Jan. 9, 1968 K. MAIERSHOFER 3,363,261

PRINTING DEVICE

Filed July 30, 1965 2 Sheets-Sheet 1

FIG. 1

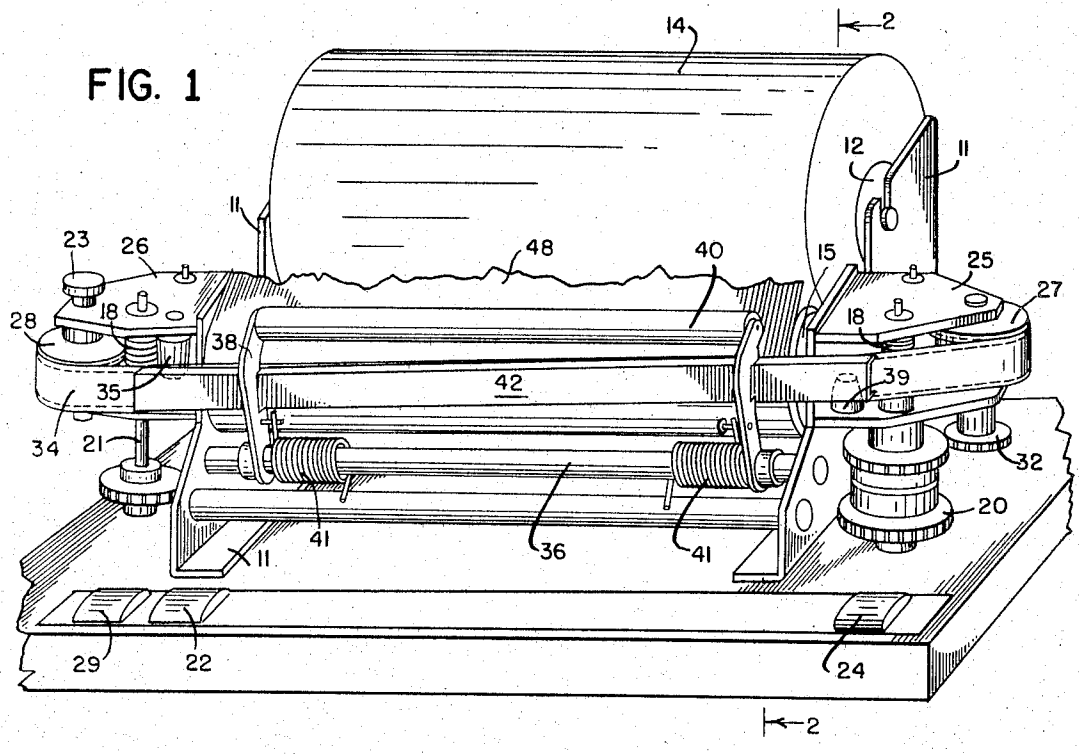


FIG. 2

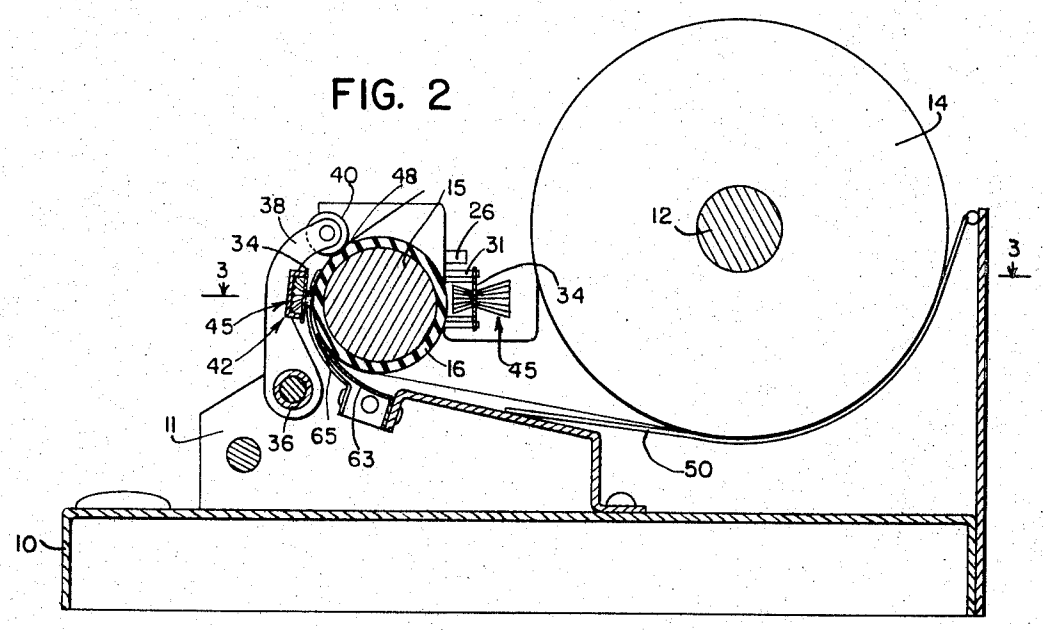
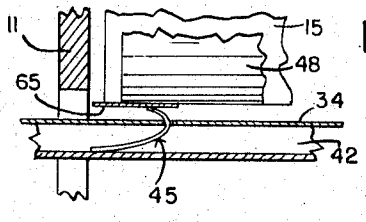


