June 6, 1967 E. E. KLEINSCHMIDT ETAL 3,324,240

TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

Filed May 6, 1963 6 Sheets-Sheet 1

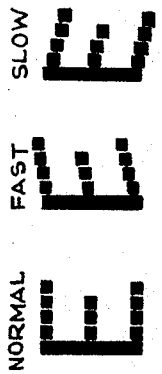


Fig. 5

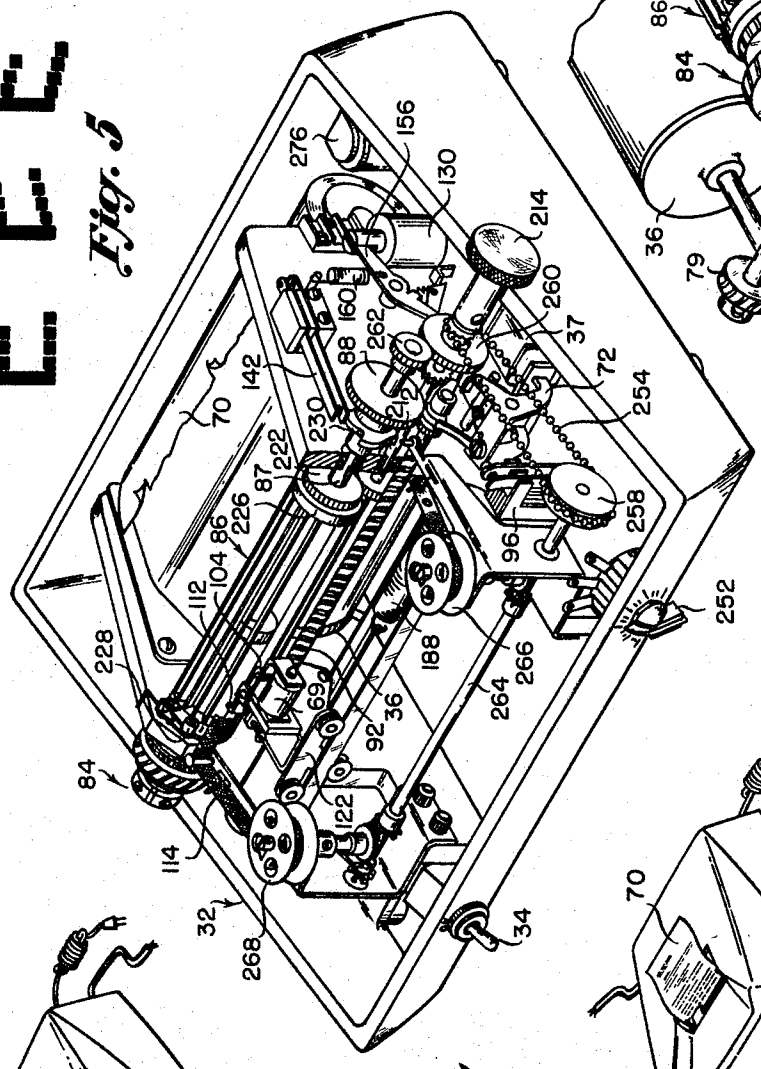


Fig. 1

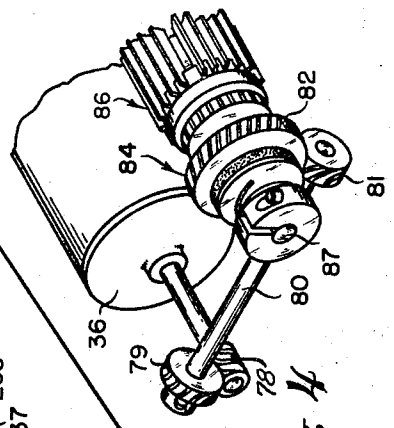


Fig. 4

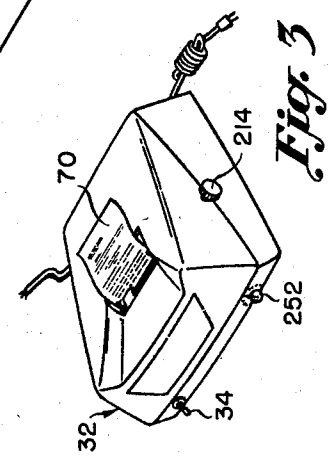


Fig. 3

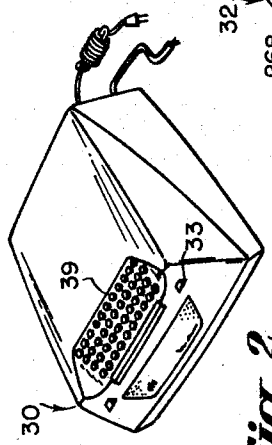


Fig. 2

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TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

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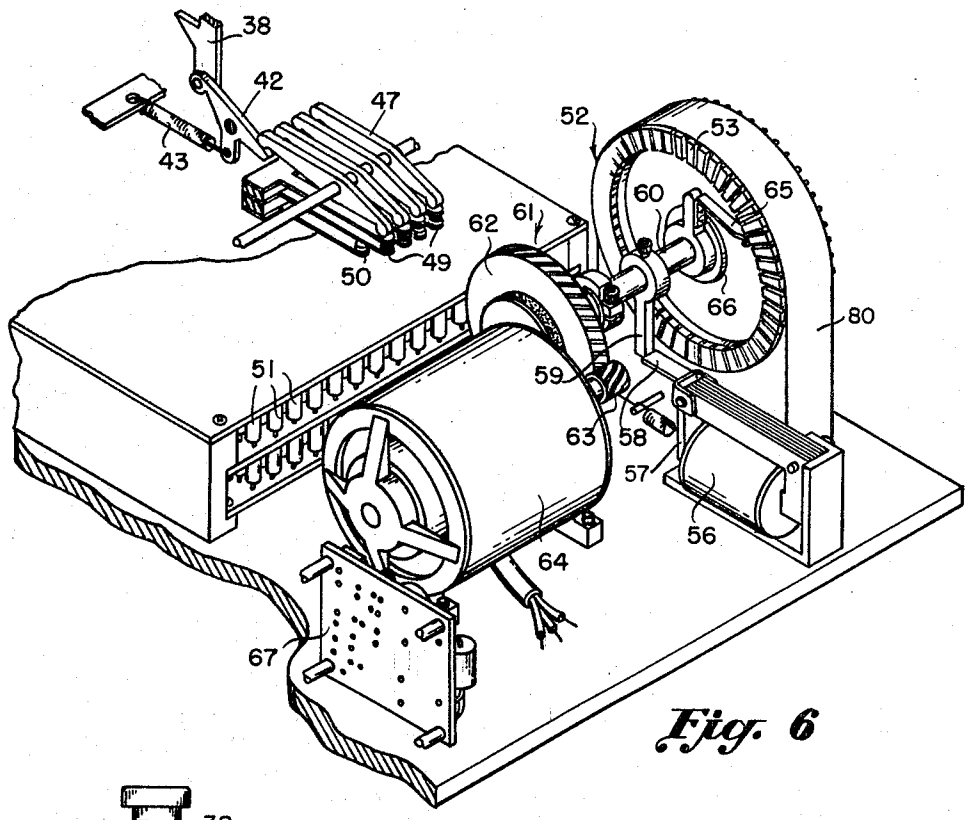


Fig. 6

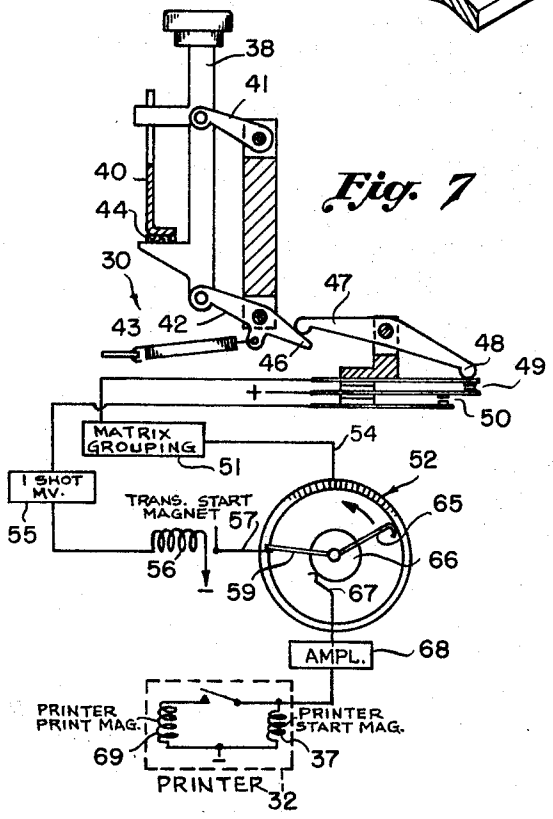


Fig. 7

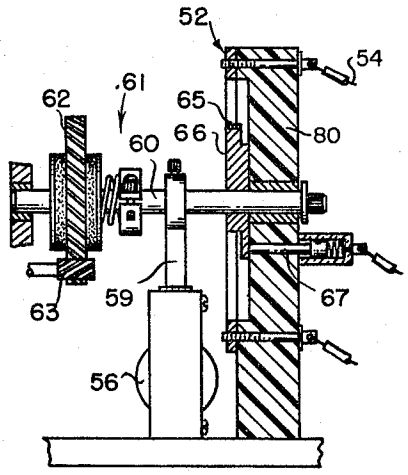


Fig. 8

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June 6, 1967 E. E. KLEINSCHMIDT ETAL 3,324,240

TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

Filed May 6, 1963 6 Sheets-Sheet 3

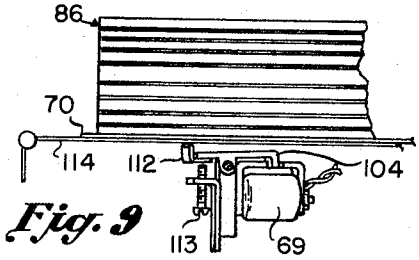


Fig. 9

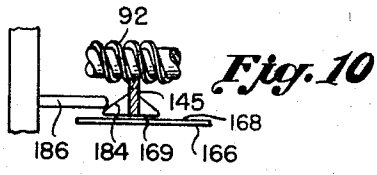


Fig. 10

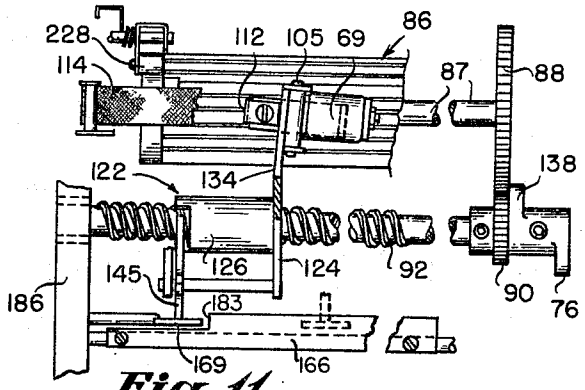


Fig. 11

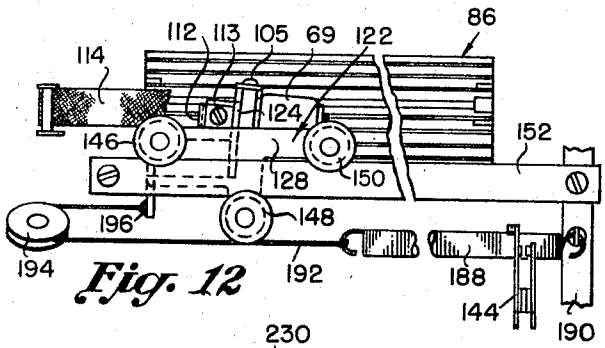


Fig. 12

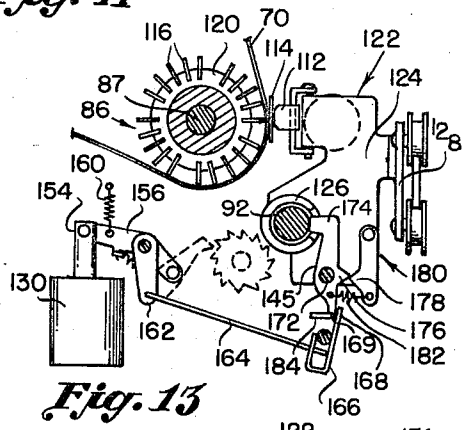


Fig. 13

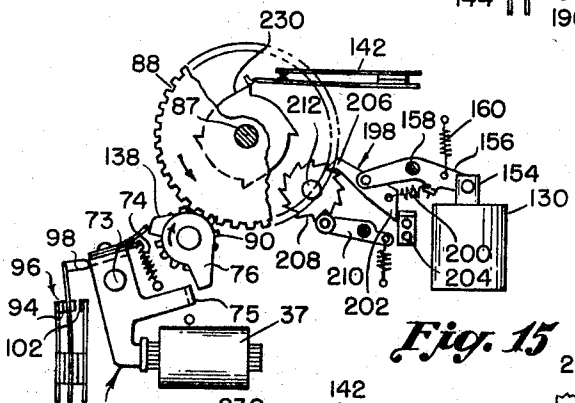


Fig. 15

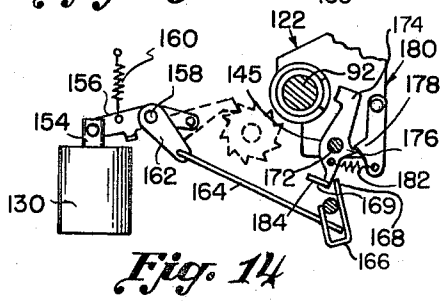


Fig. 14

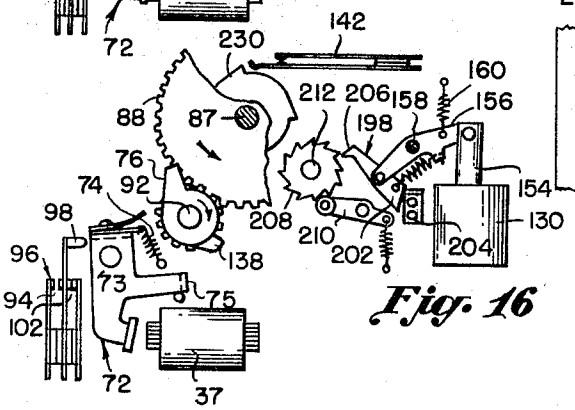


Fig. 16

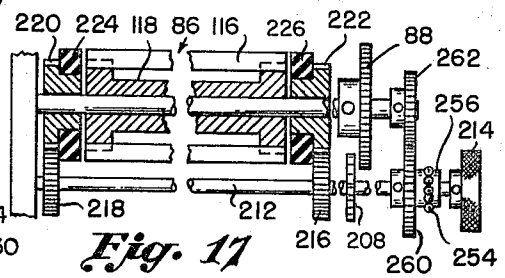


Fig. 17

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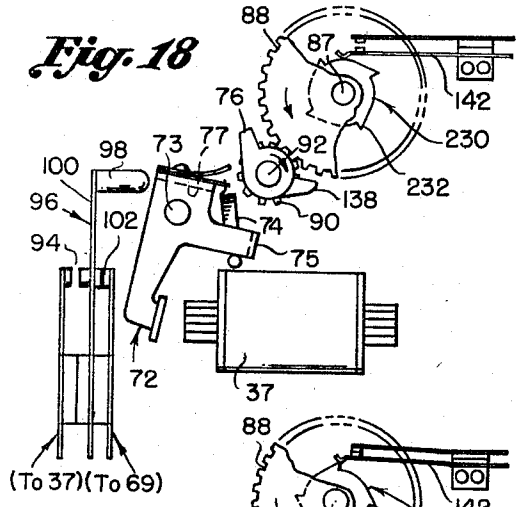
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June 6, 1967 E. E. KLEINSCHMIDT ETAL 3,324,240

TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

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Fig. 18



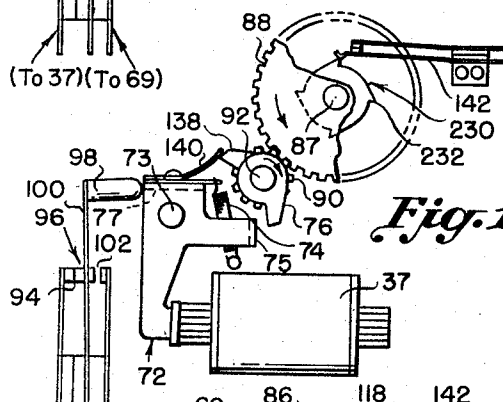


Fig. 19

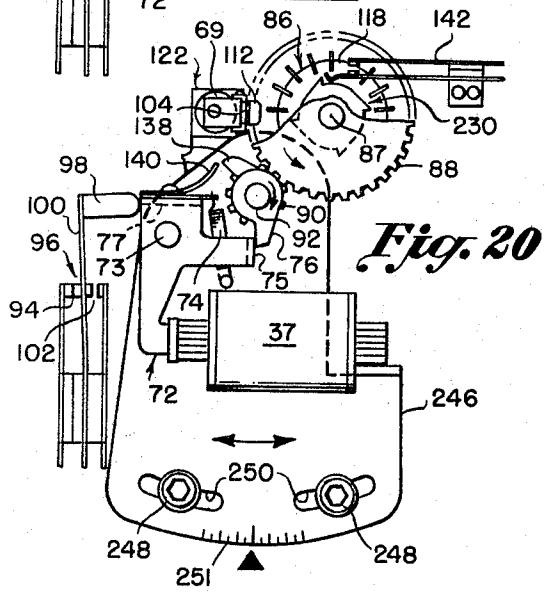


Fig. 20

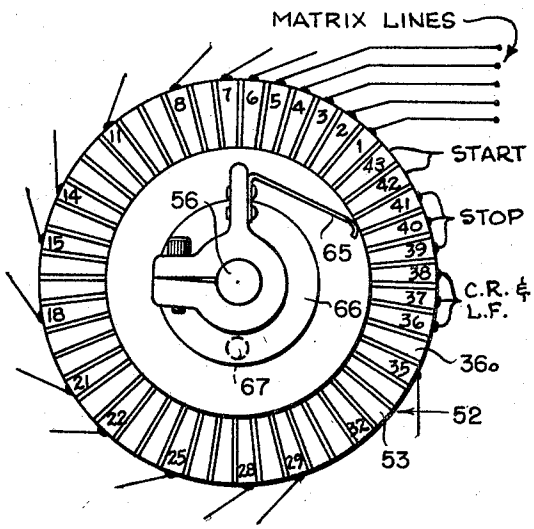


Fig. 21

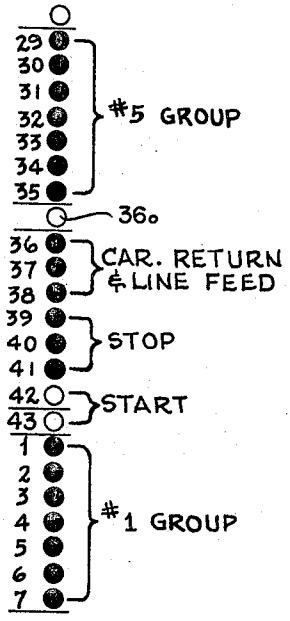


Fig. 22

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TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

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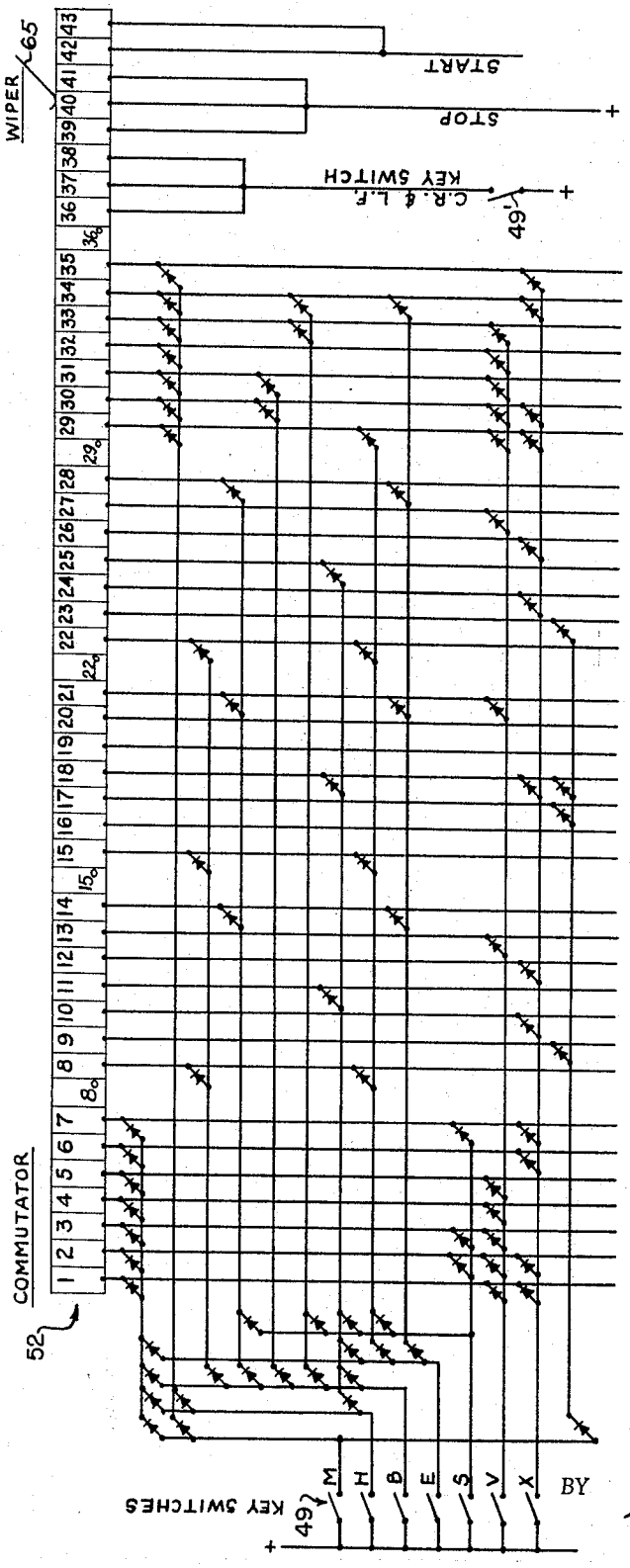


