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[56]

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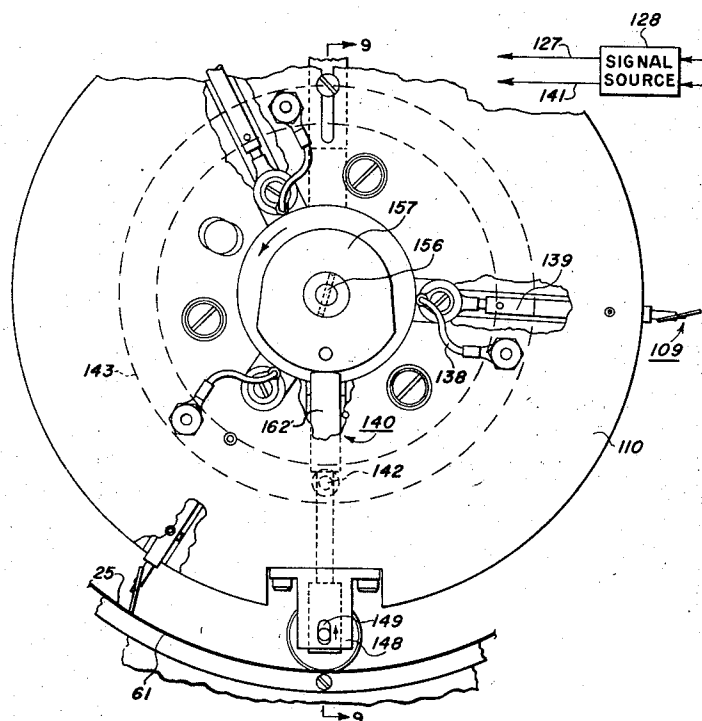
[54] **FACSIMILE RECORDING APPARATUS WITH
CAM OPERATED PAPER CUTTER**
5 Claims, 12 Drawing Figs.

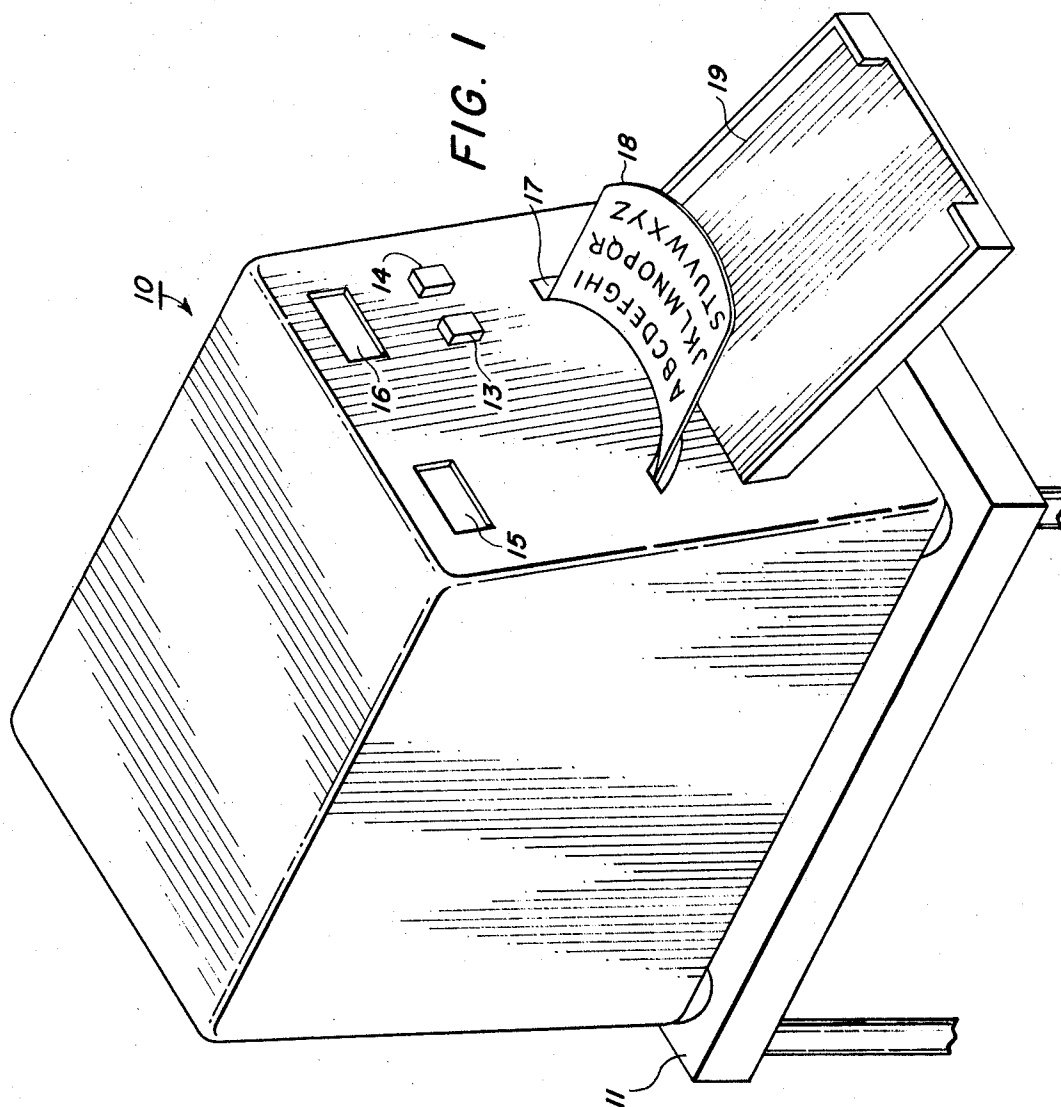
[52] U.S. Cl. **178/6.6R,**
30/347, 346/24

[51] Int. Cl. **B23d 35/00,**
G01d 15/16, H04n 1/24

[50] Field of Search **178/6.6;**
346/140, 24; 30/347

ABSTRACT: A facsimile recording apparatus in which web recording material is advanced past a recording station in a configuration conforming to a portion of the circular path of a signal responsive liquid ink recording element supported on a rotating disc and a web cutting mechanism responsive to appropriate control signals cuts the web into lengths corresponding to the length of the document from which the information was transmitted.





