Nov. 16, 1943. K. E. BALLWEG 2,334,534

TELETYPEWRITER

Filed Dec. 2, 1942 4 Sheets-Sheet 1

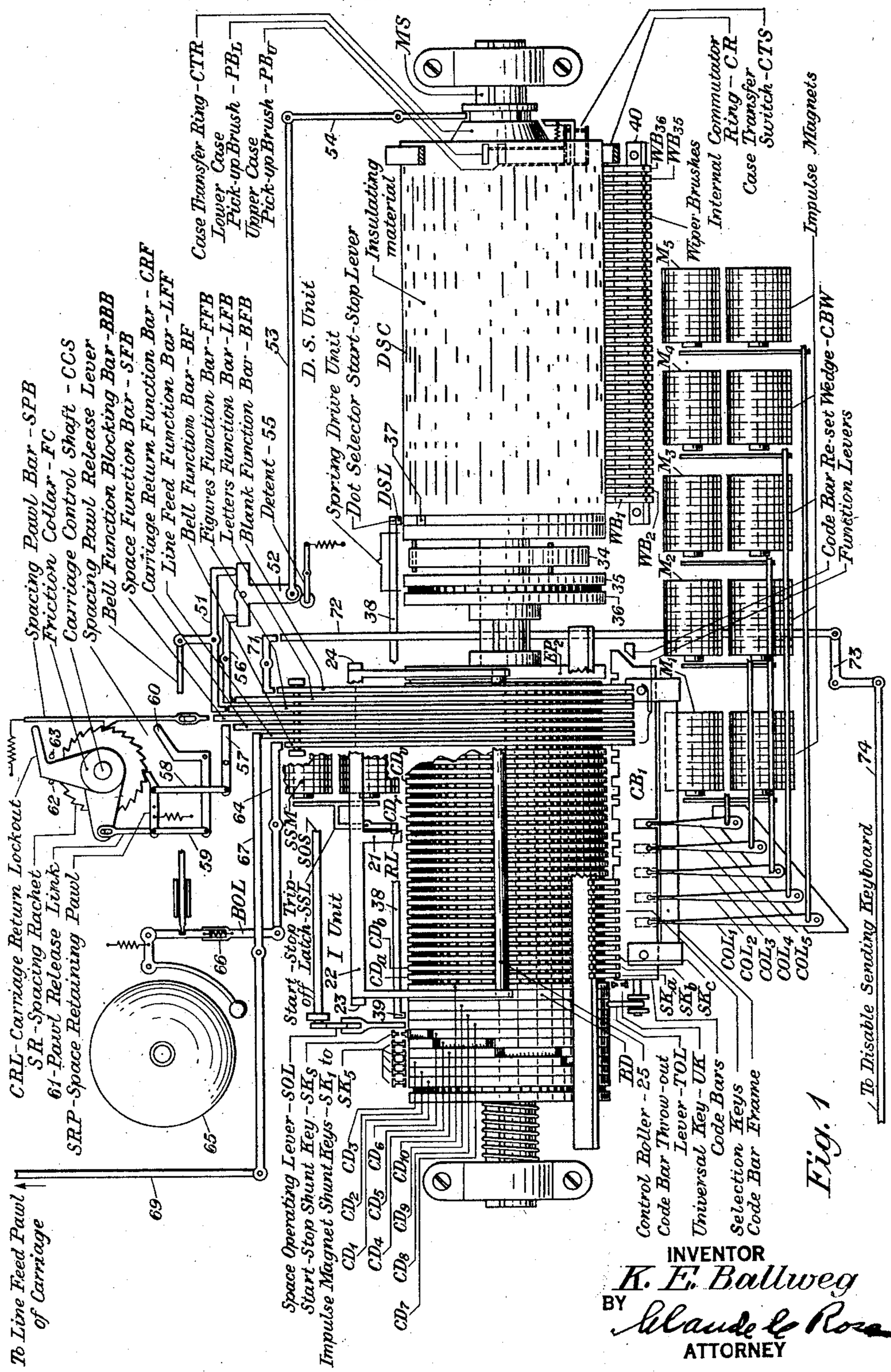

Fig. 1

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TELETYPEWRITER

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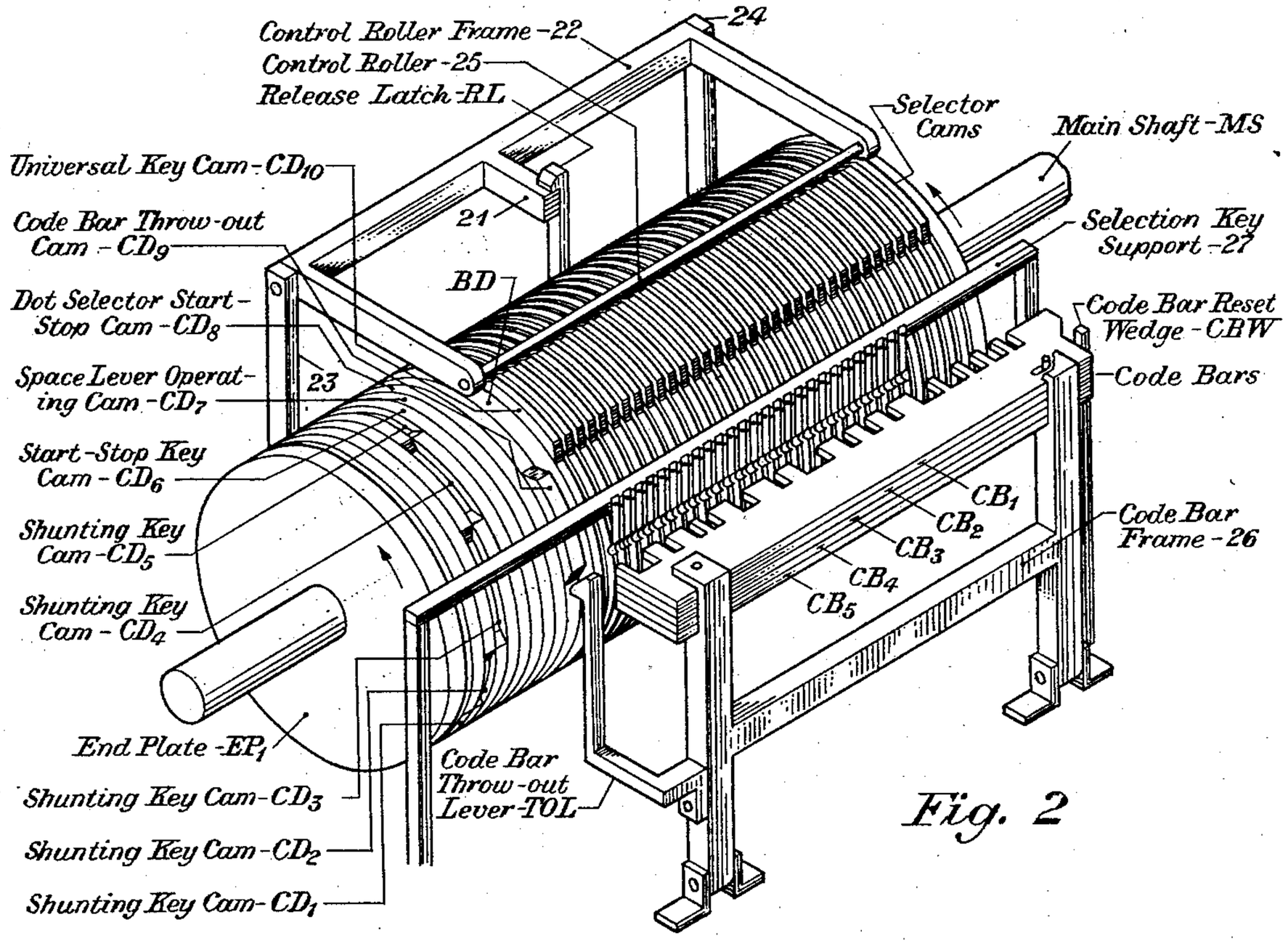

Fig. 2

Fig. 3

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TELETYPEWRITER

Filed Dec. 2, 1942 4 Sheets-Sheet 3

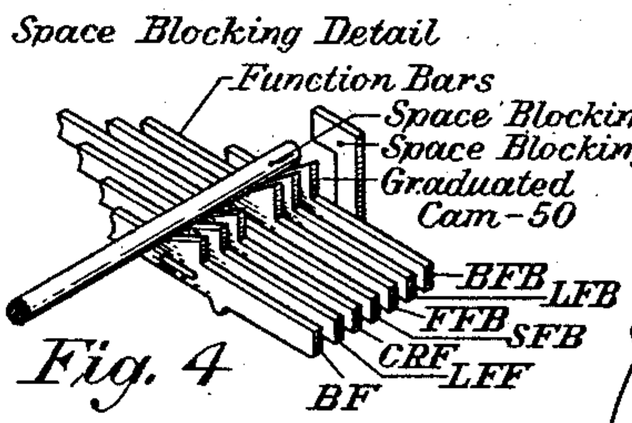

Fig. 4

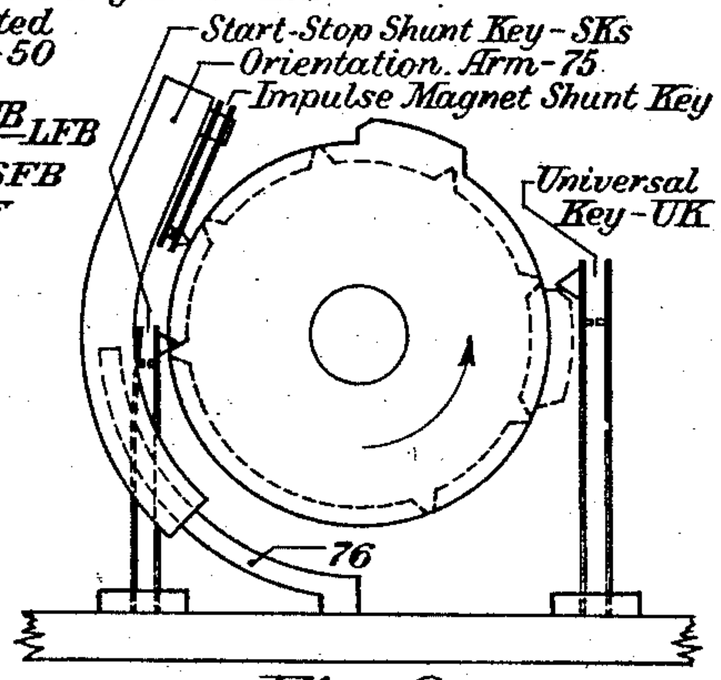

Fig. 6

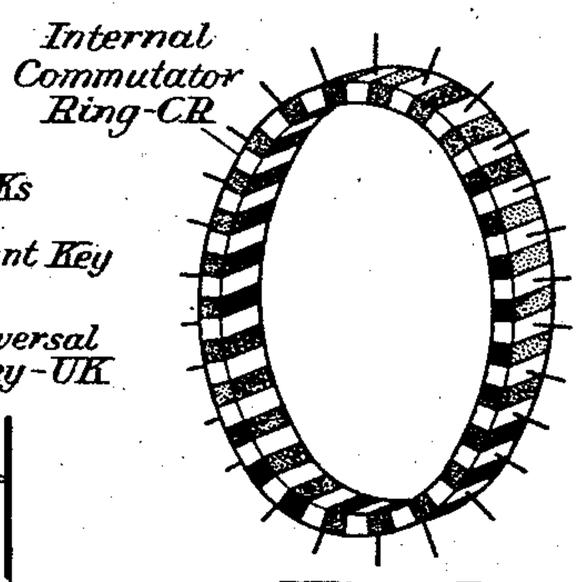

Fig. 5

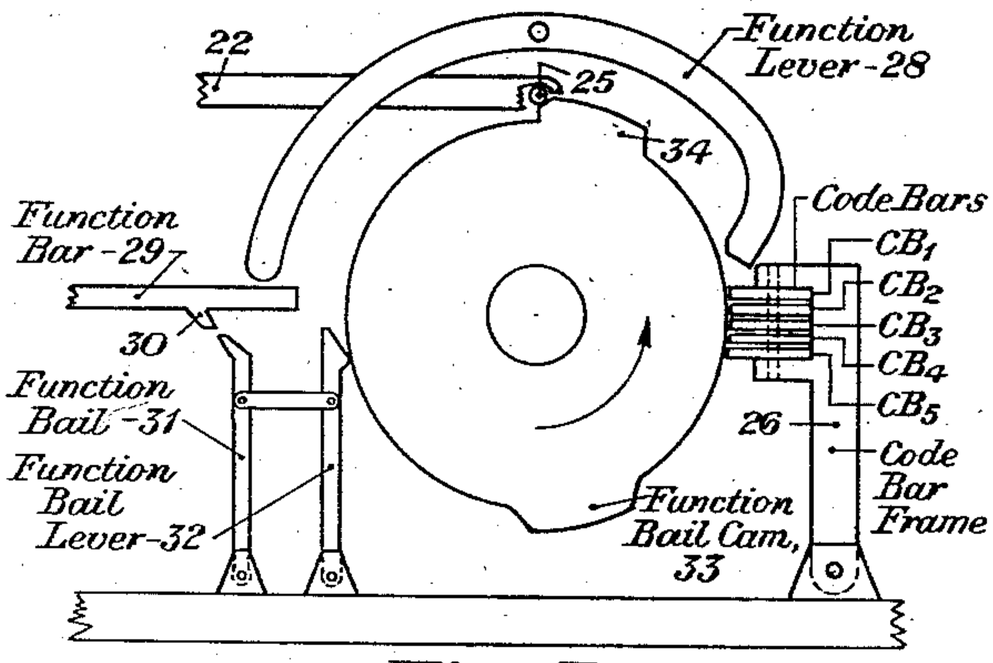

Fig. 7

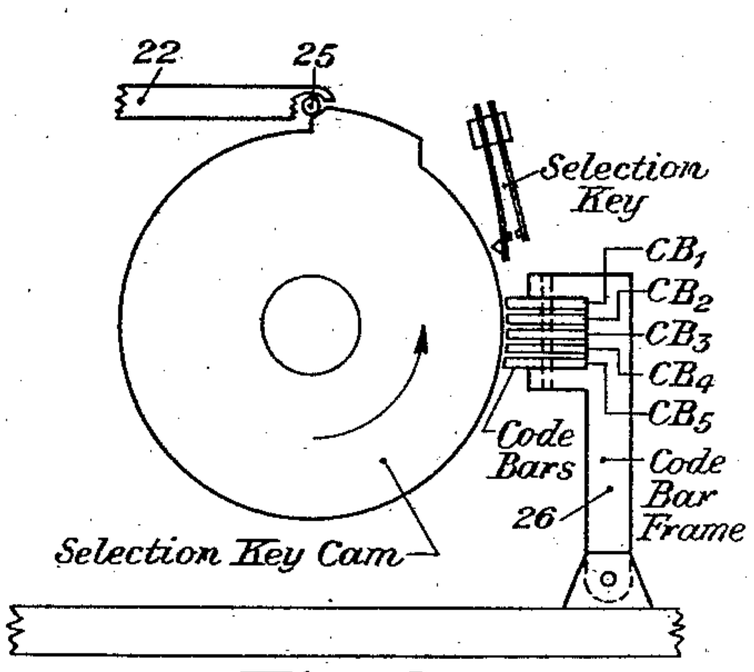

Fig. 8

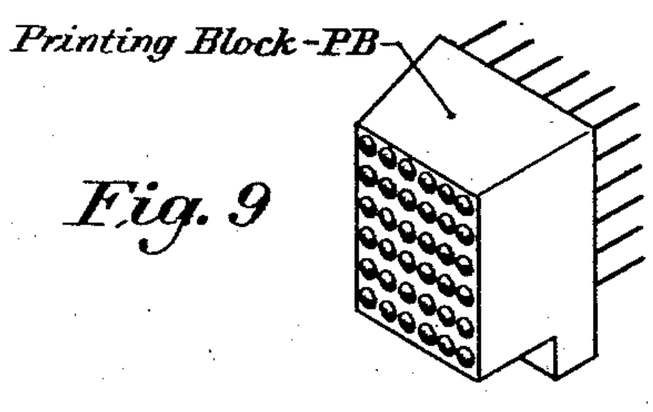

Fig. 9

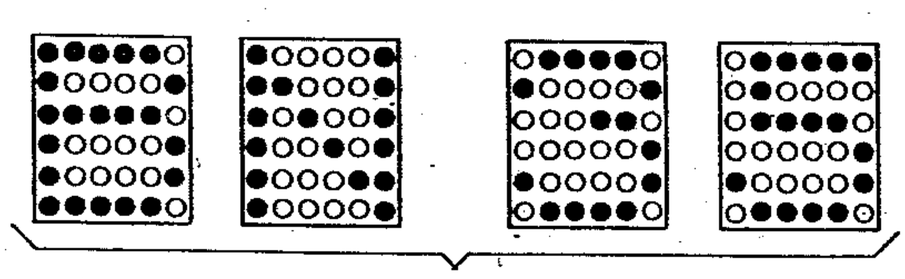

Fig. 10

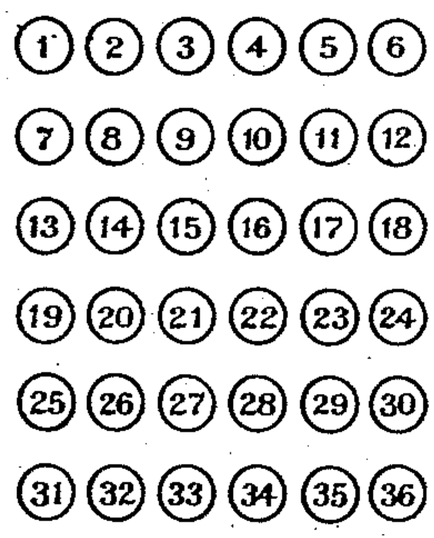

Fig. 11

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TELETYPEWRITER

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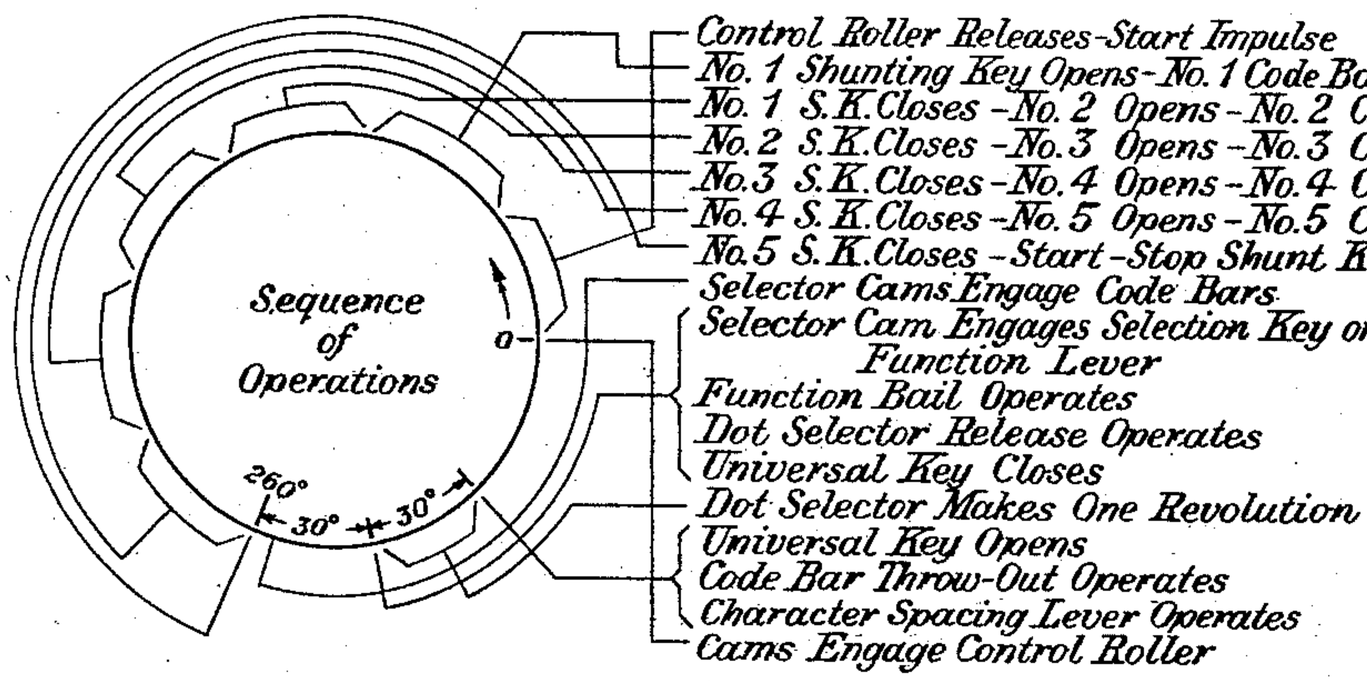

Fig. 12

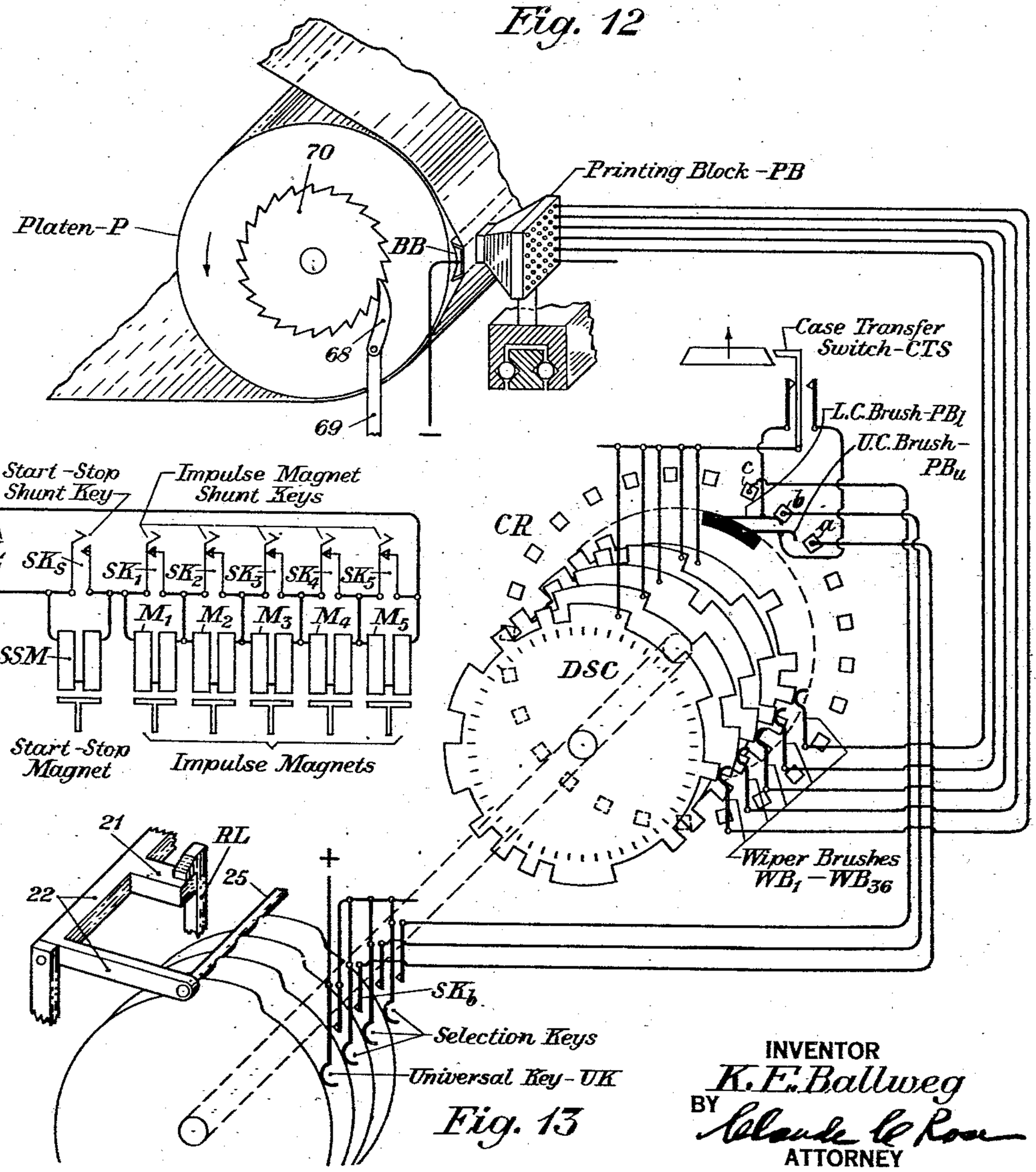

Fig. 13

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Patented Nov. 16, 1943 2,334,534

UNITED STATES PATENT OFFICE

2,334,534

TELETYPEWRITER

Kenneth E. Ballweg, Portland, Oreg., assignor to American Telephone and Telegraph Company, a corporation of New York

Application December 2, 1942, Serial No. 467,567

17 Claims. (Cl. 178—30)

This invention relates to teletypewriters and particularly to an improved form of teletypewriter in which, instead of using separate teletype bars or other typing devices for each letter or character, the letters or characters are all formed from a single printing block.

One of the objects of the present invention is to provide a teletypewriter unit having under certain conditions the following advantages: (1) simplified design at a favorable production cost; (2) high operating speed; (3) suitability for use in systems designed for and employing the present type of machines; (4) capability of performing all functions of present types of machines; and (5) adaptability to mass production.

In order to accomplish these results the teletypewriter of the present invention is designed to operate upon the principle of electro-chemical action upon specially treated paper. It is well known that by passing an electrical current from one electrode through suitably prepared paper to another electrode, a discoloration will occur at the point on the paper where the current passes. By making the circular area of the electrode sufficiently small at its point of contact with the paper, a small dot can be produced thereon.

From this it follows that if a number of insulated electrodes are grouped together in such a manner that their ends are all in contact with the paper, various patterns can be produced upon it by selectively energizing particular combinations of electrodes. A block of electrodes of this type can be used to produce all of the letters of the alphabet and other characters ordinarily used in printing telegraphy.

In its simplest form the printing block may consist of a large number of fine gauge wires suspended in an insulating plastic medium. That portion of the block which is in the position of contact with the paper is called the "face" and the opposite side is referred to as the "terminal side." The ends of the wires on the "face" of the block constitute the electrodes. The electrical conductors used in the process of selecting the electrodes are connected to the terminals of the block appearing on its terminal side. The block face is of substantially the same size as that of the character to be formed on the paper. Preferably the terminal side of the block may be made of larger size to facilitate connections to the terminals projecting from it.

While any desired number of electrodes may be provided in the block it has been found by experiment that thirty-six dot forming electrodes give good results. Less than this number would decrease the legibility of the characters, while a larger number will give characters with a higher grade of definition. The printing block, of course, displaces the type basket and associated parts used in present day teletypewriters.

The mechanism for selecting the proper dot positions and energizing them is somewhat more complicated than the printing block but is simpler than that used with existing teletypewriters employing type bars or type wheels for printing. The receiving mechanism for performing these selections must be capable of receiving standard line signals, which consist usually of five impulses of the Baudot code for character determination, preceded by a starting impulse and followed by a so-called stopping impulse. To enable use of the printer of the present invention in systems employing this code, the receiving mechanism consists of two main parts, an "interpreting unit" and a "dot selector unit." Both of these units are mounted on and are driven by a main shaft which may in turn be driven by a synchronous motor.

The interpreting unit may consist of a series of cam disks. Certain of these disks are character determining disks controlling selecting keys or switches, and in cooperation with selecting code bars, determine the character to be printed. Others of these disks are function determining disks and are selected to control mechanisms producing the so-called "functions," such as line feed, carriage return, spacing, etc. Still other of these cams are not selectively operated, but selectively receive and distribute the received impulses of each code combination, thereby controlling the selection of the character and function determining disks.

The dot selector unit consists of a lightweight cylinder made of insulating material. It is mounted to be freely rotated on the main shaft by a spring wound up by the shaft, so that when released it completes its rotation at a speed higher than that of the shaft. Along the surface of this cylinder in lines parallel to its axis, rows of commutator bars may be mounted, a row of bars corresponding to each of the characters to be printed. For the usual alphabet of twenty-six characters, if both upper case and lower case characters are to be printed, fifty-two rows of commutator bars would be required. For punctuation marks and other symbols additional rows of bars may be necessary. A number of wiper brushes are so arranged that they may make contact with the rows of commutator bars, one

wiper corresponding to each of the points or dots of the printing block. These wipers may be selectively operated by making contact with the live commutator bars in a selected row, and thus the electrodes of the printing block may be selectively activated to print any desired character.

Further features of the invention will be clear from the following detailed description, when read in connection with the accompanying drawings, in which Figure 1 is a plan view of the receiving mechanism, including the interpreting unit and dot selector unit; Fig. 2 is a perspective view of the interpreting unit; Fig. 3 is a perspective view of parts of the interpreting unit; Fig. 4 is a perspective view of the function bars of the interpreting unit; Fig. 5 is a perspective view of the commutator ring employed in connection with the dot selector unit; Figs. 6, 7 and 8 are schematic representations of certain of the cam disks and associated elements; Fig. 9 is a perspective view of the printing block; Fig. 10 is a schematic showing of the face of the printing block with certain electrodes energized to represent several different characters; Fig. 11 is a schematic layout of the arrangement of the electrodes in the printing block; Fig. 12 is a diagram or chart showing the sequences of operations of the interpreting unit and dot selector unit; and Fig. 13 is a diagram showing the electrical connections of the interpreting unit and dot selector unit. In the various drawings the various elements and parts are for the most part shown schematically and symbolically without regard to dimensions and, in certain instances, without regard to the exact form and relative positions of the elements.

Printing block

As already stated, the printing block (which is shown at PB in Fig. 9) may consist of thirty-six electrodes which are shown on the face of the printing block as black dots. Each of these electrodes is electrically connected to a terminal at the back of the block, the terminals being indicated in Fig. 9 as wires projecting from the back of the block. The electrodes may be laid out on the face of the block in the configuration shown in Fig. 11 in six rows of six electrodes each. By selectively energizing certain of the electrodes various characters may be represented. For example, in Fig. 10 the energized electrodes are shown as black dots and non-energized electrodes as small circles. The four arrangements indicated in Fig. 10 represent the characters B, N, 3 and 5. It will be understood, of course, that in actual practice the printing block and electrodes may be very much smaller than herein illustrated.

Interpreting unit

The interpreting unit and the dot selecting unit and associated parts are shown in Fig. 1, the former being also shown in Fig. 2. Reference should also be made to Figs. 3 to 8, inclusive, and Fig. 13 for further illustration of some of the parts.

In receiving a line signal the start or open circuit impulse releases the armature of a start-stop magnet shown at SSM in Figs. 1 and 13. The winding of this magnet, as shown in Fig. 13, is in series with the windings of the five code bar magnets designated M_1, M_2, M_3, M_4 and M_5 in Figs. 1 and 13. The windings of each of these six magnets are arranged to be shunted by shunt keys, the shunt key SK_s shown in Figs. 1 and 13 being arranged to shunt the winding of magnet SSM, and the shunt keys SK_1 to SK_5, inclusive, operating to shunt the windings of the impulse magnets M_1 to M_5, inclusive. Normally the start-stop shunt key SK_s is open so that the start-stop magnet SSM is bridged across the line, the windings of the several impulse magnets being shunted out by the corresponding shunt keys SK_1 to SK_5, inclusive. Upon receiving the start impulse the release of the start-stop magnet armature permits the assembly of cam disks of the interpreting unit to start revolving.

This is accomplished as shown in Fig. 1 by means of a start-stop trip-off latch SSL connected to the armature of the start-stop magnet SSM so that when the armature is released the latch SSL swings about its pivot to disengage a release latch RL (see Figs. 1 and 2) from a projection 21 on a control roller frame 22 which is pivoted to standards 23 and 24. The frame 22 is U-shaped and between the ends of the arms of the U it carries a control roller or bar 25 which normally rests against the edges of the selector cams to prevent the disks carrying said cams from rotating. When the trip-off latch SSL releases the control roller frame 22, the roller or bar 25 will be free to move vertically to release the cams.

The cam disks of the interpreting unit are arranged in three general groups. At the left in Figs. 1 are shown in order from left to right cam disks CD_1 to CD_5, which operate their switches or keys, however, in reverse order, disk CD_5 opening its key SK_5 first and disk CD_1 opening the key SK_1 last. The impulse magnet shunt keys SK_5 to SK_1 distribute to the corresponding magnets M_5 to M_1 the five impulses of the Baudot code which follow the start impulse. To the right of these disks cam CD_6 operates the start-stop shunt key SK_s, closing said key before key SK_5 opens, and opening it after key SK_5 closes. These six cams are followed by additional cams CD_7, CD_8 and CD_9 which, respectively, operate the character spacing mechanism of the printer, the release mechanism for the dot selector unit, and the code bar throwout lever TOL, as will be described later.

All nine of these disks are free to rotate on the main shaft MS but are mechanically so related that when they rotate they rotate together. Normally these nine disks do not rotate with the shaft since they are coupled together and mechanically attached to a blank disk BD, which in turn is arranged to rotate with a cam disk CD_{10}. The latter cam is prevented from rotation by the engagement of the control roller or bar 25 with the edge of its cam until said bar is released by the start signal. The purpose of the cam disk CD_{10} is to control the universal key UK, as will be described later.

In actual practice the ten cam disks C_1 to C_{10}, inclusive, and the blank disk BD may be made either of separate disks, pinned or otherwise secured together, or they may be formed of a solid block of material with its surfaces suitably cut to form the desired cam surfaces. A suitable disk of friction material may be interposed as shown in Fig. 1, between the end plate EP_1 (which is fixed to and rotates with the main shaft MS) and the cam block or group CD_1 to CD_{10}, inclusive. This frictional arrangement permits the cam block or group CD_1 to CD_{10}, inclusive, to remain stationary when the cam CD_{10} is held by the control roller or bar 25, even though the end plate EP_1 rotates continuously. When, however, the control bar 25 is released by the deenergization of the start-stop magnet SSM in response to the

starting impulse as already described, the ten disks under discussion will rotate with the end plate EP_1 due to the frictional engagement therewith. The end plate EP_1 is, of course, spring pressed against the insulating disk and the block of ten cam disks above described.

The proper operation of the start-stop shunt key SK_s and the impulse magnet shunt keys SK_1 to SK_5, inclusive, is obtained by cutting recessed cam surfaces in the cam disks CD_1 to CD_6, inclusive. These recessed cam surfaces are so related to each other that normally the lug or other cam operated element carried by the start-stop key SK_s will lie in the cam recess of disk CD_6 and hence the start-stop contact will be opened. As the cam disk CD_6 rotates in a counter clockwise direction key SK_s is closed and the cam recess in the cam disk CD_5 comes into play and permits the shunt key SK_5 to open. Upon further rotation the key SK_5 is closed and the cam recess in the disk CD_4 permits the shunt key SK_4 to open. As the rotation continues, the succeeding shunt keys SK_3, SK_2 and SK_1 are successively operated to open and then close. These operations take place during a rotation through about 260 degrees, as is indicated by the chart shown in Fig. 12. The successive operation of the shunt keys SK_5 to SK_1 causes the selective operation of the corresponding impulse magnets M_5 to M_1, inclusive, depending upon whether the Baudot code impulses distributed by the shunt keys SK_5 to SK_1 are marking or spacing impulses.

Letter determining cam disks

The second group of cam disks consists of the character determining disks CD_a, CD_b, CD_c, etc., all of which are cut alike and each of which has a single projecting cam, as is clearly shown in Figs. 2 and 8. The purpose of these projecting cams will appear later. Bearing in mind that rotation is counter-clockwise, normally the forward edge of each projecting cam rests against the control roller or bar **25** so that the disks are prevented from rotating. One cam disk is provided for each letter of the alphabet. Where punctuation marks and other symbols are included as lower case symbols, additional disks, corresponding in number to the punctuation marks or other characters to be printed in the lower case or "letters" group, will be provided unless no capital letters are arranged for, in which case the uppe case or "figures" position will be used for punctuation marks, numerals, etc.

These character determining disks are mounted upon the main shaft MS but are free therefrom and are separated from each other by friction washers as shown in Fig. 1. Consequently, when the disks are held by the control roller **25** they will remain stationary and will not rotate with the main shaft MS. When the control roller **25** is released, however, the frictional engagement between the disks and the end plates EP_1 and EP_2 will cause them to rotate together. They continue rotating with the main shaft MS until their cams come into engagement with the code bars, whereupon, as will be described later, they are held from further rotation until the code bars are released. The particular letters cam disk which is selected by a received code combination will be free to continue its rotation, however, due to the friction between its sides and the adjacent friction disks. The friction disks are arranged to rotate with the main shaft MS at all times by being keyed or otherwise secured thereto.

Code bars

In order to control the selection of a particular one of the character determining cam disks, five code bars CB_1 to CB_5, inclusive, are provided as shown in Figs. 1 and 2. These code bars are mounted in a code bar frame **26** and the legs of the code bar frame are pivoted at their ends. This enables the code bars as a group to be swung away from the cam disks by the action of a code bar throw-out lever TOL under the action of the cam CD_9 as will be described later.

Code bar operating levers COL_1 to COL_5, inclusive, are provided one for each code bar and are operated by the armature of the impulse magnets M_1 to M_5, inclusive. Therefore, depending upon the Baudot code combination received, selected ones of the code bars will be shifted to the right in response to the operation of the magnets, so that the beveled edges of the code bars rest against the code bar reset wedge CBW. For example, as the impulse magnet keys SK_1 to SK_5 are successively opened, the opening of the key SK_1 enables the magnet M_1 to operate the code bar CB_1 if a marking impulse is received from the line at that moment. During the next interval the shunt key SK_1 is closed and shunt key SK_2 is opened. If a spacing signal is received during the interval, the magnet M_2 will remain unactuated. If during the next interval a marking signal is received, the magnet M_3 will be operated, etc.

The code bars are provided with notches along their edges adjacent the cam disks. These notches are so arranged and positioned along the several bars that when all of the bars are in normal position, as will be the case when a blank signal is received, there will be no point along the code bars where the notches will be vertically aligned. Hence the edges of the raised cams on the rotating character determining cam disks will all come into engagement with the code bars and be prevented from further rotation. This occurs, as will be seen from the chart of Fig. 12, just after the start impulse and the five character selecting impulses have been received.

If, however, instead of a blank signal a character signal had been received, certain of the code bars would have been shifted to the right as previously described. This will result in an alignment of the notches of all five code bars in front of the cam disk to be selected. Consequently the selected cam disk will not be stopped because its projecting cam passes through the aligned notches in the bars. It therefore continues to rotate while the other cam disks are held stationary.

Each of the character determining cam disks is provided with a selection key as shown in Figs. 1, 2 and 13, these keys being designated SK_a, SK_c, etc. These keys are mounted on a selection key support **27** so that they are held just above the code bars. Consequently, when the raised cam of the selected cam disk passes through the aligned notches of the code bars it engages and closes the contacts of the selection key of the selected code disk. At the same time the cam disk CD_{10} will be rotating because its projecting cam is not obstructed by the code bars. Hence it will close the universal key UK simultaneously with the closure of the selection key of the selected cam disk, as will be described later. This establishes a selecting circuit to determine the character to be printed.

After the cam disk has been selected, the operations incident to the establishment of the se-

lecting circuit just described take place during the further rotation of about 60 degrees as indicated by the chart of Fig. 12. During the interval after the code bars have been operated and the selecting circuit has been established the dot selector unit operates, as will be described later. At the end of this interval the cam of the disk CD_{10} passes beyond the universal key UK which now opens. At the same time the cam of the selected disk passes beyond its selection key which also opens. The simultaneous opening of these keys disestablishes the selecting circuit.

Just after the universal key UK opens and the selection key of the selected disk opens, a projecting cam on the disk CD_9 comes into play and operates the code bar throw-out lever TOL which, as will be clear from Figs. 1 and 2, swings the frame **26** carrying the code bars outwardly and away from the cam disks. Just before this occurs the unselected disks will all be held from rotation by the code bars, and they are somewhere between 30 and 60 degrees behind the selected disk at the instant the code bars swing outwardly. As the code bars swing outwardly the unselected cam disks are released and rotate with the selected cam disk although they are delayed with respect to it by the amount above indicated.

At the end of a complete rotation the edge of the cam of the selected disk engages the control roller or bar **25** (which was released at the end of the start impulse) and accordingly the selected disk comes to rest. During a short interval after the selected disk ceases rotating the unselected disks continue to rotate until the edges of their cams in turn encounter the control bar **25**, whereupon they also come to rest. In other words, the unselected disks catch up with the selected disk during an interval following the last impulse of the Baudot code. This interval occurs while the sending station transmits the so-called stopping impulse which, as is well known, is a marking impulse.

Even if a starting impulse for a succeeding character selection should be transmitted before the unselected disks have caught up with the selected disk and come to rest, the fact that the disks are out of synchronism at the moment will cause no difficulty. When the disk previously selected reaches the code bars it will either pass through or be stopped, depending on whether it is again selected or whether it is not selected. If it is again selected it will function as already described. If some other cam disk is selected by the code bars, the previously selected disk will be stopped and the other cam disks (except the one now selected) will be stopped by the code bars. The selected cam disk will in this case lag slightly behind the distributing disks CD_1 to CD_8, inclusive, and hence will pass through the aligned notches of the code bars a little later than would otherwise be the case. Nevertheless it performs its function of establishing the desired selecting circuit when its cam comes in contact with its selection key SK.

Function determining cam disks

A third group of nine cam disks is provided at the left end of the interpreting unit as shown in Figs. 1 and 2. These disks are similar to the character selecting disks of the group previously described but are not provided with selecting keys. Instead these disks operate the so-called function bars which perform functions such as line feed, carriage return, spacing, etc. For this purpose each function cam disk as shown in Fig. 7 is provided with a function lever **28**, one end of which will come in contact with the cam of the selected disk after it has passed through the aligned notches of the code bars. The function lever **28** is pivoted midway so that its opposite end is depressed as the cam surface operates the function lever and thus causes the function bar **29** to be depressed. The function bar is provided with a shoulder **30** which is thus brought to a level such that it will be engaged by the function bail **31** when the latter is operated by the function bail lever **32**.

Each function cam disk is provided with an additional cam, herein referred to as the function bail cam, as shown at **33** in Fig. 7. This cam is so arranged with respect to the main or selecting cam **34** that it will come into engagement with the function bail lever **32** just after the selecting cam **34** engages the function lever **28**. Consequently the function bail **31** will be operated and, by engaging with the shoulder **30** of the function bar, will drive said bar to the left and away from the cam disk as shown in Fig. 7. This movement of the function bar of course occurs at the same relative point in the rotation of the interpreting unit as the selection of a character. When the function bar is thus moved it operates through certain levers and other mechanisms to perform the various selected functions, as will be described later. Further details of these function levers and mechanisms will be clear from a description of the operation of the machine which will be given hereinafter.

Dot selector

From the foregoing description of the interpreting unit it can be seen that contacts of a selected key can be momentarily closed and that this key is selected in response to a particular received code combination. It is the function of the "dot selector" to extend an electrical circuit passing through this key to the proper electrodes in the printing block PB to form the desired character pattern upon the paper.

The dot selector unit, as has already been explained, consists of a lightweight cylinder DSC of insulating material along whose surface in lines parallel to its axis are mounted rows of commutator bars. The commutator bars are symbolically represented by the black horizontal lines in Fig. 1. Another symbolic representation appears in Fig. 13 where the cylinder is made up of a set of disks having their edges recessed or notched at points where insulation appears in Fig. 1. The bars in Fig. 1 are all connected electrically common and, if both capital and small letters are to be printed, there will be two rows of bars for each letter, one corresponding to the lower case form of the letter and the other to its upper case form. There is also a row of commutator bars for each punctuation mark or other symbol in the lower case group and another row for each punctuation mark, figure or other symbol in the upper case group. Not only are the commutator bars in each row electrically common but the various rows of bars are also electrically connected together. If desired, the row of commutator bars corresponding to upper case letter S may be omitted if the combination corresponding to this character is to be used to operate a signal bell, as will be discussed later.

At one end of the cylinder DSC of the dot selecting unit is a spring drive **34** in the form of a helically coiled spring. One end of this spring is

attached to one end of the cylinder DSC and the other end is attached to a disk 35 which is frictionally engaged with another disk 36 mounted on the main shaft MS. The cylinder DSC is freely mounted on the main shaft MS and is normally held from rotation by means of a dot selector start-stop lever DSL which engages a lug 37 on the cylinder. This lever DSL is mounted on a rotatable rod 38 at the other end of which is a lever 39. Lever 39 is arranged to be operated by a cam on the cam disk CD_8 to release the cylinder DSC so that it may rotate.

When the cylinder DSC is locked by engagement of the start-stop selector DSL with the lug 37, the plate 36 rotates with the main shaft MS and frictionally drives plate 35 to wind up the spring 34 until the tension on the spring becomes great enough to cause the plate 35 to slip with respect to the plate 36. Thus at all times when the dot selecting cylinder DSC is stationary, the spring is tightly wound up. Consequently when the cylinder is released by the operation of the start-stop lever DSL (which, as seen from Fig. 12 occurs after about 260 degrees of rotation of the interpreting unit), the cylinder DSC will be rotated. Due to the tension of the spring drive 34 its movement will be so rapid that it will complete its rotation and come to rest by engagement of the lug 37 with the lever DSL, while the interpreting unit is rotating through an arc of only 30 degrees, as will be seen from the chart or diagram of Fig. 12. The cylinder DSC is stopped by engagement of the lug 37 with start-stop lever DSL, the cam of the disk CD_8 of the interpreting unit being so formed that said lever will fall back before the cylinder DSC completes its revolution.

At one end of the cylinder DSC are two pick-up brushes PB_l and PB_u, the former being the lower case pick-up brush and the latter being the upper case pick-up brush. These two brushes are insulated from each other and are mounted on the cylinder DSC a distance apart which is determined by the number of rows of commutator bars on the cylinder DSC. Thus if there are 26 lower case symbols and an equal number of upper case symbols to be printed the brushes will be separated by one-fifty-second part of a circle or by 6.92 degrees. If a larger number of rows of commutator bars is used, as will be the case where punctuation marks, figures, etc. are provided for in addition to capital and small letters, the two pick-up brushes will be correspondingly closer.

These two pick-up brushes are connected to the poles of the case transfer switch CTS mounted on the end of the cylinder DSC, opposite the spring drive. The center pole of this switch is connected to the common conductor connecting all of the commutator bars of the cylinder DSC. This center pole may be shifted from one contact of switch CTS to the other by the case transfer ring CTR. Ring CTR has a tapered cylindrical surface, and when moved to the right will force the center pole of the switch from its upper to its lower contact. The purpose of this arrangement will become apparent in connection with the description of the operation of the machine.

The pick-up brushes PB_l and PB_u wipe against the segments of the internal commutation ring CR, shown in more detail in Fig. 5. This commutation ring surrounds the end of the cylinder DSC and has an internal diameter slightly greater than that of the cylinder. The commutator ring has one conducting segment for each two rows of commutator bars on the cylinder DSC. In other words, for each lower case row of commutator bars and its associated upper case row of commutator bars there is one segment in the commutator ring. For example, if the cylinder has fifty-two rows of commutator bars there will be twenty-six conducting segments of equal width in the commutator ring CR. Each of the conducting segments of the commutator ring is conducted through cabling to one of the selection keys SK_a, SK_b, SK_c, etc., of the interpreting unit.

Mounted on a base parallel to the dot selector cylinder DSC is a strip 40 carrying thirty-six wiper brushes as shown in Figs. 1 and 13. These brushes are designated WB_1 to WB_{36}, inclusive, and correspond to the electrodes of the printing block respectively numbered from 1 to 36 in Fig. 11. Various ones of these wiper brushes will be energized, depending upon which one of the rows of commutator bars on the dot selecting cylinder is selected by the energized segments of the internal commutation ring CR and its associated pick-up brush.

Printing operation

Suppose it is desired to print the lower case letter *b* and that at some previous time the code combination for lower case printing has been received, so that the case transfer ring CTR of the dot selecting unit is in its normal position as shown in Fig. 1. The various disks on the interpreting unit will be held from rotation by means of the control bar or roller 25. Likewise the dot selector cylinder DSC will be held from rotation by the dot selector start-stop lever DSL, which is controlled by the cam disk CD_8 of the interpreting unit. When the interpreting unit is at rest the shunt key SK_8 is held open and the magnet SSM is energized until such time as a starting impulse is received. If now a starting impulse followed by five code determining impulses comes in over line L in Fig. 13, the starting impulse which is a spacing or no-current signal, will cause the release of the start-stop magnet SSM.

When the magnet releases its armature the lever SSL controlled by said armature removes the releasing latch RL from the detent 21 of the frame 22, so that the control bar or roller 25 is now free to rise. The pressure of the cams on the cam disks, which have heretofore been held against the frictional torque supplied by the main shaft MS, will force bar 25 to rise, releasing the cam disk CD_{10}, together with the character determining cam disks CD_a, CD_b, CD_c, etc., and the seven function determining cam disks, so that they all commence to rotate together. The cams CD_1 to CD_9, inclusive, are mechanically coupled to the disk CD_{10} which was released by the operation of the trip off latch SSL, and hence rotate with the other disks.

The cam disk CD_6 as it rotates closes the start-stop shift key SK_6 and at the same time the cam CD_5 opens the impulse magnet shunt key SK_5 so that the impulse magnet M_5 is conditioned to receive the first character forming impulse of the Baudot code (see chart of Fig. 12). If this impulse is a marking impulse the magnet M_5 will operate the lever COL_5 to shift the code bar CB_5 to the right until it engages the code bar wedge CBW. If the No. 1 impulse is a spacing impulse the magnet M_5 will remain deenergized.

Let us assume the code combination received is that for the character *b*, which is start—mark—space—space—mark—mark—stop. The

first character determining impulse will be a marking impulse and the code bar CB_5 will be shifted to the right. The shunt key SK_5 now closes and the cam disk CD_4 opens the shunt key SK_4 to receive the second character determining impulse. This is a spacing impulse so the magnet M_4 is not operated. As the cam disks continue their rotation, cam disks CD_3, DC_2 and CD_1 successively open their corresponding shunt contacts so that after about 260 degrees of rotation the condition is that magnets M_5, M_2 and M_1 have been operated and magnets M_4 and M_3 have not been operated. The code bars actuated by the operated magnets are accordingly shifted to the right. The cam in the disk CD_6 is so cut that as the shunt key SK_5 closes, the start-stop shunt SK_s is again opened. Hence the marking stop impulse which follows the last Baudot impulse energizes the start-stop magnet SSM to latch the detent **21** and hold the control bar **25** in its lowered position.

By this time the cam disks have rotated through about 260 degrees (see Fig. 12) and the edges of their projecting cams, with the exception of that of the selected cam disk, come into engagement with the code bars and cease rotating. The code bars are now so set that the notches opposite the cam disk corresponding to letter B are in alignment. The cam of this disk passes through the aligned notches and operates selection key SK_b. At the same time the cam disk CD_{10}, whose cam is not obstructed by the code bars, closes the universal key UK. This completes a circuit (see Fig. 13) from positive battery, over the closed contact of the universal key UK, and over the closed contact of the selection key SK_b, to the corresponding segment of the internal commutator ring SC. This circuit remains closed for a period long enough to permit the dot selector cylinder DSC to complete one full revolution, as will now be described.

It will be noted that the group of cams CD_1 to CD_{10}, inclusive, are not stopped by the code bars and hence continue to rotate together. Therefore, shortly after the circuit is closed as above described the cam disk CD_8 operates the lever **39**. This causes the dot selector start-stop lever DLS to disengage the lug **37**, thus permitting the dot selector cylinder DSC to rotate rapidly in a counterclockwise direction under the impulsion of the spring drive **34**. Bearing in mind that a circuit has been established to a segment of the commutator ring CR corresponding to the letter *b*, and that the center pole of the case transfer switch CTS is in contact with the terminal connected to the lower case pick-up brush PB_l, it will be evident that when the commutator brush PB_l comes in contact with the activated segment of the commutator ring CR the circuit previously traced will be extended as follows: from the activated commutator bar, over the lower case pick-up brush PB_l, to the center pole of the switch CTS, and thence to the common electrical connection for all of the rows of commutator bars on the dot selecting cylinder DSC.

No circuit will be extended over the upper case pick-up brush PB_u when it passes over the activated segment of the commutator ring CR, because the center pole of the case transfer switch CTS is in such position that the connection to the lower case pick-up brush is open. Only the lower case pick-up brush PB_l is effective, and hence during the moment the pick-up brush PB_l passes over the activated segment of the internal commutator ring, the row of commutator bars on the cylinder DSC corresponding to lower case letter *b* will be in contact with the wiper brushes WB_1 to WB_{36}, inclusive. Consequently, such of the wiper brushes as make contact with the live segments of this row will be activated to in turn activate the electrodes of the printing block PB to which they are connected.

The circuit which completes the printing operation may now be traced in Fig. 13 as follows: from positive battery, over the actuated universal key UK, actuated selection key SK_b to the activated segment *b* of commutator ring CR, over lower case brush PB_l, over the center pole and lower case contact of case transfer switch CDS, over the common conductor to the various segments of the dot selecting cylinder DSC, thence from live segments in the row of segments corresponding to the letter *b* over such of the wiper brushes of the group WB_1 to WB_{36} as are in contact with live segments, over individual conductors to the corresponding electrodes of the printing block PB, and finally through the paper to the bus bar BB and to negative battery. The circuit above traced causes the lower case letter *b* to be chemically imprinted upon the paper.

As already stated, a complete rotation of the dot selector cylinder just traced takes place during about 30 degrees of the rotation of the interpreting unit, and the establishment of the printing current occurs momentarily during this interval, as will be clear from Fig. 12. At the end of this 30 degree period the universal key UK opens and breaks the printing circuit above traced. However, this circuit has already been broken by the pick-up brush PB_l passing off the line segment of the commutator ring CR. Also the cam on the cam disk CD_9 is so cut that continued rotation of the shaft brings the hump of the cam against the code bar throwout lever TOL at approximately the same instant key UK opens. The operation of this lever forces the code bars CB_1 to CB_5, inclusive, outward from the cam assembly and releases all of the determining cams, which now rotate through the medium of their driving frictional contact with the friction washers which are keyed to the main shaft. The outward throw of the code bar assembly forces the diagonal ends of the code bars against the code bar reset wedge CBW, thus restoring them to their normal or "space" position.

The rotation of the selected cam CD_b is meanwhile arrested by its angular face coming in contact with the control bar **25** which was restored to its locking position at the end of the start impulse. The remaining cam disks "catch up" with the selected cam disk while the stopping impulse is being received, this being a marking impulse following the last character impulse of the Baudot code. Upon completing their rotation the non-selected cam disks also come to rest against the control bar **25**, and the whole mechanism is now ready to receive the code combination for another character.

It will be noted that the unselected cam disks, in passing from the position where they were held by the code bars to their stop position, also contact their individual selection keys SK_a, SK_c, etc. However, no circuit is completed as the result of this action, because the universal key UK is connected in series with all of the selection keys and, having cleared its cam, is now open.

Character spacing

After each character is printed it is necessary to automatically move the printing block PB and

the platen P relative to each other so that there will be a space between the character which has just been printed and the next character to be printed. Character spacing is provided for in accordance with the present invention by a space operating lever SOL (see Figs. 1 and 3). This lever is engaged by the high part of the cam disk CD_7 just after the dot selector cylinder DSC has completed its revolution. This, of course, occurs shortly before the interpreting unit completes its revolution, as will be clear from the chart of Fig. 12. The motion of the space operating lever SOL is communicated through a spring **41** to a lever **42** which is attached to the end of the space operating shaft SOS and rotates the same through a slight arc, thereby causing the space operating arm SOA to engage a shoulder **43** on the space function bar SFB.

The space function bar SFB is therefore moved in a direction away from the cam disk SCD. Consequently, it strikes the spacing pawl bar SPB, causing the latter to engage a tooth of the spacing ratchet SR and advance said ratchet one tooth. The spacing ratchet SR is arranged to move the paper carriage and printing block with respect to each other by means of a rack and pinion assembly and a rotatable shaft (not shown), the spacing ratchet and pinion being mounted on said shaft, as is well known in the art. If preferred, of course, the spacing ratchet may be connected through any other suitable known mechanism to produce a relative shift between the printing block PB and platen P. Thus the printing block PB is automatically advanced one step along the platen just after each character is printed unless this action is prevented, as will appear later.

Word spacing

Spacing between words in teletype systems is accomplished, as is well known, by sending a special Baudot code signal. In the receiver of the present invention the code bars CDB_1 to CDB_5, inclusive, are set so that in response to this "spacing" code the space cam disk SCD (see Fig. 3) is selected instead of one of the character determining cam disks. The disk SCD carries two cams, **44** and **45**, so related to each other that when the cam **44** passes through the aligned notches of the code bars, the cam **45** will strike the space bail lever **46**, which in turn drives the space bail **47** to the left in Fig. 3. Just before this occurs the cam **44** engages the space function lever **48** at its right hand end, thereby causing its left-hand end to press the space function bar SFB downwardly. Consequently its shoulder **49** is engaged by the lever **47** to drive the space function bar in a direction away from the cam disk. This causes the space function bar to operate the spacing pawl bar SPB, thereby effecting a spacing operation similar to that already described under the heading "Character spacing." No electrical connection is made to the dot selector during this operation as the spacing cam disk SCD is not provided with a selection key. Consequently no mark is produced upon the paper even though during the process of selecting the space cam disk SCD the dot selector cylinder DSC is released and permitted to make a revolution.

Space blocking

As the space operating lever SOL operates with every revolution of the cam assembly, regardless of whether a character selection or a function selection is taking place, it is necessary to block the resulting spacing action during the other function operations such as carriage return, line feed, etc. The means for accomplishing this result is illustrated in Figs. 3 and 4. Referring particularly to Fig. 4, it will be seen that each of the function bars BFB, LFB, etc., except the space function bar SFB, is provided with a graduated cam such as **50** on its upper surface. This cam engages a space blocking lever SBL, thus raising it up so that it is interposed in the path of the space blocking arm SBA which is carried on the space operating shaft SOS (see Fig. 3).

Consequently the space blocking arm SBA cannot be moved from right to left in Fig. 3, and hence the space operating shaft SOS cannot be rotated to operate the space function bar SFB when the cam on the cam disk CD_7 engages the space operating lever SOL. The motion of the space operating lever SOL is taken up by the spring **41** and no spacing operation takes place. While Fig. 3 illustrates the space blocking operation in connection with the "blank" function, the same action takes place in connection with any of the other functions. For example, if the bell function bar BF is operated, spacing is blocked, and the same holds true for all of the other function bars except the space function bar SFB itself.

Upper and lower case functions

The formation of upper and lower case patterns is determined by the position of the case transfer switch CTS, shown particularly in Figs. 1 and 13. The commutator rows on the dot selector cylinder DSC are arranged in such a manner that the row for the upper case of any given character makes contact with the wiper brushes WB_1 to WB_{36}, inclusive, a short period after the corresponding lower case commutator row makes contact with said brushes. For example, if the dot selector cylinder DSC is arranged for only twenty-six characters it will have fifty-two commutator rows and each upper case row will be separated from the lower case row by an arc of 6.92 degrees. Selection of the upper case dot pattern instead of the lower case pattern is obtained by routing the circuit through the upper case pick-up brush PB_u, which will make contact with the energized segment of the commutator ring 6.92 degrees later in the cycle, at which time the upper case row of segments on the cylinder DSC, instead of the lower case row for the desired character, will be in contact with the wiper brushes. The circuit through the lower case pick-up brush PB_l will, of course, be open and no circuit will be completed through the lower case row of character determining segments on the cylinder DSC.

In order to shift from the lower case to the upper case the "figures" or "upper case" Baudot code signal will be sent. When this code is received by the printer herein disclosed, it will operate the "figures" cam disk which, in accordance with the arrangements illustrated in Fig. 7, will cause the figures function bar FFB of Fig. 1 to be operated. This bar operates a lever **51** which in turn operates the T-shaped lever **52** to swing the vertical member of the T-lever to the left. This acts through levers **53** and **54** to shift the case transfer ring CSR to the right. The case transfer ring thus engages the arm of the mid-pole of the case transfer switch CTS to shift it from its lower case contact to its upper case

contact, thereby preparing the circuit through the upper case pick-up brush PB_u. The lever system is held in shifted position by a detent **55** having a roller bearing against the round end of the T-shaped lever **52**. Consequently, when the upper case signal has been received, upper case characters will be printed until a shift is made to lower case printing.

This is done by receiving the so-called "letters" or "lower case" code combination which selects the lower case cam disk, and through mechanism similar to that shown in Fig. 7 operates the "letters" function bar LFB. This bar engages a lever **56** which operates on the opposite end of the cross bar of the T lever **52**, thus shifting the vertical bar of the T lever to the right and causing the case transfer ring CTR to be shifted to the left on the main shaft MS. This releases the center pole of the case transfer switch CTS which shifts back to its lower case contact and prepares the circuit to the lower case pick-up brush PB_l. Consequently, character selecting codes received after this operation will cause lower case printing.

Carriage return function

When the code combination for the "carriage return" function is received the "carriage return" function bar CRF in Fig. 1 strikes a pivoted lever **57** which acts through a link **58** to withdraw the space retaining pawl SRP from engagement with the teeth of the spacing ratchet SR. This movement of the space retaining pawl operates through a link **59** and a lever **60** to throw the spacing pawl bar SPB outwardly away from the spacing ratchet SR. The spacing ratchet is thus momentarily freed and starts to rotate in a clockwise direction because of the tension exerted upon it by the carriage return spring (not shown). Since the pressure of the carriage return function bar CRF is applied to the lever **57** to accomplish the results just referred to for only a brief period of time, the pawls SPB and SRP would almost immediately fall back into engagement with the spacing ratchet SR, were it not for the action of the carriage return lockout lever CRL. This lever is mounted on the carriage control shaft CCS between friction disks or collars such as FC. Therefore, at the time of the start of the clockwise rotation of the shaft, the carriage return lockout lever CRL is also turned in a clockwise direction, causing one of its outward ends to engage the spacing pawl bar SPB and hold it in its outward position, disengaged from the ratchet SR. The other end of the carriage return lockout bar CRL is connected through a pawl release link **61** to the outer end of the space retaining pawl SRP to hold it disengaged from the spacing ratchet. Consequently, the tension applied to the carriage control shaft CCS causes it to rotate in a clockwise direction until the entire mechanism is reset to its normal condition. The limits of travel for the carriage return lockout lever CRL are determined by the adjustable stop pins **62** and **63** on either side of the lever.

Bell function

If the machine is in the upper case condition following the reception of the "figures" or "upper case" code combination, the reception of a code combination corresponding to some particular character may be caused to operate a signal bell. Let us suppose that the code combination corresponding to the letter S is to be used for this purpose. The cam disk which causes lower case printing of the letter S in response to this code combination is in such case provided with a function lever such as that shown at **28** in Fig. 7, and this lever operates the bell fuction bar BF shown in Fig. 1. This in turn operates the lever **64** which acts through the bell operate lever BOL to ring the bell **65**. When the letter S code combination is used for this purpose, said letter will not be printed when the bell is rung, because the commutator row on the dot selector cylinder DSC for upper case S will be left blank, and hence no circuit will be completed through the wiper brushes WB_1 to WB_{36}, inclusive.

While the machine is in lower case condition, operation of the bell is prevented in response to this particular code combination by means of the bell function blocking bar BBB, one end of which engages in a notch in the bell operating lever BOL. When the "figures" function bar FFB is operated as previously described, it actuates the bell crank lever **51** to withdraw the bell function blocking bar BBB from engagement with the bell operating lever BOL, so that it can ring the bell. The bell operating lever BOL is provided with a relief spring **66** so that when it is engaged by the bell function blocking bar BBB and the bell function bar BF is operated in response to the code combination for lower case letter *s*, the spring will take up the motion applied to the lever BOL by the bell function bar BF and the bell will not ring.

Line feed function

In response to the code combination for line feed, line feed function bar LFF is operated. This actuates the lever **67** shown in Fig. 1 to operate the pawl **68** shown in Fig. 13, through the rod **69** to advance the pawl to a new tooth of the ratchet **70**. The pawl **68** when released moves upwardly and operates on the ratchet **70** to advance the platen P and the paper carried by it to a new line.

Blank function

When so-called "blank" code combinations are received, all five of the Baudot impulses are spacing impulses, and consequently none of the code bars CB_1 to CB_5 are shifted. This causes one of the cam disks BCD (see Fig. 3) to operate the blank function bar BFB. The operation of this bar actuates the space blank lever SBL in a manner previously described, thereby preventing the character spacing cam CD_7 from actuating the space operating shaft SOS. Consequently, during the reception of blank signals no spacing operation takes place. No printing operation will take place because the cam disk BCD does not actuate any selection key.

The operation of the blank function bar BFB may, if desired, act through a lever **71** to actuate a rod **72** which operates a bell crank lever **73** to move the link **74**. When this link is operated two or more times in response to the reception of two or more blank signals, it may operate in a well known manner, just as in the case of teletype machines now used, to lock out the sender associated with the receiving printer. Therefore, if the operator is sending to the distant station, and the operator at the distant station throws his break key so that the line is in effect opened, successive blank signals will be received on the local printer. These cause the lever **74** to lock out the local sender so that the distant station can transmit. The details whereby this

is accomplished are, of course, known in the art, and do not constitute a part of the present invention.

Orientation

Orientation to meet varying line conditions is accomplished by shifting the relative points at which the impulse magnet shunt keys SK_1 to SK_5 are actuated with respect to the point at which the start stop shunt key SK_S is actuated. In order that this shift may be effected, the impulse magnet shunt keys SK_1 to SK_5, inclusive, are mounted on an orientation arm 75 as shown in Fig. 6, which may be adjusted along the curved rod 76 to shift the position of these switches with respect to the start stop shunt key SKs. As the position of the latter shunt key is fixed, any change of the position of the arm 75 will alter the time interval at which the impulse magnets M_1 to M_5, inclusive, are thrown across the line.

While this invention has been disclosed in certain specific arrangements which are deemed desirable, it will be obvious that the general principles herein disclosed may be embodied in many other organizations, widely different from those illustrated, without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a reproducting system, a single reproducing element having a plurality of electrodes distributed over an area at different coordinate points thereof, means to selectively produce electrical activation of different combinations of said electrodes in accordance with different preconceived patterns, all utilizing electrodes in the same area and transmitted by groups of successive pulses, each group being less in number than the activated electrodes of a given pattern, said patterns involving electrodes at a plurality of points some of which are located with respect to each other at different distances from both coordinate axes of said area, a sheet upon which said patterns may be produced, means to cause current to pass through said sheet simultaneously from each of the selectively activated electrodes representing a given complete pattern to reproduce on said sheet the selected pattern in accordance with which said electrodes are selectively activated, and means to produce relative movement between said reproducing element and said sheet after each pattern has been reproduced, so that said successive patterns will be reproduced at different points on said sheet.

2. In a reproducing system, means to successively receive different groups of code impulses representing a plurality of patterns to be reproduced, a single reproducing element having a plurality of electrodes distributed over an area at different coordinate points thereof exceeding in number the code impulses representing a pattern, means controlled by said successive groups of code impulses to selectively produce electrical activation of different combinations of said electrodes in accordance with the different patterns all utilizing electrodes in the same area, said patterns involving electrodes at a plurality of points some of which are located with respect to each other at different distances from both coordinate axes of said area, a sheet upon which said patterns may be reproduced, means to cause current to pass through said sheet simultaneously from each of the selectively activated electrodes representing a given complete pattern to reproduce on said sheet the selected pattern in accordance with which said selectrodes are selectively activated, and means to produce relative movement between said reproducing element and said sheet after each pattern has been reproduced, so that said successive patterns will be reproduced at different points on said sheet.

3. In a reproducing system, means to receive a group of code impulses representing a pattern to be reproduced, a reproducing element having a plurality of electrodes distributed over an area, means controlled by said group of code impulses to select a determining element corresponding to the pattern to be reproduced, means to electrically activate various combinations of said electrodes in accordance with the pattern to be reproduced, means controlled by said determining element to determine the combination of said electrodes to be activated, and means to cause current to pass from said activated electrodes through a sheet to reproduce the pattern corresponding to the activated group of electrodes.

4. In a reproducing system, means to successively receive different groups of code impulses representing a plurality of patterns to be reproduced, a reproducing element having a plurality of electrodes distributed over an area, means controlled by each group of impulses to select a determining element corresponding to a pattern to be reproduced, means to electrically activate various combinations of said electrodes in accordance with the pattern to be reproduced, means controlled by the selected determining element to determine the combinations of said electrodes to be activated, a sheet upon which selected patterns may be reproduced, means to cause current to pass from said activated electrodes through said sheet to reproduce on said sheet the successive patterns in accordance with which said electrodes are activated, and means to produce relative movement between said reproducing element and said sheet after each pattern has been reproduced, so that said successive patterns will be reproduced at different points on said sheet.

5. In a reproducing system, means to successively receive different groups of code impulses representing a plurality of patterns to be reproduced, a plurality of conductors leading to a plurality of points distributed over an area, means controlled by each group of impulses to select a determining element corresponding to a pattern to be reproduced, means to electrically activate various combinations of said conductors in accordance with different patterns to be reproduced, means controlled by the selected determining element to determine the combinations of said conductors to be activated, and means to successively reproduce the patterns determined by successive combinations of activated conductors upon a surface so that they will be visible thereon.

6. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent characters to be reproduced, a reproducing element having a plurality of electrodes distributed over an area, a translating device having a determining element for each character to be reproduced, means controlled by each group of impulses representing a character to select a determining element corresponding to the character represented by said group, a selecting device having separate activating mechanisms, each activating mechanism being arranged to electrically activate said electrodes in different combinations one corre-

sponding to each of said characters, means operating upon the selection of a determining element of said translating device and under the control thereof to select the activating mechanism of said selecting device corresponding to the character represented by the received group of impulses, said selected activating mechanism thereupon functioning to activate the corresponding combination of said electrodes, a sheet upon which selected character may be reproduced, and means to cause current to pass from said activated electrodes through said sheet to reproduce on said sheet the selected characters.

7. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent lower case characters to be reproduced, a reproducing element having a plurality of electrodes distributed over an area, a translating device having a determining element for each lower case character to be reproduced, means controlled by each group of impulses representing a character to select a determining element corresponding to the character represented by said group, a selecting device having separate activating mechanisms, each activating mechanism being arranged to electrically activate said electrodes in different combinations, certain of said mechanisms being assigned to lower case characters, and other of said combinations being assigned one to each corresponding upper case character, means operating upon the selection of a determining element of said translating device and under the control thereof to prepare a connection to the pair of activating mechanisms corresponding respectively to the lower case and upper case characters represented by the received group of impulses, means to determine whether said connections will be completed to the activating mechanism corresponding to the lower case character or to that corresponding to the upper case character, the activating mechanism to which the connection is completed thereupon functioning to activate the corresponding combination of said electrodes, a sheet upon which selected character may be reproduced, and means to cause current to pass from said activated electrodes through said sheet to reproduce on said sheet the selected characters.

8. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent characters to be reproduced, a reproducing element having a plurality of electrodes distributed over an area, a translating device having a determining element for each character to be reproduced, means controlled by each group of impulses representing a character to select a determining element corresponding to the character represented by said group, a selecting device having separate activating mechanisms, each activating mechanism being arranged to electrically activate said electrodes in different combinations one corresponding to each of said characters, means operating upon the selection of a determining element of said translating device and under the control thereof to select the activating mechanism of said selecting device corresponding to the character represented by the received group of impulses, said selected activating mechanism thereupon functioning to activate the corresponding combination of said electrodes, a sheet upon which selected character may be reproduced, means to cause current to pass from said activated electrodes through said sheet to reproduce on said sheet the selected characters, said receiving means also receiving groups of impulses corresponding to various "functions" such as "spacing," "line feed," etc., and said translating device also having a function determining element for each of said "functions," said function determining elements when selected operating the corresponding function mechanisms.

9. In a reproduicng system, receiving means to successively receive groups of code impulses certain of which represent lower case characters to be reproduced, a reproducing element having a plurality of electrodes distributed over an area, a translating device having a determining element for each lower case character to be reproduced, means controlled by each group of impulses representing a character to select a determining element corresponding to the character represented by said group, a selecting device having separate activating mechanisms, each activating mechanism being arranged to electrically activate said electrodes in different combinations, certain of said mechanisms being assigned to lower case characters, and other of said combinations being assigned one to each corresponding upper case character, means operating upon the selection of a determining element of said translating device and under the control thereof to prepare a connection to the pair of activating mechanisms corresponding respectively to the lower case and upper case characters represented by the received group of impulses, means to determine whether said connections will be completed to the activating mechanism corresponding to the lower case character or to that corresponding to the upper case character, the activating mechanism to which the connection is completed thereupon functioning to activate the corresponding combination of said electrodes, a sheet upon which selected character may be reproduced, means to cause current to pass from said activated electrodes through said sheet to reproduce on said sheet the selected characters, said receiving means also receiving groups of impulses corresponding to various "functions" such as "spacing," "line feed," etc., and said translating device also having a function determining element for each of said "functions," said function determining elements when selected operating the corresponding function mechanisms.

10. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable character determining cam for each character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, a selecting device having a plurality of different sets of activating elements each arranged to activate a corresponding combination of said character forming units, means operating on the selection of a cam and under the control thereof to select the set of activating elements of said selecting device corresponding to the character represented by the received group of impulses, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units, a sheet upon which selected characters may be reproduced, and means to cause said activated character forming units to form a character on said sheet.

11. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent lower case characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable character determining cam for each lower case character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, a selecting device having a plurality of different sets of activating elements each arranged to activate a corresponding combination of said character forming units, certain of said sets of activating elements being assigned to lower case characters, and others being assigned one to each corresponding upper case character, means operating on the selection of a cam and under the control thereof to preselect the two sets of activating elements corresponding respectively to the lower case and upper case characters represented by the received group of impulses, means to determine a final selection between said upper case and lower case sets of activating elements, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units, a sheet upon which selected characters may be reproduced, and means to cause said activated character forming units to form a character on said sheet.

12. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable character determining cam for each character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, a selecting device having a plurality of different sets of activating elements each arranged to activate a corresponding combination of said character forming units, means operating on the selection of a cam and under the control thereof to select the set of activating elements of said selecting device corresponding to the character represented by the received group of impulses, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units, a sheet upon which selected characters may be reproduced, means to cause said activated character forming units to form a character on said sheet, said receiving means also receiving groups of impulses corresponding to various "functions" such as "spacing," "line feed," etc., and said translating device also having function determining cams in addition to said character determining cams, said function determining cams when selected operating the corresponding function mechanisms.

13. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent lower case characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable character determining cam for each lower case character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, a selecting device having a plurality of different sets of activating elements each arranged to activate a corresponding combination of said character forming units, certain of said sets of activating elements being assigned to lower case characters, and others being assigned one to each corresponding upper case character, means operating on the selection of a cam and under the control thereof to preselect the two sets of activating elements corresponding respectively to the lower case and upper case characters represented by the received group of impulses, means to determine a final selection between said upper case and lower case sets of activating elements, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units, a sheet upon which selected characters may be reproduced, means to cause said activated character forming units to form a character on said sheet, said receiving means also receiving groups of impulses corresponding to various "functions" such as "spacing," "line feed," etc., and said translating device also having function determining cams in addition to said character determining cams, said function determining cams when selected operating the corresponding function mechanisms.

14. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable cam for each character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, said means permitting the selected cam to continue rotating while preventing rotation of the non-selected cams, a rotatable selecting device having a plurality of different sets of activating elements, each arranged to activate a different combination of said character forming units, means to release said selecting device for rotation while said non-selected cams are prevented from rotation, means operated by the selected cam to select the set of activating elements in said rotating selecting device corresponding to the character represented by the received group of impulses, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units after which the selecting device ceases rotating, a sheet upon which selected characters may be reproduced, means to cause said activated character forming units to form a character on said sheet, and means to release the non-selected cams and restore them to normal.

15. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent lower case characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable cam for each lower case character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, said means permitting the selected cam to continue rotating while preventing rotation of the non-selected cams, a rotatable selecting device having a plurality of different sets of activating elements, each arranged to activate a different combination of said character forming units, certain of said sets of activating

elements being assigned to lower case characters and others being assigned one to each corresponding upper case character, means to release said selecting device for rotation while said non-selected cams are prevented from rotation, means operated by the selected cam to preselect the two sets of activating elements corresponding respectively to the lower case and upper case characters represented by the received group of impulses, means to determine a final selection between said upper case and lower case sets of activating elements, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units after which the selecting device ceases rotating, a sheet upon which selected characters may be reproduced, means to cause said activated character forming units to form a character on said sheet, and means to release the non-selected cams and restore them to normal.

16. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable cam for each character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, said means permitting the selected cam to continue rotating while preventing rotation of the non-selected cams, a rotatable selecting device having a plurality of different sets of activating elements, each arranged to activate a different combination of said character forming units, means to release said selecting device for rotation while said non-selected cams are prevented from rotation, means operated by the selected cam to select the set of activating elements in said rotating selecting device corresponding to the character represented by the received group of impulses, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units after which the selecting device ceases rotating, a sheet upon which selected characters may be reproduced, means to cause said activated character forming units to form a character on said sheet, said receiving means also receiving groups of impulses corresponding to various "functions" such as "spacing," "line feed," etc., said translating device also having function determining cams in addition to said character determining cams, said function determining cams when selected operating the corresponding function mechanisms, and means to release the non-selected cams and restore them to normal.

17. In a reproducing system, receiving means to successively receive groups of code impulses certain of which represent lower case characters to be reproduced, a reproducing element having a plurality of character forming units distributed over an area, a translating device having a rotatable cam for each lower case character to be reproduced, means controlled by each group of impulses representing a character to select a cam corresponding to the character represented by said group, said means permitting the selected cam to continue rotating while preventing rotation of the non-selected cams, a rotatable selecting device having a plurality of different sets of activating elements, each arranged to activate a different combination of said character forming units, certain of said sets of activating elements being assigned to lower case characters and others being assigned one to each corresponding upper case character, means to release said selecting device for rotation while said non-selected cams are prevented from rotation, means operated by the selected cam to preselect the two sets of activating elements corresponding respectively to the lower case and upper case characters represented by the received group of impulses, means to determine a final selection between said upper case and lower case sets of activating elements, said selected set of activating elements thereupon functioning to activate the corresponding combination of said character forming units after which the selecting device ceases rotating, a sheet upon which selected characters may be reproduced, means to cause said activated character forming units to form a character on said sheet, said receiving means also receiving groups of impulses corresponding to various "functions" such as "spacing," "line feed," etc., said translating device also having function determining cams in addition to said character determining cams, said function determining cams when selected operating the corresponding function mechanisms, and means to release the non-selected cams and restore them to normal.

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