

Dec. 27, 1938.

W. G. H. FINCH

2,141,975

MULTIPLE STYLUS FACSIMILE RECORDER

Filed March 31, 1938

2 Sheets-Sheet 1

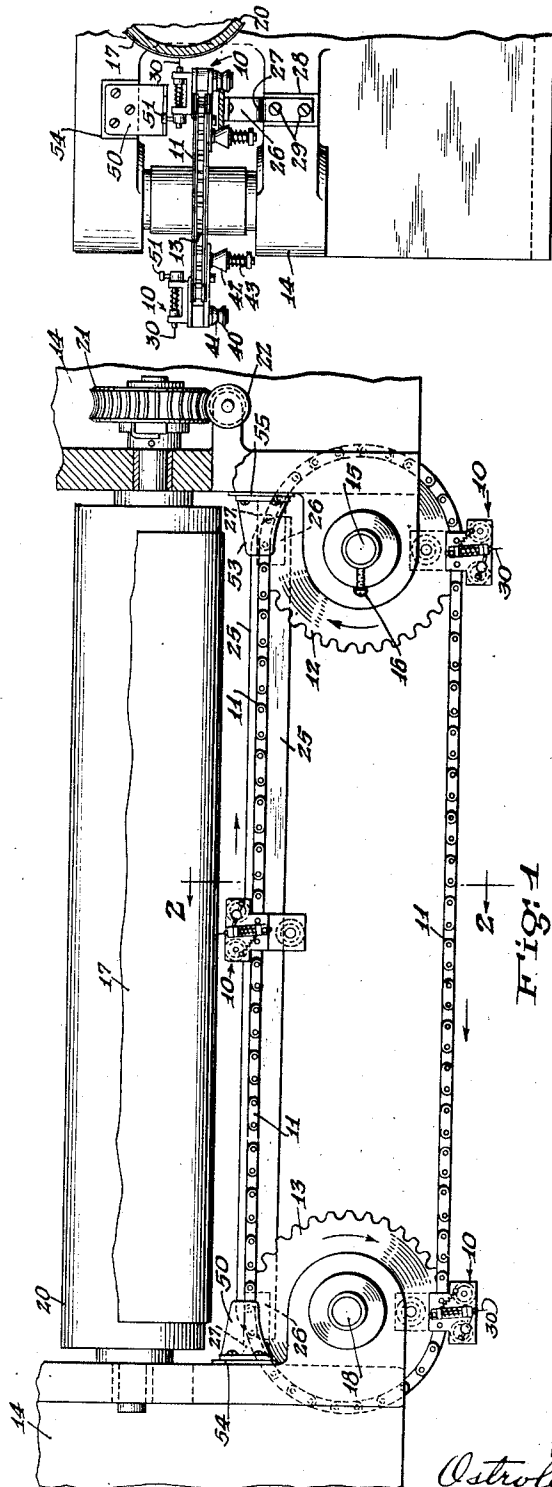


Fig. 1

Fig. 2

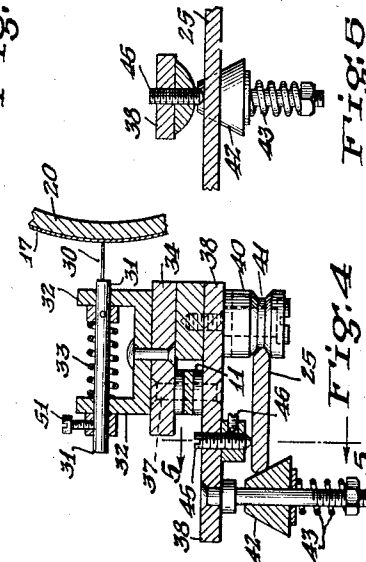


Fig. 3

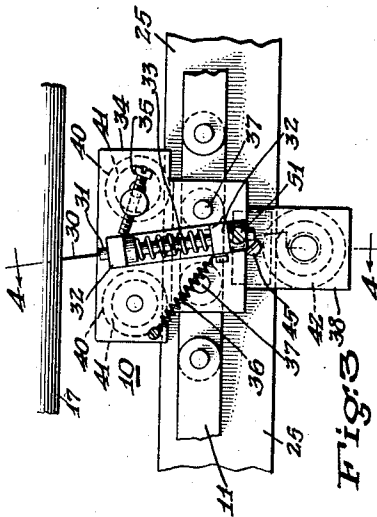


Fig. 4

INVENTOR.
William G. H. Finch
BY
Ostrolenk, Greene & Morsen
ATTORNEYS

Dec. 27, 1938.