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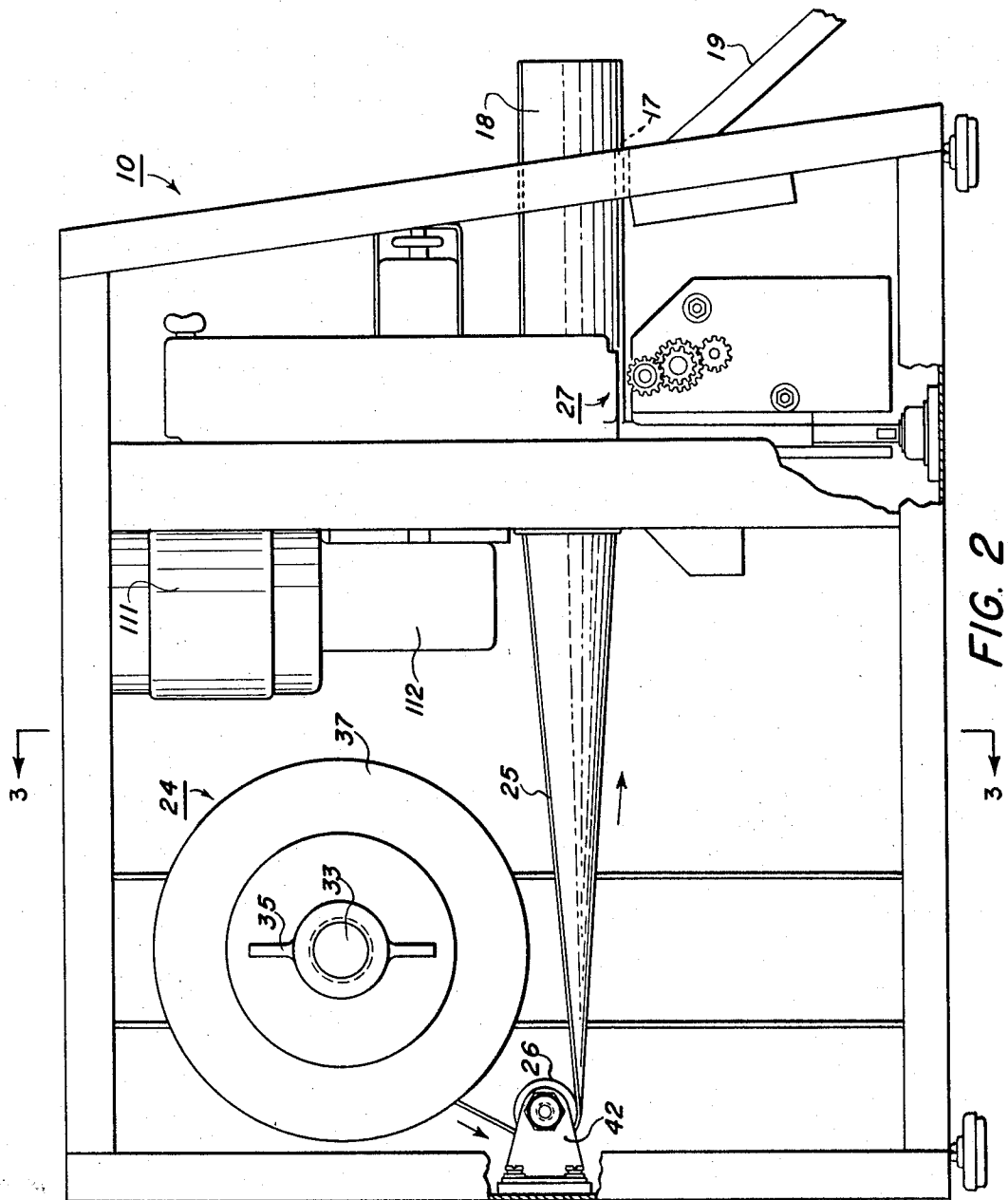


FIG. 2

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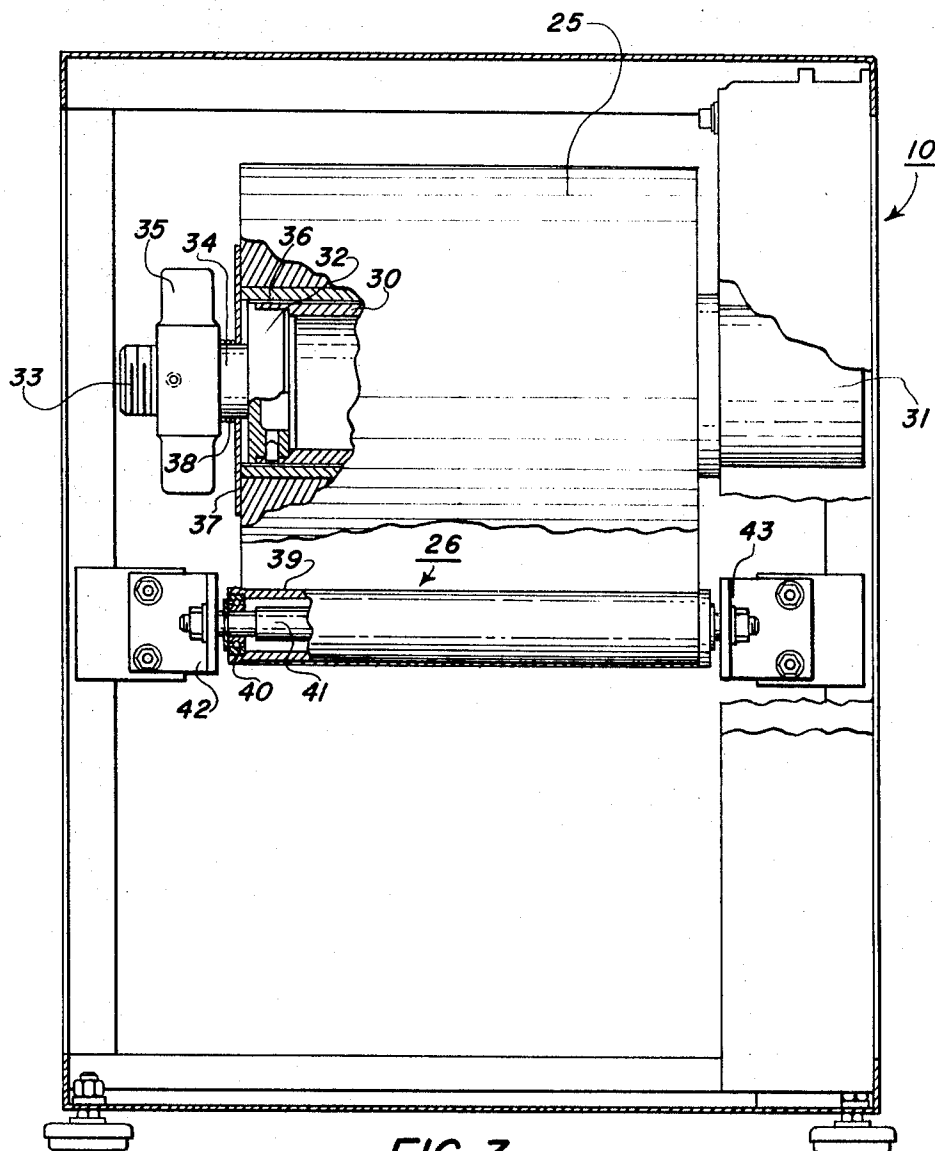


