape feeding control slide **556** and a pivoted latch **557**. Each print hammer slide **556** is provided with a notch **558** to be engaged by the latch **557**. Print hammer slides **556** are urged leftwardly by springs **559** and are restored to their extreme right-hand position by a bail **561** which is engageable with a hooked arm **562** carried by each of the slides **556**, and is biased to seek engagement with the hooked arms **562** by a spring **560** which is very light as compared with the springs **559**.

As may be observed by reference to Figs. 5 to 8, inclusive, bail **561** extends transversely of all of the print hammer slide restoring arms **562** and is pivoted at **463**. Clockwise rocking movement is imparted to bail **561** to effect the restoration of slides **556** to their extreme righthand positions, as viewed in Fig. 8, by a bail **564** pivoted at **566** and connected to bail **561** by means of a link **567**, the connection between bail **561** and link **567** being a pin **568** and slot **569**, as shown in Figs. 5 and 8. Counterclockwise movement is imparted to bail **561** by the individual print hammer slides **556** which are moved leftwardly by their springs **559**.

The lowermost end of bail **564** is disposed adjacent to the right-hand edge of the uppermost reciprocable bar **473** and the bail is provided with a roller **571** in the horizontal plane of the reciprocable bar **473**. As shown in Fig. 10, bar **473** has a portion at its left-hand end of greater width than the main body portion of the bar, and when the bar is in its normal or unoperated position, roller **571** engages the edge of bar **473** in the main body or narrow portion thereof. When bar **473** is reciprocated rightwardly, as viewed in Fig. 7, in the manner previously described, roller **571** rides up the slope between the narrow and the wide portions of bar **473** whereby clockwise movement is imparted to bail **564** and through link **567** to bail **561**, by engagement of the left-hand end of slot **569** with pin **568**. This movement of bail **561** by means of said bar **473** thereupon causes the movement of any hammer interponent assembly **556** which had been released, restoring it to its latched position as shown in Fig. 8.

Adjacent to the portion of bail **561** which engages print hammer slide restoring arms **562**, the lower arm of the bail pivotally engages a link **572** which has intermediate its ends a notch **573**. A latch **574** pivoted at **460** and biased in clockwise direction by a tension spring **575** enters notch **573** in link **572** when bail **561** has been rocked to extreme clockwise position and retains the bail in that position. The slides **556** are held in their extreme right-hand positions, as viewed in Fig. 8, by their latches **557** and by the latched bail **561**. Tension springs **552** urge slide bars **551** into engagement with their associated slides **556** so that when a previously selected slide **556** is restored to its extreme right-hand position, its associated slide bar **551** will also be restored to extreme right-hand position. As reciprocable bar **473** returns to its normal position, bail **564** is moved by its restoration spring **565** to its extreme counterclockwise position with its roller **571** engaging the narrow portion, the pin and slot connection between link **567** and bail **561** permitting this independent movement.

The release of bail **561** to permit a selected one of the slide bars **551** to trip its associated latch **557** and thereby release its associated print hammer slide **556** for leftward movement, as viewed in Fig. 8, is controlled by the previously identified T-lever **452**. Upon the reception of a code combination which contains an impulse to control the printing of figures, T-lever **452** is rocked counterclockwise, as viewed in Fig. 8, and through pin **456** it rocks bell crank **458** clockwise. Bell crank **458** has an arm **576**, the free end of which is disposed in a slot in disc **577** which is sleeved on shaft **463** below ratchet **462**. Disc **577** supports upstanding pins **578**, one of which is adjacent to pawl **459** and the other of which is disposed adjacent to holding pawl **464** and to an arm of a bell crank **579** disposed above and extending parallel to holding pawl **464**, the bell crank **579** and pawl **464** both being pivoted at **460**. When bell crank **458** is rocked clockwise by T-lever **452**, disc **577** is rotated counterclockwise a sufficient distance to cause pins **578** to withdraw operating pawl **459** and check pawl **464** from engagement with ratchet **462**. Bell crank **579** is rocked counterclockwise through the same angular distance as is pawl **464**. Upon the release of the pawls **459** and **464**, spring **466**, Fig. 7, restores shaft **463** to normal position with the shoulder on stop disc **471** engaging fixed stop **472**.

Bell crank **579** has an arm **581** which carries a pin **582** disposed adjacent to the end of latch **574** which holds bail **561** in extreme clockwise position. Pin **582** also engages one arm of a bell crank **583** which is pivotally supported upon an arm **1583** of shaft **617** in association with a printing bail **584**, the structure and operation of which will be described later. The free end of the other arm of bell crank **583** is provided with a latching shoulder which engages an extension **585** of the leved **451** which controls special blocking code disc **447**, and the latching shoulder normally holds the lever **451** in extreme counterclockwise position whereby disc **447** is normally presented in extreme clockwise position. Latching bell crank **583** is disengaged from the extension **585** of disc controlling lever **451** by pin **582** as bell crank **579** is rocked counterclockwise, but lever **451** is not thereby released for the reason that it is held by a second latch **586** pivoted at a fixed point **587**. At its foremost end, as viewed in Fig. 8, latch **586** carries a pin **588** which is disposed in a slot **589** in the left-hand end of link **572**. Since link **572** is moved leftwardly with bail **561** when the latter is moved counterclockwise by a selected and released print hammer slide **556** upon the release of latch **574** it moves idly with respect to pin **588** carried by latch **586** until the right-hand end of slot **589** engages the pin **588**. Further leftward movement of link **572** causes latch **586** to be withdrawn from engagement with lever **451** which,

being biased in clockwise direction by a spring 591, rotates its associated disc 447 in counterclockwise direction.