Fig. 23

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R-139

June 6, 1967 E. E. KLEINSCHMIDT ETAL 3,324,240

TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

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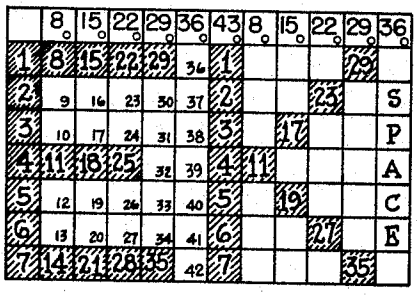


Fig. 24

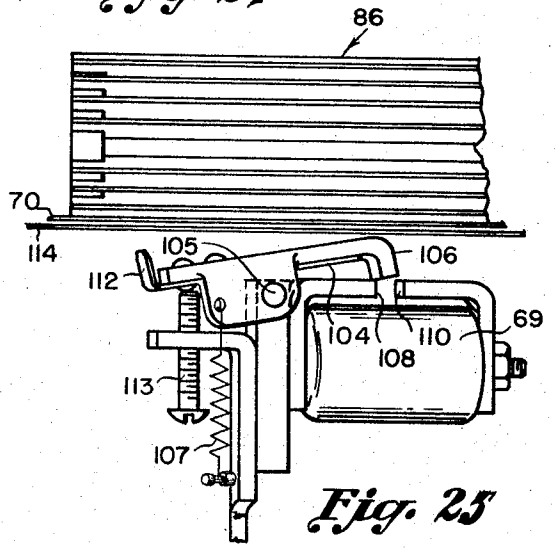


Fig. 25

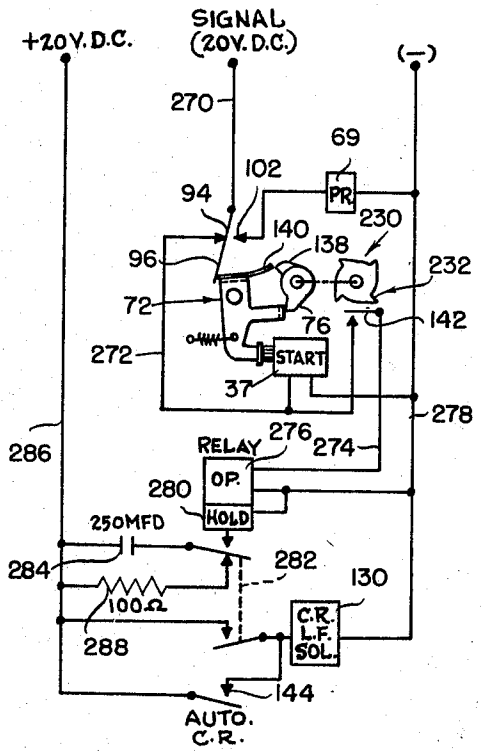


Fig. 26

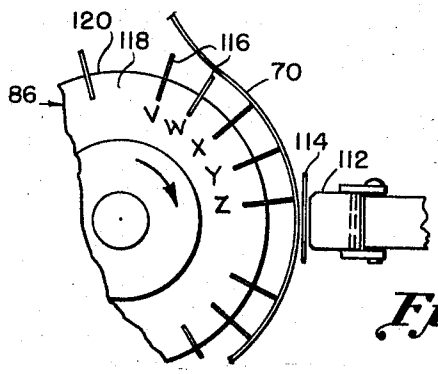


Fig. 27

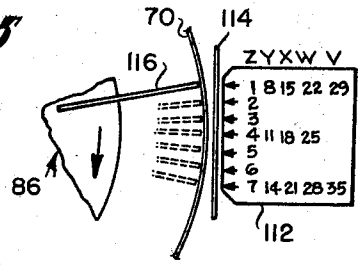


Fig. 28

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United States Patent Office 3,324,240 Patented June 6, 1967

3,324,240 TELEGRAPHIC PROGRESSIVE PRINTING SYSTEM

Edward E. Kleinschmidt, Miami Beach, Fla., and Wilburn F. Bradbury, Northbrook, and Kurt Taubmann, Lake Forest, Ill., assignors to SCM Corporation, New York, N.Y., a corporation of New York

Filed May 6, 1963, Ser. No. 278,241
26 Claims. (Cl. 178—25)

This invention pertains to automatic telegraphic systems and apparatus and more particularly to systems whereby transmitted logic is printed in directly legible symbols representative of characters of a language as well as special codes or telegraphic codes. Each symbol is progressively formed by a plurality of printing operations and will be referred to as telegraph progressive symbol printing.

The transmitting and receiving apparatus of this present invention is especially useful in conjunction with radio signaling systems as well as the usual telegraphic signaling channels. The invention does not use type, rather it specifically pertains to that form of telegraphic systems wherein each character or symbol is divided into a predetermined number of units, transmitted as such, received and progressively printed in a predetermined time-space pattern on a full page of paper (rather than on tape) until a representation of the character being transmitted has been formed thereon. It is not a facsimile system per se in that pre-scanning of a symbol is not utilized.

In previously known facsimile apparatus, the paper was moved continuously at a specific speed as was the printing mechanism and in certain models this relationship caused the printed matter to trail off toward the lower edge of the paper. Later modifications had the printing mechanism mounted angularly canted in respect to the continuous movement of the paper but difficulty was still encountered in synchronizing the printing speed with the containuously moving paper and therefore the printed matter still had a tendency to frequently trail off in an upward or downward slant. Thus, an acceptable, easily read copy was still difficult to obtain without constant readjusting of the receiver mechanism and controls.

In the present invention no definite code is used, no pre-scanning is necessary and the transmitted signals from an electronic keyboard come in on the line to the receiver and are printed directly on the paper. The incoming signal [which in the exemplary embodiment includes forty-eight (48) units] pulses a hammer magnet and the print hammer strikes the paper through an inked ribbon and prints small dots in a predetermined order to form specific symbols or characters on the paper corresponding to specific signals. By using a stop-start principle, each letter is printed in its own prescribed area in straight lines across the page as occurs with a standard typewriter. This invention also incorporates standard functions similar to those which are basic to telegraph printers, e.g., carriage return, line feed and automatic end-of-line carriage return and line feed.

The system and components of the present invention will satisfy a demand for inexpensive telegraphic systems capable of satisfactorily utilizing voice frequency installations, e.g., telephone or radio. Because its signals have 48 pulse points and thirty-five of those are used in the process of forming each symbol or letter character, interruption by normal static pulses should not completely obliterate the unit symbol or cause a wrong symbol to be printed. Such a system can be extremely useful to provide a small, page message, reproducer for police or military vehicles or the like. Furthermore, any type of letter or figure and most other symbols can be printed on a

standardized receiver merely by rearranging the unit pulses in each signal in a desired pattern.

Accordingly, a primary object of this invention resides in the provision of a novel receiver for making a printed record on a page of paper, each character or figure or other symbol being composed of a series of units or dots originated in a predetermined order by a diode matrix system or similar systems in a signal originating and transmitting unit.

Still another object resides in the provision of a novel synchronization method for a telegraphic progressive printing system wherein the speed of the receiver is independent of the speed of the transmitter and can be adjusted without any interference with the speed or operation of the transmitter by an operator as he makes visual observation of the printed image, thus eliminating the need for synchronization pulses in the transmitted signals.

A further object resides in the provision of a novel telegraph progressive print receiving apparatus capable of recording logic in non-sloping, single lines (i.e., lines which pass straight across the record as in a conventional typewriter) and without the necessity of printing duplicate or fractional characters in order to assure recording the features of a complete line of type as was necessary in many previously known facsimile recorders.

Still another object resides in the provision of a novel telegraph progressive print receiver capable of immediate recordation of legible characters or symbols as signals are received and without the necessity of using photographic development or chemically prepared materials.

Another object resides in the provision of a novel inexpensive telegraphic receiver capable of receiving, with recording, foreign languages using French characters and also many foreign languages that do *not* use English characters, this being accomplished without the need of any selector mechanisms, conversion devices and complex linkages all of which require delicate adjustment, and are expensive.

Further objects of this invention will become apparent from the following detailed description when read in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective drawing of a telegraphic progressive print receiving unit constructed in accord with this invention, the cover being removed to illustrate the working mechanism and the general location of the major components;

FIGURE 2 is a reduced size perspective view of a complete keyboard transmitting unit constructed in accord with the present invention;

FIGURE 3 is a reduced size perspective view of the receiving unit shown in FIGURE 1, in this instance, the cover being included;

FIGURE 4 is a perspective view of a detail portion of the power train for the receiving unit, showing the main drive motor and gear train to the vaned drum;

FIGURE 5 is a detail drawing illustrating the dot construction of the letter E as printed in various configurations depending upon the speed of the receiver in relation to the inter-pulse speed within an incoming multiple pulse signal;

FIGURE 6 is a cut away perspective view illustrating the principal components in the keyboard transmitting unit;

FIGURE 7 is a diagrammatic drawing showing, in elevation, a single key and switch assembly of the keyboard unit and broadly illustrates the concept by which the key controlled switching system connects to set up the matrix group which in turn connects a current source to selected segments of the commutator. A portion of a monitoring receiving printer is also illustrated in this figure:

FIGURE 8 is a vertical cross-section illustrating the transmitter commutator, its drive power input train and its relationship to the transmitter start-stop magnet;

FIGURES 9–20 are detail views illustrating components in the receiver as follows:

FIGURE 9 is a detail plan view showing the print hammer assembly and its relation to the vaned drum;

FIGURE 10 shows a small detail of the print hammer carriage screw in plan view and illustrates the lower end of the print hammer mechanism release lever engaging the stud which cams the lever back into engagement with the carriage screw;

FIGURE 11 is a front elevation detail view of the print hammer assembly and the vaned drum, and shows the structure by which the hammer assembly is attached to the carriage screw;

FIGURE 12 is another front elevation detail showing components omitted from FIGURE 11, illustrating the print hammer assembly return spring and the monorail assembly used to transport the print hammer assembly;

FIGURE 13 illustrates left-hand side details of the print hammer assembly, the monorail carriage and associated operating members, the print hammer assembly being illustrated as it would be connected to the carriage screw during normal travel, the carriage return and line feed solenoid being de-energized;

FIGURE 14 illustrates left-hand side details (as in FIGURE 13) but shows the carriage return and line feed solenoid in an energized condition and the print hammer assembly as it would appear during the carriage return condition;

FIGURE 15 illustrates details which are located on the right-hand side of the machine and shows the paper feed mechanism in an engaged condition and also shows the start-stop mechanism in the stop position;

FIGURE 16 is a right-hand detail view similar to FIGURE 15, showing the start-stop magnet de-energized, the start-stop mechanism in a neutral position, the paper feed mechanism disengaged and its solenoid de-energized.