FIG. 3

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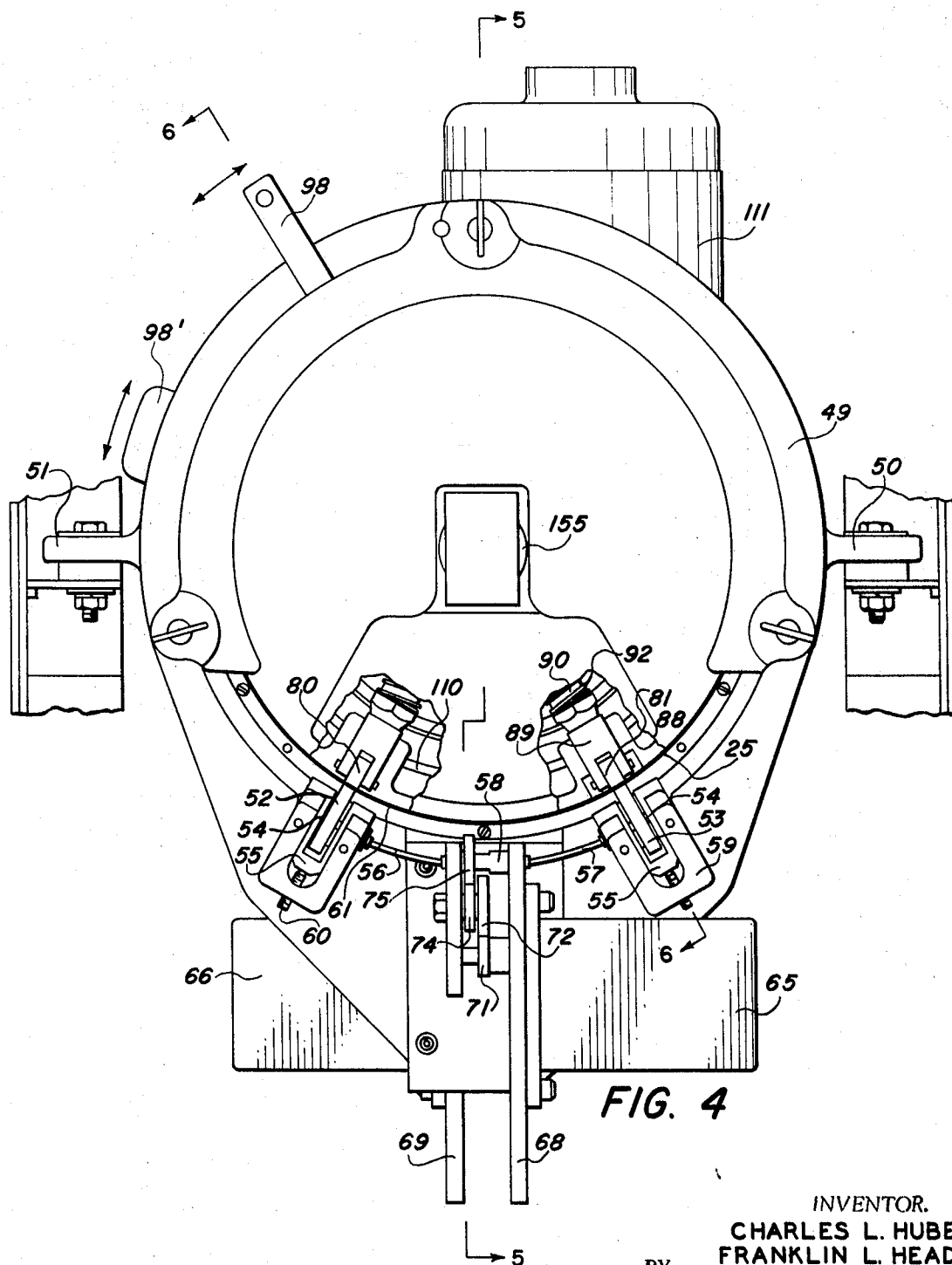