Disc 447 is provided with notches spaced according to the spacing of selectable pins 592 of code disc selector mechanism 448 (Fig. 8). When disc 447 is in extreme clockwise position it blocks all of the pins 592 and prevents any one which may otherwise have been selected by code discs 446 from moving inwardly radially of code disc selector mechanism 448. When disc 447 is rocked to extreme counterclockwise position upon release of latches 583 and 586, it presents its notches to all of the selectable pins 592 and any such pin to which an alignment of notches is presented by the five code discs 446 is permitted to move inwardly radially of selector mechanism 448.

The two latches 583 and 586 are provided because the control of blocking disc 447 involves several factors. Latch 583 is released upon the transfer of a signal combination in which the sixth pulse is of marking nature. Due to the association of latch 583 with the printing bail, the latch is reengaged with and relatches the lever which controls disc 447 after each printing operation, the purpose of this being to prevent a second printing of a character in response to one selection of that character. Latch 586 is released by the latch link 572 of bail 561 at the time that bail is moved into its extreme counterclockwise position by a selected print hammer slide 556, the slide having moved into effective position at that time. It thus delays the unblocking of the printing control pins 592 to insure the operation of the print hammer slide. The latch 586 remains released until the selected slide 556 is retracted to ineffective position. The restoration of any one of said slides 556 is effected through the operation of bail 561 as has already been stated.

The movement of bail 561 in a clockwise direction about its pivot 563 is preceded by the operation of printing bail 584 which member, in effecting printing, rotates clockwise about its shaft 617 until bail blade 626 is brought sharply against the interponent hammer 594 of the particularly selected slide 556, whereby printing is effected through percussion engagement with an associated type wheel 599. Upon the restoration of printing bail 584, however, which result is effected by a cam 618 acting against following roller 620, shaft 617 and all of its integrally associated elements is rocked counterclockwise and as an incident thereto aforementioned arm 583, Fig. 5, which carries a latching bell crank 583 and which had been retracted during the printing motion of bail 584 is now rocked counterclockwise as bail 584 is retracted so that the shoulder of bell crank 583 may again engage portion 585 of blocking disc operating arm 451 and rock the latter in a counterclockwise direction about its shaft 444 returning the selector blocking disc 447 to its effective position as indicated in Fig. 8.

Latch 586 is also effective to prevent the operation of the printing bail 584 when stock price signal combinations are received for stocks for which no coded slide bars or recording tapes have been provided. There will be no print hammer slide selected or released when the identifying letter signals for such stocks are released when the identifying letter signals for such stocks are received, and therefore bail 561 will not be rocked counterclockwise nor latch 586 be tripped when the figure signals are received. Blocking disc 447 will therefore be retained in blocking relation to pins 592, one of which must be selected in order to cause operation of the printing bail. Preferably latch 583 holds extension 585 of lever 451 slightly farther counterclockwise than does latch 586, as the latter is required to engage and hold the extension, after the release of latch 583, in such position that should latch 583 return to normal position before the release of latch 586, the latch 583 cannot relatch the extension nor otherwise deprive latch 586 of its proper control over blocking disc 447.

Each of the print hammer slides 556 carries a flexible arm 593 at the left-hand end of which (Fig. 8) is a print hammer head 594. Intermediate the ends of each slide 556 a spacing control pin 596 is reciprocably supported, the pin being maintained in retracted position by a compression spring 597 which is compressed between one of the supports for pin 596 and a flange 598 carried by the pin. The movement of print hammer slide 556 leftwardly, as viewed in Fig. 8, when permitted by the release of bail 561 and by the release of the latch 557 under the control of a selected slide bar 551, is sufficient to bring the print hammer head 594 into printing position between the type wheel 599 and print hammer operating blade 626 of print bail 584, and to bring the spacing control pin 596 into alignment with the operating lug 601 of a spacing pawl 602. The apparatus is now in readiness for the printing of the figures of a stock quotation, the stock designating letters having served to effect the selection of a particular print hammer slide 556 and during the reception of the letters code combinations, the code disc selector pins 592 having been blocked and prevented from responding to the letters selections by means of the special blocking disc 447.

The type wheels 599 are secured to type wheel shaft 406, which is continuously rotatable. Adjacent to the top of code disc selector mechanism 448, type wheel shaft 406 carries in fixed angular relation to the type wheel an arm 603 (Figs. 7 and 13). At its outer end arm 603 pivotally supports a print bail controlling lever 604. Lever 604 is provided at its outer end with an obliquely directed extension 607 which trails the lever 604 as arm 603 rotates. Extension 607 of lever 604 revolves about the axis of shaft 406 just inside the alignment of selectable pins 592 when those pins are in their outermost or unselected positions. When all of the selectable pins 592 are blocked by the special disc 447, arm 603 and lever 604 revolve idly as shaft 406 rotates and the trailing extension 607 of lever 604 does not come into engagement with any of the pins 592. However, upon the selection of one of the pins 592, its upper end is moved into the path of obliquely disposed extension 607 of lever 604 and when the trailing extension comes into engagement with the selected pin, it rides over the top of the pin, thus rocking lever 604 counterclockwise, as viewed in Fig. 7, and thereafter drops off, permitting the lever to return to normal position.

Above the code disc selector mechanism 448, shaft 406 carries a sleeve 608 which is urged upwardly by a compression spring 609. Sleeve 608 is provided with spaced flanges 611. The inner end of lever 604 is disposed between two of the flanges 611 so that when lever 604 is rocked counterclockwise (as viewed in Fig. 13) by one

of the selectable pins 592, sleeve 608 is moved downwardly along shaft 406, thereby compressing spring 609. The free end of a latch 612 pivoted at 613 is disposed between two of the discs 611 so that when sleeve 608 is moved downwardly, latch 612 will be rocked clockwise, as viewed in Fig. 7.