W. G. H. FINCH

2,141,975

MULTIPLE STYLUS FACSIMILE RECORDER

Filed March 31, 1938

2 Sheets-Sheet 2

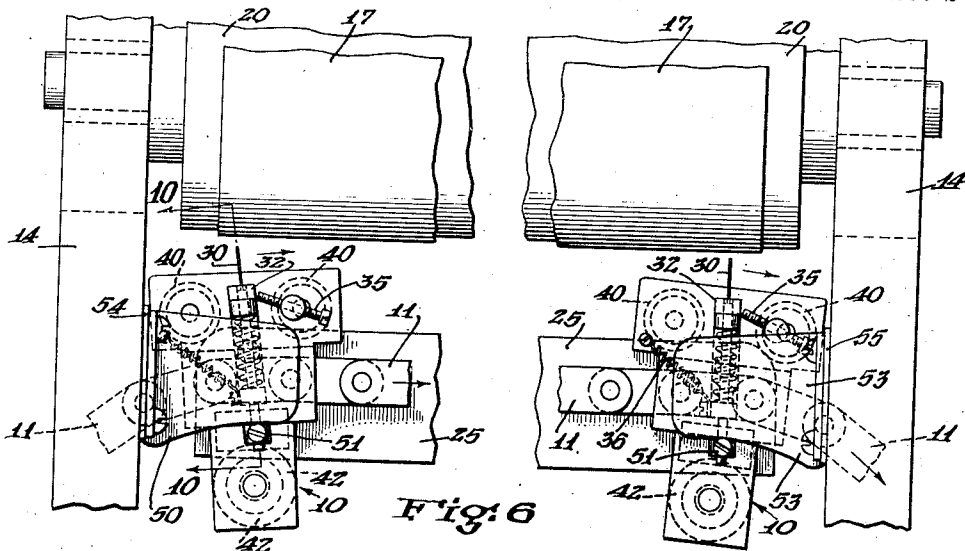


Fig: 6

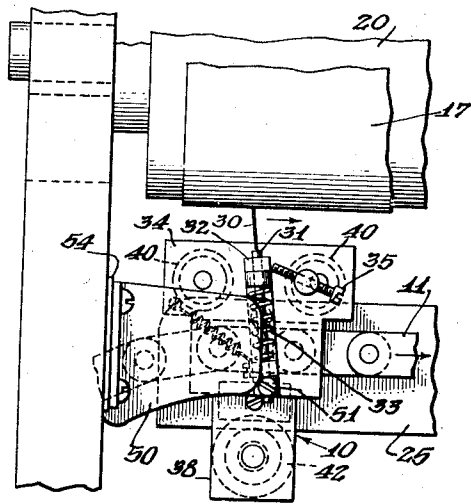


Fig: 7

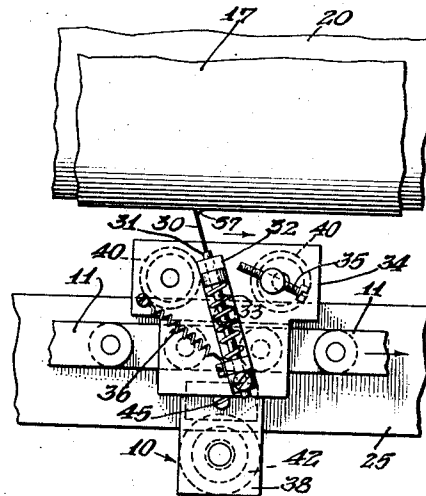


Fig: 8

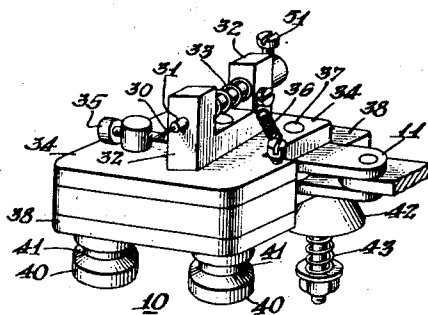


Fig: 9

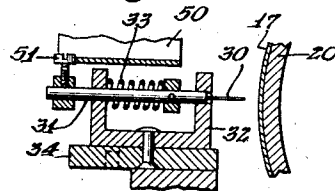


Fig: 10

INVENTOR.
William G. H. Finch

BY
Ostrolenk, Greene & Marxson
ATTORNEYS

UNITED STATES PATENT OFFICE

2,141,975

MULTIPLE STYLUS FACSIMILE RECORDER

William G. H. Finch, Spuyten Duyvil, N. Y.

Application March 31, 1938, Serial No. 199,141

12 Claims. (Cl. 178—8)

This invention relates to facsimile recorders and more particularly relates to improvements in multiple stylus continuous sheet recorders. This invention is a continuation-in-part of my co-pending applications Serial No. 165,448, filed September 24, 1937, entitled "High speed portable facsimile system", and Serial No. 178,654, filed December 8, 1937, entitled "High speed facsimile recorder".

My present invention is directed to improvements in recording styli useful in the multiple styli recorders such as disclosed in my co-pending applications hereinabove mentioned. More specifically, the objects of my present invention are directed towards the provision of means for insuring accurate and predetermined impingement of the styli upon the record sheet in the normal angular position. Cam plates are provided adjacent the edges of the recording sheet and are arranged to withdraw the styli from the sheet until they reach the predetermined normal recording angular relation with the sheet when the styli are released for recording.

My present invention is further directed to novel arrangements for the styli whereby accurate and rigid alignment is maintained during the recording traverse. The styli of my present invention are also adapted to be readily adjusted with respect to various angular positions to insure accurate passage of each stylus across the recording region.

Furthermore, in accordance with my present invention, improved means for accurately and rigidly guiding the individual styli across the recording path of the record sheet are provided. Further means are employed for effectively adjusting the coercion of the styli with the record sheet in a simple and efficient manner.