FIG. 4

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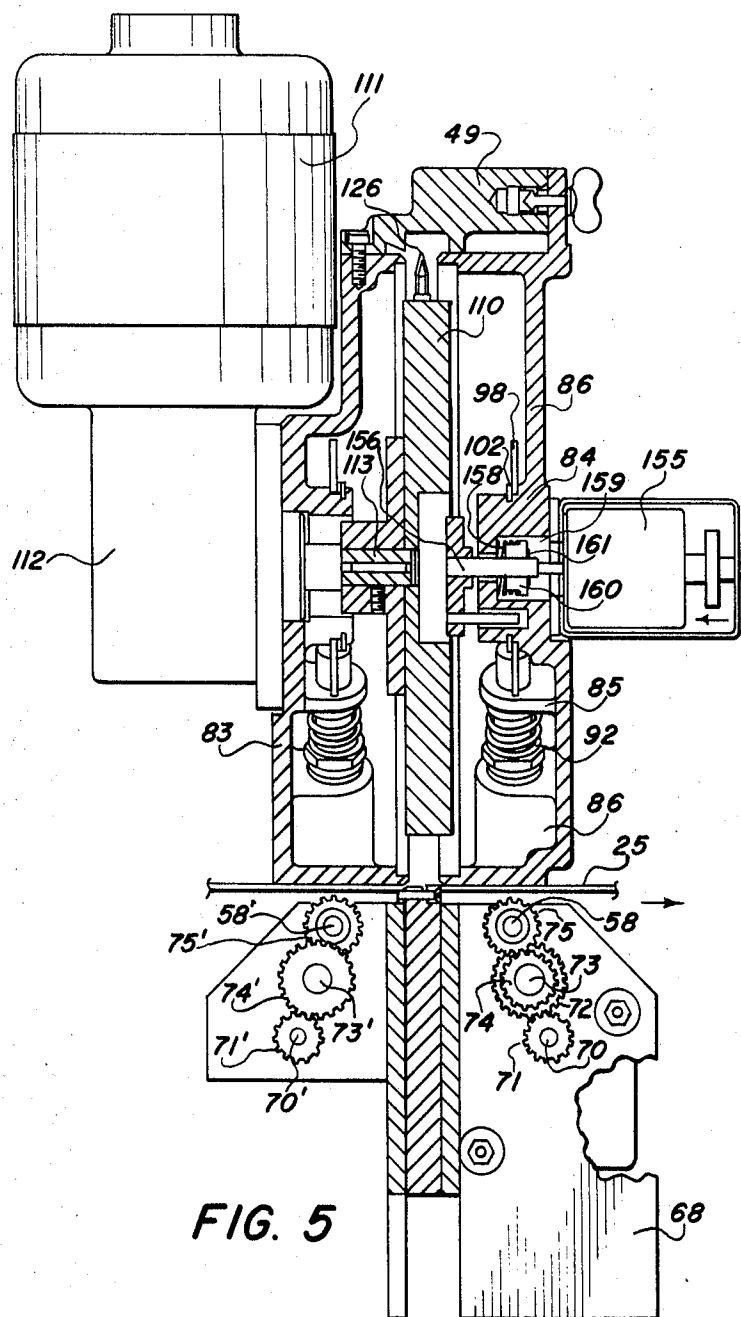
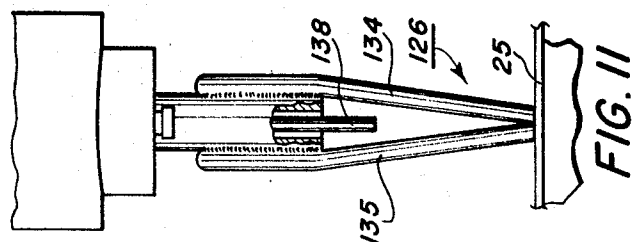
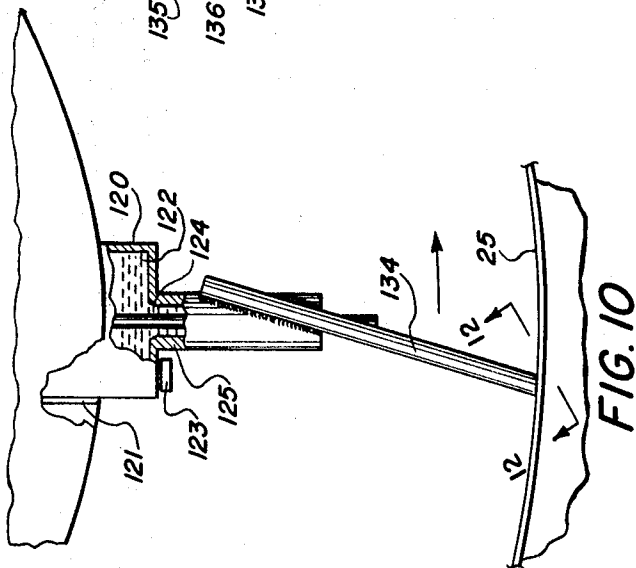
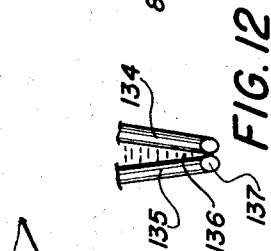
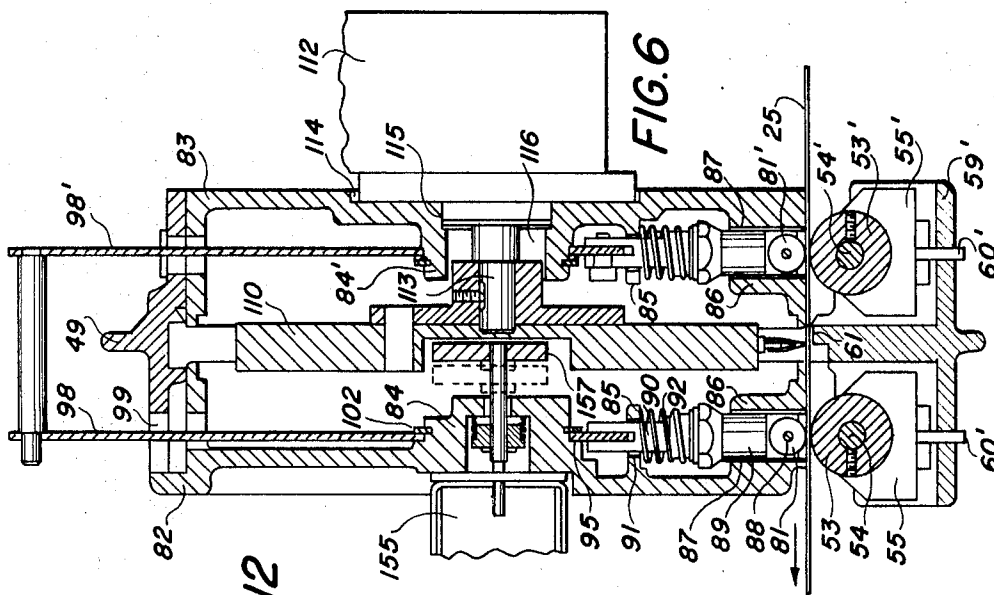


FIG. 5

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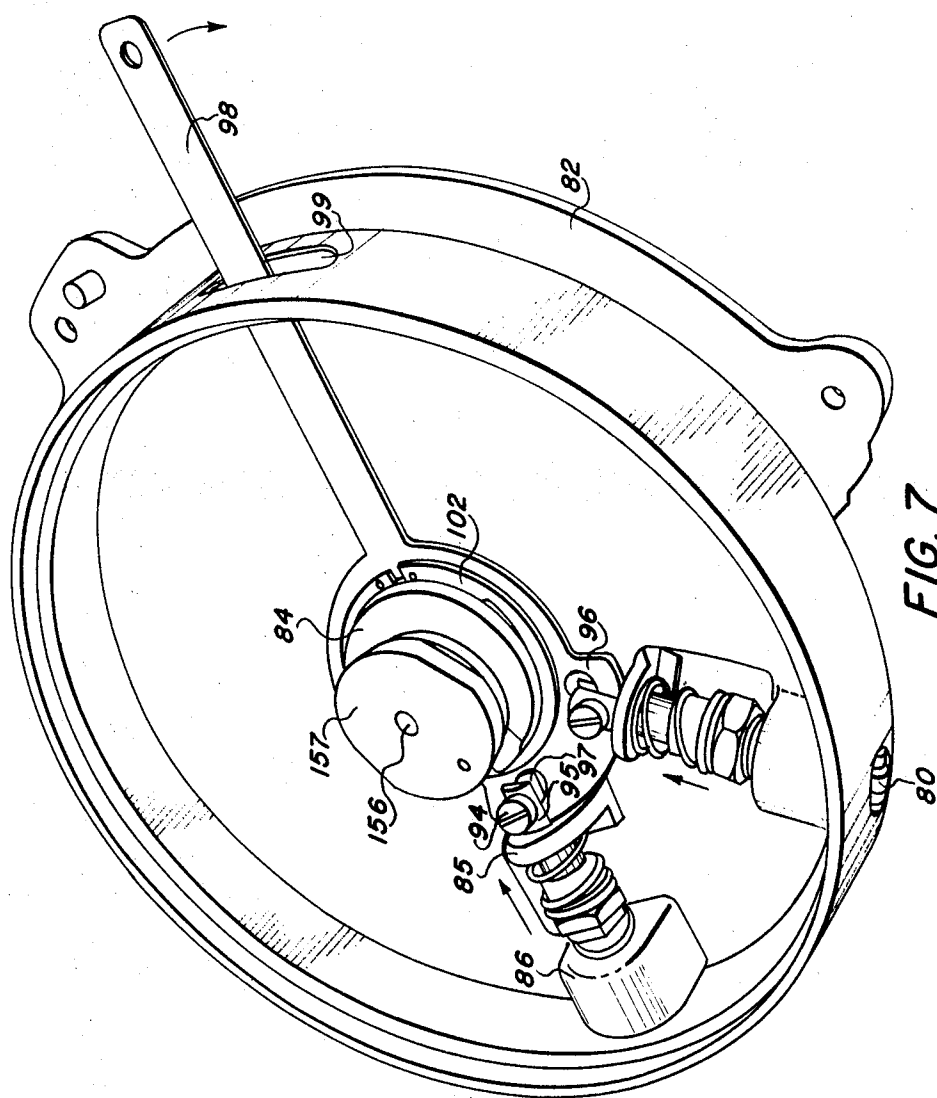