Latch 612 is provided with a shoulder which normally holds printing bail arm 1584 in the position shown in Figs. 8 and 9, the bail being biased in clockwise direction against the shoulder by a tension spring 614 connected to an arm 616 secured to the shaft 617 to which printing bail 584 is secured. Arm 616 is disposed in the same horizontal plane as a bail restoring cam 618 which is carried by main shaft 408 and is connected to the shaft through a friction clutch. Above the cam 618 and connected thereto for controlling the rotation is a stop disc 619 which is provided with stop shoulders equal in number and spacing to the number of bail restoring apices with which cam 618 is provided. A stop pawl 621 is pivoted at 622 in the same horizontal plane as stop disc 619 and is urged by tension spring 623 into engagement with the stop disc. At the opposite end from that which engages stop disc 619, stop lever 621 is provided with a depending pin 624 which is disposed in the path of printing bail arm 616 when the latter is rocked in clockwise direction.

Upon the release of latch 612, printing bail 584 is rocked in clockwise direction by spring 614 to cause blade 626 carried by bail 584 to strike a selected print hammer head 594 to cause it to strike against type wheel 599, a tape upon which printing is to be effected and an ink ribbon being interposed between print hammer head 594 and type wheel 599, as will appear hereinafter.

As the printing stroke is performed, a roller 620 carried by the free end of bail restoring arm 616 is brought into engagement with restoring cam 618. Restoring arm 616 in moving to its extreme clockwise position rocks stop lever 621 counterclockwise, as viewed in Fig. 8, due to engagement with its depending pin 624. Stop lever 621 is thus withdrawn from engagement with a shoulder of stop disc 619 and rotation is imparted to cam 618 and disc 619 by shaft 408. The rotation of shaft 408 is in clockwise direction, as viewed in Fig. 9, and cam 618 rocks lever arm 616 and therefore bail 584 counterclockwise a distance greater than that required to re-engage it with latch 612, the overtravel in counterclockwise direction being provided for the control of tape spacing as will presently be described. As bail restoring arm 616 is rocked counterclockwise, it is withdrawn from engagement with depending pin 624 of stop lever 621 which is thus enabled to return to engagement with stop disc 619 to arrest the disc by engagement with next succeeding shoulder carried thereby. Cam 618 and disc 619 are not arrested until after a restoring apex of cam 618 has passed and moved free of roller 620 whereby arm 616 returns in clockwise direction from its limit of overtravel until bail arm 1584 engages the shoulder on latch 612. The bail 584 is thus prepared for the next release of latch 612 when it can be rocked in clockwise direction by spring 614, printing thus being by spring and restoration by cam, from which roller 620 is held disengaged in normal or idle condition.

As previously stated, each of the type wheels carried by shaft 406 has associated with it a tape upon which quotations are to be printed. The tapes, identified by reference numeral 630, are supplied from individual tape rolls 631, each of which is supported, as shown in Figs. 1 and 10, on an individual arm 635 pivotally supported on a vertically disposed post 640. Adjacent arms 635 on post 640 extend on opposite sides of a limit bar 645 against which they are biased by individual springs 650, the leftwardly extending arms in counterclockwise direction and the rightwardly extending arms in clockwise direction. Tape guides 655 may be provided for guiding the individual tapes from their respective supply reels to their tape feed control rollers 632 with which the tapes are frictionally engaged by pressure rollers 633.

With the arrangement described in the foregoing paragraph two vertical alignments of tape supply rolls are provided, a space intervening any two adjacent supply rolls on one side of limit bar 645, due to the alternate disposition of successive supply rolls on opposite sides of bar 645. The space provided affords access to individual supply roll supports, and an exhausted supply of tape may be replenished by swinging the particular arm 635 away from limit bar 645 and clear of the other supply rolls on the same side of bar 645. Thus, the supply rolls are individually and independently supported, and may be replaced without disturbing any other supply rolls.

The tape feed controlling rollers 632 are mounted one above the other on a stationary shaft 636 and are individually rotatable upon the shaft. Each feed roller 632 has secured thereto a ratchet wheel 637 which is engaged by the previously identified escapement pawl 602. Each of the pawls 602 is biased to extreme counterclockwise position by a spring 638. As shown in Figs. 5, 6, and 9, shaft 617 to which printing bail 584 is secured also has fixed thereto a spacing bail 639. The free end of bail 639 is in alignment with the operating lug 601 carried by escapement pawl 602, and when print hammer slide 556 is moved to the left, as viewed in Figs. 5 and 8, the reciprocable pin 596 becomes aligned with lug 601 and with spacing bail 639. Upon the release of printing bail 584 by latch 612 (Fig. 9) and during the movement of printing blade 626 through its printing stroke, spacing bail 639 is drawn away from the end of pin 596. Reciprocation of pin 596 to effect clockwise movement of escapement pawl 602 is accomplished during that portion of the counterclockwise movement of bail arm 616 which was previously identified as overtravel beyond the position for latching of bail 584. When pawl 602 is rocked, ratchet wheel 637 escapes for rotation through a distance equal to one character space and the tape, which is pressed against the roller 632 by pressure roller 633, is advanced by the tape puller drum. Before cam 618 is arrested, follower roller 620 drops off the apex of cam 618, as previously described, and spring 614 withdraws bail 639 from engagement with pin 596, thereby permitting spring 597 to retract the pin to normal position and spring 638 to restore pawl 602 to its normal or extreme counterclockwise position.

The spacing mechanism provided in the printer herein described includes mechanism for automatically inserting a space between any two consecutive quotations on a tape. Thus, no tape spacing signal need be transmitted to effect separation of the quotations. This mechanism is shown in Fig. 8 and comprises a cam projection 625 on print hammer slide 556 which engages op-

erating lug 601 of spacing pawl 602 and holds the pawl in clockwise position when slide 556 is latched in its right-hand position, the pawl being released and permitted to rock to counterclockwise position when slide 556 moves to the left. As previously described, one cycle of oscillation of pawl 602 results in the advancement of tape 630 one character space. By the retraction of the print hammer slide following the printing of a stock price, and the release of the slide preparatory to the printing of another quotation relating to the same stock, the pawl 602 is oscillated through one complete cycle, and therefore the tape will be advanced one character space, the advancement being accomplished in two steps. The first step, representing part of one tooth distance on the ratchet wheel 637, occurs following the printing of a stock price, and the second step, representing the remainder of one tooth distance, occurs before the printing of the next quotation on the same tape. During the printing of a quotation, cam projection 625 is clear of pawl 602, so that it does not interfere with the operation of the pawl by pin 596.