FIG. 6



Inventor
KARL MAIERSHOFER
BY Mueller, Aichele & Rauner
ATTYS.

Jan. 9, 1968 K. MAIERSHOFER 3,363,261

PRINTING DEVICE

Filed July 30, 1965 2 Sheets-Sheet 2

FIG. 3

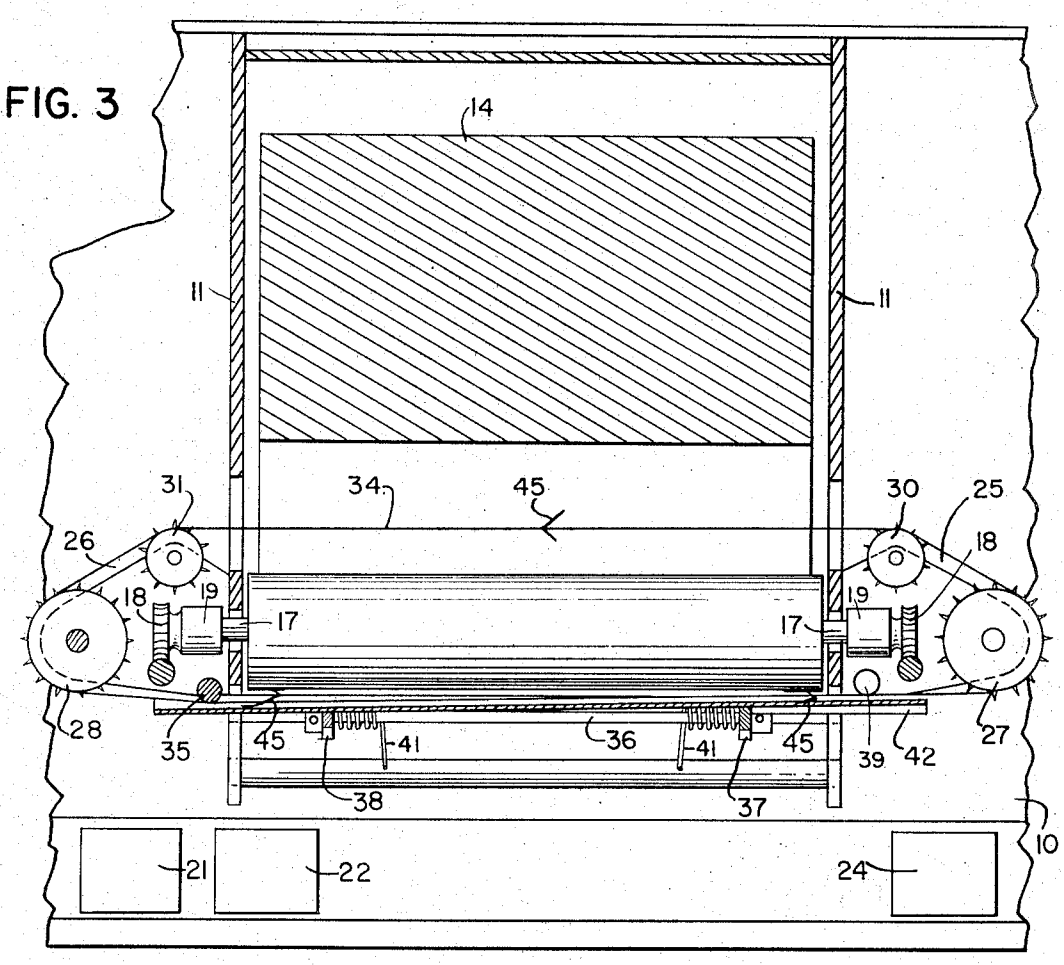


FIG. 5

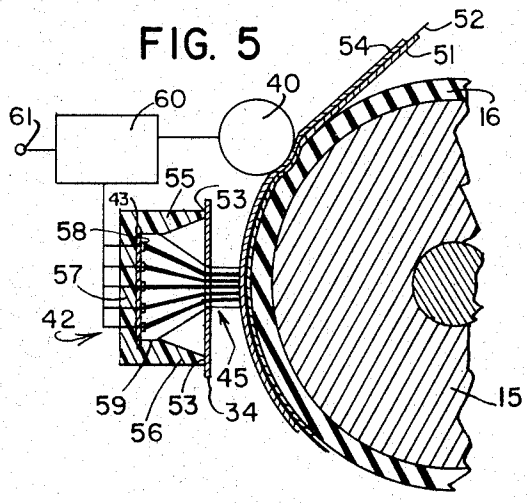


FIG. 4A

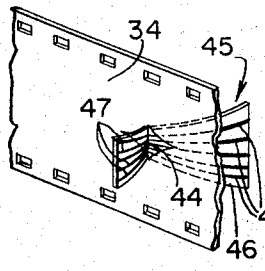
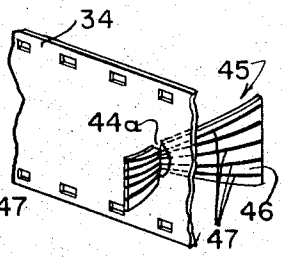


FIG. 4B



Inventor

KARL MAIERSHOFER

BY

Muller, Aichele & Rauner

ATTYS.

United States Patent Office 3,363,261 Patented Jan. 9, 1968

3,363,261

PRINTING DEVICE

Karl Maiershofer, Park Ridge, Ill., assignor to Motorola, Inc., Franklin Park, Ill., a corporation of Illinois

Filed July 30, 1965, Ser. No. 476,052
9 Claims. (Cl. 346—74)

ABSTRACT OF THE DISCLOSURE

A high speed printing system in which the scanning electrode structure prints characters in response to electrical signals. The electrode structure consists of printed circuit electrodes formed on a flat resilient body and held in an opening in the belt. The belt is skewed with respect to the movement of the recording paper, and idler pulleys are provided to twist the belt to maintain the spacing between the belt and the recording paper substantially constant. Shields are provided at each end of the line being scanned to hold the electrode structure away from the recording paper.

Known electrical printers as they are described in the U.S. Patent No. 3,116,752 are capable of high speed printing. These teleprinters have the disadvantage that a voltage discharge or spark is produced at the marking electrode. Further, accurate alignment of the transverse moving stylus with reference to the surface for the paper is required. Because the stylus has to be in alignment at several points at the same time, this presents a problem. Prior high speed teleprinters have been so complicated that the presence of a skilled operator has been required.

Accordingly, it is an object of the present invention to provide an improved printing device that is small, compact and silent in operation.

Another object of the invention is to provide an automatic alignment of the printing heads in relation to the paper surface along the whole length of the printed line.

A further object of the invention is to provide printing heads which are attached to an endless driven belt avoiding a dynamic torque movement to the belt during printing.

Still another object of the invention is to provide a printer for use with current-sensitive paper which allows high speed for printing.