FIGURE 17 is a partially sectioned front elevation of the vaned drum and the manual paper feeding mechanism;

FIGURE 18 is a view similar to FIGURES 15 and 16, showing the start magnet switch open, the carriage return-line feed switch open and the associated mechanism in an operative position;

FIGURE 19 is similar to FIGURE 18 and shows the start-stop switch closed, the start-stop magnet energized and the carriage return-line feed switch closed;

FIGURE 20 is a view similar to FIGURE 19 with the machine shown in the stop position with the start-stop switch closed, the start-stop magnet energized and holding, and the carriage return-line feed switch open. This figure also shows the coincidence adjustment mechanism which is used to synchronize the machine with the incoming signal;

FIGURE 21 represents the transmitter commutator in elevation from the left side (see FIGURE 6), and shows the segments which are wired from the matrix components representing the letter E and also identifies the segments which control the various functions;

FIGURE 22 is a schematic drawing showing three groups of commutator segments: the fifth group, the last group which controls the functions and the first group;

FIGURE 23 is a schematic layout of the 48 segments of the commutator, a portion of an exemplary diode matrix group and several of the key switches. The matrix portion shown is wired to the proper commutator segments and to selected key switches to result in transmission of the letters M, H, B, E, S, V and X when the appropriate key switch is closed;

FIGURE 24 is a block representation of the letters E and K, the shaded squares being those units which must be printed to effect progressive printing of the letter, the shaded squares being numbered in the order of their progressive recording on the paper;

FIGURE 25 is an enlarged plan view of the print hammer assembly;

FIGURE 26 is a schematic wiring diagram for the receiver and includes the carriage return-line feed operating circuit;

FIGURE 27 is an enlarged view of the vaned drum and the print hammer illustrating their relationship before printing; and

FIGURE 28 is an enlarged view of one drum vane and the hammer blade illustrating schematically the seven positions on the print hammer which effect printing of selected ones of the seven dots in each of the five vertical rows to result in the letter E.

General operation

A basic telegraphic progressive printing system (see FIGURES 1–3 and 7) includes a transmitter unit **30** (FIGURE 2) and a receiver unit **32** (FIGURES 1 and 3). Each unit will be connected to a power source (not shown) furnishing electrical power, e.g., 110 volts AC and 12 volts DC, for drive power and signal power. The output signal line from the transmitter unit can be connected by direct line, e.g., a power circuit or telephone line, to the input of the receiver unit or by radio equipment through a radio channel. The power supply circuits to the transmitter unit **30** and the receiver unit **32** are turned "on" by respective "ON-OFF" switches **33** and **34**, whereupon the system will be ready for operation.

In the receiver **32**, when switch **34** is "on" the receiver motor **36** is energized as is also the receiver start-stop magnet **37** which immediately blocks all functioning activities of the receiver **32** until the first incoming pulses (start pulses) of a transmitted character signal are received from transmitter **30** as will be explained in greater detail hereinafter.

The receiver **32** now is ready to receive the first of the incoming pulses of a signal which will occur when a key on the transmitter unit keyboard **39** is depressed. Referring to FIGURE 7, when a key **38** is depressed it will move down along vertical guide slots in a comb **40**, also being guided in a pantograph manner by two pivoted levers **41** and **42**. The key unit is moved downwardly against the biasing force of a spring **43** which is connected to a lug on the lower lever **42**, and urges the key pantograph unit in a CW direction. When released, the key **38** returns under spring bias to its normal position whereat a lower key lug abuts a bumper strip **44**, made of a material such as felt, cork, rubber or foam plastic.

When the key is depressed and the lower lever **42** of the pantograph linkage for key **38** moves CCW against the force of spring **43**, its projected right-hand lever arm **46** pushes upward against one arm of an associated switch operator lever **47** causing the lever to rotate CW, so a second arm **48** of the operator lever in turn will engage and cause two associated leaf switches **49** and **50** to close in respective, sequential order although closure is almost simultaneous. The first (upper) switch **49** closes a circuit to a diode matrix bank **51**, setting up a predetermined circuit through selected diodes in accord with the key which was depressed. The second switch **50** closes a circuit to the transmitter starting mechanism which will be discussed hereinafter.

The diode matrix bank **51** in the transmitter unit can be wired to form characters of any language using English letters and many other foreign language characters and symbols, so long as they can be formed within the established limits of the squares in the symbol blocks as shown in FIGURE 24. If desired, these limits can, of course, be expanded by making certain changes and modifications in the exemplary mechanisms and circuits and will fall within the confines of this present invention.

The various symbol keys on the keyboard are similar and each will operate two leaf switch units, the first of which in each case connects a circuit to a desired spe-

cific matrix diode pattern associated with the specific key and the second of which energizes the transmitter start magnet. In addition to the keyboard, transmitter **30** incorporates a motor driven commutator, by which the key selected matrix diode circuits are energized in a predetermined order and timed relationship, and a commutator start-stop magnet and mechanism.

The transmitter commutator **52** can be seen in FIGURES 6, 7 and 8 (it is also represented in FIGURE 23) and, in the exemplary embodiment herein described, consists of forty-eight individual stationary segments **53** arranged in a ring on a dielectric base **80** and having no electrical connection between each other. If more complex characters or more functions are needed, or if more time were needed to accomplish the existing functions, additional segments **53** may be added to the commutator. Each segment **53** of commutator **52** is directly connected via an individual line **54** to the diode matrix bank **51** (only one line **54** being depicted in FIGURE 7). The connections will be explained in more detail hereinafter with reference to FIGURE 23.

After the first switch **49**, the matrix switch, associated with a depressed key is closed and has set up the desired diode pattern in the matrix bank **51**, the second switch **50** is closed and completes a circuit sending current through a one-shot multivibrator **55** (FIGURE 7) to a transmitter starting magnet **56**, which, when energized, attracts the armature **57** shown in FIGURE 6, moving it in a CCW direction until its blocking end **58** moves out the path of a commutator shaft blocking lever **59**. With the blocking armature removed from its path, blocking lever **59** and commutator shaft **60** will start rotating due to drive force transmitted through a slip clutch **61** which includes a gear **62** driven by a worm **63** rotated directly from the transmitter motor **64**.

Attached to the right end of and rotating with the commutator shaft **60** is a wiper arm **65** which in turn is fixed to a wiper disc **66** also rotating with shaft **60**. Working in sliding contact relationship with the rotational wiper disc **66** is a brush contact **67** (FIGURES 7 and 8). It is through this brush contact **67** that electrical pulses are sent over an output line to the transmitter amplifier **68**. The amplified pulses are sent out over the telegraphic network to the aforedescribed receiver start-stop magnet **37** and thence on into the coil of the print hammer operating magnet **69** after certain switching operations have been performed which will be explained later in the text. Note, the rotational speed of the segment wiper **65** is such that it will make a complete rotation before the key operated matrix switch can open upon release of the depressed key.

The basic signal for the system is a character or symbol block made up of forty-eight individual pulse units which, for convenience, can be referred to as "mark" or "space." Each pulse unit corresponds to a segment **53** of the commutator **52**. Shown in FIGURE 24, the signal pulse units are arranged in six vertical rows of eight pulse positions or squares in a rectangular block. Thirty-five squares (or pulse units) of the signal block are used to form the actual character or symbol while the remaining thirteen squares are used in the performance of or to effect the various functions such as "character spacing," "line feed," "carriage return," "stop" and "start." This is more clearly illustrated in FIGURE 22 where each numbered commutator segment corresponds to the same number in the squares of the character or symbol block (FIGURE 24).

As stated hereinbefore, the diodes in the matrix bank **51** are wired to set up circuits to the appropriate commutator segments for desired characters and symbols in accord with a depressed key and each of these characters will be printed on a page of paper **70** in one or more printing sequences passing down from square to square from the top to bottom of each vertical row starting in the first row in a character block progressing through the first five rows from left to right. This, too, will be more fully explained hereinafter.

Receiver

After the transmit starting magnet **56** is energized to unblock the commutator shaft **60**, the wiper arm **65** begins to move around the inside of the commutator **52** (see FIGURE 21). During initial movement the wiper arm **65** moves off of the stop segment #**41** (see FIGURE 23), which has a positive signal potential applied thereto, and moved on to the dead "start" segments #**42** and #**43**. Since the wiper is connected to the transmitter output the signal will commence with two "space" or no-current pulses and power is instantly removed from the receiver start-stop magnet **37**. The receiver stop lever **72** (FIGURES 18, 19 and 20) will immediately pivot CW on its pivot pin **73**, under bias force of a spring **74** so its blocking arm **75** will instantly move out of the path of a stop cam **76** on the receiver function shaft.

During this time, the receiver motor **36** is, of course, running and transmitting drive power through a worm **78** to a worm wheel **79** secured on a transfer shaft **80** (FIGURE 4). On the opposite end of transfer shaft **80** is a gear **81** meshed with a larger gear **82** which is part of a slip clutch **84**. By means of the gearing described, rotational power is transmitted to a vaned drum **86** which, like the driven components of slip clutch **84**, is non-rotatably attached to the function shaft **87**.

On the opposite end of the receiver unit drum shaft **87** is secured another large gear **88** (see FIGURES 1 and 11) which is meshed with a small gear **90** in a 4:1 ratio. Gear **90** is non-rotatably fixed on a carriage screw **92** and imparts rotational movement thereto (see FIGURES 15 through 20) whenever the drum shaft **87** rotates. By appropriate timing, the time period for a complete signal cycle is made equal to a one-fourth revolution of the drum shaft **87** and therefore, when gear **88** makes a one-fourth revolution, the carriage screw gear **90** and of course the carriage screw **92** itself will make one complete revolution. If no further logic is transmitted, the drum shaft **87**, gear **88**, gear **90** and carriage screw **92** will be blocked at the end of the signal cycle by the start-stop magnet stop lever **72** in a manner as will now be described.

Referring to FIGURE 20, the receiver start-stop magnet **37** is illustrated in an energized condition, which pulls the stop lever **72** CCW and holds it with its blocking lug **75** positioned in the path of rotation of drum shaft stop arm **76**. This stops the rotation of the drum and the carriage screw **92** and thus prevents the receiver **32** from further printing cycle operations. During periods when no logic is being transmitted, this receiver stop condition will be maintained because current is being channelled through the "stop" segment of the commutator **52**, through the contacts **94** of a DPST switch **96** and from there to the receiver start-stop magnet **37**. The start of transmission of the next character, as has been described hereinbefore, causes the transmitter wiper arm **65** to move onto the start segments #**42** and **43** (FIGURE 21), thereby breaking the circuit and removing the current flow to the receiver start-stop magnet **37**, whereupon the stop lever **72** is released and will immediately rotate CW biased by its spring **74**.

During the receiver print operation cycle, when the stop lever **72** is released as shown in FIGURE 18, and rotates CW, a control edge of a top finger **77** moves away from abutment with a switch camming button **98** of DPST switch **96** permitting its movable contact arm **100** to spring in a CW direction, opening switch contacts **94** in the receiver start-stop magnet circuit and immediately cutting off the current to the start-stop magnet **37**. The same movable switch arm **100** simultaneously closes contacts **102** to connect the receiver circuit to the print hammer magnet **69** (see FIGURE 26).