FIG. 7

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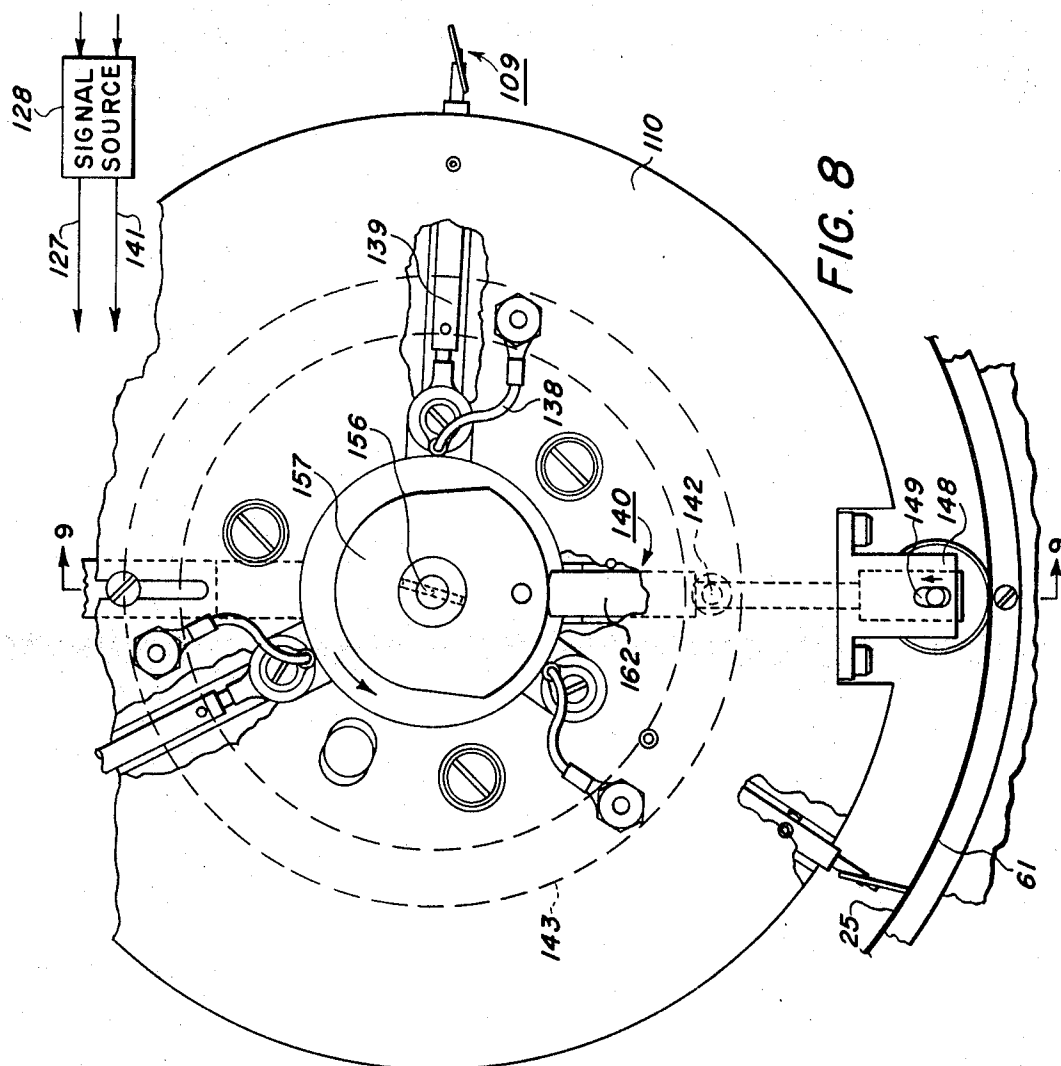


FIG. 8

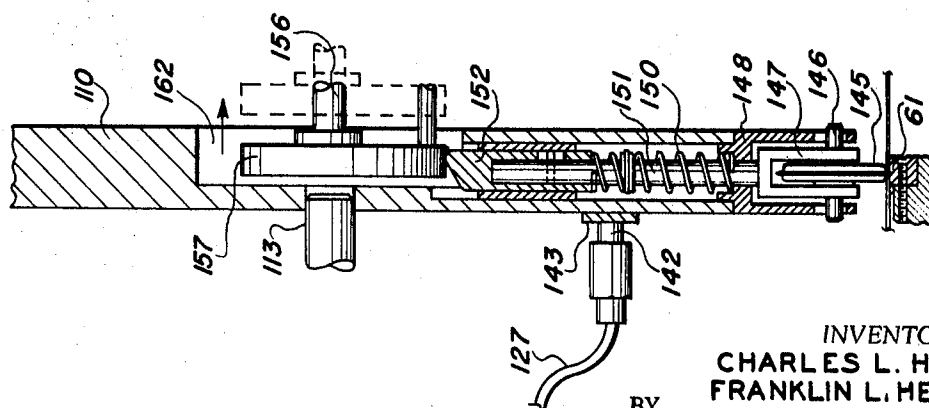


FIG. 9

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FACSIMILE RECORDING APPARATUS WITH CAM OPERATED PAPER CUTTER

This application is a continuation of application Ser. No. 804,334, filed Dec. 5, 1968, now abandoned, which is a continuation of application Ser. No. 492,830, filed Oct. 4, 1965, now abandoned.

This invention relates to facsimile recording and in particular, to novel apparatus for depositing marking material onto a recording surface in response to emitted voltage signals of information intelligence.

Facsimile recording, as is generally known, is a system for sending graphic or other forms of intelligence information over long distances by electrical means. In a facsimile transmitter, a subject copy such as a document page of graphic information, is scanned by a light beam, a minute area at a time, until the entire page has been swept by the scanning beam. Reflected light, modulated in intensity by the copy information, is picked up by a phototube or the like and converted into electrical signals. Ordinarily, the light beam is interrupted at a fixed rate, or a carrier frequency is added to the signal, so that each cycle represents one elemental area of the copy being scanned. The signals are then transmitted over telephone lines or by radio to a facsimile receiver with which there is associated a printout process to record each elemental area as black or white in accordance with the corresponding area originating from the subject copy.

A most common type of facsimile recorder employs a recording surface, such as paper, wrapped about a rotating drum and a marking implement moving parallel to the drum axis for marking the recording surface in response to electrically received signals. While such systems are widely used and enjoy wide commercial success it should be apparent that with this arrangement the length or width of the recording surface is necessarily limited by a fixed drum size. Furthermore, because of the necessity for frequent loading and unloading of recording material to and from the drum, as for example, after each reproduced document, it has not been possible to record continuously without interruption and without regard to document dimensions. That is, during the period of unloading and reloading of paper on the drum a lapse of time occurs during which recording cannot be accomplished and the facsimile apparatus is inoperative. Because of these latter disadvantages, the drum type recorder is regarded as unsuitable at higher recording speeds at which the fixed time required to load and unload the recording material becomes an even greater percentage of the total cycle. In addition, the dimension limitations imposed on the recording material as a function of the drum dimension has handicapped prior art devices which are unable to use varying lengths of recording material compatible with different sized originals in higher speed operation.

Now in accordance with the instant invention there is provided a novel facsimile recording apparatus that permits continuous recording without loading interruptions as associated with prior art devices. In addition, the apparatus hereof permits varying the length of the recorded material to a size corresponding to that of the original being reproduced. These are accomplished in accordance with the invention hereof by employing an extensive length of stored recording web that is fed continuously past a rotating signal-responsive recording element traversing the web surface substantially perpendicular to the direction of web movement. More specifically, a plurality of recording implements are peripherally supported angularly displaced on a rotating disc the axis of which is parallel to the direction of web movement. The drawn web is formed convex at the recording plane to effect a substantially exact arcuate match for the circular path of the recording implements which mark the subtending web in direct response to signals received of original subject copy from a signal source. By cutting the web in response to a transmitted signal from the original, indicative of the leading and trailing edges thereof, the recording web is cut into lengths corresponding to the original as required by the consumer.

It is accordingly an object of the invention to provide a novel facsimile recording apparatus adapted for continuous high speed operation.

It is a further object of the invention to provide a novel facsimile recording apparatus in which recording can be continuous without the necessity of interruption for loading and unloading a separate recording sheet for each original document transmission received.

It is a still further object of the invention to provide a novel facsimile recording apparatus in which the individual recording length of recording material consumed can be varied commensurate with the different lengths of original subject copies being transmitted.

It is a still further object of the invention to provide a novel, facsimile recording apparatus for recording intelligence information transmitted as electrical pulses and which is compact, efficient, and characterized by relatively low manufacturing costs as compared to prior art devices.

Further objects and features of the invention will become apparent by reading the following description in connection with the drawings wherein:

FIG. 1 is an isometric exterior view of the apparatus;

FIG. 2 is a side elevation of the apparatus with the covers removed;

FIG. 3 is a sectional front elevation taken substantially along lines 3-3 of FIG. 2;

FIG. 4 is a front view at the recording station primarily illustrating the paper feed mechanism;

FIG. 5 is a sectional elevation taken substantially along the lines of 5-5 of FIG. 4;

FIG. 6 is a sectional elevation taken substantially along the lines of 6-6 of FIG. 4;

FIG. 7 is an interior isometric of the paper feed retract mechanism to permit initial threading of the paper therepast;

FIG. 8 is a front view of the turret supporting the marking and cutting implements;

FIG. 9 is a sectional elevation of the paper cutter taken substantially along lines 9-9 of FIG. 8; and

FIGS. 10, 11, and 12 are front, side and bottom views respectively of a preferred marking implement for use herewith.

Referring to FIG. 1 the apparatus as shown includes an outer housing cabinet 10 enclosing the operative components and adapted to be supported on a table or the like 11.

Certain components are contained on the front wall 12 and which includes a start button 13, a stop button 14, and indicating panels 15 and 16 indicating operational parameters of transmission. Also formed in the front wall is an aperture 17 from which reproduced copy 18 emerges to be received by collecting tray 19.

As can be seen in FIG. 2 the general arrangement of components comprising the apparatus hereof includes a rotatable supply spool 24 containing wound thereabout a stored extended length of paper recording web 25. The web is drawn therefrom over a rotatable guide roll 26 to pass a recording station, generally designated 27, at which it is marked and cut before emerging through slot 17. Of particular significance as shown in this figure, the web 25 after passing guide roll 26 is caused to fan to a convex curvature as it approaches and passes the recording station to emerge outward of the cabinet.

The supply spool 24, as shown also in FIG. 3, comprises a cantilevered stationary core member 30 secured flange connected at one end to vertical cabinet channel 31. The core includes at its opposite end a forced fit plug 32 from which extends a stud bolt 33 having a shoulder portion 34 against which can be screw tightened a hand-sized butterfly nut 35. The spool section on which the recording web is contained, is designated 36, and comprises an easily replaceable elongated sleeve extending loosely over the core member to be rotatable thereabout. Annular flanges 37 on opposite ends of the sleeve provide an alignment for the web material thereon when forced into position by a spring 38 compressed between the flange and nut 35. This also provides for simple removal and

replacement when the material thereon has become exhausted by simply removing the nut and slipping sleeve 36 forward over the core member.

The guide roll 26 comprises an elongated cylindrical shell 39 secured at opposite ends to bearings 40 secured in turn on a stationary shaft 41. The shaft is mounted at opposite ends in bracket members 42 and 43 secured to the frame of the apparatus.

The components at the recording station 27 will be described below in connection with FIGS. 4 through 11 specifically as noted. Included thereat is a paper fanning and transport mechanism, a paper marking mechanism, and a paper cutting mechanism all secured in integral cooperating relation from a cylindrical casting support 49 mounted via its boss members 50 and 51 to the frame of the machine.

The paper transport mechanism is most specifically shown in FIGS. 4 through 7 and comprises two pair of front and rear feed rolls radially extending relative to an axis, as will be understood, with each pair being circumferentially displaced from each other approximately 60° for advancing the paper web convexly past the recording station to exterior of the cabinet. Each pair of feed rolls likewise in turn comprises a pair of front and rear rolls supported vertically aligned in driving relation to the web wherein the lower of the rolls are driven while the upper of the rolls are spring biased against the recording member passing thereunder. In order to permit initial threading or loading of a new web supply, the upper rolls can be raised to provide a threading gap relative to the lower rolls. Because of their similarity of construction both front drives will be referred to but only one front drive will be described in detail with its cooperating rear drive carrying identical prime numbers for corresponding components of the latter.

Referring now to FIGS. 4 through 6, the lower of the front drive rolls are designated 52 and 53 each secured on a rotatable bearing 54 mounted in a bifurcated bracket or clevis 55. Directly connected to each of the bearings are flexible drive shafts 56 and 57 linked by means of coupling 58 and driven as will be described below. Each of the brackets 55 are in turn slidably secured in bifurcated brackets 59 whereby an exact position of the former can by means of set screw 60 be adjusted to accurately position the drive plane of rolls 52 and 53 coplanar with respect to the surface of circular platen 61.

The front rolls, as are the rear rolls, are synchronously driven with the drives for the front and rear rolls being initiated respectively from motors 65 and 66 directly mounted on respective support plates 68 and 69. The output shaft of motor 65 is designated 70 and on which is secured a pinion gear 71 meshing with idler spur gear 72 mounted on a common shaft 73 with spur gear 74. The latter gear meshes with pinion gear 75 secured on the coupling 58 to which the flexible drive shafts 56 and 57 are connected.