A feature of the invention is the provision of a printing device having a belt looped around driving means for the recording sheet and a plurality of conductive electrodes on a flat body supported by and extending through the belt for repeatedly moving across the recording sheet.

Another feature of the invention is the provision of a printer including a leading roller and a pressure roller or bar causing the recording sheet to be pulled in a direction transverse to the direction of movement of the belt such that the conductive electrodes scan across the pulled part of the recording sheet beneath the pressure roller.

Another feature of the invention is the provision of an electrode structure including a flat resilient body having an interior portion narrower than both the end portions, with the narrower portion held in an opening of the belt such that the body extends through the belt and is bent to a V-shape making electrical contact with the recording sheet and with stationary conductors positioned opposite to the leading roller with regard to the belt.

A further feature of the invention is the provision of a printer for operating with a recording sheet having a nonconductive backing, a top coating and an intermediate coating of electrically conductive material, which top coating is sensitive to current density and changes in color as a result of high current density. The printer

operates to apply electrical impulses between the electrodes and a pressure roller and/or a pressure plate such that the scanning electrodes cause high current density within the top coating to mark the sheet, and the conductive pressure roller and pressure plate engage the sheet over a large area to cause low current density so that there is no significant marking. The plate also acts to prevent overrunning of the paper supply roll.

The invention is illustrated in the drawings wherein:

FIG. 1 is a perspective view of a teleprinter forming an embodiment of the invention;

FIG. 2 is a sectional view of the teleprinter taken along line 2—2 of FIG. 1;

FIG. 3 is a sectional view of the teleprinter taken along line 3—3 of FIG. 2;

FIGS. 4A and 4B show perspective views of different portions of belts with flat printing heads carrying scanning electrodes;

FIG. 5 shows diagrammatic the applying of electrical impulses; and

FIG. 6 shows an enlarged portion of the electrode structure and the action thereof during printing.