Looking at FIGURE 21, the transmitter wiper arm **65**,

continuing its rotational cycle, moves on past the two dead "start" segments **42** and **43** and makes contact with the #**1** segment of the commutator. If a potential has been placed on this segment by the matrix **51** which has been conditioned by the depressed key, that started the transmission signal cycle, e.g., the #**1** segment will be energized in the case of letter E, the receiver circuit to the print hammer magnet **69** is pulsed as the wiper contacts the #**1** segment. Such a pulse will occur in a closed circuit from the diode matrix **51** to the #**1** segment of the commutator **52**, thence through the wiper arm **65** to the wiper disc **66**, through the brush contact **67** over the communication lines, or network, to the receiver **32** and finally to the print hammer magnet **69**. The print magnet armature **104** (see FIGURE 25) is instantly drawn against the force of its bias spring **107** in a CW motion until its pole end **106** is floating in the air gap between core ends **108** and **110** of the print hammer electro-magnet **69**. The floating action is a unique feature in this type of printing mechanism. Note, a sharp impact will occur when the print hammer **112** is operated to strike the inked ribbon **114** and the record paper **70** against a drum vane, yet the gap between magnet core ends **108** and **110** and the armature pole end **106** provide a magnetic flux resilience which provides freedom to the print hammer enabling it to rebound on impact. This relationship eliminates the need for strict tolerances that would otherwise be necessary in the hammer-armature combination and also effectively eliminates the tendency of the print hammer **112** to cut into the paper **70**. To provide an adjustment of the travel of the print hammer **112** a small hammer abutment limit screw **113** is located at the spring biased hammer limit position.

Thus, as a result of a current pulse through the #**1** commutator segment, the print hammer armature **104** swings on its pivot **105** toward the print hammer magnet **69**, and the thin print hammer head **112** (which may be designated as a line-shaped hammer or hammer head), attached to the armature **104**, is moved toward the vaned drum **86**. The head **112** first strikes the inked ribbon **114** and presses it against the paper **70** and the paper **70**, in turn, is pressed against a vane **116** of the vaned drum **86** with a resultant printing of a small dot on the paper **70**. Each consecutive print operation a segment of the commutator **52** is contacted by the wiper arm **65** and, if potential has been supplied to that segment by the matrix, the completed circuit sends a pulse to the print hammer magnet **69** and the aforedescribed printing operation is repeated until a completed character, such as shown in FIGURE 24, is formed. Complete character forming by specific timing of the printing of dots will be more fully described hereinafter with reference to the vanes on the vaned drum **86**.

The vaned drum **86** desirably has a small periphery and comprises a flanged core **118**, shown in FIGURES 17 and 27, around the periphery of which four equally spaced apart groups of five equally spaced apart vanes **116** have been secured. The core flange may be slotted and the vanes brazed in the slots. Between each group of five vanes **116** there is a blank space **120** which is twice the distance between vanes in a group. Space **120** is provided to accomplish the desirable slight spacing between letters, and to provide a non-printing portion of a signal cycle permitting carriage return, stopping and starting functions of the receiver **32**. Only one group of five vanes is used in conjunction with the printing of one symbol or character, and since the exemplary mechanism is arranged to provide a physical space between each symbol equal to one of the five vertical rows of blocks in a character signal, the spacing between groups of vanes is double the spacing between vanes within a group.

As has been previously described, during a receiver print cycle the vaned drum **86** rotates and the carriage screw **92** also rotates through gears **88** and **90**. Due to rotation of the carriage screw **92**, the print hammer carriage **122** will undergo a gradual movement to the right throughout a printing cycle and while dots are being printed in the selected squares to form the character represented by the signal which initiated the print cycle.

Referring to FIGURES 24, 27 and 28, the first row of the letter E (FIGURE 24) is printed by cooperation between the print hammer head **112** and the first vane of a group of vanes **116** (FIGURE 27), the first vane being designated by the reference character Z. Through proper synchronization, the first vane Z arrives at the proper position near the top of the thin print hammer head **112** (see FIGURE 28) at the precise instant that the print hammer magnet **69** is pulsed for the first printed dot at the top of the first row. As shown in FIGURES 27 and 28, any dot required in the first row for any symbol or character will be printed on the Z vane **116** from the top down. In the exemplary letter E, all seven dots in the first row are printed, forming a straight line.

It is here noted that when adjacent segments of the commutator **52** are consecutively energized, the print hammer head **112** remains pressed against the inked ribbon **114** and will tend to draw a line on the paper instead of printing a row of dots (see FIGURE 5).

When the first vane Z has moved past the print hammer, one sixth of a print cycle is completed and the carriage screw **92**, has rotated one sixth of a revolution moving the print hammer assembly at a constant speed through one sixth of the width of a block (or the width of one row of dots). This increment of travel aligns the print hammer head **112** to start to print at the top of the second row, of the letter E. The commutator wiper arm **65** passing from segment #**7** in the first print row has moved on to the dead segment #8_0 between segments **7** and **8** and thence on to pulse the second row segments #**8**, #**11** and #**14** of the commutator **52** and the print hammer magnet **69** is concurrently pulsed according to the energized segments.

The second row of dots will be printed by cooperation between hammer head **112** and the second of vanes **116** which is designated as Y in FIGURE 27. It will not print in the first or extreme top space (see top of FIGURE 24) because of the dead commutator segment #8_0 but it will print dot #**8**. There will be no printing in the next two squares or spaces because the print magnet **69** receives no pulses. Then another dot is printed in square #**11**, two more spaces are skipped and finally the dot in square #**14** is printed. The print hammer assembly, which is still being constantly moved to the right by the carriage screw, now aligns the print hammer **112** to print the third row of dots in cooperation with the third of the group of vanes **116**, which is designated by the letter X in FIGURE 27. The wiper arm **65** makes contact, first with a dead segment #15_0, and then with matrix conditioned segments #**15**, #**18** and #**21** of the commutator **52**, pulsing the print hammer magnet **69** at appropriate times and the specific dots in the third row are printed in the manner previously described. The wiper arm **65** then contacts a dead segment #22_0 and proceeds to pass matrixed conditioned segments #**22**, #**25**, and #**28**, the print hammer magnet **69** being again pulsed at appropriate times to print the specific dots in the fourth row, this time in cooperation with the fourth of the group of vanes **116**, designated by the letter W.

Finally, the wiper arm **65** contacts the final group of print operating segments which have two energized segments #**29** and #**35** the final corresponding portions of the letter E are printed in cooperation with the fifth and last of the group of vanes **116** which is designated by the letter V.

This will complete the forming of the letter E, it being noted that five vanes **116** (or one complete group) were used to form the single letter E. Thus, it becomes evident that for every complete revolution of the vaned drum **86**, which has four groups of five vanes, four characters can be formed from printed dots.

Clearly depicted in FIGURE 11 (and as will also be apparent in FIGURES 9 and 25), a slight angular bend **134** has been formed in the vertical support plate of the print hammer carriage **122**. This places an angular cant on the print hammer head **112** which, in conjunction with the constant travel of the print hammer head and relative rotation of the vaned drum, will assure that the dots in each row of a character will be vertical. Without canting the print hammer head **112** as shown, all printed characters would be very noticeably inclined to the left. On the other hand, if it is desired that the vertical aspect of the characters should incline or slant to the right, the print hammer could be canted still further. Whether or not the vertical alignment is used, the horizontal aspect, i.e., horizontally parallel points in a letter, will depend upon achieving synchronization between receiver speed and transmitter speed, to be hereinafter discussed.

After the wiper **65** has moved off of segment number thirty-five of the commutator **52**, the wiper arm **65** contacts a blank segment 36_0 and concurrently the receiver stop lever **72** (see FIGURE 19) is mechanically cammed CCW to its stop position, i.e., toward the receiver start-stop magnet **37**, by a lug **138** on the carriage screw shaft which engages a spring leaf arm **140** on the upper stop lever lug **77**. The CCW movement of stop lever **72** causes contacts **94** of the receiver switch **96** to close and complete the circuit through the coil of the receiver start-stop magnet **37**.

Bearing in mind that the mechanical camming action at this instant is still holding the start-stop switch **96** closed, the commutator wiper arm **65** will next contact segment #**36**, **37** and **38** (the carriage return-line feed segments) and if current is present on those segments, a circuit through a carriage return-line feed switch **142** on the receiver and shown in FIGURES 18, 19 and 20, which has, at this point (FIGURE 19), been closed by a lug **232** of a four lobe cam **230** fixed on the function shaft **87**, will be pulsed. Note that segments #**36**, **37** and **38** will be energized if a carriage return function is called for from the keyboard transmitter **30**. Also, if it is desired that the carriage return-line feed operation be performed automatically, a switch **144** shown in FIGURE 12 and to be hereinafter described in further detail, will put the conjoint CR-LF functions into operation. For simplicity, carriage return and line feed will hereinafter be designated simply as CR and LF.

Print hammer carriage feed and return

With reference to FIGURES 11 and 12, a print hammer carriage **122** mounts and moves the print hammer assembly from left to right, during each signal cycle, including any printing operations, by means of the aforedescribed carriage screw **92** in cooperation with a carriage mounted drive lever **145** pivotally secured to the print hammer carriage **122**. The lever **145** is shiftably mounted on the carriage and is adapted to engage and ride in the threads of the carriage screw **92**. The main body of the carriage **122** is a plate member **124** which has an upper portion carrying the print hammer magnet **69** and its armature, a lower portion carrying a guide sleeve **126** slidably disposed over the carriage screw **92**, and a mid-portion which is secured to a roller suspension plate **128** which mounts three small grooved wheels **146**, **148** and **150**. The three wheels straddle a monorail **152** as shown in FIGURE 12.

Print hammer carriage **122** will move to the right along the monorail **152** during the printing operation and when it comes to the end of a completed printed line, the lower wheel **148** will engage and close the automatic CR and LF switch **144** (FIGURE 12). Closing of switch **144** sends current to the CR-LF solenoid **130** (FIGURE 13), energizing it and pulling the solenoid plunger **154** down (see FIGURE 14), which causes a lever **156** which is fixedly secured on a pivotally mounted shaft **158** to rock in a CCW direction against the biasing force of a spring **160**. Attached rigidly to the opposite end of the lever shaft **158** is another lever arm **162** to which is pivotally fixed a long wire push rod **164**. Rod **164** extends forward to a carriage return tripping bail **166** which is pivotally mounted in the receiver frame below the carriage **122** and in front of the carriage drive lever **145**. When solenoid operated lever arm **162** operatively moves CCW, it shifts the push rod **164** to the right which pushes the tripping bail **166** causing it to pivot in a CCW direction. Pivoting of trip bail **166** causes the operating bail edge **168** to push against a cam portion **169** of the drive lever **145** causing it to pivot CW on its pivoting pin **172**, which removes its upper screw engaging tooth **174** from engagement with the carriage screw **92**. The drive lever **145** includes a detent point **176** which cooperates with a mating detent point **178** on a detent lever **180** in a manner enabling the drive lever to be detained either in or out of engagement with the carriage screw **92**. The detent lever **180** and drive lever **145** are biased toward each other by a spring **182**.