A simple modification of cam projection 625 will permit the apparatus to interpose two character spaces between any two quotations on a tape. This may be accomplished by providing a cam slope on the left-hand edge as well as on the right-hand edge of cam projection 625, and by relocating it so that it is at the right of pawl projection 601 when slide 556 is at extreme right, and is at the left when slide 556 is at extreme left. With this arrangement, cam projection 625 operates and releases pawl 602 upon being retracted, whereby the tape 630 is caused by roller 632 to advance one character step, and also operates and releases pawl 602 upon movement to effective position preparatory to printing, whereby the tape is advanced another character step.

The tape pulley drums 641 are rotatably mounted upon hub sleeves 642 carried by shaft 643. Continuous rotation is imparted to shaft 643 from type wheel shaft 406 through gear 650 carried by type wheel shaft 406 (Fig. 7), gears 1655 and 658 carried by an intermediate shaft 657, and gear 659 carried by shaft 643 (Fig. 1). Drum 641 is capable of rotation with respect to hub sleeve 642 and the drum and sleeve are both normally stationary while shaft 643 by which they are supported rotates continuously. One end of a flat coiled spring 644 is secured to the inner annular surface of drum 641, and the other end is secured to hub sleeve 642. The hub sleeve 642 has secured thereto a check ratchet wheel 646 which is checked against counterclockwise rotation by spring biased check pawl 647. Hub sleeve 642 also has secured thereto a disc 648 on which is pivotally mounted a spring winding pawl 649 biased in clockwise direction by spring 651. On the inner annular surface of drum 641 is a pin 652 which normally holds pawl 649 out of engagement with a ratchet 653 secured to and continuously driven by shaft 643.

Spring 644 furnishes the necessary torque for advancing the tape, which is held in frictional engagement with drum 641 by pressure roller 654 carried by spring biased pressure roller arm 656. As drum 641 rotates clockwise in advancing the tape, it advances its pin 652 until the pin is moved out of engagement with the tail cam of pawl 649, which is thus urged by its spring 651 into engagement with continuously driven ratchet 653. Rotation is thus imparted from ratchet 653 through pawl 649, disc 648, and hub sleeve 642 to rewind spring 644. During this rewinding, check ratchet 646 advances tooth-by-tooth with respect to check pawl 647 and holds hub sleeve 642 against reverse rotation upon the disengagement of pawl 649 from ratchet 653. The rewinding of spring 644 is terminated when the tail cam of pawl 649 overtakes and engages drum pin 652. The pin engages the cam and withdraws pawl 649 from engagement with ratchet 653, whereupon the clockwise rotation of hub sleeve 642 is arrested. The head of pawl 649 is provided with a finger 657, the end of which is disposed in close proximity to the inner annular surface of drum 641 when pawl 649 is held out of engagement with ratchet 653 by pin 652. Finger 657 blocks the path of pin 652 whether pawl 649 is engaged with or disengaged from ratchet 653 and assures engagement of the pawl with the ratchet as well as prevents unwinding of spring 644 by limiting the amount of clockwise rotation of drum 641 relative to hub sleeve 642.

Since the driving torque is applied to drum 641 solely through spring 644, it will be apparent that there is no restraint upon counterclockwise rotation of the drum and, therefore, that the tape may be retracted, if desired, without necessitating slipping of the tape with respect to drum 641. Use is made of this feature of the present invention by providing means for effecting a retraction of the tape prior to the printing of a stock quotation and permitting the tape to advance the distance that it was retracted, following the printing of the quotation. The necessary concentration of certain elements at the printing point; such as, the printing bail, ink ribbon, and type wheel, may cause the last character or last few characters to be obscured by elements of the printer and to become visible only after the tape has been advanced several character spaces. When the printed characters are to be projected upon a viewing screen, a greater number of the most recently printed characters on the tape may be outside the field of the optical system, due the presence of structural elements of the printer at the printing point. The advancement of the tape a sufficient distance to bring the last character printed into position to be observed directly may not be sufficient to bring it into the field of the projecting system. Merely to advance the tape several character spaces following the printing of each quotation has certain disadvantages among which is the relatively wide blank space that appears between quotations on the tape with the result that only a small number of quotations may occupy positions in the projecting field at one time, the wide spaces between quotations on a tape being entirely wasted. To overcome these disadvantages, the present invention has been provided with means for forming a loop in the tape between the supply roll and the printing position prior to the printing of a quotation, the loop being formed by moving the tape backward against the torque supplied by spring 644 to the tape feed drum 641, the tape between the point of formation of the loop and the supply roll being held stationary by the tape feed controlling roller 632.

Referring particularly to Fig. 8, it will be observed that print hammer slide 556 has been provided with a leftwardly extending arm 661 at the free end of which is a roller 662. The length of arm 661 is such that when the slides 556 are