In brief, the invention may be utilized advantageously for a teleprinter with scanning electrodes which print complete lines of a message on a recording sheet as they scan across the sheet. The recording sheet is provided in the form of a paper roll and is moved past the scanning electrodes by a leading roller and an electrically conductive pressure roller which engage the recording sheet causing it to be pulled around the leading roller. A flexible, electrically conducting pressure plate is provided beneath the paper roll to prevent overrunning of the paper roll at high speed paging. The recording sheet consists of a nonconductive backing, a top coating and an intermediate coating of electrically conductive material sandwiched between the backing and the top coating. The top coating is sensitive to current density and changes its color as a result of high current density. The scanning electrodes are attached to a flat resilient printing head and insulated from one another. Several of these providing heads extend through different openings in an endless sprocket-driven belt which encircles drive and idler pulleys. These drive and idler pulleys are arranged on both sides of the driving roller so that the belt moves around the driving roller and the printing heads move across the sheet in a direction transverse to the direction of movement of the recording sheet. One printing head is always approaching on the left of the sheet as one leaves the right. The driving roller is supported on both ends and driven by a motor through worm gears mounted on the axle journals. Two spring loaded one-armed levers are positioned in the front of the driving roller such that the pressure roller, which is pivoted at the free ends of the one-armed levers, bears against the driving roller and pulls the recording sheet in an upward direction. Beneath the pressure roller a stationary energizing bar is mounted with multiple electrode elements in the form of parallel linear conductors such that the energizing bar is disposed at a slight angle with respect to the direction of the pulled recording sheet. Also the level in which the drive and idler pulleys are positioned is skewed upward in order to move the belt in the same slight angle and to produce a horizontal line as the paper continually moves upward during printing sweep. In consequence of this inclined position, the energizing bar and the belt has to be twisted to follow the outside contour of the driving roller. The resilient flat printing heads which extend through the belt are bent to V-shape, laying respectively into contact against the recording sheet and the energizing bar positioned which are spaced by a distance shorter than the elongation of the flat printing head, as the heads

move across the sheet. Because the two one-armed levers are spring loaded against the driving roller and because of the twist of the belt, the flat printing head aligns automatically even when the electrodes wear during a long time of operation. During operation the non-conductive backing of the recording sheet lays against the driving roller, whereas the electrodes of the printing head scan over the top coating of the current sensitive material. The electrical impulses applied to the scanning electrodes produce a high current in the localized areas of the point contact of the electrodes such that the color changes. This high current conducts through the intermediate coating of the electrically conductive material and back through the top coating to the pressure roller and the pressure plate, which are electrically connected to impulse circuitry. Since the pressure roller and also the pressure plate beneath the paper roll conduct over the whole width of the recording sheet, and further the pressure roller deforms the surface of the driving roller, the area of electrical contact is many times the area of the point contacts so that a change in color is not produced.

Referring now particularly to the drawings, in FIGS. 1 to 3 there is shown a teleprinter according to the invention. The unit has a chassis **10** on which a frame **11** is mounted. The frame **11** consists of a back section with vertical slots **12** in which a paper supply roll **14** is rotatably mounted and of a front section with the scanning and transport mechanism. This mechanism includes a driving roller **15** covered preferably with a rubber layer **16** which roller is supported in frame **11**. The axle journals **17** of the driving roller **15** project through the frame and carry overrunning clutches **19** and worm gears **18** (FIG. 3). The worm gear **18** on the right side in FIGS. 1 and 3 is driven through a one revolution clutch **20**, and the worm gear on the left side is driven by shaft **21**. The clutch **20** and the shaft **21** are coupled to a motor with a drive mechanism for a slow and fast speed, or to two motors which provide the slow and fast speeds. The slow speed is used for both printing and slow paging, whereas the fast speed is only used for paging. The printing speed is transmitted through clutch **20** and the paging speeds through shaft **21**. The motor which is not shown, can be mounted beneath the chassis **10**. For controlling the teleprinter, there are pushbuttons **29**, **22** and **24** mounted in the front of the chassis **10**.

At the same level in which the driving roller **15** is mounted, there are U-shaped brackets **25**, **26** attached at both sides of the front section of frame **11**. The worm gears **18** are positioned inside the U-shaped brackets, which also support the drive pulley **27** and the idler pulleys **28**, **30**, **31**. The pulley **27** is driven by the driven portion of the one revolution clutch **20** through a gear **32** connected by a shaft to the pulley **27** (FIG. 1). A belt **34** loops around the driving roller **15** and is supported by the drive and idler pulleys **27**, **28**, **30**, **31**, which belt consists preferably of a 16 millimeter film. The arrangement of the belt looping around the paper and the driving roller gives the advantage that if required the belt can be replaced rapidly without removing the recording sheet. In this case shaft **23** of the idler pulley **28** has to be pulled out. Thus the belt gets free of tension and can be changed. This transport mechanism is skewed upward to the right so that the belt moves at a slight angle with respect to the driving roller **15**. Because the belt **34** has to be twisted to follow the outside contour of the driving roller **15**, an idler wheel **39** is mounted at the lower part of the U-shaped bracket **25**, and another idler wheel **35** is mounted at the upper part of the U-shaped bracket **26**. The axis of these idler wheels is positioned in front of the surface of the driving roller **15** and engages the lower margin of the belt **34** at the left side and the upper part of the belt **34** at the right side such that the required twist is obtained.

In the frame **11**, there is further pivoted a shaft **36** beneath and in front of the driving roller **15**. On this shaft two one-armed levers **37**, **38** are mounted. On the free ends of the levers **37**, **38** an electrically conductive pressure roller **40** is pivotally connected and spring-loaded against the driving roller **15** by springs **41** supported on the shaft **36**. This lever can be locked open for paper loading and the change of the belt. The two one-armed levers **37**, **38** further carry an energizing bar **42** with a U-shaped cross-section in which a further flat plate **43** with printed parallel linear conductors **58** is provided. The energizing bar **42** consists preferably of a flexible material such as rigid vinyl for the U-shaped portion and standard Fiberglas for the printed circuit plate. The energizing bar **42** is supported in a lower position on the left side lever **38** than on the right side lever **37**, and is on the right side also twisted against the driving roller **15** whereas it is twisted off the driving roller **15** on the left side. The difference of level corresponds to the inclination of the upward skewed transport mechanism for the belt.

As especially illustrated in FIGS. 4A and 4B the belt **34** is provided with openings **44** through which a printing head **45** is extended. The printing head **45** consists of a flat, resilient body **46** of insulated material such as Mylar with a plurality of printed electrically conductive electrodes **47** on one side thereof insulated from one another. The figures show five but any number of electrodes can be used. The electrodes **47** consist preferably of thin tungsten layers applied by one of the well known methods for printed circuits. The resilient body is shaped to form a V and has an interior portion with a notch on each side. One end portion has the same width as the inside recess **57** of the U-shaped energizing bar **42** as will be described in connection with FIG. 5, and the other end corresponds to the height of the used characters.

As shown in FIG. 4A the opening **44** in the belt **34** has a rhombic shape with two different diameters so that the printing head can be put through this opening with its narrow end portion in parallel to the longer diameter; by twisting it about 90° it will be snapped in a fixed position. Another kind of attachment is shown in FIG. 4B wherein the opening **44*a*** has a semicircular shape with a straight edge of the same length as the narrower interior portion of the printing head.

As the belt **34** is driven round the driving roller **15** the preformed printing head **45** is bent furthermore to a V-shape as illustrated in FIG. 3, and the electrodes **47** make contact with the recording sheet **48** and the energizing bar **42** respectively, because the distance between the recording sheet and the energizing bar is shorter than the elongation of the flat printing head **45**.

The recording sheet **48** is supplied from the paper supply roll **14** and directed along a flexible pressure plate **50** (FIG. 2) and through a paper feed strip **63** to the driving roller **15** which moves the sheet past the scanning electrodes **47** of the printing head. The pressure plate **50** preferably consists of a stainless steel spring which extends over the width of the paper roll **14** and prevents an overrunning of the paper roll at high speed printing. Further, head shields **65** are connected beneath the paper feed strip at both sides of the driving roller **15** (FIGS. 2 and 6). These head shields **65** extend along the driving roller up to the upper portion of the belt **34** so that the printing heads during their time of rest do not touch the paper. Thus the paper can be loaded and paged without difficulty. The sheet is caused to be pulled around the leading roller as a result of the engagement of the pressure roller **40** and the driving roller **15**. Because the pressure plate **50** is very thin (approximately 0.008" thick) it fits very well to the paper roll providing a further electrical conduction for the return current. The interaction of the pressure plate **50**, the paper feed strip **63** and the head shields **65** provides the advantage of automatic paper loading, since the paper is guided along the pressure plate between the driv-

ing roller and the paper feed strip and also along the head shields beyond the printing heads and the open pressure roller by merely rotating the paper roll.

As shown in FIG. 5, the recording sheet consists of a non-conductive backing **51**, a top coating **54** and an intermediate coating **52** of electrically conductive material sandwiched between the backing and the top coating. The top coating **54** of this recording sheet is sensitive to current density so that a high current density causes a color change, whereas a low current density does not change the color of the top coating **54**.

Also illustrated in more detail in FIG. 5 is the energizing bar **42**, which consists of a body portion **57** and two integral side portions **55** and **56**. The side portions have flat front surfaces **53** for guiding the belt **34** and a further flat portion **59** near the inside part of the body **57** for guiding the printing head **45**. On the inside part of the body **57** of the energizing bar there is provided a further flat bar **43** with multiple electrodes in the form of parallel linear conductors **58**, which are connected to scanning circuitry **60**. That scanning circuitry has an input **61** for the printing signal and is further connected to the conductive pressure roller **40**.

In operation, the motor, which is not shown, drives the driving roller **15** through the one revolution clutch **20**, the shaft **21**, the overrunning clutches **19** and the worm gears **18**. Also the pulley **27** is driven by the driver portion of the clutch **20** through the gear **32** connected by a shaft to the pulley **27**. This one revolution clutch **20** permits the printing of one line at a time and brings the printing heads always in stand position after the printing is executed. The sprockets of the pulley **27** mesh into the perforation of the belt **34** and drive it in constant speed in a counter clockwise direction over the idler pulleys **28**, **30**, **31** around the driving roller **15**. When the recording sheet **48** is fed between the pressure and the driving roller, it is pulled around the driving roller avoiding paper wrinkles in the scanning area. The printing heads **45** are spaced equidistantly along the length of the belt **34**, and the looping belt moves these heads across the width of the sheet **48** in sequence. Thus, when one of the scanning heads is leaving the right side of the paper, the next following head is positioned at the left side ready to print the next line of the message. One end of each electrode **47** contacts the paper, and the other end of the electrode contacts the corresponding one of the parallel linear conductors **58**. The printing heads are resilient and, therefore, apply pressure to the paper to obtain proper electrical contact. The portion of the head connecting the energizing bar **42** is bent and rides in the U-shaped groove of the bar. Thus, when the printing signal is applied to the input **61**, the signal is coded and timed with respect to the scanning movement of the movable electrodes to selectively apply electrical current impulses to the electrodes. This impulse produces an array of marks arranged in columns on the top coating by means of the current conducted in the localized area of the point contact of the electrodes through the top coating and the electrically conductive intermediate coating to the pressure roller and the pressure plate. Thus, complete characters are formed one after the other as the electrodes scan across the recording sheet. Because the pressure roller and the pressure plate lie above and below the printing area close to the sheet over the whole width of the recording sheet, the area of electrical contact is a large multiple of the area of the point contact of the electrodes **47** so that no color change is caused by the impulse current flowing back to the circuitry **60**.

After the printing has been finished, or if a paging without print is wanted, it is possible using two different driving speeds and by means of the overrunning clutches to transport the paper slow or fast out of the teleprinter, whereby it is provided to cut the paper manually or automatically at random or at fixed page length.

I claim:

1. Apparatus for recording information on a recording sheet, said apparatus including in combination, a driving roller and a pressure roller causing the recording sheet to be pulled in a predetermined direction, a belt looped around said driving roller, at least one movable electrode structure consisting of a flat resilient body of dielectric material with a plurality of printed conductive electrodes on one side thereof insulated from one another, said electrodes having portions for engaging the recording sheet and movable in a direction transverse to the direction of movement of the recording sheet, a plurality of elongated stationary conductors insulated from one another and positioned opposite the recording sheet and extending substantially along the path followed by said electrodes in scanning across said sheet, said flat resilient body having an interior portion narrower than both the end portion said belt having an opening therein shaped to permit the insertion of an end portion therethrough and further to hold the narrower portion of said flat resilient body, said body extending through said belt and being bent to a V-shape, said stationary conductors being positioned at a distance from said recording sheet whereby one end of said electrodes makes contact with the recording sheet and the other end of said electrodes makes contact with said stationary conductors, and circuit means for selectively applying electrical impulses to said conductors, with said impulses being coded and timed with respect to the scanning movement of said movable electrode structure to produce an array of marks arranged in columns on the recording sheet such that complete symbols are formed one after the other as said movable electrode structure scans across the recording sheet.

2. Apparatus for recording information on an electrosensitive recording sheet including in combination, driving means and a conductive pressure roller causing the recording sheet to be pulled in a predetermined direction, a belt movable along said driving means, at least one movable electrode structure consisting of a flat body of dielectric material with a plurality of conductive electrodes fitted on one side of said body and insulated from one another, said electrodes having portions for engaging the recording sheet and movable in a direction transverse to the direction of movement of the recording sheet, a plurality of stationary conductors insulated from one another and positioned so that said belt is between said stationary conductors and said driving means, said flat body having an interior portion narrower than both end portions, said belt having an opening therein shaped to permit the insertion of an end portion therethrough and to hold the narrower portion of said flat body, said body extending through said belt for repeated movement across the recording sheet, said electrodes respectively making contact with said recording sheet and said stationary conductors as they move across the recording sheet, said recording sheet having a nonconductive backing, a top coating and an intermediate coating of electrically conductive material sandwiched between said backing and said top coating, said top coating being sensitive to the current density and changing in color as a result of high current density, and circuit means for selectively applying electrical impulses between said conductors and said pressure roller, with said impulses being coded and timed with respect to the scanning movement of said movable electrode structure to produce an array of marks arranged in columns on said top coating by means of said current in the localized area of the point contact of the electrodes such that complete symbols are formed one after the other as said movable electrode structure scans across the recording sheet.

3. Apparatus for recording information on an electrosensitive recording sheet, said apparatus including in combination, a frame, a driving roller and a pressure roller supported on said frame, the recording sheet being wrapped around a portion of the circumference of said

driving roller to cause the recording sheet to be pulled in a predetermined direction, driving pulleys and first and second idler pulleys supported on said frame at both sides of the driving roller, a belt looped around said driving roller by said driving and idler pulleys, printing heads consisting of a flat resilient body of dielectric material with a plurality of printed conductive electrodes on one side thereof insulated from one another, one-armed levers having free ends positioned in front of the driving roller rotatable around an axis parallel to said driving roller and spring loaded thereagainst, said free ends of said levers being connected to said pressure roller, an energizing bar connected to said levers and including a plurality of elongated conductors insulated from one another and positioned opposite the recording sheet, said printing heads being attached to said belt with said electrodes engaging the recording sheet and said elongated conductors and further being movable in a direction transverse to the direction of movement of the recording sheet, said energizing bar and said belt being positioned skewly upward to produce a horizontal printed line as the recording sheet continuously moves upward during printing sweep, said first and second idler pulleys being positioned at opposite sides of said driving roller, said first idler pulley engaging one margin of one side of said belt and said second idler pulley engaging the other margin of said one side of said belt, said first and second idler pulleys acting to impart a twist to said belt to maintain the spacing between said belt and said driving roller substantially constant across said driving roller and circuit means for selectively applying electrical impulse to said conductors, with said inpulses being coded and timed with respect to the scanning movement of said movable printing heads to produce an array of marks arranged in columns on the recording sheet such that complete symbols are formed one after the other as said movable printing heads scan across the recording sheet.

4. Apparatus for recording information on an electrosensitive recording paper, said apparatus including in combination, a frame, a driving roller and a pressure roller supported on said frame for pulling the paper in a predetermined direction, driving and idler pulleys supported on said frame at both sides of the driving roller, a belt looped around said driving roller by said driving and idler pulleys, printing heads consisting of a flat resilient body of insulated material with a plurality of printed conductive electrodes on one side thereof insulated from one another, levers positioned in front of the driving roller rotatable around and axis parallel to said driving roller and spring loaded thereagainst, said levers being connected to said pressure roller pressing said pressure roller against the driving roller, an energizing bar connected to said levers comprising a plurality of elongated printed conductors insulated from one another and positioned on the opposite side of the recording paper, said printing heads being attached to said belt and engaging the recording paper and said printed conductive electrodes and movable in a direction transverse to the direction of movement of the recording paper whereby said printing heads scan across the recording sheet, said driving and idler pulleys and said energizing bar and said belt being positioned skewly upward to produce a horizontal printed line as the recording paper continuously moves upward during printing sweep, a paper supply roll and a flexible pressure plate supported on said frame, said flexible pressure plate touching said paper roll, a pair of head shields positioned beneath the driving roller and touching said driving roller, one of said head shields being positioned at each end of said driving roller opposite said energizing bar whereby said printing heads cross over said head shields at the beginning and end of each scan, said head shields being positioned between said printing heads and the recording paper whereby said printing heads are prevented from contacting the recording paper with said printing heads in a rest position, the recording paper being loaded automatically past the printing heads along said head shields when the paper is pushed between said paper feed strip and said driving roller, and circuit means for selectively applying electrical impulses to said conductors, with said impulses being coded and timed with respect to the scanning movement of said movable printing heads to produce an array of marks arranged in columns on the recording sheet such that complete symbols are formed one after the other as said movable printing heads scan across the recording sheet.

5. Apparatus for recording information on an electrosensitive recording sheet, said apparatus including in combination, a frame, a driving roller and a pressure roller supported on said frame, the recording sheet being wrapped around a portion of the circumference of said driving roller to cause the recording sheet to be pulled in a predetermined direction, driving pulleys and first and second idler pulleys supported on said frame at both sides of the driving roller, a belt looped around said driving roller by said driving and idler pulleys, printing heads consisting of a flat resilient body of dielectric material with a plurality of printed conductive electrodes on one side thereof insulated from one another, one-armed levers having free ends positioned in front of the driving roller rotatable around an axis parallel to said driving roller and spring loaded thereagainst, said free ends of said levers being connected to said pressure roller, an energizing bar connected to said levers including a plurality of elongated printed conductors insulated from one another and positioned opposite the recording sheet, said printing heads having an interior portion narrower than both end portions, said belt having openings therein shaped to permit insertion of an end portion therethrough and to hold the narrow interior portion of the printing head, said printing heads extending through said belt and being bent to a V-shape and making contact with the recording sheet and said printed conductors respectively, and being movable in a direction transverse to the direction of movement of the recording sheet, said energizing bar and said belt being skewed to produce a horizontal printed line as the recording sheet continuously moves upward during the printing sweep, said first and second idler pulleys being positioned at opposite sides of said driving roller, said first idler pulley engaging one margin of one side of said belt and said second idler pulley engaging the other margin of said one side of said belt, said first and second idler pulleys acting to impart a twist to said belt to maintain the spacing between said belt and the driving roller substantially constant across said driving roller, and circuit means for selectively applying electrical impulses to said conductors with said impulses being coded and timed with respect to the scanning movement of said movable printing heads to produce an array of marks arranged in columns on the recording sheet such that complete symbols are formed one after the other as said movable printing heads scan across the recording sheet.

6. Apparatus for recording information on a recording sheet, including in combination, paper driving means for moving the recording sheet in a predetermined direction, a flat belt formed in a loop and having at least one opening therein, belt driving means for positioning said belt opposite the recording sheet and transverse to said predetermined direction, an electrode structure comprising a flat resilient body of dielectric material having at least one printed circuit electrode thereon extending the length of said flat resilient body, said electrode structure having first and second end portions and an interior portion narrower than both said end portions, said belt opening being shapd to permit the insertion of one of said first and second end portions therethrough and further being shaped to hold said electrode structure at said interior portion, said belt driving means acting to move said belt whereby said electrode structure scans across the record-

ing sheet, an energizing bar positioned opposite the recording sheet, said energizing bar having at least one conductor thereon extending substantially along the path followed by said electrodes in scanning across the recording sheet, said belt being positioned between said energizing bar and the recording sheet, said flat resilient body extending through said belt with one end of said electrode being in contact with the recording sheet and the other end of said electrode being in contact with said conductor, and circuit means for selectively applying electrical impulses to said conductor, with said impulses being timed with respect to said scanning movement of said electrode structure to produce desired markings on the recording sheet.

7. The recording apparatus of claim 6 wherein, said belt opening is in the shape of a segment of a circle, said curved portion of said segment being longer than the width of one of said end portions of said electrode structure, said chord portion of said segment being of a length to hold said electrode structure at said interior portion thereof.

8. The recording apparatus of claim 6 wherein, said belt opening is shaped to have a first axis and a second axis at an angle with said first axis, said first axis being longer than the width of one of said end portions of said electrode structure whereby said electrode structure is inserted through said opening, said second axis being of a length whereby with said electrode structure rotated through said angle said electrode structure is held in said belt at said interior portion.

9. Apparatus for recording information on a recording sheet, including in combination, a driving roller, the recording sheet being wrapped around a portion of the circumference of said driving roller, said driving roller acting to move the recording sheet in a predetermined direction, driving pulleys and first and second idler pulleys, a flat belt formed in a loop around said driving pulleys and said first and second idler pulleys, said belt having an electrode structure connected thereto, an energizing bar positioned opposite the recording sheet and having conductors thereon extending across the recording sheet, said belt being positioned between said energizing bar and the recording sheet whereby the electrode structure contacts both said conductor and the recording sheet, said driving pulleys acting to move said belt whereby said electrode structure scans across the recording sheet, said belt being skewed with respect to a line transverse to said predetermined direction to produce a horizontal printed line as the recording sheet moves continuously in said predetermined direction as said electrode scans the recording sheet, said first and second idler pulleys being positioned at opposite sides of said driving roller, said first idler pulley engaging one margin of one side of said belt and said second idler pulley engaging the other margin of said one side of said belt, said first and second idler pulleys acting to impart a twist to said belt to maintain the spacing between said belt and said driving roller substantially constant across said driving roller.

References Cited

UNITED STATES PATENTS

2,141,975	12/1938	Finch	346—139
2,723,897	11/1955	Zabriskie	346—139
3,166,752	1/1965	Waterman	346—139
3,263,604	8/1966	Dalton	101—149.2

STEPHEN J. TOMSKY, *Primary Examiner.*

RICHARD WILKINSON, *Examiner.*

L. M. LORCH, *Assistant Examiner.*