Upon the carriage completing a return movement to the left-hand margin, the drive lever **145** will be pivoted CCW to re-engage the carriage screw. The reset movement is accomplished by an inclined camming edge **184** of a cam slide **169** on the lower arm of the lever striking a fixed stud **186**, see FIGURE 10. The positive camming engagement between lever **145** and stud **186** over-rides the detent action of detent lever **180**. The reset movement of drive lever **145** is rendered possible, even though the CR-LF solenoid **130** might be still energized, by a cut-out portion **183** in the left hand end of the drive lever tripping bail **166**, see FIGURE 11. Upon being reset, the tooth **174** of drive lever **145** once again engages between the threads of the carriage screw **92** and the print hammer carriage **122** is ready to again move the print hammer **112** across another line of the page as further signals are received.

The power to provide the carriage return function is derived from a coiled tension spring **188**, shown in FIGURE 12, one end of which is anchored to a receiver frame member **190**, the other end being secured to a cable **192** which passes over to the left side of the receiver **32**, around an idler pulley wheel **194** and back to an anchor lug extension **196** on the print hammer carriage plate **124**. As the print hammer carriage **122** moves to the right under the power of rotating carriage screw **92**, it pulls the cable **192** which stretches and stores return power in the coil spring **188**. Thus, the instant that drive lever **145** on the print hammer carriage **122** is tripped and released from the carriage screw **92**, the hammer carriage **122** will be snapped back, by the spring **188**, to the left hand, start-of-line position.

Automatic line feed

Automatic line feed occurs simultaneously with a carriage return operation, whether instigated by a received signal or accomplished mechanically upon the carriage reaching an end-of-line position. In either mode, CR and LF is initiated by the same solenoid **130**.

Referring now to FIGURES 15, 16 and 17, when the CR-LF solenoid **130** is pulsed and its plunger **154** is pulled down, the aforedescribed lever **156** (as now viewed by its opposite side) is rotated in a CW direction around its pivot **158**. A pawl **198**, carried on an arm of lever **156**, is moved forward and upward, being forced to rotate slightly in a CCW direction by a biasing spring **200** connected between it and the lever **156**. Spring **200** forces the lower end **202** of the pawl **198** to slide against a guide **204** (FIGURE 15), thus restricting the movement of the pawl **198** to a degree that the toothed end **206** of the pawl will engage a tooth on a line feed ratchet wheel **208** and index it only one position or the equivalent of one line space. A detent **210** for the line feed ratchet wheel **208**, is provided to insure against over-traveling more than one line for each solenoid operation. After

the solenoid **130** is de-energized, its plunger **154** will move upward, the lever **156** will rotate CCW and will reset the pawl **198** into a position from whence it can engage the next tooth of the ratchet wheel **208** when the solenoid **130** is again energized.

Turning to FIGURE 17 and with additional reference to FIGURE 1, the line feed ratchet wheel **208** is non-rotatably fixed to a shaft **212** paralleling and below the drum with one end projected to an exterior location on one side of the covered receiver **32**. A manual operating knob **214** is fixed on the projected end of the shaft **212** to enable an operator to manually turn the shaft **212** for feeding as much paper **70** as desired out of the receiver **32**. Upon rotation of shaft **212** paper record feeding is accomplished through two gears **216** and **218** non-rotatably secured on the shaft **212** and respectively meshing with two additional gears **220** and **222** which are rotatably mounted on the vaned drum shaft **87** adjacent the ends of the vaned drum **86**. The rotatably mounted gears **220** and **222** at the ends of drum **86** have rubber rims **224** and **226** and pressed against each rubber rim is a small, spring loaded roller **228**, one of which can be seen in FIGURE 11. A roll of record paper **70** is supported at the rear of the receiver **32**, the paper **70** being fed from the supply roll under the vaned drum **86**, up in front of drum **86** and behind the ink ribbon **114**, between the two rubber rims **224** and **226** and the two spring loaded rollers **228** and out through the top of the receiver. Thus, when feed shaft **212** is turned, either by the solenoid operated pawl **198** and ratchet **208** or by the manual knob **214**, record paper **70** will be fed out of the receiver **32**.

To accomplish the conjoint CR-LF function as a result of a signal from the transmitter keyboard **39**, the keyboard includes a key and an associated dual switch assembly for CR-LF, similar to key **38** and associated switches **49** and **50** shown in FIGURE 7. Depressing the CR-LF key will cause the lever **42** for that key to rotate CCW and its end **46** causes an associated switch operating lever **47** to rotate CW, closing the associated first switch **49'** (see FIGURE 23) to the diode matrix bank **51**. Switch **49'**, when closed, completes a circuit placing positive potential on commutator segments **#36**, **#37** and **#38**, the three segments which control the CR-LF functions. The second CR-LF key operated switch **50**, which is in parallel with all of the second key operated switches **50**, (see FIGURE 7) is then closed to start the transmitter wiper arm **65** in the same manner as hereinbefore described.

Because the CR-LF key operated switches do not control any circuits in the diode matrix, all of the print operating commutator segments **#1–#35** will be dead and the transmitter commutator wiper **65** will therefore pass over the print segments **#1–#35** without effect but when it engages segment **#36**, it will close a hot circuit to the receiver CR-LF switch **142** shown in FIGURES 18, 19, 20 and 26. The receiver switch **142** is operated four times by a cam wheel **230** during each revolution of the receiver drum shaft **87**. The cam wheel **230** is non-rotatably fixed to the drum shaft **87** and is angularly located in synchronization with the vaned drum **86** in such a manner as to cause one of the four cam projections **232** to close the CR-LF switch **142** the instant the last vane **116** of an associated one of the four groups around the periphery of the vaned drum **86** passes beyond the printing range of the print hammer **112**. Cammed closure of the receiver switch **142**, coinciding with the wiper **65** contacting the commutator segment **#36**, completes the circuit between the CR-LF switch on the transmitter keyboard **39** and the receiver **32**, the receiver CR-LF solenoid **130** is energized and the mechanical CR-LF functions are accomplished, as has been previously described in conjunction with FIGURES 13, 14, 15 and 16.

In further describing the CR-LF solenoid operation, reference is made to the FIGURE 26 circuit diagram. If the receiver stop lever **72** is in the "stop" position, as shown (same as FIGURE 20), contacts **94** of switch **96** will be closed. If a CR-LF pulse is transmitted it comes in on the signal line **270**, through closed contacts **94** of switch **96**, on through line **272** to the start-stop magnet **37** which, when energized, stops the receiver **32** from printing. Current in line **272** is also applied to the CR-LF switch **142**, which at this stage is closed by the cam wheel **230**, and thence through line **274** to energize the coil of a control relay **276** which has one side connected through line **278** to negative. Energizing of the control relay **276** is an instantaneous action which would, in itself, not allow enough time for the CR-LF solenoid **130** to effectively operate. Therefore, a holding coil **280**, incorporated with the control relay **276**, will hold the relay contacts **282** closed for a longer period of time, allowing the CR-LF solenoid **130** ample time in which to operate effectively. While the holding coil **280** is energized and is holding the relay contacts **282** in the closed position, current is building up in the holding circuit which includes a capacitor **284** and will continue to build up until the capacity of the capacitor **284** has been reached. When this point has been reached, the current stops flowing through capacitor **284**, whereupon the holding coil **280** releases the relay, its contacts **282** go to normal releasing the CR-LF solenoid **130** and simultaneously connecting a resistor **288** across the capacitor. The built-up current in capacitor **284** is dissipated to line **286** through resistor **288**. The three commutator segments **#36**, **#37** and **#38** shown in FIGURE 23 are energized on a CR-LF signal to permit sufficient energizing time to assure operation of the control relay **276**. Likewise, the three segments **#39**, **#40** and **#41** are all energized to assure energizing the receiver start-stop magnet for stopping of the receiver.

As has been hereinbefore described, once the CR-LF solenoid is energized, the print hammer carriage **122** with the print hammer **112** will be mechanically shifted back to the left side of the paper **70**, the paper **70** will have been simultaneously stepped one line space, and the receiver **32** is in condition to receive the next transmitted signals from the keyboard transmitter **30**.

Receiver synchronization

Throughout the operation, complete synchronization between the keyboard transmitter **30** and the receiver **32** must be closely maintained. A signal representing a symbol to be transmitted is originated at the keyboard transmitter **30** by depressing a key **38** which first, instantly sets up a representation of that symbol in the diode matrix group **51** by placing a potential through predetermined diodes in the matrix, on selected segments of the transmitter commutator **52**. This is followed instantaneously by closing the circuit to the transmit starting solenoid **56** to release and permit rotation of the wiper arm **65**. As the wiper arm rotates, the pulses from the matrix selected segments are then transmitted to the print hammer magnet **69** of the receiver **32**.

If the keyboard transmitter **30** and the receiver **32** are not properly synchronized, the print hammer **112** and the first vane **116** of a group of five vanes on the vaned drum **86** to be used as the print hammer platen for the first row of squares of the transmitted symbol, will not be in proper alignment and, consequently, portions of the printed characters would not be printed. This situation would make the incoming message very hard to read if not totally illegible.

In the exemplary embodiment, each character or other symbol is formed within the bounds of a block area which is divided into 48 units or squares, 8 units high and 6 units wide. This arrangement provides an extra vertical row for a blank interval between each letter as well as providing a extra top line of squares for a blank interval between each line of print. Thus 35 units or squares of the block area are available for forming the actual sym-

bol, 7 units high and 5 units wide. Referring to FIGURE 28, if the first vane of a group of vanes **116** was to rotate too far past the top edge of the hammer toward the center of the hammer head **112** before the print hammer magnet **69** received first row pulses from the commutator **52** in the keyboard transmitter **30**, it could cause the print hammer **112** to record the number one print pulse **234** (FIGURE 24) late, for example, in the print area for the number two pulse. The number two pulse **236** would then fall in the area for the number three pulse **238**, number three pulse **238** would fall in the area for the number four pulse **240**, etc. The number seven pulse **242** would, of course, be printed by the top of the hammer head **112** on the second vane in the group of vanes **116** in the desired blank space **243**, at the top of the second row of square positions. This pattern would continue throughout the printing of the character which, if it happened to be the letter E, would cause the complete lower bar **244** to be lost and printed above the normal character position. If this pattern were to continue it is easily seen that any incoming message could appear somewhat confusing if synchronization were not immediately adjusted.

Synchronization involves two aspects, (1) position of vane groups relative to the complete signal and (2) speed of receiver relative to speed of transmitter.

Vane position synchronization is an aspect wholly within the receiver and is controlled by an orientation device **246**, shown in FIGURE 20, a movable support plate that can be adjustably swung a limited amount CW or CCW around its pivot point which is on the right end of the carriage feed screw **92**. By loosening two clamping screws **248** (which may, if desired, have knobs for easy manipulation), the orientation plate **246**, when moved to the left for example, within the limits of two arcuate slots **250** in plate **246** causes the stop lever **72** and its pivot pin **73**, the start-stop magnet **37** and switch **96** to move with it. The stop lever **72** and its blocking arm **75** will thereby be swung CW away from the stop cam **76**. As the foregoing direction of adjustment occurs, the slip clutch **84** on shaft **87** (FIGURE 4) which carries the vaned drum **86**, then causes the gap or slack to be taken up through a small increment of rotation of the gears **88** and **90** (FIGURES 18 and 20) thus keeping the stop cam **76** flush against the blocking arm **75** at all times.