held in their extreme right-hand positions, as viewed in Fig. 8, the tape will be permitted to occupy an approximately straight path between tape feeding control rollers **632** and idler rollers **634**. However, when a print hammer slide **556** is released for leftward movement by the tripping of its latch **557** by a selected slide bar **551**, the roller **662** will be moved leftwardly and will increase the length of the path between the point of engagement of the tape with rollers **632** and **633** and the point of its engagement with idler roller **634**. The tape required to increase the length of the path will be supplied by rightward movement of the tape past the printing position, as viewed in Fig. 8, tape feed drum **641** rotating counterclockwise as the tape is retracted. Thus, the most recently printed quotation on the tape will be moved back toward the printing position, thereby reducing to a predetermined low amount the blank tape intervening adjacent quotations. Printing of the figures of the quotation may then proceed in the normal manner, the tape being advanced one character space for each character printed, by the tape feed controlling roller **632**. After the last character of the quotation has been printed, and upon the next clockwise movement of bail **561** to its latched position, the print hammer slide **556**, which has been selected, will be restored to its extreme right-hand position and roller **662** will be retracted to permit the tape to assume an approximately straight path between rollers **632** and **634**. The reduction in the length of the path between these two points will result in slack tape which will be taken up by tape feed drum **641**, thus advancing the last quotation printed from the printing position by the distance that the path is reduced. In order that the retraction of the tape, which causes counterclockwise rotation of drum **641**, shall not draw pin **652** off the counterclockwise end of the tail cam of pawl **649**, whereby the pawl would escape from control by the pin, the tail cam should be of sufficient length to accommodate retraction of the type while maintaining pawl **649** disengaged from ratchet **653**.

An ink ribbon supporting and feeding mechanism is provided for passing an ink ribbon, such as is used on typewriters and various forms of printing telegraph apparatus, between the tapes **630** and the print hammer heads **594** when the latter are moved into printing position. The ribbon spool supporting and driving mechanism is similar to that shown in copending application Serial No. 77,796 filed May 4, 1936, by Albert H. Reiber. As shown in Figs. 5, 6, and 8, a ribbon feed mechanism supporting plate **666** is mounted above the primary selector mechanism and is provided with spindles **667** upon which ribbon spools **668** are adapted to be mounted. Each of the spindles **667** has secured thereto a ribbon feed ratchet **669**, as shown in Fig. 6. A ratchet feed pawl (not shown) is provided in accordance with the disclosure of copending application Serial No. 77,796 for imparting rotation alternatively to either of the spools **668** and, in the present adaptation of the apparatus, the pawl is operated by a link **671** which is pivoted to a lever arm **672** secured to shaft **617** which carries printing bail **584** and tape spacing bail **639**. Upon each operation of printing bail **584**, clockwise rotation is imparted to shaft **617** by the printing spring **614** and counterclockwise rotation is then imparted to the shaft by restoring cam **618**. Link **671** is then moved endwise and is retracted to effect rotation of whichever of the ratchets **669** the ribbon feeding pawl engages.

From the left-hand of the spools **668**, ink ribbon **673** passes behind the ribbon guide **674**, and around the obliquely cut right-hand end of the guide **674**, whereby the path of the ribbon is changed from horizontal to vertical. The ribbon extends upwardly past all of the tapes **630** and across a horizontally disposed guide mounted above the uppermost of the type wheels by which the ribbon is directed rearwardly of the printer. From this point, the ribbon extends downwardly behind all of the type wheels to a point below the lowermost of the type wheels where there is located a guide similar to the guide **674** for changing the direction of travel of the ribbon from vertical to horizontal. The ribbon is then brought forwardly to the right of the printing position, being guided by means of pins **676**, and is engaged with the right-hand spool **668**. By virtue of the provision of two ratchets **669**, the direction of travel of the tape may be reversed. Thus, at times the ribbon **673** may pass upwardly in front of the tapes and at other times may pass downwardly, being alternately transferred from the right-hand to the left-hand spool and from the left-hand to the right-hand spool.

The multiple tape printer, hereinbefore described, is shown in all figures in the normal or idle condition with the single exception of print hammer slide restoring bail **561**. This bail is not restored to extreme clockwise position as an incident to the printing of a stock quotation, but remains in its extreme counterclockwise position, permitting a selected print hammer slide **556** to remain in its extreme left-hand position, as viewed in Fig. 8, until the reception of the next signal combination transmitted, which would ordinarily be the signal combination relating to the first stock designating letters of the next stock quotation.

Upon the reception of the first code combination representing a designating letter of the stock for which a quotation is to be printed, the sword levers **421** are set according to the code combination, the transfer levers are unlocked and are set in correspondence with the received code combination by the transfer bail, which also rocks the T-lever **452** in clockwise direction, due to the fact that the code combination represents a letter and the impulse which distinguishes between letters and figures is of spacing condition. The T-lever **452** is not provided with a locking extension to be locked by the bail which locks transfer levers **426**, for the reason that it performs the functions for which it is provided merely by rocking to its clockwise or counter-clockwise positions, and it is not necessary and may not be desirable to lock it in those positions. The T-lever operates pawl lever **457** to effect the rotation of ratchet wheel **462** and shaft **463** one step. The uppermost of the reciprocable bars **473** is thereby conditioned for operation by bail **486**.

In timed relation to the unlocking of transfer levers **426** and the setting of discs **446** and bars **449**, reciprocable bar **473** is operated to effect the restoration of bail **561** to latched position, whereby the previously selected print hammer slide **556** and all of the other slides **556** as well are retracted to extreme right-hand position, as viewed in Fig. 8 thereby; to operate bail **531** to disengage all of the latches **527** from the transfer bars **501** to permit those bars to drop to their lowermost position; and to operate bail **492** to effect the setting of storage bars **501** in accordance with

the setting of bars 449 through the agency of transfer bell cranks 507 carried by bail 509. During this time, all of the selectable pins 592 are blocked from being selected by special blocking disc 447 which is latched in extreme clockwise position by latch 583, which is pivoted on an arm 1583 carried by printing bail shaft 617 and which is, therefore, operated to restore disc 447 to blocking relation to selectable pins 592 following each printing operation. Thus, none of the pins 592 can move into selected position during the reception of stock designating letter combinations and the print bail 584 cannot be released for operation.

The second and third letters of the stock designation are received, transferred, and stored in the same manner as the first letter code, pawl 459 being operated by T-lever 452 for each letter code to advance ratchet 462 and shaft 463 to its second and third positions, whereby first the bar 474 and then the bar 476 will be actuated by bail 486 to effect the operation of of bail 493 and 494 to store in bars 502 and 503 the successive selective conditions of bars 449.