The facsimile recorder of my present invention is adapted to wide variations of design to meet very wide requirements in service. Thus the multi-styli scanning system can very conveniently be employed for very high speed operation by merely increasing the number of styli used, or may be used for very wide sheet recording, i. e., the width of a newspaper sheet, by merely lengthening the continuous chain carrier to increase the spacing between the styli. The increased length of the carrier chain or in the number of styli does not materially increase the weight or bulk of the apparatus beyond that necessary for accommodating the wider record sheet.

It is accordingly an object of my present invention to provide novel styli for multiple styli facsimile recording systems.

Another object of my present invention is to provide novel styli and means whereby the styli are withdrawn from the sheet to insure a predetermined initial angular relation of the styli with the recording sheet.

A further object of my present invention is to provide novel arrangements for adjusting the stylus position in a multiple styli recording system.

Still another object of my present invention is to provide improved guiding means for a plurality of successively operated styli in a facsimile recorder.

Still a further object of my present invention is to provide improved mounting means for the styli of a multiple styli facsimile recorder.

These and further objects of my present invention will become apparent in the following description taken in connection with the drawings, in which:

Figure 1 is a plan view of the multiple styli recording unit corresponding to Figures 8 and 1 respectively in the aforementioned co-pending applications.

Figure 2 is a cross-sectional view taken along 2—2 of Figure 1 through the styli conveyor system.

Figure 3 is an enlarged plan view of my novel stylus.

Figure 4 is a cross-sectional view taken along 4—4 through the stylus of Figure 3.

Figure 5 is a sectional view taken along 5—5 through a detail in the stylus of Figure 4.

Figure 6 is an enlarged view, broken away, showing the initial and final positioning of the styli with respect to the recording sheet effected by the styli-withdrawing cams.

Figure 7 is a partial enlarged view showing the positioning of a stylus with respect to the recording sheet at the beginning of the recording stroke.

Figure 8 is a plan view of the stylus abutting a protuberance in the recording sheet to illustrate the self-correcting means for the stylus.

Figure 9 is a perspective view of my novel stylus assembly.

Figure 10 is a cross-sectional view taken along 10—10 through the withdrawn stylus of Figure 6.

Reference is herewith made to the complete facsimile transmitter and receiver system disclosed in my co-pending application Serial No. 165,448 hereinabove mentioned, as a preferred system for employing the improved styli mechanism of my present invention. The partial plan view, Figure 1, showing my improved styli motivating mechanism for the facsimile recorder corresponds to Figure 8 of the co-pending application referred to. It is to be understood that the necessary motor gearing and other components of the facsimile receiver unit as a whole may well be taken bodily from the mechanism illustrated in the co-pending application. However, the present invention is not limited to any specific

motivating means as will be evident to those skilled in the art.

The styli 10 are spacedly mounted upon sprocket chain 11, operated by sprocket wheels 12 and 13. It is to be understood that the sprocket wheels 12 and 13, together with the chain 11 are electrically integral and are insulated with respect to the frame 14 of the facsimile unit. The sprocket wheel 12 is arranged to be driven clockwise (as indicated by the arrow) by means of the shaft 15 to which it is secured by set screw 16. The drive shaft 15 is operated at a predetermined rate by a local motor with associated gearing and synchronizing mechanism 15 (not shown) to maintain the travel of the styli 10 across the record sheet 17 in synchronism with the corresponding scanning operation effected at the transmitter, as will be evident to those skilled in the art. Sprocket wheel 13 is idly mounted upon shaft 18.

Sprocket chain 11 is accordingly operated at a continuous rate, carrying the styli 10 successively into scanning position. The recording sheet 17 is motivated by metallic platen 20, in turn operated by the gearing arrangement 21—22 directly related to the gearing (not shown) which operates the scanner drive shaft 15. The metallic chain 11, together with the electrically related styli 10, are connected to one terminal of the facsimile signal current; the metallic platen 20, to the other terminal. The reason for such electrical connections for the recorder unit is to establish a definite difference in potential between each stylus point and the plate whereby the electrical effect of facsimile signals is made apparent upon the surface of the recording sheet 17. Recording sheet 17 is preferably of conductive nature. A suitable paper is one saturated with carbon black having a mercuric oxide, titanium oxide or the like coating.

The metallic platen 20 is electrically identical with the electrical potential of frame 14. The styli 10 together with its conveyor 11 and gearing 12—13 are electrically isolated from the frame 14 in a manner previously described in the parent application Serial No. 165,448 hereinabove referred to. A guiding member or rail 25 is positioned parallel to the scanning region for rigidly guiding each stylus in its predetermined recording path in a manner to be hereinafter described in detail. Rail 25 is suspended from frame 14 by means of angle brackets 26. It is necessary to shape brackets 26 to permit passage of each stylus and unit 10 together with its projecting rollers and appendages. To this end, a compound bend at 27 is required as will be understood by those skilled in the art.

The brackets 26 are insulatingly mounted with respect to the frame in a well-known manner. A fiber strip 28 is inserted between bracket 26 and the frame as will be evident from Figure 2. Fiber bushings are also used to surround the screw members 29, fastened with brackets to the frame 14.

Figure 3 is an enlarged plan view of the stylus assembly 10. The recording point 30 is mounted at one end of the longitudinally movable post 31 mounted in a U-shaped metallic supporting frame 32. Spring 33 mechanically biases needle 30 against the record sheet 17 to maintain the predetermined recording pressure on the paper. Needle frame 32 is pivotally supported upon a plate 34 of the stylus assembly. A set screw 35 is employed to predetermine the marking angle 75 of the needle 30. A biasing spring 36 is employed

to maintain needle frame 32 in position against the end of set screw 35.

The stylus assembly 10 is fastened to the conveyor chain 11 by means of pins 37 as seen in the cross-sectional view, Figure 4. Pin 37 passes through two parallel plate members 34 and 38 disposed on opposite sides of the chain 11.

An important feature of my present invention is to provide novel means for rigidly guiding each stylus assembly during the recording interval. The conveyor 11 cannot be practically maintained sufficiently taut to accomplish the function. In my copending application, Serial No. 178,654, I disclosed a method employing two rails and two guide wires for guiding each stylus. The present invention is directed to an improved and simplified structure employing a single rail. This element is rail 25 supported parallel to the platen 20 as seen in Figure 1. I provide two rollers 40 extending from the bottom plate 38 of the stylus coactable with one edge of rail 25. Rollers 40 preferably have grooved or notched annular rings 41 for riding upon the rail edge. At the opposite rail edge I provide a spring-biased element 42. Element 42 extends from a projection of plate 38 and is preferably of conical shape. Spring 43 mechanically biases the slidable conical element against the rail edge to prevent looseness or play in the position of the stylus. Figure 5 illustrates a sectional view of this co-action as seen from 5—5 of Figure 4.

The function of conical roller 42 is to maintain the front rollers 40 tightly against the rail edge. Any variation in the contour of the rail, brought on by temperature or mechanical wearing conditions, is compensated for by the spring biased roller 42 which continuously and automatically adjusts itself to maintain the rigid guidance of the stylus assembly. The grooves 41 in roller 40 firmly ride on the rail edge. Each stylus is thus assured of an accurate parallel path for guiding the successive stylus points in truly successive parallel relationship.

An adjusting screw 45 projects from plate 38 against rail 25. Screw 45 has a rounded point which rides upon the surface of rail 25. Adjusting screws 45 coact with rollers 40 and 42 for the rigid guidance of each stylus assembly with rail 25. The physical action of the three rollers and screw element 45 is to rigidly predetermine the position of the stylus in two perpendicular planes; a horizontal plane being determined by the two rollers 42; and a vertical plane being determined by the rollers on opposite edges of rail 25 in conjunction with the screw element 45. The angular position of the stylus assembly with respect to the rail 25 is readily adjusted through screw 45. A lock screw 46 serves to prevent displacement of screw 45.

A further important function of the spring biased conical roller 42 is to permit the preliminary adjustment of the stylus upon rail 25 at the initial end of the rail. In Figure 6 an enlarged detail of stylus 10 at the left edge of rail 25 is shown. The forward rollers 40 ride over the curved edge of the rail. The spring-biased conical roller 42 is automatically adjustable and serves to permit a proper gripping of the stylus onto the rail 25 as will be evident to those skilled in the art.

During this preliminary adjustment of the stylus upon the forward end of the guide rail 25, the angle of the recording point 30 is not at the proper recording angle. As the stylus progresses 76

continuously towards the scanning region, the recording point gradually assumes the proper recording angle with sheet 17. In the prior art, it has been the problem to insure a smooth initial coaction of the recorder point with the recording sheet due to such off-angle position of the recording point. The effect was to tear into the sheet or bend the recording point. In accordance with my present invention, I provide means to obviate such difficulties and always insure the proper angle position of the recording point on the sheet.

A cam member 50 is supported near the forward edge of rail 25. A screw 51 is attached to the rear end of the post 31 supporting recording point 30. Sectional view Figure 10 clearly shows this feature. Projecting element or screw 51 coacts with the cam surface of cam 50 while the stylus is at this region of its travel. As previously explained, recording point carrier 31 is spring-biased by spring 33 towards recording position. Cam 50 serves to counteract the pressure of spring 33 thereby releasing recording point 30 away from sheet 17 until the initial instant of recording. Cam 50 in conjunction with screw 51 keeps the recording point away from the recording sheet until stylus unit 10 together with its rollers 40 and 42 are properly aligned on rail 45 and until the angular position of the recording needle 30 is correct with respect to the sheet 17.

Summarizing, the action of the stylus assembly at its initial engagement with the guide rail 25: The rollers 40 engage one edge of rail 25 and roll about the curved corner thereof, as clearly seen in Figure 6. The rear conically shaped roller 42 presses against the back side of rail 25. The stylus assembly through its rollers is rigidly gripped in position upon the rail 25. As the stylus assembly approaches rail 25, a projecting element 51 abuts the cam surface of plate 50, forcing the recording needle in a direction away from sheet 17 against the action of spring 33. The shape of cam 50 is such as to permit the needle 31 to gradually approach the record sheet. The trailing corner of cam 50 is rounded to permit the recording needle 30 to move into contact with sheet 17 when the stylus is properly engaged with rail 25 and the angle of the needle is correct for recording.

I prefer to employ a second cam plate 53 which is similar to cam 50 but positioned at the trailing edge of guide rail 25. Cam 53 becomes effective in withdrawing recording point 30 from sheet 17 at the predetermined end of the recording region on sheet 17. Projecting element 51 of the needle assembly abuts the cam surface of plate 53, moving the needle 30 away from sheet 17. Tearing of the recording sheet or bending of the recording needle is thus obviated while the stylus is removed from the recording path and its direction and motion are changed so that it may be guided to in turn start another scanning cycle as will now be evident. Should the projecting element 51 and needle shaft 31 be of conductive material and cam plate 50 also of conductive material, it is necessary to electrically isolate these elements from the frame 14, since the platen 20 is at frame potential and the recording needle is at the opposite potential. Insulating inserts 54 and 55 are accordingly employed, against which the cam plates 50 and 53 are respectively secured to the recorder frame. Insulation bushings surround the securing screws for the cam plates as will be evident to those skilled in the art.

Figure 7 is similar to the left end portion of

Figure 6 and illustrates the position of the stylus assembly 10 at the instant the recording needle 30 is released by cam 50 at the initial recording position on sheet 17. Projecting element 51 of the needle assembly is shown just passing the rounded trailing corner of cam 50, permitting spring 33 to be released and force needle 30 against sheet 17. Set screw 35 maintains needle 30 at the proper angle. The releasing action by cam 50 on needle 30 is arranged to occur where the stylus is firmly in position on rail 25 as will now be evident to those skilled in the art.

Figure 8 illustrates the action of the recording needle assembly when the point 30 abuts a protuberance such as 57 during the recording. Supporting element 32 is pivotally displaced away from set screw 35 against the tensioning action of spring 36. When the protuberance or tear is passed, the recording point 30 is immediately returned to its proper recording angle or position by spring 36. The disturbance is accordingly localized. Figure 9 is a perspective illustration of the preferred stylus assembly as already described. Rollers 40 contain grooves 41 which are preferably V-shaped to coact with a rounded rail edge. Conical roller 42 is shown at the opposite side of the stylus. U-shaped frame 32 is pivotally mounted on plate 34 and adjusted in proper angular position by set screw 35 coacting with spring 36. Recording needle 30 is a wire of durable metal such as tungsten. Its diameter corresponds to the number of lines recorded per inch, and may for example be .01 inch in diameter. Screw 51 projects from the needle post 31 to coact with the guiding cams 50 and 53, as already described.

It is evident that modifications may be made in the illustrated arrangements and embodiments of my invention without departing from the broader spirit and scope thereof, and accordingly I do not intend to be limited except as set forth in the following claims.

I claim:

1. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor; a plurality of stylus units spacedly fastened on said conveyor; a guiding member for said stylus units; and means individual to each of said stylus units for coacting with said guiding member to rigidly guide each stylus point in a predetermined linear scanning path comprising a pair of rollers for riding on one side of said guiding member, and an element extending from the stylus unit on the opposite side of said guiding member.
2. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor; a plurality of stylus units spacedly fastened on said conveyor; a rail for said stylus units parallel to the scanning side of said conveyor; and means individual to each of said stylus units for coacting with said rail to rigidly guide each stylus point in a predetermined linear scanning path comprising a pair of rollers having grooved portions for riding on one side of said rail and a conically-shaped element extending from the stylus unit on the opposite side of said rail and being spring-biased towards the rail.
3. A stylus unit for a multi-stylus recorder employing a guide rail for the unit; embodying a recording point; and means for coacting with said guide rail to rigidly guide said stylus point in a predetermined linear scanning path comprising a pair of rollers for riding on one side of said guide rail, and an element extending from the stylus unit on the opposite side of said guide rail.

4. A stylus unit for a multi-stylus recorder employing a guide rail for the unit; embodying a recording point; and means for coacting with said guide rail to rigidly guide said stylus point in a predetermined linear scanning path comprising a pair of rollers having grooved portions for riding on one side of said guide rail and a conically-shaped element extending from the stylus unit on the opposite side of said guide rail.
5. A stylus unit for a multi-stylus recorder employing a guiding member for the unit; embodying a recording point; and means for coacting with said guiding member to rigidly guide the stylus point in a predetermined linear scanning path comprising a pair of rollers having grooved portions for riding on one side of said guiding member and a conically-shaped element extending from the stylus unit on the opposite side of said guiding member, and being spring-biased towards the guiding member.
6. A stylus unit for a multi-stylus recorder employing a guide rail comprising mechanism for gripping the rail to maintain said unit in a predetermined plane of movement with respect to the rail, and means extending from said unit and coactable with the rail for adjusting the position of said unit with respect to the rail in a direction transverse to said plane of movement.
7. A stylus unit for a multi-stylus recorder employing a guide rail comprising means for gripping said rail to maintain said unit in a predetermined plane of movement including three roller elements, and means coactable with said rail for adjusting the position of said unit in a plane transverse to said plane of movement including an element having a rounded point arranged to ride on said rail.
8. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor; a plurality of stylus units spacedly fastened on said conveyor; a fixed member for guiding said stylus units in a predetermined recording path with respect to the record sheet when each stylus unit is moved into the recording region; and mechanism individual to each of said stylus units for gripping said fixed member when the stylus unit reaches the member to hold the stylus unit in a substantially rigid alignment with respect to the fixed member as the stylus unit moves along the member, whereby the individual stylus units are successively guided along the recording path in a rigid manner by the fixed member.
9. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor; a plurality of stylus units spacedly fastened on said conveyor; a fixed rail for guiding said stylus units in a predetermined recording path with respect to the record sheet when each stylus unit is moved into the recording region; and mechanism individual to each of said stylus units for gripping said rail when the stylus unit reaches the rail to hold the stylus unit in a substantially rigid alignment with respect to the fixed rail as the stylus unit moves along the rail, said mechanism comprising means for riding on one side of said rail, and an element extending from the stylus unit over the opposite side of said rail, whereby the individual stylus units are successively guided along the recording path in a rigid manner by the fixed rail.
10. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor; a plurality of stylus units spacedly fastened on said conveyor; a fixed member for guiding said stylus units in a predetermined recording path with respect to the record sheet when each stylus unit is moved into the recording region; and mechanism individual to each of said stylus units for gripping said fixed member when the stylus unit reaches the member to hold the stylus unit in a substantially rigid alignment with respect to the fixed member as the stylus unit moves along the member, said mechanism comprising means for riding on one side of said member and an element having a conical shape extending from the stylus unit over the opposite side of said member and being spring-biased towards the rail, whereby the individual stylus units are successively guided along the recording path in a rigid manner by the fixed member.
11. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor including two spaced gear elements about which the conveyor rides; a plurality of stylus units spacedly fastened on said conveyor, each stylus unit having a spring-biased stylus point; a fixed member for guiding said stylus units in a predetermined recording path with respect to the record sheet when each stylus unit is moved into the recording region, said member extending to the forward end of said conveyor; a cam positioned near the forward end of said member and the adjacent gear; and means individual to each of said stylus units coactable with said cam for guiding the stylus points towards the record sheet at the normal angular relation with respect to the sheet, whereby a maximum effective recording path is provided for the scanner.
12. A facsimile scanner comprising a conveyor; mechanism for driving said conveyor; a plurality of stylus units spacedly fastened on said conveyor; a fixed rail for guiding said stylus units in a predetermined recording path with respect to the record sheet when each stylus unit is moved into the recording region, said member extending to each of said gear elements; and mechanism individual to each of said stylus units for gripping said rail when the stylus unit reaches the rail to hold the stylus unit in a substantially rigid alignment with respect to the fixed rail as the stylus unit moves along the rail; the stylus points on said stylus units being supported in a direction transverse to the direction of motivation of said conveyor; a cam positioned near each end of said member and the adjacent gears; and means individual to each of said stylus units coactable with said cam for guiding the stylus points towards the record sheet at the normal angular relation with respect to the sheet, whereby a maximum effective recording path is provided for the scanner.