Each of the lower rolls as stated above has in mating, rolling engagement therewith a retractable upper roll between which the web advances and the front ones of which are designated 80 and 81. Supporting the top rolls is a front casting 82 and a rear casting 83 for both front and both rear top rolls respectively. The castings are connected to primary support casting 49 and except for details as will be noted are symmetrically opposite hand in construction.

Considering as before the details of the front rolls only, casting 82 includes an axial hub 84, a lower shoulder 85 and a lowermost boss 86. In the boss there is provided a vertical bore 87 through which the roller 81 is normally supported and retractable upwards for web threading purposes as described above. As can be seen, roll 81 is secured via a pin 88 rotatably supported in threaded clevis 89 which receives a shouldered arbor 90 extending through a bore 91 in shoulder 85. A spring 92 wound about the arbor is compressed from the underside of the shoulder 85 against the clevis urging roll 81 into downward engagement with lower roll 53 or against the surface of recording material 25 passing thereunder.

The top arbor 90 (see also FIG. 7) has connected thereto a short section of plate 95 that is connected via follower 94 to a cam plate 96 having cam cutouts 97 and supported about hub 84. Integrally forming part of the cam plate, is a hand lever 98 that extends outward from through a slot 99 in the casting sufficiently far to permit hand manipulation thereof. By moving the lever as shown by the arrow in FIG. 7 to the extent permitted by the slot, the cam action causes roll 81 to be elevated or withdrawn away from its engagement with the lower roll 53 permitting threading of the recording web therepast. An expandable annular ring 102 secured in the hub maintains the cam plate in position. By this means operation of hand lever 98 simultaneously raises both front top rolls 80 and 81 while hand lever 98' is similarly operable raising the rear top rolls 80' and 81'.

Recording of information transmitted as electrical pulses via lead 127 as from a signal source 128 (FIG. 8) is effected onto the web sheet 25 as it passes between the front and rear drive rolls over platen 61. On passing over the platen, as shown also in FIGS. 5, 6, and 10-12, the web sheet is subjected to a continuous contact from the stylus of a recording pen 109 contained on a rotating recording head 110, and connected to an electrode 139 to which lead 127 applies signals via lead 138, brush 142 and slip ring 143. Rotation of the recording head provides a circumferential path for the pen corresponding to the curved shape formed of the web sheet thereat. Recording head 110 is comprised of a cylindrical disc or turret being continuously driven by a motor 111 through a gear reducer 112 having an output shaft 113 to which the turret is secured. Casting 83 includes recesses 114, 115, and bore 116 to receive the drive mount.

Supported about the periphery of the turret are the one or more recording pens 109 equally angularly displaced thereabout. The number of pens, whether one or more, depends for a given relative speed upon the width and curvature of the web sheet and follows the basic formula for the number of pens equal to $2\pi \times \frac{\text{radius of paper curvature}}{\text{paper width} \times \text{blanking time}}$. Accordingly, as an example, an overall recording having a circumference of about 27 inches for a given condition requires three pens and for a 36 inch circumference requires four pens. This ensures that at least one pen stylus is always maintained in continuous contact with the recording sheet as it passes thereunder.

The marking pen can comprise any of a variety of types known in the art and in a preferred embodiment employed herein is of the type described in copending application Ser. No. 453,960, now U.S. Pat. No. 3,375,528, filed May 7, 1965 in the names of Klavsons, et al. and assigned to the same assignee as the instant application. As therein described, each recording pen includes an ink reservoir 120 that is pressure to fit into a recess 121 in the periphery of the turret. Each reservoir is sealed pressure tight for maintaining the liquid ink 122 therein against centrifugal forces of acceleration encountered during the rotation of the turret member. A removable pressure tight cap 123 permits adding liquid ink into the reservoir. Orifice 124 at the topmost surface of the reservoir provides for ink metering therefrom and about which is coaxially attached a capillary tube 125 extending a distance approximately $\frac{1}{4}$ to 2 inches.

At the outermost end of each pen is an ink stylus 126 whereat ink is retained in the absence of a signal received from source 128 and from which ink deposits when a signal is received. The stylus is comprised of electrode wires 134 and 135 secured on opposite sides to the capillary 125 as by brazing or cementing, and are radially offset obliquely in a plane from the rotative direction of the turret. Extending from the capillary sides, the electrodes converge to form an internal apex 136 just behind the point of their touch which is a continuous pressured engagement by the electrodes without a gap between. The angle tips 137 of the electrodes are adapted during rotation for continuous contacting of the recording surface below. Ink deposition on receipt of a signal occurs from a meniscus at the apex in otherwise finitely nonwetting contact

with the recording sheet and not from between the electrodes per se.

Extending coaxially through the capillary from in contact with the liquid ink in the reservoir, partially into the "V" pocket of each stylus is a thin wire 138. This serves to restrict the dispensing ink flow against the centrifugal forces of rotation, such that ink will completely fill the "V" without overflowing or spilling. With the electrodes in continuous pressure engagement against each other, wear on the tips occurs uniformly against both electrodes and the spring tension maintains them together to form a fixed rotative path of apex 136. In operation of the recording head, ink is retained in the "V" against the electrodes by surface tension and a meniscus is formed at the apex finitely above the surface of the passing recording web. As the turret rotates, the stylus of one recording pen is always in continuous contact with the moving recording sheet to deposit ink interruptedly in response to a control signal from source 128. The path of the stylus is substantially linear relative to the recording sheet and as one stylus is separating from the recording surface, the next stylus is beginning an engagement therewith.

After forming a completed reproduction, as for example that represented by the alphabet characters shown on copy 18 of FIG. 1, it is desirable to sever that portion corresponding to the length of the original from the balance of advancing web 25.

To cut the web as shown in FIGS. 8 and 9 there is provided herewith a cutter mechanism designated 140 and responsive to signals received from signal source 128 via lead 141. The cutter mechanism extends radially through turret 110 and includes a rotatable cutting wheel 145 shown in these FIGS. in cutting relation to the web and in a path about 1/16 inch behind that of the pens. The wheel is supported on axial pin 146 secured in clevis 147 through the opposite times of bifurcated bracket 148. Elongated slot 149 in the bracket defines the uppermost position at which the cutting wheel is normally retained in the absence of a cutting signal received from the source.

To retain the cutting wheel normally retracted out of contact with the web 25 there is provided a coil spring 150 wound about clevis rod extension 151 that passes through the top of bracket 148 to connect to cam follower 152. By being compressed between bracket 148 and ring seat 152, the spring urges the latter upward to the limit imposed by slot 149 thus raising the cutting wheel.