The vaned drum **86** being fixed to shaft **87** will rotate as the shaft **87** rotates to take up the adjustment gap, thus repositioning the first vane **116** of the first group in a downward direction to be printed on accordingly in relation to the print hammer **112**.

If the orientation plate **246** were moved to the right, the blocking lever arm **75** pushing against the stop cam **76**, would force the stop cam, carriage screw and carriage screw gear **90** to rotate CCW. The carriage screw gear **90**, being meshed with gear **88** would rotate function shaft gear **88** CW and it, in turn, being fixed to shaft **87** would rotate the shaft **87** CW, overriding slip clutch **84**. This, adjustment operation would also reposition the vanes **116** but moves them up in relation to print hammer **112**.

Thus, through the adjustment of the orientation plate **246**, the print hammer **112** and the leading vane **116** of any one of the four groups of vanes around the periphery of the vaned drum **86** can be exactly synchronized with the incoming start pulses from the keyboard transmitter **14**, and this will inherently adjust and synchronize all four groups of vanes.

If tension on the slip clutch **84** would always remain constant, no adjustment of vane position synchronization would probably ever be needed but, due to the construction of the slip clutch **84**, a certain amount of wear is inevitable over long periods of time. So, from time to time, the slip clutch **84** will need adjusting which in turn, will call for an adjustment of the orientation device **246**. The calibrations **251** on the lower edge of the orientation device **246** aid the operator in making finer adjustments.

The second synchronization aspect, speed of the receiver **32**, correlates the receiver and transmitter and must also be held under close control so that receiver speed does not vary to any degree with the transmission speed of the pulse units within a signal originating from the keyboard transmitter **30**. Receiver operating speed is controlled by a simple rheostat, the control knob **252** of which is seen on the front panel of the receiver **32** in FIGURE 1. The rheostat (not shown) controls the speed of the receive motor **36** which is a D.C., shunt wound motor. This, in turn, through the drive train consisting of worm **78**, gears **79** and **81** and the slip clutch **84**, controls the speed of rotation of the vaned drum **86** and, of course, all other receiver functions associated therewith.

The operator can tell precisely by visual observation whether or not the receiver **32** is functioning at a proper speed relative to the transmission speed within an incoming signal. Turning to FIGURE 5, three representations of a receiver printed letter E are shown, the first is a normal E, that is, it is symmetrically perfect, denoting that synchronization of receiver speed is in perfect accord with transmitter speed. The second "fast" E denotes that the receiver **32** is running too fast for the incoming pulses in the transmitted signal, consequently forming the characters with a distinct upward slant. The third "slow" E, denotes a receiver **32** is running too slow for the speed of the pulses in the transmitted signal, thus forming all characters with a distinct downward slant. In either case, the operator can correct any speed deviation in the reception by a simple adjustment of the aforementioned speed control knob **252**.

Ink ribbon drive

The ink ribbon **114**, as shown in FIGURE 1, is driven by a small continuous bead chain **254** which operates between a small sprocket **256** and a larger sprocket **258**, the latter having four times as many bead sockets as the small sprocket. The small sprocket **256** is attached to a large gear **260** both of which are rotatably mounted on the line feed shaft **212**, the gear **260** being rotated by a meshing gear **262** which, by virtue of being non-rotatably fixed to the shaft **87**, derives drive power from the receiver motor **36**. The large chain sprocket **258** is fixed to the end of a ribbon drive shaft **264**, and because of the 4:1 ratio between the bead chain sprockets **256** and **258**, the inked ribbon **114** will travel very slowly across the printing area and moves only when the drum shaft **87** is being rotated. The ribbon drive shaft **264**, through associated gear mechanism, drives either one of the two ink ribbon spools **266** and **268**. The gear mechanism is of the reversible type, similar to many mechanisms commonly known and used in the art. Since its specific construction is not per se a part of this invention, it will not be further described.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A receiving recording unit for use with a telegraph system wherein symbols are represented by a single electrical signal comprising a multiplicity of sequential intra-signal pulse units and including initiating start and terminating stop pulse units with a multiplicity of intermediate sequential pulse units equal in number to a predetermined number of blocks constituting a grid block arrangement of a symbol encompassing rectangular space, each specific symbol to be transmitted comprising a predetermined or-

der of distinct electrical value pulse units corresponding to specific grid block locations in the symbol rectangular space which, when visually reproduced in a symbol rectangle space on a record medium, will depict the specific symbol; said receiving recording unit comprising:

(a) means for receiving said signal;

(b) means for recording, by progressive transcription printing, the symbol represented by said multiplicity of intermediate intra-signal pulse units of said signal including

(1) means actuated by the receiving means for causing the initial pulse units of said symbol signal to start the recording means; and

(c) means comprising portions of said receiving means and portions of said recording means and responsive to said terminating pulse units for stopping said recording means after each symbol recordation so that the beginning of the recordation of the subsequent received symbol representing signal of at least two successive such signals will begin at a uniform distance from the terminal point of the rectangular space for the preceding recorded symbol.

2. A telegraphic progressive symbol printing receiver comprising: transcribing printing means including a plurality of line platen devices mounted for concurrent rotation about a common axis, marker means, means for rotating said plurality of platen devices including means for starting and stopping rotational movement, means for shifting said marker means parallel to the axis of rotation of said line platen devices including means for starting and stopping movement of said marker means parallel to the axis of and concurrently with starting and stopping the rotation of said line platen devices, means for causing cooperative relative movement of said marker means and said line platen devices to accomplish coordinated print action therebetween upon a record medium, and control means having control connections with said means for starting and stopping of the rotation of said platen devices and of the shifting movement of said marker means respectively at the beginning and at the end of the electrical pulses contained within a received symbol signal.

3. A telegraphic progressive symbol receiver as defined in claim **2**, wherein said marker means is capable of a multiple number of said print actions as each platen device moves past said marker means, and an adjustable device mounts said means for starting and stopping rotation of said plurality of platen devices to enable selective change of the platen device start positions relative to said marker device for receiver orientation to the pulse logic within a received signal.

4. A telegraphic progressive symbol printing page printer comprising: a drum having a plurality of straight line vane platens extending parallel to the axis thereof and each platen having a straight edge positioned radially outward from the axis of said drum; means to rotate said drum about its axis; a printing member mounted for shifting movement in a path parallel to the axis of said drum adjacent the peripheral path of said platen vanes; means to shift said printing member in the parallel path with such shifting movement directlyl coordinated with drum rotation; means for moving a sheet of record material between said drum and said printing member and for maintaining the sheet of record material stationary between said moving drum and moving printing member during symbol printing; and signal responsive means for selectively moving said printing member, concurrent and coordinated with its shifting movement and with drum rotation, toward the drum to effect printing on the record material.

5. A telegraphic progressive symbol printing page printer as defined in claim **4**, wherein said printing member comprises a magnet armature and said signal responsive means comprises an electromagnet and means are provided whereby said printing member and said electromagnet are mounted for conjoint shifting movement parallel to the axis of drum rotation.

6. A telegraphic progressive symbol printing page printer comprising: a drum having a plurality of straight line vane platens extending parallel to the axis thereof and with a straight edge positioned radially outward from the axis of said drum; means to rotate said drum about its axis; a printing member mounted for shifting movement in a path parallel to the axis of said drum adjacent the peripheral path of said platen vanes; means to shift said printing member in the parallel path with such shifting movement directly coordinated with drum rotation; means for moving a sheet of record material between said drum and said printing member; and signal responsive means for selectively moving said printing member, concurrent and coordinated with its shifting movement and with drum rotation, toward the drum to effect printing on the record material; said printing member comprising a magnet armature and said signal responsive means comprising an electromagnet, both of which are mounted by said means to shift said printing member for conjoint shifting movement parallel to the axis of drum rotation, said electro-magnet having pole faces opposing each other and spaced apart to provide a flux gap, and means pivotally mount said printing member magnet armature relative to said flux gap, so that upon energization of said electromagnet to attract said armature for a printing stroke, said armature moves into the flux gap to provide a floating resilience to the printing member at its impact, position for absorbing rebound forces in the magnetic lines of flux.

7. A telegraphic progressive symbol printing page printer as defined in claim **4**, wherein said printing member includes a line shaped hammer disposed transverse to the straight line platens and the logic in the received signals enables plural successive hammer print strokes during the period when each platen vane rotates past the hammer; said hammer having a mechanically variable connection so the exact transverse angular relationship of the line hammer relative to the line platens can be changed to enable counter control of the lateral inclination of the transcribed symbols resulting from the concurrent transcription movements of the rotating drum and the shifting hammer member during symbol printing.

8. A telegraphic progressive symbol printing page printer comprising: a drum having a plurality of straight line vane platens extending parallel to the axis thereof and with a straight edge positioned radially outward from the axis of said drum; means to rotate said drum about its axis; a printing member; means to shift said printing member including a carriage device carrying said printing member, mounted for shifting movement parallel to the axis of said drum adjacent the peripheral path of said platen vanes with such shifting movement directly coordinated with drum rotation; means for moving a sheet of record material between said drum and said printing member; signal responsive means mounted on said carriage means for selectively moving said printing member, concurrent and coordinated with its shifting movement and with drum rotation, toward the drum to effect printing on the record material; said means to shift said printing member includes a spring biased latch means on said carriage, a spring biasing means connected to said carriage and a rotatable screw connected to rotate with said drum, said latch means being biased into engagement with said screw so that screw rotation will move said carriage against spring bias toward an end-of-line position; and means responsive to a special signal condition to release said latch means from said screw and permit opposite shifting movement of said carriage to start-of-line position by said spring biasing means.

9. A telegraphic progressive symbol printing page printer as defined in claim **8**, wherein means are provided to positively reengage said latch means with said screw when said carriage reaches a start of line position.

10. A telegraphic progressive symbol printing page printer as defined in claim 8, wherein said means to release said latch means is connected to and actuates said means for moving a sheet of record material each time said latch release means responds to a special signal condition.

11. A telegraphic progressive symbol printing receiver-printer comprising: a rotary mechanical printing device; a member cooperating with said rotary printing device while shifting parallel with the axis of rotation of said printing device for effecting progressive transcription printing of characters on a stationary record medium; mechanism for advancing the record medium subsequent to the printing of a line of characters; and means rendered operable by, and during the final shifting movement of, said shifting member for initiating the operation of said advancing mechanism, operable subsequent to the progressive printing of a character in response to a received signal.

12. A telegraphic progressive symbol printing receiver for receiving data information, including symbol signals, on communication circuits, including voice frequency circuits, each signal comprising a multiplicity of selectively spaced sequential pulse units and including initiating start and terminating stop pulse units with a multiplicity of intermediate pulse units equal in number to a predetermined number of blocks in a block grid arrangement of a symbol rectangle, each specific symbol to be transmitted comprising a predetermined order of distinct electrical value pulse units for specific grid blocks in the symbol rectangle which, when visually reproduced in a symbol rectangle space on a record medium, will depict the specific symbol; said receiver comprising:

(a) means adapted to be connected for receiving said signals;

(b) means operable through a cycle in response to each received signal representing a symbol to progressively print portions of said symbol in selected blocks of a grid block arrangement corresponding to the specific symbol representative pulse units within a signal, until the symbol is reproduced on a record medium; and

(c) said means to progressively print portions of said symbol including means which automatically initiate progressive printing of individual symbols representative of successive signals at positions which are character spaced from preceding symbols and printed in a straight line across the record medium relative to other symbols in the same line.