If the stock designation should consist of only one letter or of two letters, the bars 502 and 503, or the bars 503, respectively, will not be set but will remain in their lowermost positions, to which they were restored by their springs upon the operation of bail 531 in connection with the transfer of the first received code combination.

If any stock designation should contain more than three letters, or if message material such as news bulletins should be received by the selector, the letter codes in excess of three will have no effect on the signal storage mechanism. They will merely attempt to step ratchet 462, and as the ratchet has four notches in addition to that which is engaged by pawl 459 in the rest position of the ratchet, as shown in Fig. 1, it can be stepped only until cam 469 has been carried one step beyond its effective position.

Following the last letter of the stock designation, whether the designation has consisted of one, two, or three letters, the signal combination representing the first figure of the price quotation will be received. In this signal combination, the impulse which determines that it pertains to a figure will be of marking nature, and the T-lever 452 will be rocked in counterclockwise direction. This determines that the last of the letters of the stock designation has already been received and no idle interval, representing the time for setting the storage bars 502 and 503, need be interposed between the last letter code of a stock designation consisting of less than three letters and the first figure code of the price.

The counterclockwise rocking of T-lever 452 causes pawls 459 and 464 to be stripped from engagement with ratchet 462 which permits shaft 463 to return to normal position. Bell crank 579 is rocked counterclockwise as holding pawl 464 is disengaged from ratchet 462, the rocking of bell crank 579 resulting in the release of printing hammer slide restoring bail 561 and the simultaneous release of one of the latches holding the special blocking disc 447 in blocking position with respect to selectable pins 592. As bail 561 rocks to counterclockwise position, it takes up the lost motion afforded by slot 569, and thus becomes closely coupled to bail 564 for subsequent restoration to extreme clockwise position. Thus, one of the print hammer slides 556, corresponding to the slide bar 551, which had been released as a result of the setting of storage bars 501, 502, and 503 according to the code combinations representing a stock combination, becomes unlatched and is moved by its spring 559 to present its print hammer head 594 in printing position. This movement causes loop forming roller 662 to form a loop in the tape upon which the quotation is to be printed, and the tape is thereby retracted to reduce the blank space between the last printed quotation and the printing position.

At the end of the counterclockwise travel of bail 561, secondary latch 586 for blocking disc 447 is released and this latch will remain released until bail 561 is restored to extreme clockwise position, which operation will occur in connection with the reception of the code combination representing the first letter of the next stock quotation. Upon the release of disc 447 all of the selectable pins 592 are unblocked and the pin corresponding to the code combination of the first figure of the price moves into the path of printing control lever 604 and rocks that lever to effect the release of printing bail latch 612, whereupon the bail blade 626 strikes the print hammer head 594 which is presented in its path and causes the figure corresponding to the selected pin 592 to be impressed upon the tape by the continuously rotatable type wheel. Upon the restoration of printing bail 584 to normal position, spacing ratchet escapement 602 is operated to permit the tape to be advanced one step and primary latch 583 for blocking disc 447 is re-engaged with the disc controlling lever 451 and is actuated to restore the disc to blocking relation to selectable pins 592.

The code combination representing the next figure in the price also contains a marking impulse indicating that the code combination pertains to a figure, which again causes bell crank 458 to be rocked in clockwise direction. Pawls 459 and 464 are again disengaged from ratchet 462, but since this ratchet has already returned to normal position the operation is idle. Lever 579 is operated along with holding pawl 464, as before, but this operation is not idle, the latch 583 being thereby again disengaged from blocking disc controlling lever 451. Latch 583 is released and disc 447 is rocked to its extreme counterclockwise position, thus permitting a selectable pin 592 to move into the path of the type wheel shaft arm, whereby the next figure of the stock quotation price is printed. The type wheels may be provided with fractions and any marks of punctuation and special characters ordinarily used with or as part of stock quotation prices. During the printing of the several figures of the stock price, the code bars 449 are set in accordance with the setting of the code discs 446, but since ratchet 462 is not operated in response to signal combinations containing an impulse pertaining to the selection of figures, the transfer bails 509, 512, and 514 are not operated.

By means of the apparatus hereinbefore described, quotations from selected stocks may be printed upon individual tapes identified with the stocks so that the stock designation letters are not printed but are used for selecting the tape upon which the quotation is to be printed. A much larger number of quotations may thus be displayed or projected than there could be if the stock designation letters accompanied each quotation on the tape. Furthermore, the latest quotation with reference to any stock is moved out into position to be observed or projected as soon as a code combination in which the sixth pulse

is of spacing nature has been received, such a code combination causing the stock slide last selected to be retracted. When a price is to be printed upon any tape, the tape is retracted so that the quotation is printed in proximity to the next preceding quotation, thus further increasing the number of quotations that may be applied to a given length of tape.

The printer hereinbefore described may, if desired, be employed directly as a quotation board, by printing on relatively wide tapes with sufficiently large characters to enable them to be read at distances from which quotation boards may ordinarily be observed. This requires considerably larger type wheels than those employed in ordinary type wheel telegraph printers. The fact that the type wheels of the printer according to the present invention are rotated continuously renders the printer particularly adapted to the use of large type wheels because the inertia effects which would interfere with the arrestment of all of the type wheels for each printing operation are avoided.

A modified form of tape retracting and releasing mechanism is shown in Fig. 14, other elements of the printer which have already been identified in the foregoing description being designated by the same reference numerals. In the modified form of tape controlling mechanism, print hammer slides **556** are not provided with tape loop forming rollers as in the previously described apparatus. Additional fixedly located idler rollers are provided, however, there being two designated by the reference numeral **681** to be engaged by the right-hand face of the tape as it passes from the tape feed roller **632**, that face being the front of the tape, and two rollers **682** to be engaged by the same face of the tape just in advance of the point of engagement of tape **630** with the tape puller drum **641**.

A loop forming device which comprises roller supporting platforms **683** and **684** joined by a connecting bar **686** which must be as small as possible and as close to the tape as possible to avoid interference with a light beam when a projecting system is used with the printer is supported for endwise movement adjacent to each tape. Platform **683** supports loop forming rollers **687**. The rollers **687** are so positioned with respect to the rollers **681** that they may move through the plane defined by the rollers **681** as platform **683** is moved rightwardly. Similarly, platform **684** is provided with rollers **688** so positioned with reference to rollers **682** that they may move through the plane defined by the rollers **682** when platform **684** is moved to the right. Rollers **687** and **688** engage the rear surface of the tape and the rollers **688** are disposed a substantial distance to the left of the rollers **682** so that the tape follows a tortuous path around rollers **688** and **682** alternately to reach tape puller drum **641**. Thus, the rollers **688** form loops of substantial dimensions in the tape beyond the printing point.

When the tape loop controlling device which comprises platforms **683** and **684** and connecting bar **686** is moved rightwardly, as viewed in Fig. 14, the loops of tape formed by rollers **688** are gradually reduced in size until left-hand platform **684** engages stop **708**. As rollers **688** are carried rightwardly and the loops formed thereby are diminished, the rollers **687** pass through the plane defined by the axes of rollers **681** and continue rightwardly thereof to form loops in the tape at the right-hand end of the tape loop controlling device. The transference of tape loops from the left-hand end to the right-hand end of the tape loop controlling device is accompanied by movement rightwardly past the printing position of a section of tape which had previously moved leftwardly past that position. Thus, the retraction of the tape to permit the printing of a stock quotation price in close proximity to the previously printed price which had been drawn out into viewing or projecting position and the drawing out of the printed quotation into printing or viewing position following the printing operation results solely from the transference of slack accumulated in the form of loops from one side of the printing position to the other without necessitating movement of the tape past the point of engagement with tape feed controlling roller **632** or tape advancing drum **641**. Since four passes of tape form the loops around rollers **682** and **688**, the tape loop forming device need be moved only one-fourth of the distance that tape **630** is to be retracted or advanced by the transference of loops from one side of the printing position to the other.

For moving the tape loop device to the right, as viewed in Fig. 14, to retract the tape toward the printing position, there has been provided a lever **691** pivoted at **692** and carrying a pin **693** which is disposed in a slot **694** in platform **683**. Lever **691** is provided with a cam follower projection **696** engageable with a cam **697** carried by a shaft **698** and driven therefrom through a friction clutch. A tension spring **699** biases lever **691** in clockwise direction to maintain engagement of cam follower projection **696** with cam **697**. A stop disc **701** is provided with shoulders engageable with the armature **702** of an electromagnet **703** when the magnet is deenergized. The circuit of electromagnet **703** includes a pair of contacts **704** adapted to be closed by a lug **706** carried by print hammer slide **556** when the print hammer slide moves to its extreme left-hand position. Upon energization, electromagnet **703** withdraws its armature **702** from blocking engagement with stop disc **701**, whereby cam **697** is released for rotation and continues to rotate until the print hammer slide **556** is restored to its extreme right-hand position which, as previously described, occurs upon reception of the first signal combination of the next stock quotation identification. As cam **697** rotates, it rocks lever **691** to its extreme counterclockwise position in opposition to its biasing spring **699**. As lever **691** is rocked to that position, it takes up the lost motion afforded by slot **694** and then moves the tape loop device to its extreme right-hand position, slot **694** being wider at its right-hand end than at its left-hand end to permit the tape loop device to move in a straight line while lever **691** moves in an arc. Stops **707** and **708** are provided for limiting the movement of the tape loop device in right-hand and left-hand directions, respectively. It is important that stop **708** shall be so positioned so as to afford the tape loop device sufficient movement to the right to permit cam follower projection **696** of lever **691** to clear the cam projection of cam **697**.

As cam follower projection **696** escapes from each of the projections of cam **697**, spring **699** attempts to restore lever **691** to its normal position. However, the clockwise motion of lever **691** is retarded by a dashpot device **708** which prevents lever **691** from rotating clockwise a sufficient distance to take up the lost motion

afforded by slot 694 during the rotation of cam 697 the distance of 180° between its cam projection. Lever 691 may move a short distance in clockwise direction between cam projections, but it will be restored to extreme counterclockwise position immediately and the result will be a slight oscillation of lever 691 which, however, will not be imparted to the tape loop device which comprises platforms 683 and 684 connected by bar 686.

Fig. 15 shows in schematic form an arrangement for projecting real images of the stock quotations printed on multiple tapes upon a viewing screen. The multiple tape printer is indicated merely by a diagrammatic showing of a tape supply roll, a tape idler roller, a type wheel, and the tape puller drum. At the rear of the printer are located a lamp 711, which is backed by a reflector 712 for concentrating and focusing the illumination, and a condenser lens system 713. In front of the printed tapes is located an objective lens 714 by which the beam of light passing through the tape may be focused upon a plane reflector 716. Plane reflector 716 turns the beam of light through 90° and directs it to the rear of a translucent viewing screen 717 from the front of which the images of quotations printed on the tape of the printer may be observed. The transmission of light through the tape from the rear and the use of a single objective lens and a plane reflector necessitates the printing of figures upon the tape in the position shown in Fig. 18, the tape being viewed from the front. With the characters thus printed, the image inversion and rotation taking place at objective lens 714 and reflector 716 will produce upon viewing screen 717, when viewed from the front of the screen, erect real images of the printed characters moving from right to left as the tape is advanced, which is the actual direction of movement of the tape from the printing position. Since the type wheels are located behind the tapes but the inking ribbons and the print hammers are in front of the tapes, the characters will be arranged on the type wheel according to the showing of Fig. 17. It is to be noted that printed characters viewed from the front of the tape, which is the side upon which they are printed, appear in the same relative positions that they do on the type wheel. For this type of image projection, it is desirable to use transparent tape for the printing of the quotations in order that the translucent viewing screen shall be brightly illuminated to cause the dark type impressions to stand out distinctly.

It will be apparent from Fig. 15 that the projecting system hereinbefore described is readily adapted to duplication along a wall with important advantages from the standpoint of space economy, less depth being occupied than would be required if the projecting elements from lamp to viewing screen should be arranged in a straight line extending from the back wall to the viewing screen. Also, a plurality of projecting compartments may be formed by a plurality of spaced plane reflector supports, arranged parallel to each other and obliquely to the back wall, and a plurality of viewing screens parallel to the wall.

In order to keep the projection distance a minimum and in order to employ the most economical optical arrangement, the tapes are divided into groups and short focal-length, inexpensive condenser and projecting lenses are used with each group of tapes, in place of a lesser number of long-focus and much more expensive condenser and projecting lenses. The importance of keeping the projection distances low is to reduce the total space occupied so that the board can be used where space is very limited or is expensive. This arrangement is shown in Fig. 16, wherein a single type wheel shaft 406 and single set of each of the storage bars 501, 502, and 503 serve to control the printing upon two or more sets of tapes spaced according to the vertical dimensions of the tape images.

It should be noted that the optical system of each group of tapes inverts, in the image, the order of the tapes in that group, causing the uppermost tape of a group to appear at the bottom of the image of the group upon the screen. Such inversion of individual groups causes to be brought into adjacency on the screen the uppermost tape of one group and the lowermost tape of the group next below it. This necessitates that if the tape images are to appear on the screen in a particular order, a different order of coding the print hammer selecting slides, having reference to the group inversion, must be established in the printer. Thus, if an alphabetical order of tape images is desired, the order of tapes in the printer must be from bottom to top of the uppermost group, then from bottom to top of the second group, then from bottom to top of the third group, and similarly down to and including the lowermost group of tapes.

Although certain specific embodiments of the present invention have been shown and described herein, it is to be understood that the invention is not limited to such embodiments, but is capable of modification, rearrangement, and substitution of parts and elements without departing from the spirit of the invention, and within the scope of the appended claims.

What is claimed is:

1. In combination with a telegraph selector mechanism, a plurality of tape supply sources, means including a plurality of groups of identical type wheels each for printing selectively on one of the tapes from said sources, an individual tape advancing apparatus for each one of the tapes for drawing said tape from its said supply source, means for disposing said tapes parallelly with limited portions of each tape arranged in a straight line and in a common plane, a plurality of optical systems one associated with a number of said tapes comprising a group and associated with its said single plane comprising condenser and projection lenses, a source of light for producing a beam through said optical system to project an image from each one of said single planes, and a viewing screen for receiving a composite image of the projected images from said plurality of groups of tapes.

2. In combination with a type wheel selecting mechanism comprising a shaft, a plurality of type wheels carried by said shaft in vetrical alignment each having the same series of characters with corresponding characters of said plurality of type wheels in the same radial position on said shaft, means for printing selectively upon any of a plurality of light penetrable tapes individually associated with each of said type wheels, a light projecting system for projecting the images of a plurality of said tapes parallelly as they emerge from their several ones of said type wheels onto a common object screen, and apparatus under signal control for moving any one of said tapes independently with respect to said light system comprising apparatus responsive to a selection of

any of said plurality of type wheels for advancing its associated tape longitudinally as the printing by said type wheel progresses, said tape advancing apparatus being operative following each type wheel operation to advance said tape to expose the most recently printed tape surface for projection onto said common object screen.

3. In combination, a printing telegraph apparatus comprising a rotatable shaft carrying a plurality of type wheels at various elevations, a plurality of tape supply rolls each supported in horizontal alignment with one of said elevations, a plurality of tape pulling means supported parallelly with respect to and predeterminedly spaced from said tape supply rolls with intervening distance to afford a predetermined area of parallel straight line tape bands, automatically supervised mechanism including a plurality of print hammers each associated with one of said type wheels for effecting printing engagement with its said type wheel in response to certain print hammer selecting signals, means for moving a tape into position to expose the most recent printed matter to a projecting system following the operation of its print hammer and back to contiguous printing position upon reselection, and a light projecting system for casting images of printed matter carried upon said tapes within said area onto an object screen.

4. The combination set forth in claim 3 in which said means comprises a plurality of individual tape advancing mechanisms responsive to the selection of associated ones of said print hammers to shift in one direction and to the release of said hammers from selection to move in an opposite direction.

5. In combination, a plurality of light permeable bands supported in parallel alignment within a substantially vertical plane, a light projection system for casting an enlarged image of printed matter carried by said bands onto an object field, means to select any one of said bands in response to a telegraph selecting signal received over a common channel, means to print upon said selected band including a type wheel individual to each band, a common operating shaft for the several of said type wheels, apparatus responsive to the individual type wheels of each band for advancing said band longitudinally as the printing thereupon progresses, and tape shifting means operative following each selection to shift a tape to expose the most recently printed matter to locate in said vertical plane.

6. In combination, a plurality of web supply rolls supported one above the other in coaxial alignment, a plurality of web pulling rolls also supported one above the other in coaxial alignment parallel to said web supply roll coaxial alignment and in predetermined spaced relation therefrom, a telegraph printing mechanism comprising a rotatable shaft having thereon a plurality of type wheels each one in horizontal alignment with one of said web supply rolls, a print hammer interponent for cooperating with each of said type wheels, and signal supervised means for rotationally positioning said type wheel carrying shaft selectively and for operating any one of said interponents in correspondence with the character of signals received, and a plurality of light projecting systems arranged in parallel horizontal alignment to project from the webs of contiguous pluralities of supply rolls onto contiguous objective screens to produce a continuously appearing object of said pluralities of webs during the printing thereon and transverse movements thereof.

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