Operation of the cutter during rotation of the turret is initiated by a signal from signal source 128 via lead 141 indicating the end or beginning of an original document being supplied to the remote transmitting unit. An emitted signal is connected to a pull type solenoid 155 having secured on its armature 156 a cam 157. When the solenoid is deenergized, cam 157 is retained as shown in FIG. 6 in the dotted position by means of a coiled spring 158 compressed between the inside wall 159 of hub 84 and the shoulder of collar 160 secured about the shaft and retained by annular ring 161. Energizing the solenoid in response to a signal from the source forces the armature forward placing cam 157 into the turret cavity 162. At that time the solenoid pulls its armature and ring seat 152 downwardly until cutting wheel 145 is positioned to sever the web as it rolls with the rotation of the turret cutting the paper against platen 61. At the same instant the solenoid is energized, the rear drive motor is stopped. This positions the web edge to be cut and provides immediate availability for subsequent document transmission.

By the above description there is disclosed a novel facsimile recording apparatus capable of continuous facsimile recording without interruption for loading recording material with each document transmitted as has been required heretofore. By means thereof a substantially endless quantity of paper is available on which any feasible size document facsimile transmission can be recorded to effect a reproduction length directly corresponding to the original. By a cutter mechanism operable in response to a signal indicating the beginning or

end of the transmitted original, the recording is cut to size automatically before the copy emerges from the apparatus. By maintaining the cutter path about one-sixteenth inch behind the path of the pens, a single unit can form the trailing edge of completed copy and the leading edge of subsequent copy closely following. The apparatus is compact, versatile and offers advantages not available in previous type facsimile recording apparatus.

We claim:

1. A facsimile recording apparatus comprising, supply means supporting a quantity of web material onto which information is to be recorded, platen means positioned at a recording station for supporting said web material in a generally arcuate configuration, web transport means for advancing said web material from said supply means over said platen means, support means adjacent said recording station and rotatable about an axis extending generally parallel to the direction of web advancement, recording means operatively associated with said support means for recording information intelligence on said web, web cutting means operatively associated with said support means for severing portions of said web material from said supply, a cutting wheel radially movable on said support means from a first position normally out of passing contact with said platen means to a second extended position engageable with said platen means, cam means reciprocally moveable in the axial direction within said support means from a first position to a second extended position, electromagnetic drive means operatively connected to said cam means for advancing said cam means to the extended position, and follower means operatively connected to said cutting wheel and engageable with said cam means in the extended position to radially move said cutting wheel to the extended position.
2. A facsimile recording apparatus comprising, supply means supporting an extended length of web material onto which information is to be recorded, platen means positioned at a recording station for supporting said web material in a generally arcuate configuration, web transport means for advancing a portion of all of said web material from said supply means over said platen means, support means adjacent said recording station and rotatable about an axis extending generally parallel to the direction of web advancement, recording means operatively associated with said support means for traversing said web material supported at said recording station to form a record of information intelligence in response to signals from a signal source, web cutting means operatively associated with said support means to traverse said web material, control means operatively associated with said web cutting means for actuating said web cutting means to cut said web, a cutting wheel radially movable on said support means from a first position normally out of passing contact with said platen means to a second extended position engageable with said platen means in response to said control means, cam means reciprocally moveable in the axial direction within said support means from a first position to a second extended position, electromagnetic drive means operatively connected to said cam means for advancing said cam means to the extended position, and follower means operatively connected to said cutting wheel and engageable with said cam means in the extended position to radially move said cutting wheel to the extended position.
3. A facsimile recording apparatus comprising,

supply means supporting an extended length of web recording material onto which information is to be recorded,
 platen means positioned on one side of said web material at a recording station for supporting said web material thereat in a generally arcuate configuration,
 web transport means for advancing all or a portion of said web material from said supply means over said platen means at said recording station,
 a signal source adapted to emit electrical signals representative of information intelligence to be recorded and control signals indicative of a recording sequence,
 support means adjacent said recording station and rotatable about an axis extending generally parallel to the direction of web advancement,
 recording means operatively associated with said support means for traversing said web material supported at said recording station and forming a record of the information intelligence in response to the representative signals from said signal source,
 web cutting means operatively associated with said support means to traverse said web material supported at said recording station,
 means operatively associated with said web cutting means and said signal source means for actuating said web cutting means to cut said web at said recording station in response to a control signal indicative of a recording sequence,
 a reservoir containing a supply of liquid ink,
 means for supporting ink from said reservoir contiguous to the web surface and for releasing ink therefrom onto the web surface in response to a representative signal from said signal source,
 a cutting wheel radially movable on said support means from a first position normally out of passing contact with said platen means to a second extended position engageable with said platen means in response to said control signal,
 cam means reciprocally movable in the axial direction within said support means from a first position to a second extended position,
 electromagnetic drive means operatively connected to said cam means for advancing said cam means to the extended position in response to said control signal, and
 follower means operatively connected to said cutting wheel and engageable with said cam means in the extended position to radially move said cutting wheel to the extended position.

4. A facsimile recording apparatus comprising, supply means supporting an extended length of web recording material onto which information is to be recorded,
 platen means positioned on one side of said web material at a recording station for supporting said web material thereat in a generally concave arcuate configuration,
 web transport means for uniformly advancing said web material from said supply means over said platen means at said recording station including at least two feed roll assemblies oppositely spaced on either side of said recording station providing a transport plane substantially coinciding with the surface of said platen means,
 a signal source adapted to emit electrical pulse signals representative of information intelligence to be recorded and control signals indicative of a recording sequence,

support means adjacent said recording station and rotatable about an axis extending generally parallel to the direction of web advancement,
 marking means operatively associated with said support means for traversing said web material supported at said recording station and forming a record of the information intelligence in response to the representative signals from said signal source,
 web cutting means operatively associated with said support means to traverse said web material supported at said recording station,
 means operatively associated with said web cutting means and said signal source means for actuating said web cutting means to cut said web at said recording station in response to a control signal indicative of a recording sequence,
 a reservoir containing a supply of liquid ink,
 means for supporting ink from said reservoir contiguous to the web surface and for releasing ink therefrom onto the web surface in response to a representative signal from said signal source,
 a cutting wheel radially movable on said support means from a first position normally out of passing contact with said platen means to a second extended position engageable with said platen means in response to said control signal,
 cam means reciprocally movable in the axial direction within said support means from a first position to a second extended position,
 electromagnetic drive means operatively connected to said cam means for advancing said cam means to the extended position in response to said control signal, and
 follower means operatively connected to said cutting wheel and engageable with said cam means in the extended position to radially move said cutting wheel to the extended position.

5. Apparatus adapted for use in a facsimile recorder for severing portions of web recording material from a source of supply comprising,
 support means rotatable about an axis,
 a backing member for supporting said web material in a generally arcuate configuration about the axis of said support means,
 a cutting wheel radially movable on said support means from a first position normally out of passing contact with the web material on said backing member to a second extended position engageable with the web material on said backing member,
 means operatively associated with said support means for driving said cutting wheel to the extended position to cut the web material as said support means is rotated,
 cam means reciprocally movable in the axial direction within said support means from a first position to a second extended position,
 electromagnetic drive means operatively connected to said cam means for advancing said cam means to the extended position in response to a control signal, and
 follower means operatively connected to said cutting wheel and engageable with said cam means in the extended position to radially move said cutting wheel to the extended position.