13. A page record telegraphic progressive symbol printing receiver as defined in claim 12 wherein said means for progressively printing said symbol further comprises: a rotatable plural line platen drum mounted with its rotation axis parallel to a line across the page record; a record feed wheel means rotatably mounted adjacent each end of the drum rotatable relative to said line platen print drum; and feed mechanism cooperating with said record feed wheel means to provide line feed of the page record.

14. A telegraphic progressive symbol printing receiver as defined in claim 13, wherein said coaxial feed wheels are friction feed wheels and means mount said wheels adjacent the ends of and coaxial with said drum.

15. A telegraphic progressive symbol printing receiver comprising:

(a) a rotatable, plural vaned platen drum;

(b) drive means including a motor and start-stop means connected to said drum for selectively rotating said drum;

(c) an electro-magnetically operated print hammer assembly;

(d) a carriage mounting said hammer assembly;

(e) a screw type carriage shifting means including a screw parallel with the axis of said drum and rotatable thereby and releasable means on said carriage

enabling a drive engagement between said carriage and said screw;

(f) means for returning said carriage to start-of-line position including means to store power for said return movement during power screw driven movement of said carriage toward the end-of-line position;

(g) means including rotatable coaxial feed wheels rotatable relative to said drum and means to step drive said wheels for feeding a sheet record medium up between said drum and said hammer assembly;

(h) means responsive to receipt of a signal, which comprises a plurality of pulse units, for starting a cycle of operation of said start-stop means as a result of an initial portion of said plurality of pulse units, accomplishing a coordinated sequence of relative movements between said hammer assembly and said drum to scribe a symbol representation on said record medium in accord with a second intermediate portion of said plurality of pulse units, and to assure stopping of said drum rotation due to a third terminating portion of said plurality of pulse units;

(i) said record medium being retained stationary, said print hammer assembly being continuously shifting toward the end-of-line position and said drum being continuously rotating during said scribing operation of a symbol intermediate the start and stop pulse units of a signal; and

(j) control means including a holding circuit device for actuating said releasable carriage return drive engagement means and simultaneously actuating said means to step drive said feed wheels to feed said record medium one step, responsive to a fourth portion of said plurality of pulse units in a signal and to said carriage reaching an end-of-line position for accomplishing automatic carriage return and line feed.

16. A telegraphic progressive symbol printing receiver as defined in claim 15, wherein said holding circuit device includes an R-C circuit the capacitance of which provides a timed holding action and said holding circuit including a switch means actuated upon termination of holding action to couple the R-C circuit resistance to the capacitance for dissipating the capacitance.

17. A telegraphic progressive symbol printing receiver comprising:

(a) a rotatable, plural vaned platen drum;

(b) drive means including a motor and start-stop means connected to said drum for selectively rotating said drum; an electro-magnetically operated print hammer assembly;

(c) means for feeding a sheet record medium up between said drum and said hammer assembly; and

(d) means responsive to receipt of a signal, which comprises a plurality of plus units, for starting a cycle of operation of said start-stop means as a result of an initial portion of said plurality of pulse units, accomplishing a coordinated sequence of relative movements between said hammer assembly and said drum to scribe a symbol representation on said record medium in accord with a second intermediate portion of said plurality of pulse units, and to assure stopping of said drum rotation due to a third terminating portion of said plurality of pulse units;

(e) the record medium being retained stationary by said feed means, said print hammer assembly being continuously shifting toward the end-of-line position and said drum being continuously rotating during said scribing operation of a symbol intermediate the start and stop pulse units of a signal.

18. A telegraphic progressive symbol printing receiver as defined in claim 17, wherein said means to assure stopping of drum rotation includes means responsive to drum rotational position providing an arming control, rendered operable after starting said drum, permitting stopping of

said drum rotation only by the final portion of pulse units of a received signal.

19. A telegraphic progressive symbol printing receiver as defined in claim 18, wherein said plural vaned platen drum includes groups of platens, all groups being equally spaced apart circumferentially around the drum and one of said groups rotating past the print hammer assembly during the drum rotation occurring between the start portion of a signal and the stop portion of the same signal; and said means which is responsive to drum rotational position and provides an arming control includes at least one operator connected to said drum and movable in a fixed path during drum rotation so that a said operator moving along said fixed path intersects a fixed location once each time one of said groups of platen vanes has moved past said print hammer assembly, and a drum stop circuit control device actuated each time a said operator moves into said fixed location.

20. A telegraphic progressive symbol printing receiver comprising:

(a) a rotatable, plural vaned platen drum;

(b) drive means including a motor and start-stop means connected to said drum for selectively rotating said drum;

(c) a print hammer assembly;

(d) means operatively associating said drum and said hammer assembly, adapted, in response to receipt of a signal, which comprises a plurality of pulse units, to accomplish a coordinated sequence of relative movements between said hammer assembly and said drum to progressively scribe a symbol representation on said record medium in accord with an intermediate portion of said plurality of pulse units;

(e) record feed means including rotatable coaxial record feed wheels at each end of said drum and selectively controlled means to step drive said wheels for feeding a sheet record medium up between said drum and said hammer assembly and otherwise maintain the record medium stationary while said drum is rotated during said scribing operation of a symbol.

21. A progressive symbol printing recording device for receiving data communication signals, each of which consists of a multiplicity of pulse units at least part of which may represent print points of a symbol, comprising:

(a) a plurality of lateral line platen means and an upright line hammer device shiftable in paths substantially normal to each other only during the period when a signal is received, each of said plurality of line platen means and said hammer being capable of a plurality of relative movements toward each other during reception of a signal;

(b) power drive means, including starting and stopping means and means connected to power drive said platen means and said hammer means at a constant speed rate and also including means to variably adjust said constant speed rate, and

(c) adjustable means, interconnecting said starting means, said stopping means and said means connected to drive said platen, enabling adjustment of orientation of the means to start the recording means with the relative positions of said platen means and said hammer means.

22. A telegraphic progressive symbol printing receiving printer comprising:

(a) a rotatable drum shaped device with elongate line platen means mounted exteriorly around the drum axis and extending from one end of the drum device to its other end;

(b) means for driving said rotatable drum device including start-stop control means; a print hammer means including a magnetically operable hammer device with a line shaped hammer head disposed transverse to the direction of extension of said platen means and adjacent the rotatable path of the platen means, and an electro-magnet adapted to actuate said hammer device toward the peripheral platen means;

(c) means mounting said print hammer means for shifting movement in a direction parallel to the axis of said drum;

(d) means coupled between said hammer means and said drum driving means to directly coordinate rotation of said drum device with and cause driven shifting movement of said hammer means in one direction;

(e) means enabling disposition of a record means between said hammer means and said drum device; and means for receiving a signal, which comprises at least one start pulse unit, a plurality of symbol pulse units and at least one stop pulse unit, responsive to a signal start pulse unit to initiate starting action of said start-stop means, responsive to symbol pulse units to energize said electro-magnet at progressive predetermined time increments representative of the specific symbol to cause magnetic force on said hammer device urging said hammer head to press the record means, during said predetermined time increments, against predetermined successive ones of said platen strips to thereby progressively inscribe a symbol on the record means, and responsive to the signal stop pulse unit to stop drive rotation of said drum.

23. A telegraphic progressive symbol printing receiving printer as defined in claim 22 wherein an inking device is disposed between said hammer and said platen means.

24. A telegraphic progressive symbol printing receiving printer comprising: a rotatable drum shaped device with elongate line platen means mounted exteriorly around the drum axis and extending from one end of the drum device to its other end; means for driving said rotatable drum device including start-stop control means; a print hammer means including a magnetically operable hammer device with a line-shaped hammer head disposed transverse to the direction of extension of said platen means and adjacent the rotatable path of the platen means, and an electro-magnet adapted to actuate said hammer device toward the peripheral platen means; means mounting said print hammer means for shifting movement in a direction parallel to the axis of said drum; means coupled between said hammer means and said drum driving means to directly coordinate rotation of said drum device with and cause driven shifting movement of said hammer means in one direction; means to shift said hammer means in the opposite direction to said driven shifting movement; means enabling disposition of a record means between said hammer means and said drum device; means for receiving a signal, which comprises at least one start pulse unit, a plurality of symbol pulse units and at least one stop pulse unit, responsive to a signal start pulse unit to initiate starting action of said start-stop means, responsive to symbol pulse units to energize said electro-magnet at progressive predetermined time increments representative of the specific symbol to cause magnetic force on said hammer device urging said hammer head to press the record means, during said predetermined time increments, against predetermined successive ones of said platen strips to thereby progressively inscribe a symbol on the record means, and responsive to the signal stop pulse unit to stop drive rotation of said drum; and means responsive to a special pulse unit originated in a signal subsequent to receipt of all printing pulse units and responsive to a special signal to actuate said means for shifting said hammer means in its opposite direction.

25. A telegraphic progressive symbol printing receiving printer comprising:

(a) a rotatable drum shaped device with elongate line platen means mounted exteriorly around the drum axis and extending from one end of the drum device to its other end;

(b) a print hammer means including a magnetically

operable hammer device with a line shaped hammer head disposed transverse to the direction of extension of said platen means and adjacent the rotatable path of the platen means, and an electro-magnet adapted to actuate said hammer device toward the peripheral platen means;

(c) means mounting said print hammer means for shifting movement in a direction parallel to the axis of said drum;

(d) means for receiving a signal, which comprises at least one start pulse unit, a plurality of symbol pulse units and at least one stop pulse unit, responsive to a signal start pulse unit to initiate starting action of said start-stop means, responsive to symbol pulse units to energize said electro-magnet at progressive predetermined time increments represenative of the specific symbol to cause magnetic force on said hammer device urging said hammer head to press a record means, during said predetermined time increments against predetermined successive ones of said platen strips to thereby progressively inscribe a symbol on the record means.

26. For use in combination with a transcription telegraph system for symbol signal transmission, a transcribing receiver having a driven printing mechanism to progressively inscribe a symbol by a group of intra-signal pulse unit current condition signals, a point printing

operating electro-magnet device, with a line shaped electro-magnet operated printing hammer, for receiving and accomplishing symbol printing responsive to the symbol portions of said signals, a cycling start-stop device including a stop magnet for said printing mechanism, said start-stop device being operable but once for each complete inscribed symbol, and means including said stop magnet to start said start-stop device upon reception of an initial no-current pulse unit of a signal, to enable operation of said point printing operating electro-magnet device during and responsive to intermediate current pulse units of said signal and to cause the stop operation of said start-stop device responsive to a current pulse unit of said signal only subsequent to a predetermined operating period of said driven printing mechanism.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,324,240 June 6, 1967

Edward E. Kleinschmidt et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 39, for "containuously" read -- continuously --; column 2, line 33, for "French" read -- English --.

Signed and sealed this 28th day of November 1967.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents