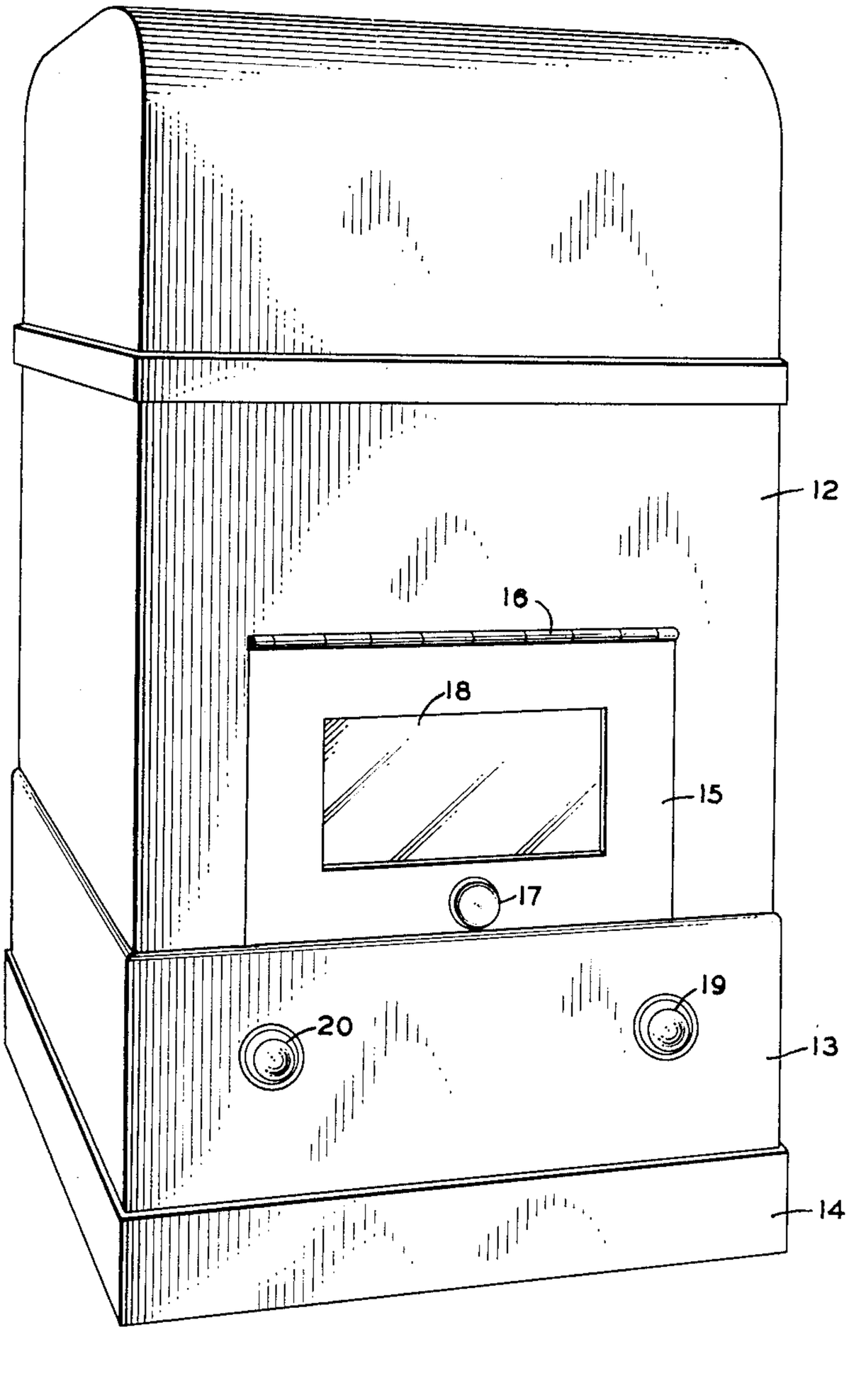
March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 1

FIG. 1



INVENTORS
L.G. POLLARD
G.H. RIDGE
A. HOFER

BY A. A. Thomas

ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 2

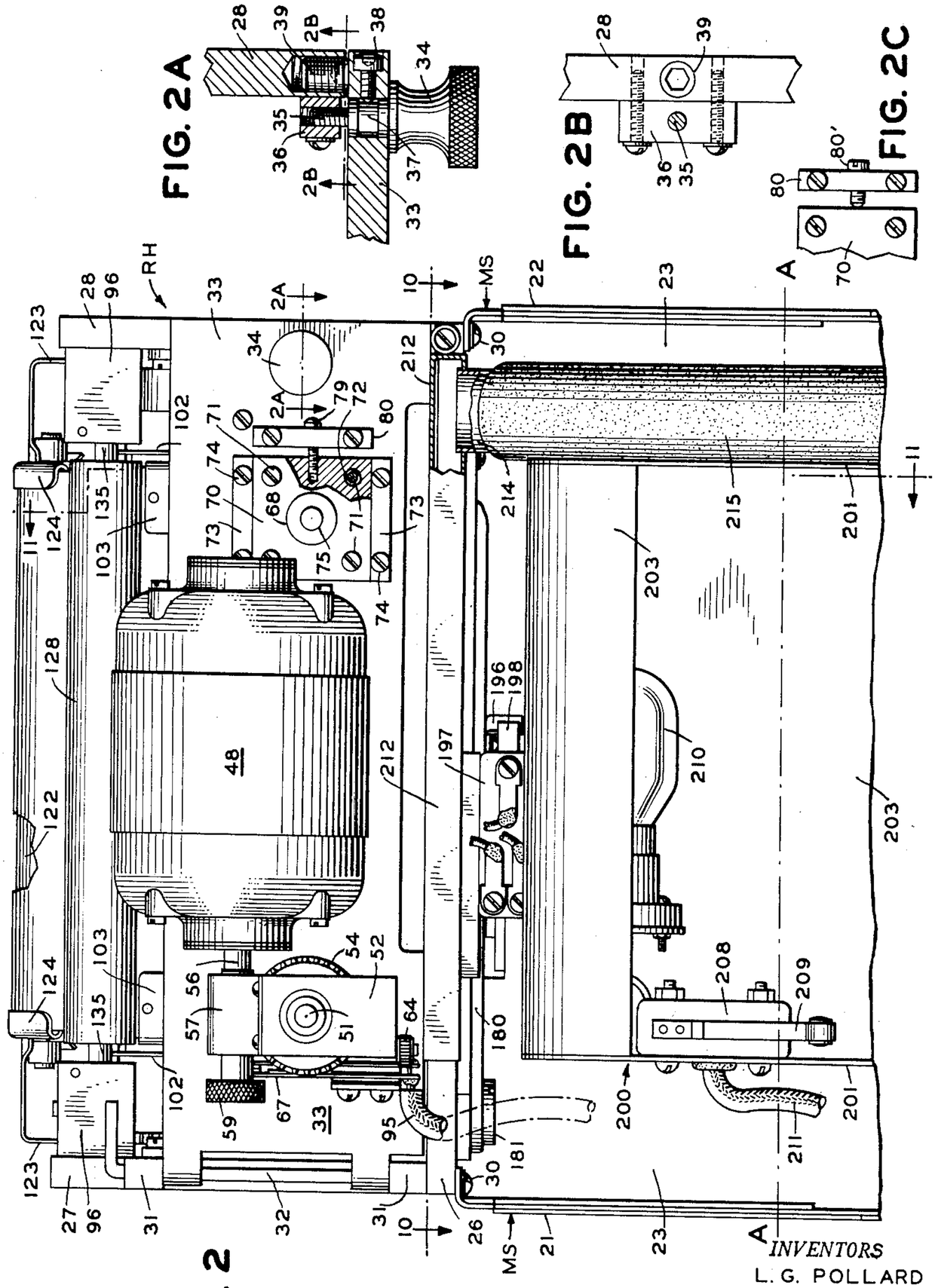


FIG. 2

FIG. 2A

FIG. 2B

FIG. 2C

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY

ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 3

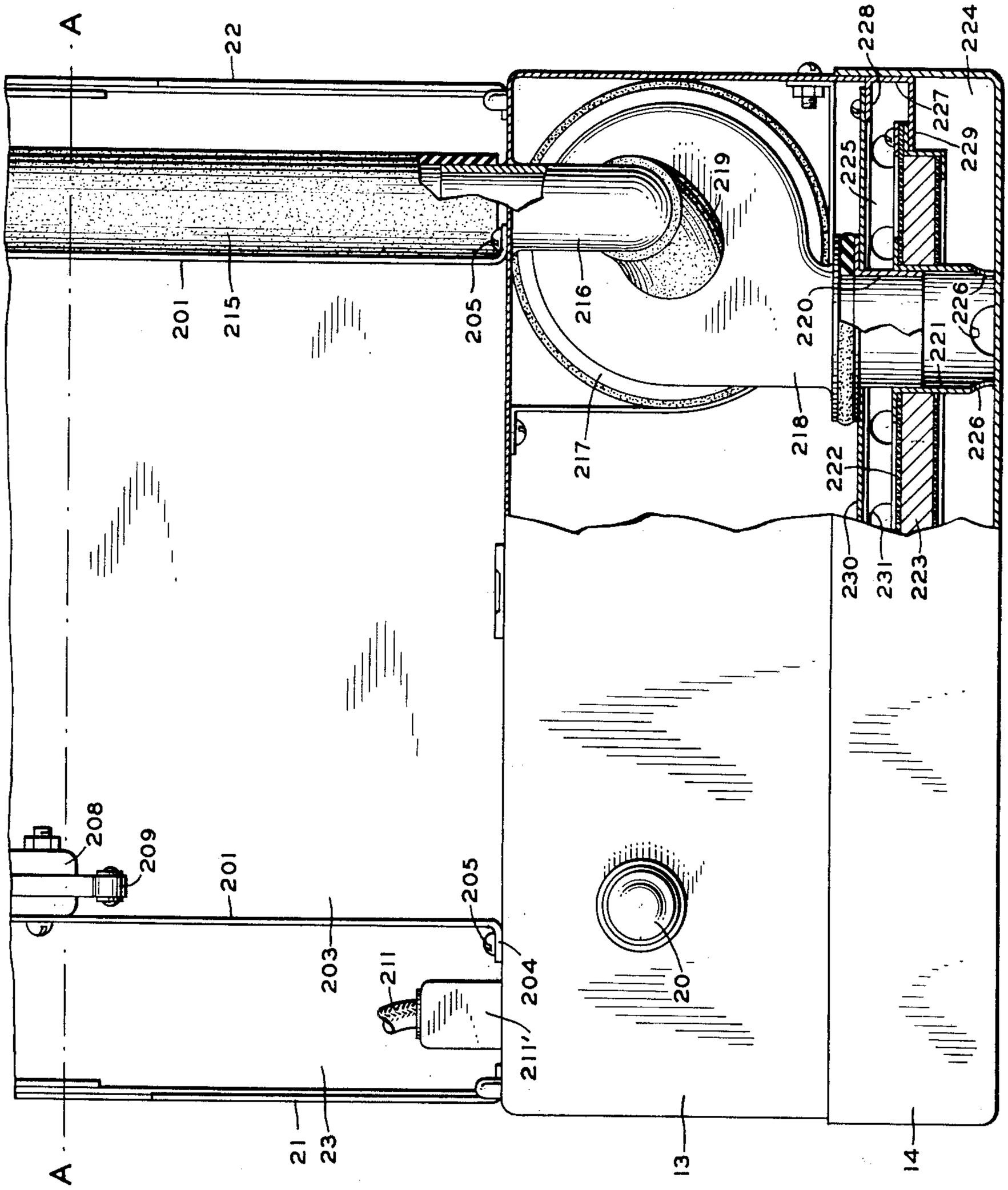


FIG. 3

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 4

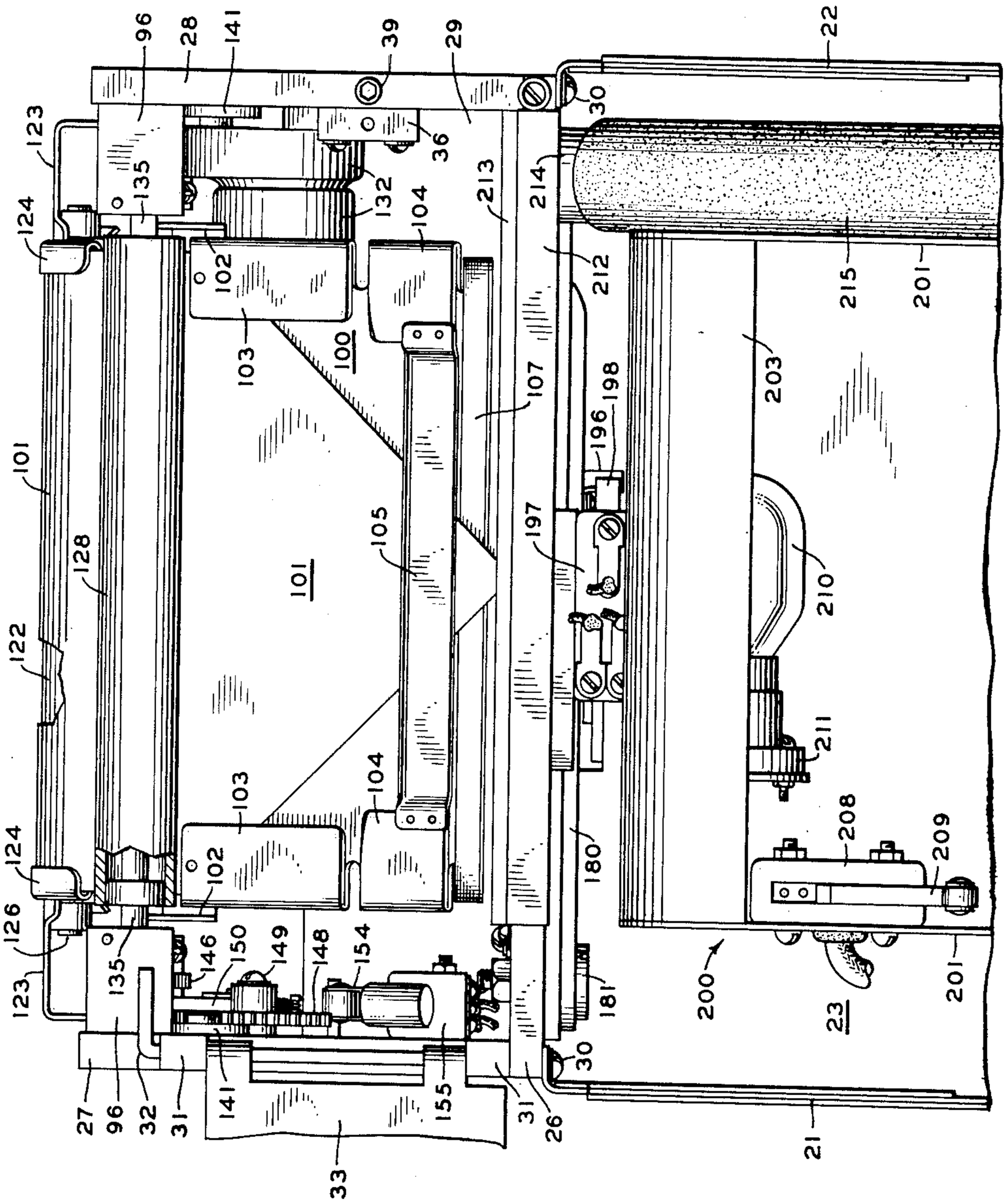


FIG. 4

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

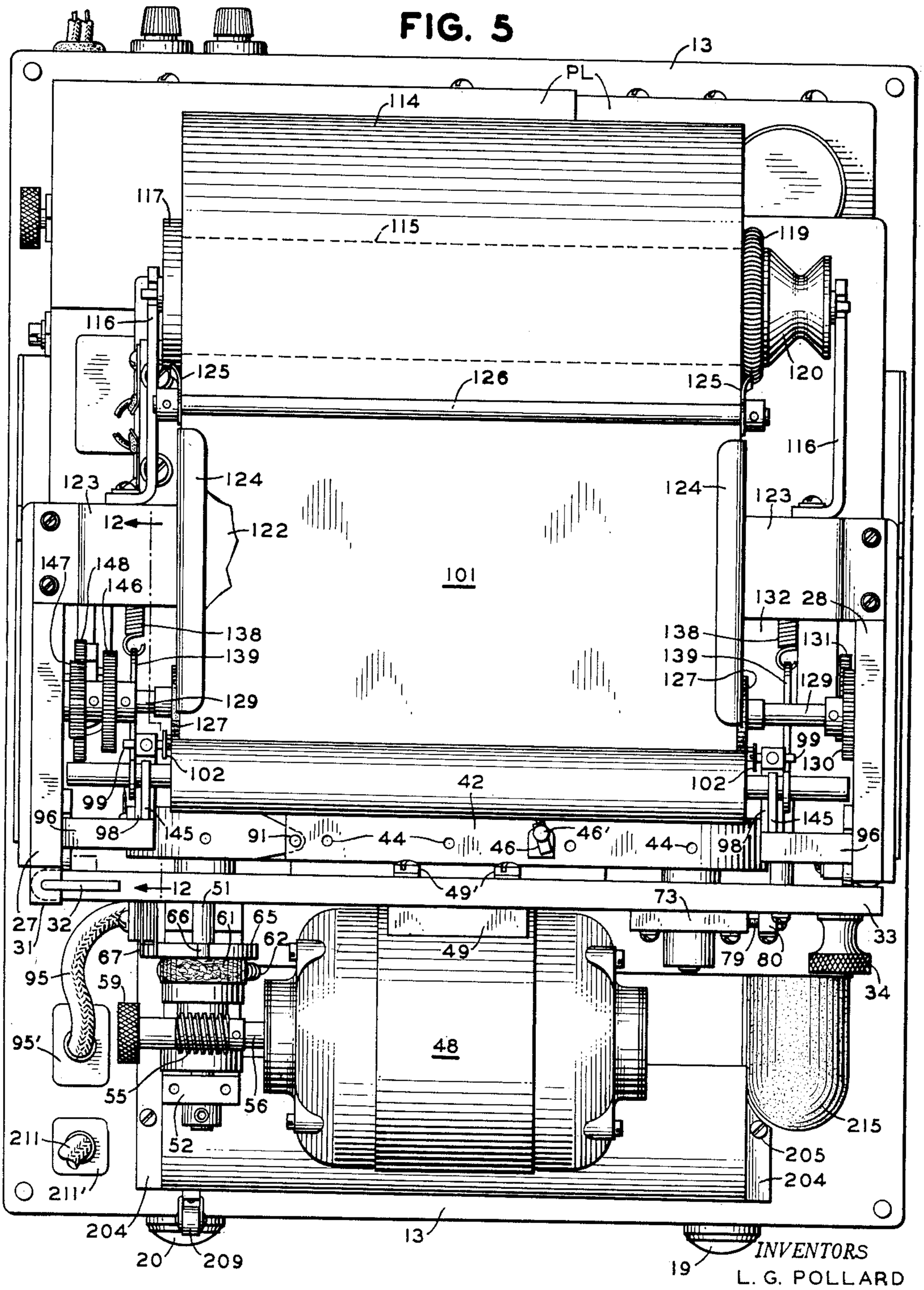
BY A. A. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 5

FIG. 5



INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 6

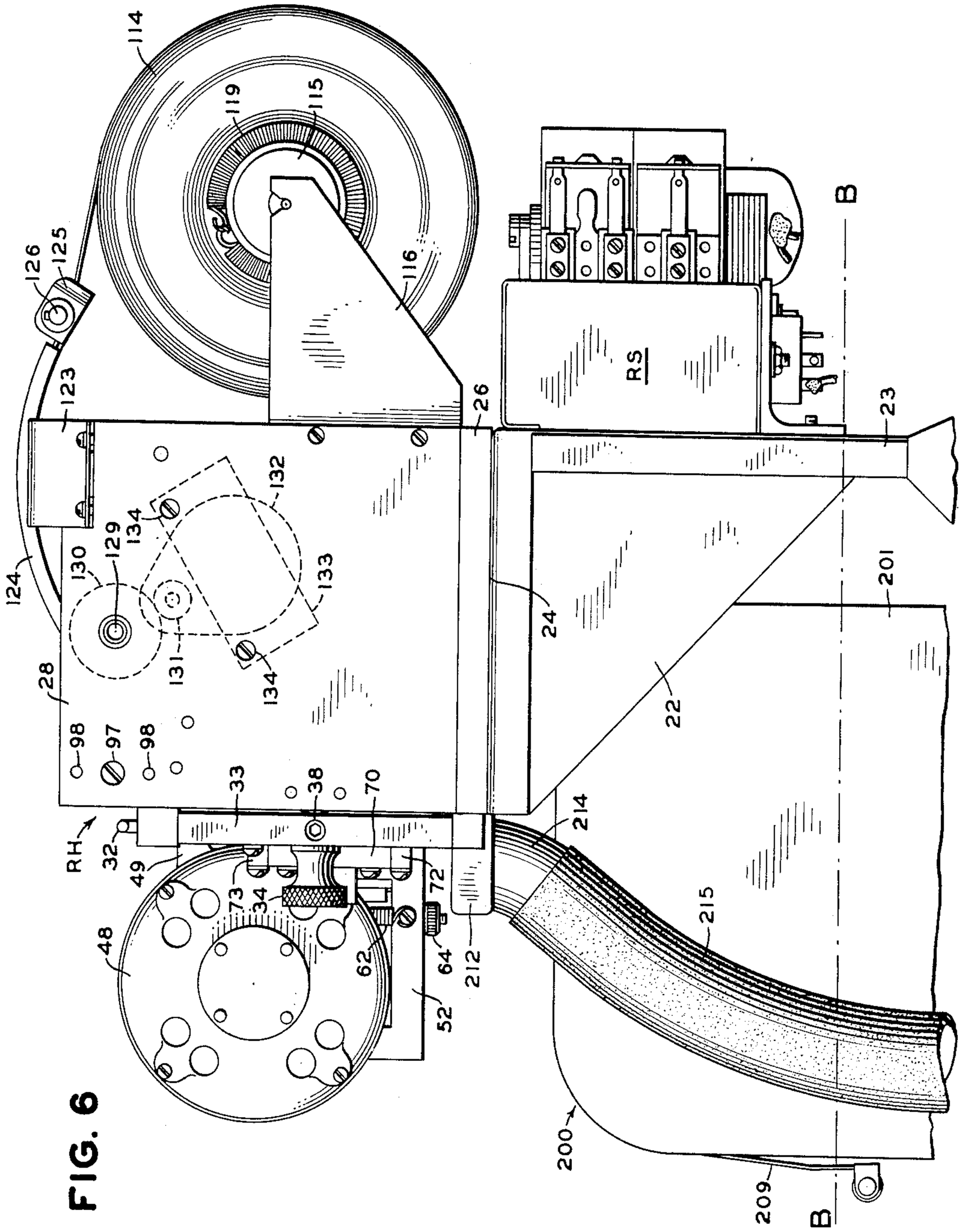


FIG. 6

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 7

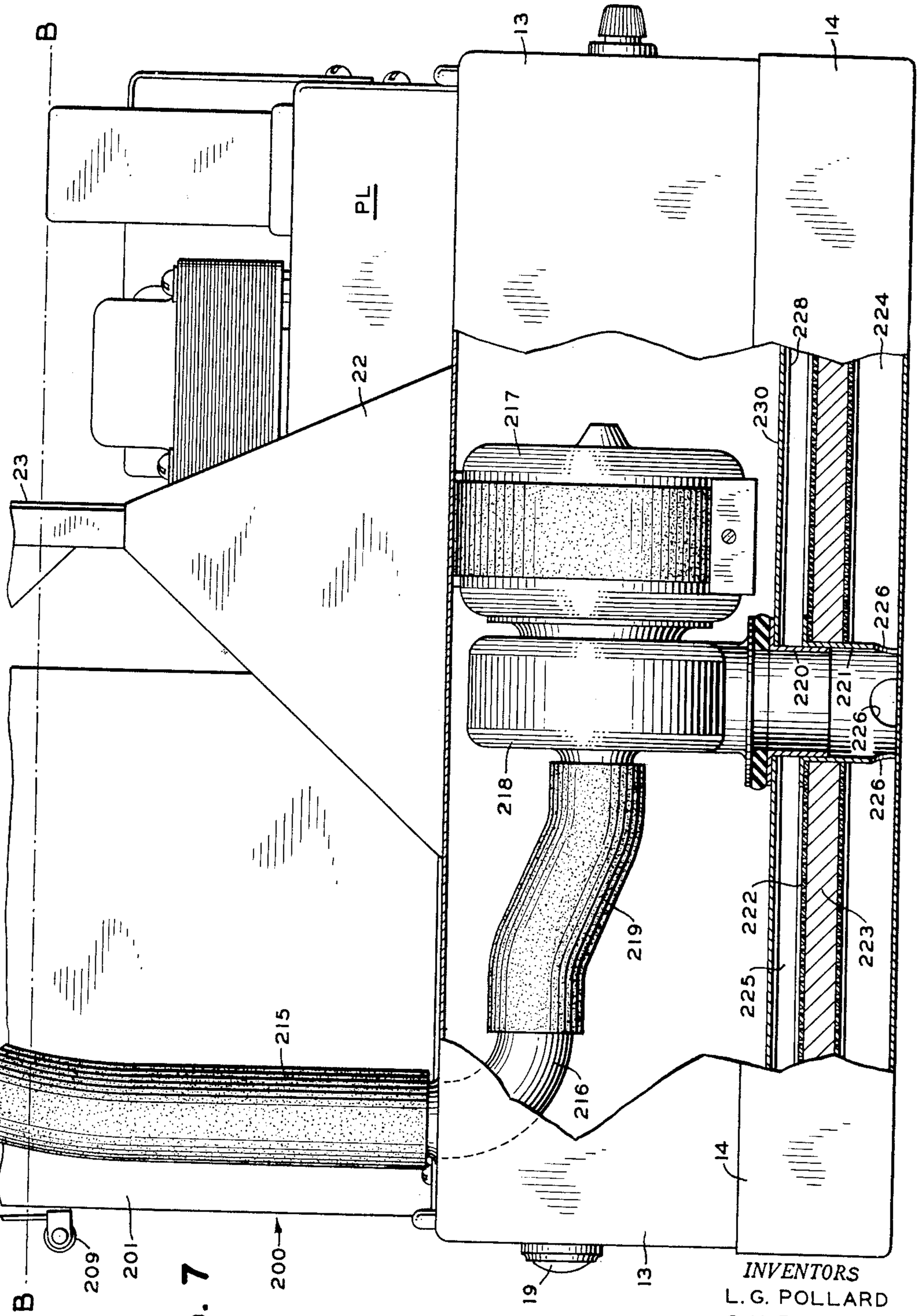


FIG. 7

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas

ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 8

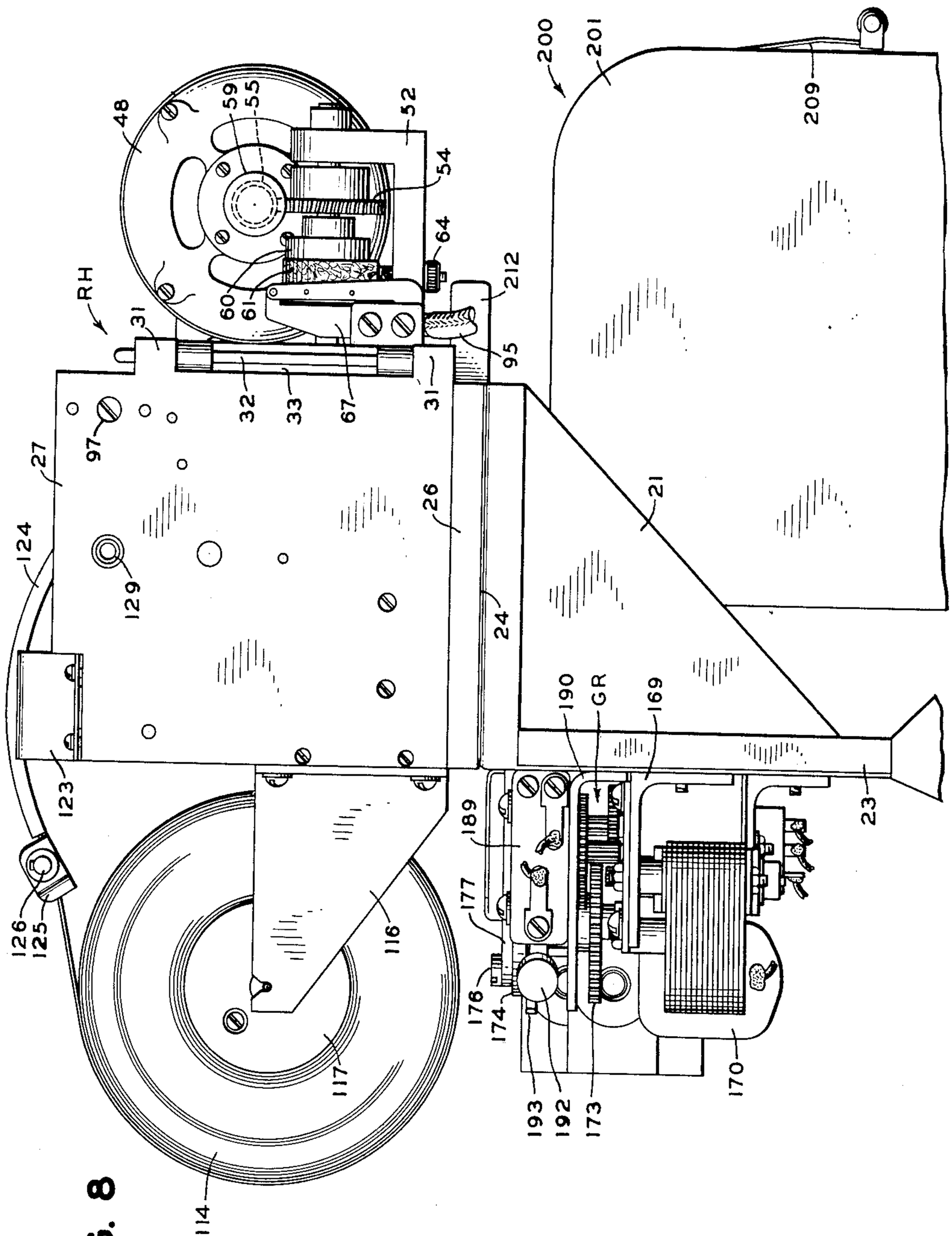


FIG. 8

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. H. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 9

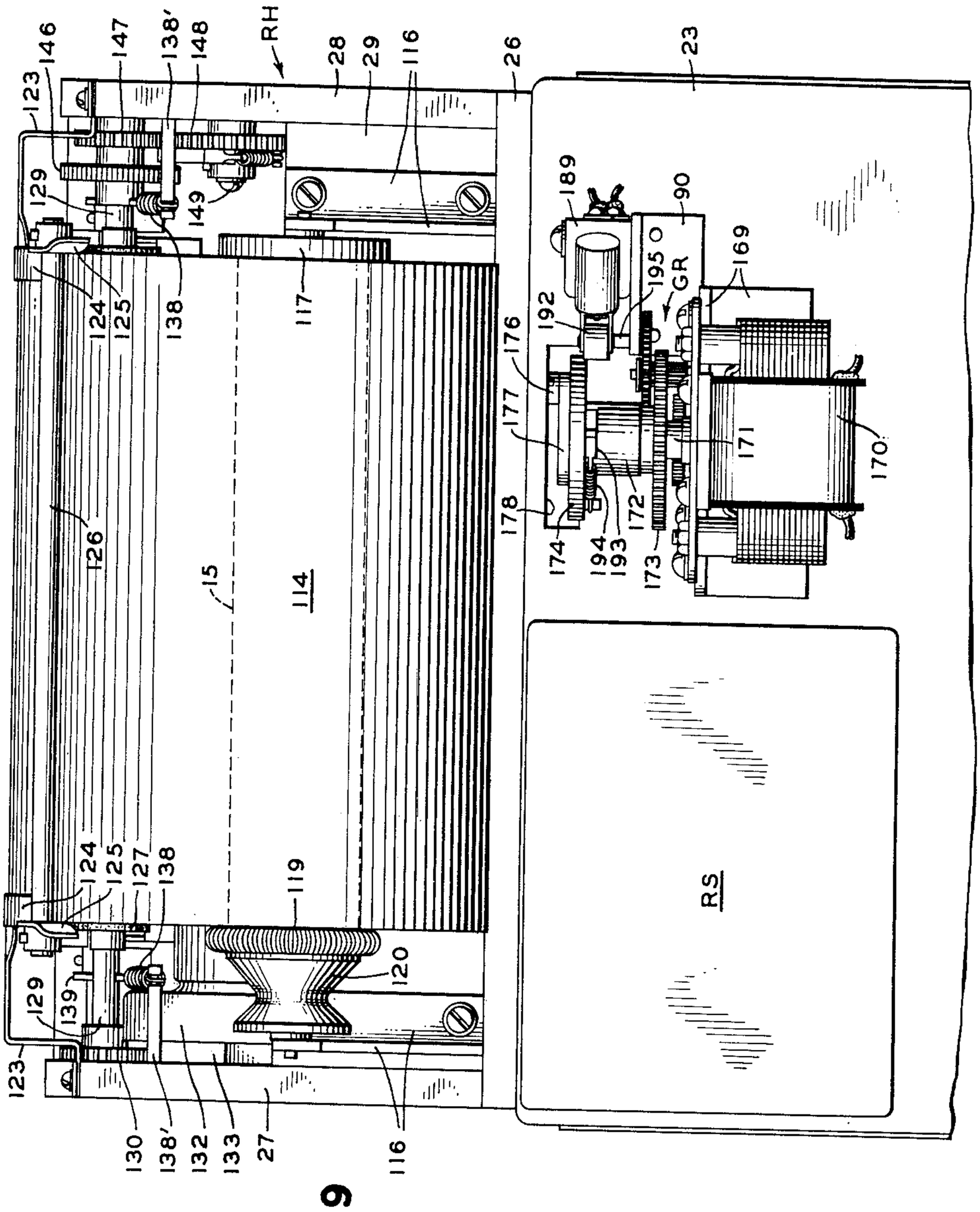


FIG. 9

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

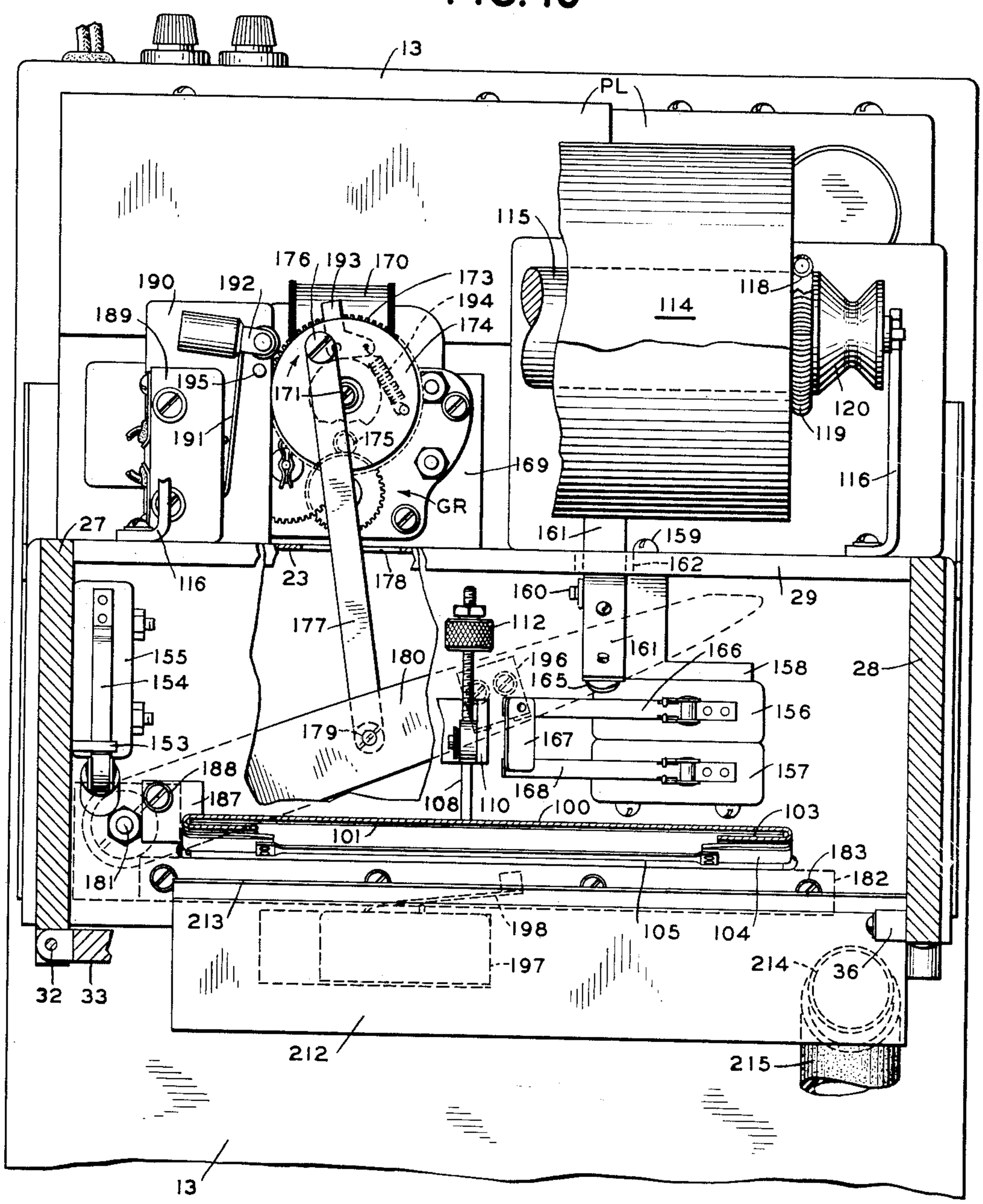
BY A. A. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 10

FIG. 10



INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. L. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 11

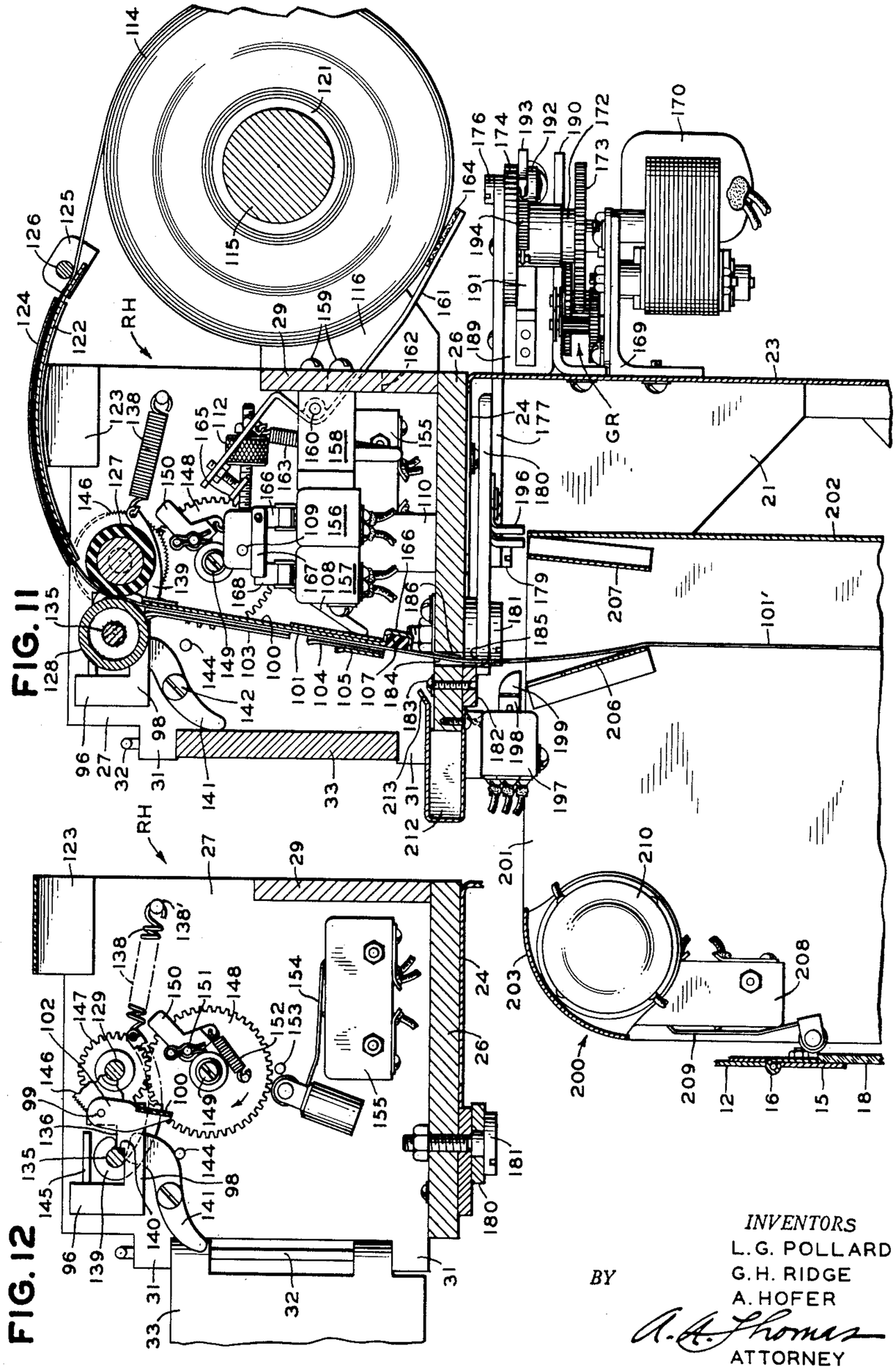


FIG. 11

FIG. 12

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas
ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 12

FIG. 13

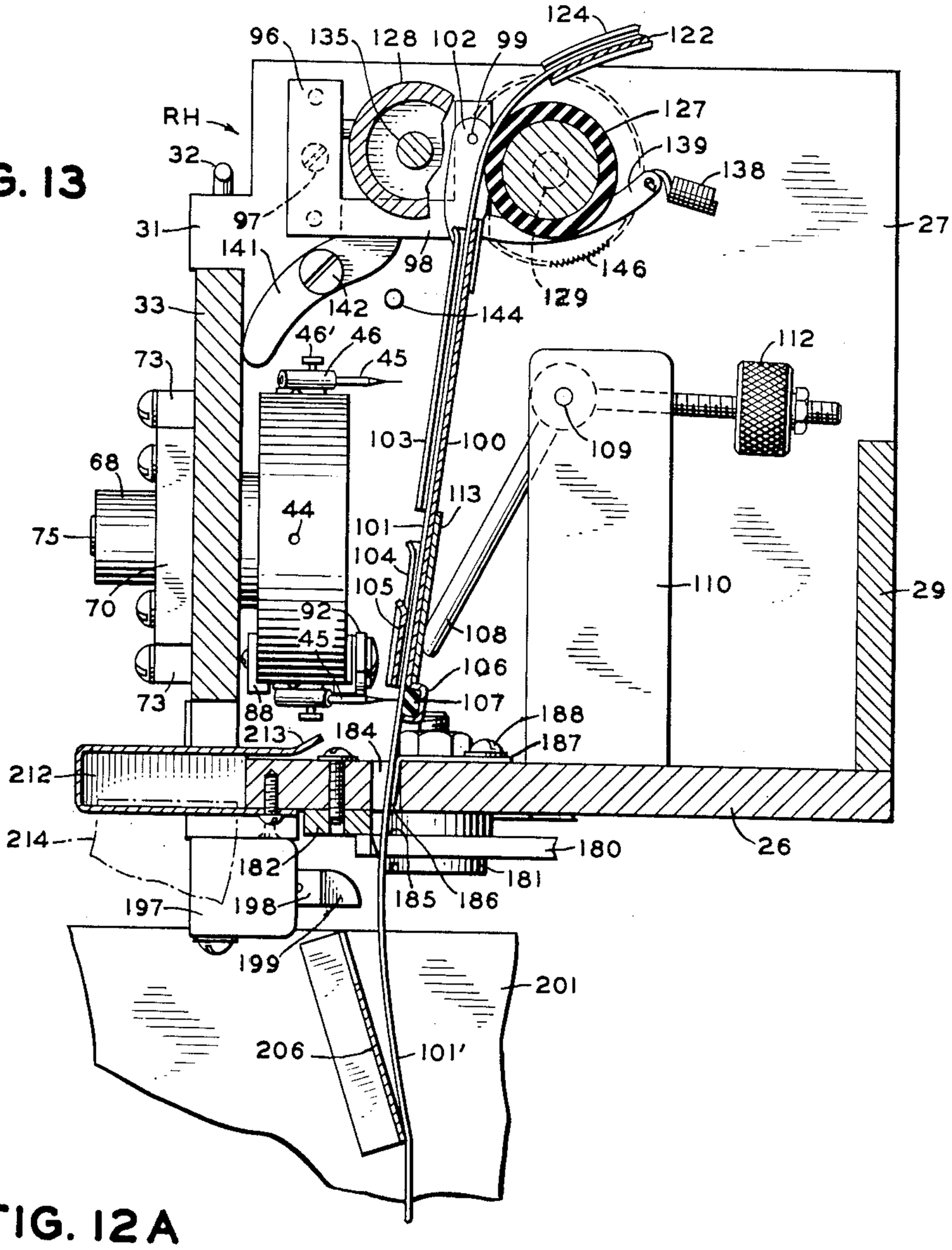
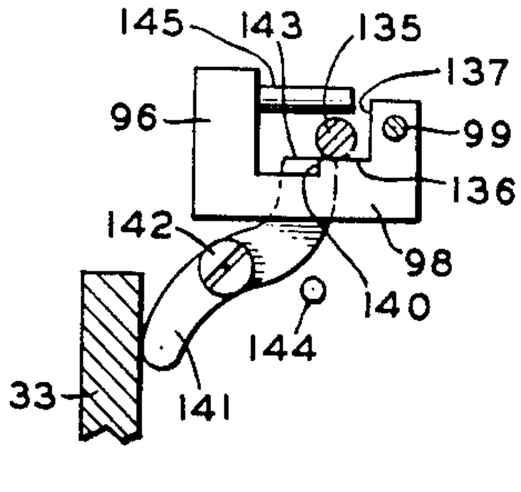


FIG. 12A



INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas

ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 13

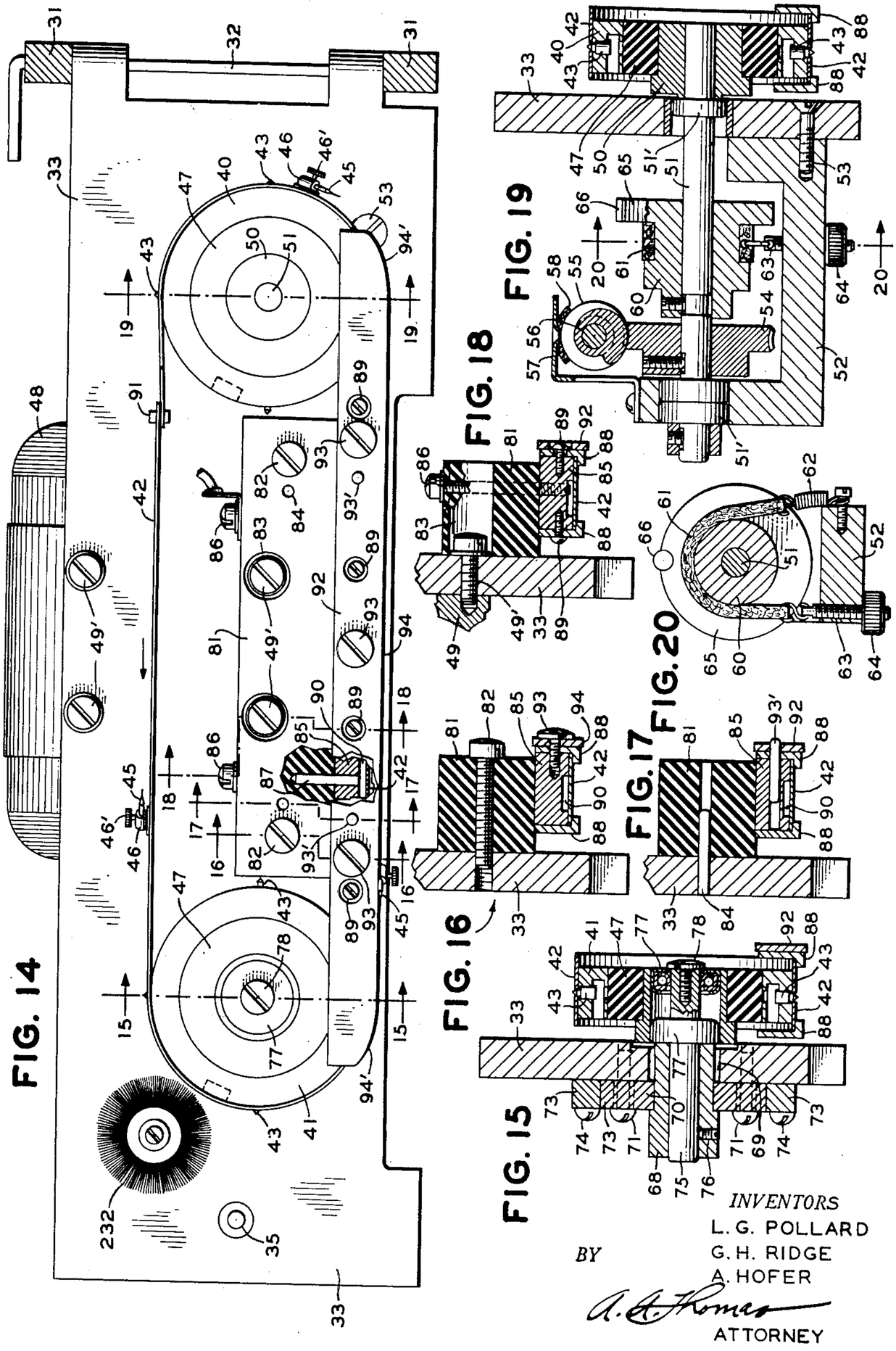


FIG. 14

FIG. 15

FIG. 16

FIG. 17

FIG. 18

FIG. 19

FIG. 20

INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY

ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 14

FIG. 21

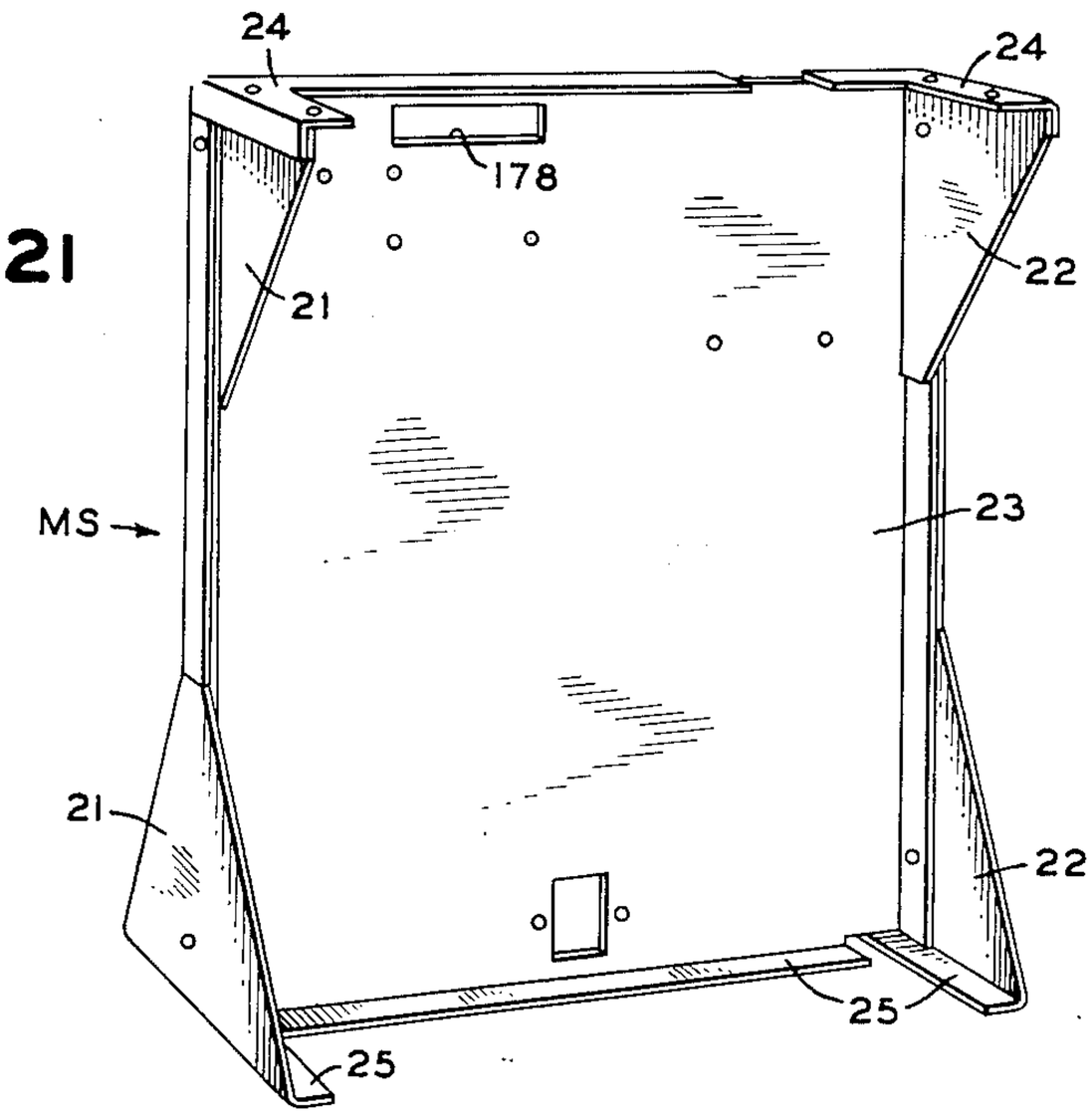
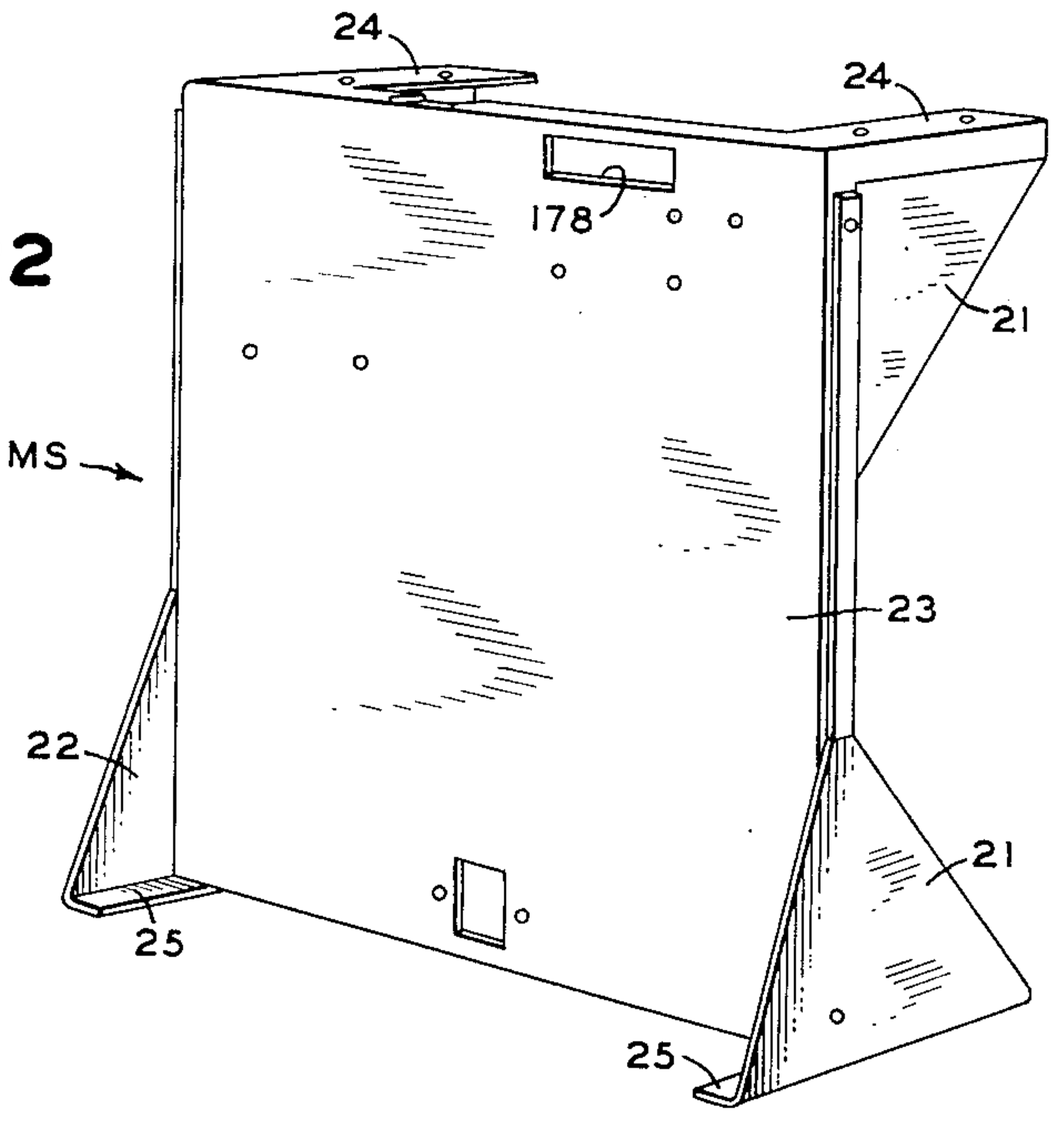


FIG. 22



INVENTORS
L. G. POLLARD
G. H. RIDGE
A. HOFER

BY A. A. Thomas

ATTORNEY

March 20, 1956 L. G. POLLARD ET AL 2,739,029

STYLUS FACSIMILE RECORDERS

Filed Dec. 19, 1950 15 Sheets-Sheet 15

FIG. 23

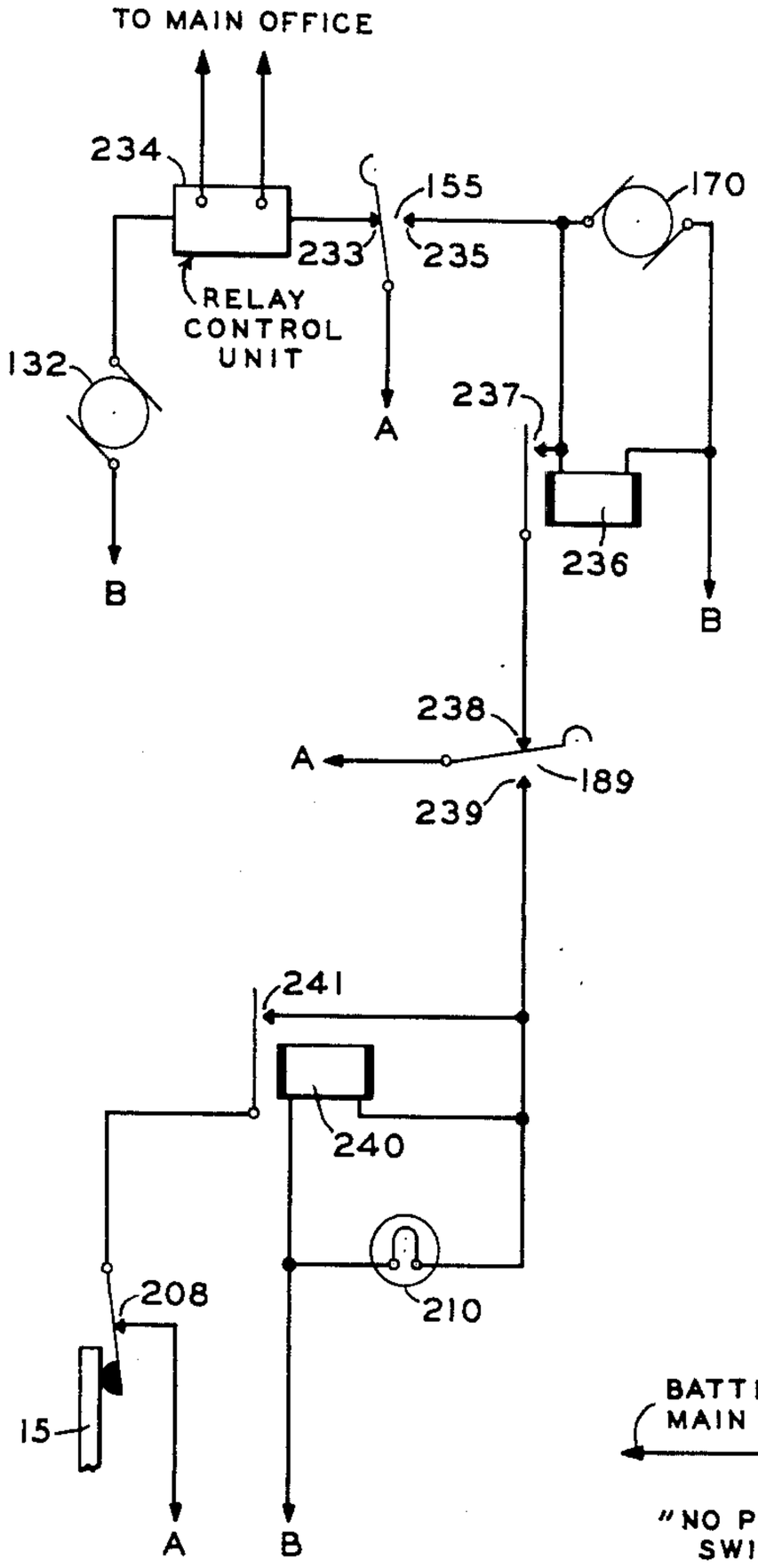


FIG. 24

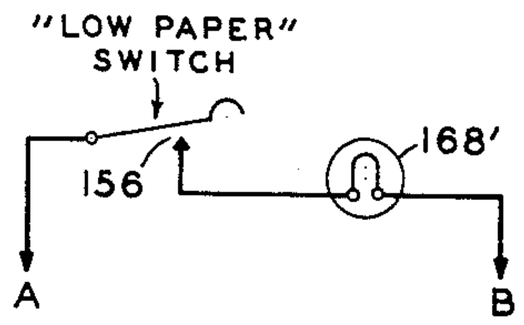
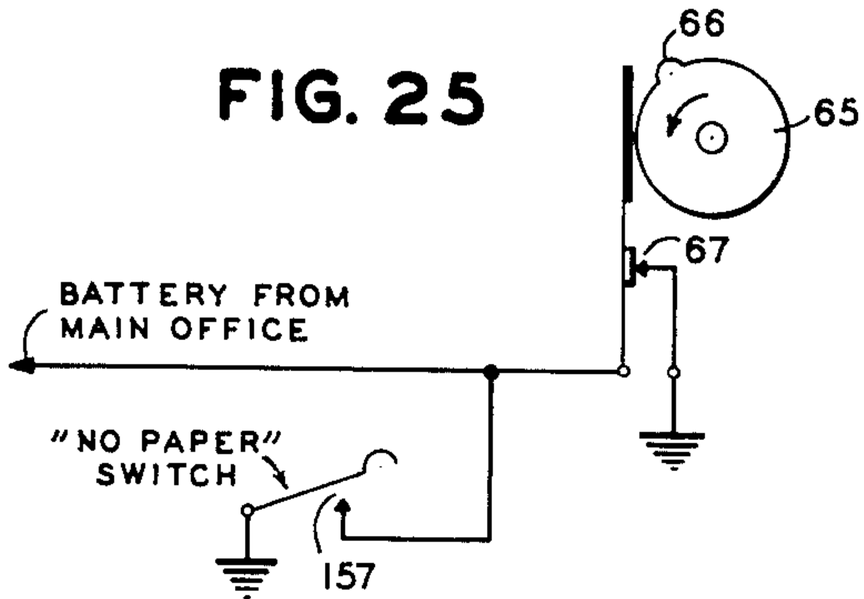


FIG. 25



INVENTORS
L.G. POLLARD
G.H. RIDGE
A.HOFER

BY A. A. Thomas
ATTORNEY

United States Patent Office

2,739,029

Patented Mar. 20, 1956

2,739,029

STYLUS FACSIMILE RECORDERS

Leon G. Pollard and Guy H. Ridge, Southampton, and Adolph Hofer, Hampton Bays, N. Y., assignors to The Western Union Telegraph Company, New York, N. Y., a corporation of New York

Application December 19, 1950, Serial No. 201,608

7 Claims. (Cl. 346—24)

This invention relates to facsimile recorders of the stylus type and its object is to provide a new and improved machine for the automatic recording of facsimile telegrams at a terminal station connected with a main office.

Our automatic recorder is in some respects similar to the three-stylus belt machine disclosed in the pending application of Hallden and Zabriskie Serial No. 83,333, filed March 25, 1949, now Patent No. 2,639,211, but it differs from that earlier machine in several important particulars. Whereas the Hallden and Zabriskie recorder was primarily designed for concentrator use at a main office where an attendant would always be present to connect the machine with a calling subscriber's transmitter, the recorder of the present invention is equipped with novel features for the automatic facsimile recording of messages sent from the main office while the machine is unattended.

The only personal attention our recorder requires is the removal of received messages from a compartment in the machine, replenishing the supply of recording paper, and replacing worn styluses. This machine is therefore especially suitable for installation in hotels, apartment house lobbies, and other terminal stations operating as telegraph agencies.

Considered more specifically, the new equipment of our automatic recorder includes a scanning head located at the top of the machine as a unitary support for the stylus recording assembly, the paper supporting platen and the paper feed mechanism.

The stylus recording assembly is mounted as a unit on a horizontal gate which is hinged to the scanning head at the left and releasably secured to the head at the right end, so that the gate can be swung out of the way of the platen or for removal when necessary. This hinged gate carries on its inner face a pair of sprocket wheels supporting an endless metal belt on which several styluses (usually three) are mounted in properly spaced relation. The belt is driven by a synchronous motor secured to the outer face of the gate.

Behind the recording gate is a floating platen adapted to hold a sheet of paper in flat recording position. A synchronous motor feeds the paper slowly downward through the platen from a supply roll located at the rear of the scanning head. After emerging from the platen, the paper passes down through a slot in the base of the recording head and a motor operated knife automatically cuts off the same length of paper after each recording cycle. The severed telegram sheet drops into a compartment at the bottom of the machine for removal by the attendant.

The recording path of the styluses in this machine is along the lower loop or run of the belt, so that the recording is done from right to left and upside down (as viewed from the front) on the downward moving paper. This method of recording involves, as far as we know, a concept of basic novelty and we claim it as such.

The foregoing and other distinctive features of our

recorder will be fully brought out in the description of the accompanying drawings in which—

Fig. 1 shows a perspective of our machine as built for commercial use, with the outer cover in place;

Fig. 2 is a front view of the upper half of the machine, with the cover removed;

Fig. 2A shows a detail on line 2A of Fig. 2;

Fig. 2B is a section on line 2B of Fig. 2A;

Fig. 2C shows a modified detail of Fig. 2;

Fig. 3 is a downward continuation of Fig. 2, showing the lower half of the machine, with certain parts in section;

Fig. 4 shows the upper portion of the machine, with the recording gate assembly swung aside to reveal the paper supporting platen behind it;

Fig. 5 is a top view of the machine;

Figs. 6 and 7 together show a right end view of the machine;

Fig. 8 illustrates a left hand view of Fig. 2;

Fig. 9 is a rear view of the machine looking from left to right of Fig. 8;

Fig. 10 is a plan view in section on line 10—10 of Fig. 2;

Fig. 11 is a section on line 11—11 of Fig. 2;

Fig. 12 shows a section on line 12—12 of Fig. 5;

Fig. 12A shows a detail of Fig. 12;

Fig. 13 is similar to Fig. 11 with certain parts removed to present a clear view of the recording mechanism;

Fig. 14 is an enlarged illustration of the inner face of the recording gate;

Figs. 15 to 19 show details in section on lines 15 to 19, respectively, of Fig. 14;

Fig. 20 is a section on line 20—20 of Fig. 19;

Figs. 21 and 22 show respectively front and rear views of the main supporting stand in the machine; and

Figs. 23 to 25 are circuit diagrams connected with certain switches in the machine.

Referring to Fig. 1, the machine has a cover 12 of appropriate design and color removably set upon a hollow rectangular base 13 which provides a housing for certain parts, as will appear later. The base 13 rests on a pan 14 which contains a filter device for the stylus fumes generated during a recording operation. The cover 12, usually of sheet metal, has a door 15 hinged at 16 and provided with a hand knob 17. Behind the door 15 is a compartment into which the recorded telegrams drop after being cut off. A glass panel 18 in the door enables the attendant to spot any received message. The receipt of a telegram is also indicated by a lighted jewel 19 which the attendant can see from a distance. Aside from the removal of received messages, the only attention this machine requires is the replenishing of the recording paper supply and the replacement of worn styluses. For this purpose another jewel 20 automatically lights up to warn the attendant when the paper supply is running low.

The stylus mechanism

The main supporting stand in the machine, shown separately in Figs. 21 and 22, is a built-up sheet-metal structure MS consisting of a pair of sides 21 and 22, a back plate 23 and a top 24 which is cut away to make room for other parts. This unitary structure is rigidly mounted on base 13 in any practical way, as by welding the bottom flanges 25 of the stand to the top of the base. Needless to say, the supporting frame MS may be of any practical construction and the particular frame shown is merely by way of example.

A recording head indicated as a unit by RH is mounted on top of frame MS and serves as a common support for the stylus mechanism, the paper holding platen, the paper

feed connections and the paper cutting device. All of this apparatus will be described in proper order.

The recording head RH is a heavy metal frame, for example, of aluminum alloy, comprising a bottom plate or base **26**, a pair of vertical sides **27** and **28** and back piece **29**. This rectangular construction of the recording head can be seen in Figs. 2, 4 and 9, with side views in Figs. 11 and 13. The parts **26** to **29** are secured together by screws or otherwise into a rigid structure which is fastened to the stand MS by screws **30**, as shown in Figs. 2 and 4.

As seen in Figs. 2 and 12, the left hand plate **27** of the recording head is provided on the front edge with a pair of aligned lugs or ears **31** which carry a pintle **32** on which a gate **33** is hinged. The pintle **32** is easily pulled out to permit quick removal and replacing of the gate. A knurled knob **34** at the right end of gate **33** (Fig. 2A) has a screw **35** adapted to enter a nut **36** on the fixed plate **28**. A collar **37** held in the gate by a set screw **38** prevents axial movement of the screw knob **34** without interferring with its rotation. When the knob **34** is turned clockwise, the screw **35** moves into the nut **36** until the gate strikes the head of an adjustable screw **39** in the edge of the plate **28**. The adjustment of this screw determines the closed position of gate **33** with micrometric accuracy. The importance of this adjustment will be apparent later on.

The hinged gate **33** carries the entire stylus mechanism, as best shown in Figs. 14 to 19. Two sprocket wheels **40** and **41** are mounted on the rear or inner face of the gate and those sprocket wheels support an endless flexible steel belt **42**. Each sprocket wheel has a number of pins **43**, in this case four, arranged to engage sprocket holes **44** in the belt (Fig. 5) to form a positive drive connection between the sprocket wheels and the belt.

A number of recording styluses **45**, in this case three, are mounted on the steel belt **42** by means of holders **46** which are rigidly anchored to the belt at equal distances in accurate positions. Each stylus is removably clamped in its holder by means of a set screw **46'** (like a phonograph needle) and firmly held at a trailing angle. Since the belt and the styluses must be insulated from the metal framework of the machine, the outer metal rim of each pulley is supported on an insulated collar or bushing **47**.

In the present machine, the sprocket wheel **40** is the drive sprocket wheel which is operatively connected with a synchronous motor **48** mounted on the outer or front face of the gate **33** by a suitable bracket **49** (Fig. 5), which is fastened to the gate by screws **49'** (Fig. 14). The driving connections between sprocket wheel **40** and motor **48** are shown in Figs. 5, 19 and 20. The pulley **40** has a metal hub **50** which is fixed on the inner end of a shaft **51**, as by a forced fit or a spline, and the front end of this shaft is journaled in a U-shaped bracket **52** attached to the gate **33** by screws **53**. A worm wheel **54** (preferably of insulating material like Bakelite) is fixed on shaft **51** and meshes with a worm **55** on the shaft **56** of motor **48**. In the present machine, the gear ratio between the motor shaft **56** and the pulley shaft **51** is such that the stylus belt **42** operates at 180 R. P. M. A sheet metal plate **57** secured to the bracket **52** holds an oil pad **58** against the worm **55**. The motor shaft **56** is preferably provided with a knurled button **59** to permit adjustment of the stylus belt **42** by hand when necessary.

Referring to Figs. 19 and 20, the pulley drive shaft **51** has fixed thereon a hub or collar **60** formed with an annular groove in which a friction band **61** of felt or leather is held in pressure contact by a spring **62**. A screw **63** is operated by a thumb nut **64** to permit adjustment of the band **61** for the required brake effect to be placed on shaft **51** as a constant load for holding the gear members **54** and **55** in firm steady engagement. The hub **60** is formed on its inner end with a disk **65** which has a cam tooth **66** on its periphery arranged to operate a switch **67** mounted on the gate **33** (Figs. 2 and 5). The switch **67** is opened briefly once for each revolution of the drive shaft **51**; that is to say, once for each complete turn of the belt sprocket wheels **40**—**41**. The purpose of switch **67** is to produce battery pulses at the main office for phasing the recorder with the connected main office transmitter at the start of each message cycle. The phasing circuits controlled by switch **67** are not a part of this invention and therefore have not been shown in the drawings.

The idler sprocket wheel **41** is slightly adjustable lengthwise of belt **42** in order to tighten the belt to the proper degree of tautness as well as to loosen the belt for removal when required. This adjustment of sprocket wheel **41** is effected by a novel mounting shown in Figs. 2 and 15. A cylindrical bushing **68** passes through a hole **69** in the recording gate **33**, this hole being slightly larger than the bushing. A heavy rectangular plate **70** is mounted on bushing **68** in a forced fit and screws **71** pass through holes **72** in the plate into screw-threaded engagement with gate **33**. The holes **72** are not screw-threaded and are slightly larger than the screws **71**, so that a slightly horizontal adjustment of the plate **70** (and with it the sleeve **68**) is permissible. The plate **70** is held against vertical movement by a pair of guide pieces **73** secured to the gate **33** by screws **74**.

The bushing **68** supports a stub shaft **75** which is secured in place by a set screw **76** and does not rotate. The inner end of shaft **75** carries ball bearings **77** on which the sprocket wheel **41** is supported. A headed screw **78** locks the pulley **41** in place. The bushing **68** and plate **70** constitute a unitary support for the idle sprocket wheel **41** for linear adjustment thereof toward and from the drive sprocket wheel **40**. The adjustment of plate **70** is effected by means of a screw bolt **79** which passes through a fixed bar **80** on gate **33** into screw-threaded engagement with the plate **70**. To adjust this plate it is only necessary to loosen the screws **71** slightly and turn the bolt **79** in one direction or the other, to loosen or tighten the belt **42**, as required. The plate **70** stays locked in either adjusted position. The adjustment screw **79** may be replaced by a fixed stop **80'** in bar **80** for the plate **70** (Fig. 2C).

Referring to Fig. 14 and the associated detail views, an elongated block **81** of insulating material is fastened by screws **82** to the inner face of gate **33** between the sprocket wheels **40** and **41**. Holes **83** in the block allow room for the two lower screws **49'** that secure the motor **48** to the gate. The block **81** is readily located in position by pins **84** on gate **33** (Fig. 17). A channeled bar **85** of metal is rigidly attached to the underside of insulating block **81** by screws **86**, one of which serves as a binding post to connect the insulated bar in the stylus circuit. One or more pins **87** (Fig. 14) locate the bar **85** in position for the screws **86**. The bar **85** is provided with flanged side strips **88** which are attached by screws **89**. The flanged strips **88** are slightly spaced from the bottom of bar **85** to provide narrow grooves or channels for the sides of the stylus belt **42**, which is thereby supported and guided along the bar in its lower run between the pulleys **40** and **41**. The guide bar **85** has a channel **90** to clear the rivet **91** (Fig. 14) that holds the overlapped ends of the belt together.

The bar **85** carries a long steel rail **92** which is secured in place by screws **93**, and pins **93'** in bar **85** locate the rail in correct position. The rail **92** has a straight bottom edge **94** with upwardly bevelled ends **94'** for easy riding of the styluses onto and off the rail. As seen in Figs. 15 to 18, the straight bottom edge **94** of the rail projects slightly below the adjacent side strip **88** of bar **85** so as to be engaged in pressure contact by each stylus during its scanning movement. This pressure contact is due to the fact that, as each stylus encounters the fixed rail **92** and rides under it, the spring belt **42** is slightly twisted or distorted transversely and thereby holds the stylus in pressure contact with the edge of the rail. As a result, the styluses travel the same recording path across the paper and

produce uniformly spaced lines of recording. For this reason the rail **92** has been called an anti-grouping bar, since it prevents grouping or bunching of the scanning lines.

The above described guide structure for the belt and styluses is like that set forth in the pending application of Hallden and Zabriskie, Serial No. 83,333, filed March 25, 1949. In that case the guide rail is arranged along the upper loop or run of the belt where the recording takes place from left to right as the paper moves up. In the present machine the recording is done by the stylus on the lower run of the belt from right to left as the paper moves down. These differences in structure and operation are part of the present invention, but we do not claim broadly the idea of causing the lateral flexure of belt **42** to hold the styluses **45** in pressure contact with the fixed rail **92** during their recording movements. This basic concept belongs in the Hallden and Zabriskie application referred to.

Let it be noted that the hinged gate assembly—that is, the gate **33** and all the parts mounted thereon—is a unitary structure capable of quick replacement when necessary. All electrical connections to the gate are carried by a short cable **95** (Figs. 2 and 5) which has a terminal plug **95'** inserted in a socket on the base of the machine. By simply pulling out the plug **95'** and lifting out the hinged pin **32**, the gate assembly is free to be removed and another one can be quickly put in its place. This rapid interchange of gates makes it possible to keep the machine in running order without waiting for repairs in the event of failure in the recording mechanism.

The platen and paper feed mechanism

Referring to Figs. 5, 12, 12A, and 13, the side plates **27** and **28** of the recording head RH carry a pair of heavy U-shaped brackets **96** which are secured thereto by screws **97**. Each bracket **96** has a rear extension **98** which carries a pivot pin **99** for suspending a platen **100** adapted to support a sheet of paper **101** in scanning position.

As seen in Figs. 4 and 13, the platen **100** is a rectangular sheet metal plate (preferably of aluminum) formed with upstanding ears **102** for receiving the pivot pins **99** and turned inward along the sides to provide spaced flanges **103** and **104**. These flanges form shallow channels which are just deep enough to receive the sides of the paper sheet in an easy fit so as to hold it flat against the platen during the downward travel of the paper. A cross bar **105** is riveted to the lower pair of flanges **104** to hold the paper close to the platen at the scanning line. The member **105** also serves as a guide for the tapered end of the paper when a new roll is inserted.

The lower edge **106** of platen **100** (Figs. 11 and 13) is offset rearward to provide a groove or channel in which a strip **107** of hard insulating material (such as Bakelite) is firmly seated to provide a solid backing for the moving paper along the recording track of the styluses **45**. Another practical advantage of the insulating strip **107** lies in the fact that no deposit of particles accumulates thereon from the stylus operation, as would be liable to happen if the strip were of metal. The ends of strip **107** are curved rearward at the sides and also curved backward at the top toward the platen, as indicated by the double shading in Fig. 4. This double curvature allows the fast moving stylus points to ride smoothly onto the surface of the paper at the beginning of the scanning stroke and to recede gradually at the end of the stroke.

The floating platen **100** is constantly being pushed forward by a weighted arm **108** (Fig. 13) pivoted at **109** on a stand **110** which rises from the base **26** of the scanning head. The arm **108** carries an adjustable weight **112** for regulating the pressure of the arm against the platen. The lower end of arm **108** is not connected

to the platen but is merely in sliding contact with a hard steel plate **113** attached to the platen back. The weighted arm **108** constantly holds the paper against the recording stylus points with the right degree of pressure.

The paper is fed downward through the platen in a continuous sheet from a supply roll **114** mounted on a roller **115** (Fig. 5) which rests at its pivot ends in a pair of brackets **116** secured in the rear plate **29** of the scanning head RH (Figs. 6 and 8). One end of roller **115** (usually of wood) has a metal retaining disk **117** and the other end of the roller has a circular groove **118** (Fig. 10) for holding a spring garter **119** which can be easily rolled out of the way onto a neck **120** of the roller to permit withdrawal of an exhausted paper core **121** and the insertion of a fresh supply roll. This construction of roller **115** is not a part of our invention, being disclosed in the pending application of Hallden and Zabriskie, already identified.

Referring to Figs. 6, 8 and 11, the paper passes upward from the supply roll **114** over a fixed guide bridge **122** which is carried by a pair of brackets **123** mounted on the side plates **27** and **28** of the recording head. The guide bridge **122** is an arched piece of sheet metal provided with side flanges **124** and a pair of ears **125** which support a rod **126**. The paper passes under the rod **126** onto the bridge and the sides of the paper pass through the shallow channels provided by the flanges **124**, which cause the moving sheet to follow the smooth curved surface of the bridge.

The paper is fed out of the supply roll **114** by means of a pair of rollers **127** and **128**. The roller **127** is a rubber covered feed roller operated by a synchronous motor, and the roller **128** is a metal idler held in pressure contact with the feed roller. As shown in Fig. 11, these two rollers are arranged to receive the paper as it leaves the guide bridge **122** and to push it downward over the platen **100**. The rollers **127** and **128** are mounted independently of each other so that the idler **127** can be adjusted laterally with respect to the feed roller, as will presently be described.

The feed roller **127** is fixed on a shaft **129** which is journaled in the side plates **27** and **28** of the recording head RH. A gear **130** (Figs. 5 and 9) secured on the right end of shaft **129** meshes with a pinion **131** on the shaft of a small synchronous motor **132** mounted on the side plate **28** by means of a cross bar **133** which is secured by screws **134** (Fig. 6). The reduction gear ratio between the motor **132** and the feed roller **127** is such that the paper is pushed down over the platen in a slow continuous movement at the rate, for example, of 0.01 inch per stylus scanning stroke.

The idle roller **128** has a shaft **135** extending loosely therethrough at both ends and this shaft is adjustably supported on the brackets **96** (Figs. 12 and 12A). In the normal sheet feeding position of the roller **128**, the shaft **135** rests at each end on a raised ledge **136** of the bracket arm **98** without touching the rear edge **137** of the bracket arm. This slight clearance is necessary to hold the roller **128** in floating position against the elastic surface of the feed roller **127**. The idler **128** is held against the feed roller by a pair of contractile springs **138** (Figs. 5 and 12) connected to links **139** which hook over the shaft **135**. The rear ends of springs **138** are attached to pins **138'** carried by the side plates **27** and **28**.

The spring hook connections **138—139** allows the idler **128** to be pulled forward by hand for the insertion of a new sheet. When the idler **128** is moved forward, the shaft **135** snaps down automatically at each end against the shoulder **140** (Fig. 12) where it is held by the spring **138**. In other words, the idler **128** is now kept away from the feed roller **127**, so that it is easy to thread a new sheet from the supply roll **114** over the guide bridge **122**, past the roller **127** and down through the side channels of the platen **100**.

The idler **128**, however, can not be moved forward unless the hinged gate **33** is swung open, which must be done to get access to the platen when a new sheet is to be inserted. When the gate **33** is in closed or recording position, as shown in Figs. 12, 12A and 13, the idler shaft **135** is prevented from dropping against the retaining shoulders **140** of the brackets **96** by means of a pair of dogs **141** pivoted on the side plates **27** and **28** of the scanning head by screws **142**.

As best shown in Fig. 12A, the closed gate 33 engages the lower ends of the dogs **141** and thereby holds their flat upper ends **143** in line with the supporting ledge **136**, so that the shaft **135** can not engage the shoulders **140**. When the gate **33** is opened, the released dogs **141** drop by gravity against stops **144** into the position shown in Fig. 12, leaving the shoulders **140** of the bracket arms **98** clear of the upper ends **143** of the dogs. The idler **128** can now be moved forward and it will be held in that position by the shaft **135** snapping against the retaining shoulders **140**. The mere closing of the gate 33 rocks the dogs **141** upward to lift the shaft 135 off the shoulders **140**, whereby the idler returns automatically to sheet feeding position, as shown in Fig. 11. Retaining pins **145** on the brackets **96** prevent accidental lifting of the roller **128** too far.

Referring to Figs. 5, 9 and 12, the left end of the feed roller shaft **129** (the right end in the rear view of Fig. 9) carries a knurled handwheel **146** of insulating material and a gear **147**, both of these wheels being fixed on the shaft. The wheel **146** is used to feed the paper by hand when necessary, as when putting in a new sheet. The gear **147** meshes with a larger gear **148** which is mounted on the adjacent side plate **27** by means of a pin or stud **149**.

As best shown in Fig. 12, the large gear **148** carries a bell crank **150** pivoted on a pin **151**. A contractile spring **152** holds the bell crank in the position shown in Fig. 12. A fixed stop **153** in plate **27** is in the path of the projecting end of bell crank **150**. Therefore, when the bell crank strikes the stop **153**, the continued slow rotation of gear **148** in a clockwise direction causes the stop to rock the bell crank against the tension of spring **152**. The instant that the bell crank is carried by the gear **148** past the stop **153**, the tensioned spring **152** snaps the bell crank forward into momentary impact with the weighted free end of a spring arm **154**. This arm operates a flip switch **155** secured to the side plate **27**.

The switch **155** is called the end-of-message switch because it is operated at the close of a message recording cycle to stop the motor **132** after a prescribed length of paper has been fed past the roller **127**. The diameter of this roller and the transmission ratio of gears **147** and **148** are so related that for one revolution of gear **148** the roller **127** feeds out the standard length (at present, four and five-eighths inches) of a Western Union telegram sheet. Therefore, the operation of switch **155** by the gear **148** occurs only after a uniform length of paper has been fed through the platen **100** in a recording cycle. Another function of switch **155** is to set the paper cutting mechanism in operation simultaneously with the stopping of the paper feed motor **132**. This will be fully explained in the circuit diagram of Fig. 23.

In connection with the paper feed mechanism, we provide automatic signal means for indicating when the paper in the supply roll **114** is getting low, then indicating when the paper is exhausted. Referring to Figs. 10 and **11**, two microswitches **156** and **157** are mounted side by side on an angle bracket **158** which is secured by screws **159** to the rear plate **29** of the recording head RH. The bracket **158** carries a pin **160** for pivotally supporting a long lever **161** which extends rearward through a vertical slot **162** in plate **29**. A contractile spring **163** holds the rear end of lever **161** in continuous pressure contact with the paper supply roll **114**. A cushion **164** of felt or the like is preferably attached to the end of

lever **161** for smooth sliding contact with the paper. As the size of the paper roll decreases, the lever **161** acts as a follower and swings counterclockwise, as viewed in Fig. 11.

The inner end of lever **161** carries an adjustable button **165** arranged to engage the operating arm **166** of switch **156** when the paper supply has reached a predetermined low point. The switch arm **166** carries a cross-piece **167** which overlies the arm **168** of switch **157**. The switch arm **168** is so adjusted that when the supply of paper is exhausted (that is, not enough left for the next recording), the cross-piece **167** operates the arm to close the switch **157**. It will thus be seen that the "low paper" switch **156** and the "no paper" switch **157** are automatically operated in that order by the paper controlled lever **161**. When the "low paper" switch is closed, it lights a lamp **168'** (Fig. 24) that shines through the jewel **20** at the front of the machine. The operation of the "no paper" switch **157** disables the machine in a manner to be explained later.

The paper cutting mechanism (Figs. 8 to 11)

The rear wall **23** of the supporting stand MS carries an angle bracket **169** to which a small A. C. motor **170** is secured with its shaft vertical. A stud **171** fixed on top of bracket **169** supports a rotary sleeve or hub **172** which has a gear **173** secured on its lower end and a crank **174** on its upper end (Fig. 9). Between the motor pinion **175** (Fig. 10) and the gear **173** is a speed reduction train GR calculated to turn the crank **174** at the required low speed.

The crank **174** carries an eccentric pin **176** on which is pivoted the rear end of a link or rod **177** arranged to extend forward through an opening **178** in the plate **23**. The front end of rod **177** is pivoted to the stud **179** of a knife blade **180** which is pivotally mounted at one end on a vertical pin **181** secured to the base **26** of the scanning head (Fig. 12). It is clear from Fig. 10 that during the forward movement of crank pin **176** for a half revolution of disk **174** the rod **177** pushes the knife **180** forward and during the receding movement of the crank pin the knife is withdrawn. A fixed knife blade **182** (Figs. 10 and 11) is fastened to the underside of the base plate **26** by screws **183** in shearing relation to the movable knife **180**.

Referring to Figs. 11 and 13, the base plate **26** has a longitudinal slot **184** in line with the lower edge of the platen **100**, so that the paper **101** passes freely from the platen through the slot **184** into a lower compartment of the machine. The recorded section **101'** of the paper is cut off by the knife **180** along a horizontal line indicated at the point **185**. Since the knife **180** starts cutting the paper at the left end (Fig. 10), we found it desirable to provide a slanting tongue **186** in the left end of slot **184**. This slanting tongue (Fig. 11) is a guide to keep the left edge of the message sheet from catching on the knife **180**, which in its normal or rest position does not quite clear the back edge of the left end of slot **184**. The guide tongue **186** may be an integral extension of a small sheet metal plate **187** secured on base plate **26** by a screw **188** (Fig. 10).

Still referring to Figs. 8 to 11, there is a microswitch **189**, usually called a flip switch, mounted on an angle bracket **190** which is attached to the rear plate **23** of the stand MS. This switch has an operating arm **191** of spring metal provided with a weighted end **192**. The disk **174** carries on its underside a pivoted bell crank **193** which is normally held by a contractile spring **194** in such position that the outer end of the bell crank projects beyond the disk. As the knife **180** nears the end of its return movement, the bell crank **193** encounters a fixed stop **195** which temporarily holds the bell crank back against the tension of spring **194**. When the bell crank snaps out of engagement with stop **195**,

it strikes the end of switch arm **191** which momentarily opens the switch **189** to break the circuit of the knife motor **170** and simultaneously energizes a signal circuit. This will be explained more fully in Fig. 23.

As shown in Fig. 11, the knife **180** carries on its underside a two-pronged bracket **196** adapted to operate a microswitch **197** when the knife in its forward movement encounters a sheet of paper. The switch **197** has an operating arm **198** with its end **199** arranged to be bridged by the spaced prongs **196** when there is no paper in the path of the knife. Under those conditions, the switch **197** will not be operated. However, when the recorded message **101** hangs down ready for cutting off, the forward swing of the knife **180** pushes the prongs **196** against the paper which is sufficiently stiff to operate the switch arm **198**.

The circuits controlled by switch **197**, which we call the message finder switch, are not a part of this invention and belong to the two-way facsimile system disclosed in the pending application of G. H. Ridings, Serial No. 178,815, filed August 11, 1950. It is enough to say here that the operation of switch **197** by the knife **180** through the medium of the recorded sheet brings up a signal light at the main office to inform the operator that the transmitted message has been recorded and cut off. The failure of switch **197** to operate at the end of the cutting cycle tells the central operator that the paper in the recorder has failed to feed properly and that the transmitted message has not been recorded.

Compartment for received messages

From what we said previously about the function of the end-of-message switch **155**, it is clear that the message sheets cut off by the knife **180** have all the same length regardless of the amount of text they contain. The cut-off messages drop to the bottom of a compartment formed by a sheet metal casing **200** rising from the base **13** (Figs. 2, 3 and 11). This casing comprises a pair of sides **201**, a back **202** and a curved front piece **203** on top, the rest of the top being open (Fig. 11). The sides **201** have bottom flanges **204** (Fig. 3) which are secured to the base **13** by screws **205**. A slanting cross strip **206** secured to the sides **201** near the top (Figs. 11 and 13) serves as a guide for the message sheet **101'** that hangs down into the casing ready for cutting. A second cross strip **207** may be put in to prevent a person from touching the knife **180** with his finger tips.

A normally open switch **208** is attached to one of the sides **201** and this switch has a spring arm **209** which is pressed into circuit closing position by the closed door **15** of the outer casing **12** (Fig. 11). The switch **208** is in the circuit of a lamp **210** secured within casing **200** to the top piece **203**, and this lamp will automatically light whenever a message is received. When the attendant opens the door **15** to take out the message, the switch **208** releases and disconnects the lamp **210**. The circuit for this operation will be described in Fig. 23.

To permit easy mounting and removal of casing **200** as a unit, the electrical connections that go to switch **208** for lamp **210** are contained in a short cable **211** which has a terminal plug **211'** (Figs. 3 and 5) inserted in a socket on the base of the machine. By pulling out the plug **211** and taking out the screws **205**, the message casing **200** is free to be removed when necessary.

The fume removing apparatus

It is generally known that in a facsimile recorder using an electric stylus on a special kind of recording paper, the contact of the stylus with the paper generates smoke or fumes which it is desirable to deodorize. While fume removers or deodorizers have been used before in facsimile recorders, we have provided the present machine with novel apparatus for that purpose.

As shown in Figs. 11 and 13, a channel **212** is secured to the front edge of the base plate **26** and forms a ventilating duct along the scanning path of the stylus. The upper end of channel **212** is slightly spaced from the base **26** and preferably terminates in an upturned lip **213** to provide an easier entry for the stylus fumes into the channel. The right end of this channel is open at the bottom to a nipple **214** to which a flexible rubber pipe **215** is connected (Figs. 2 and 6).

Referring to Figs. 3 and 7, the lower end of pipe **215** is joined to an elbow **216** extending upward from the hollow base **13** which forms a housing for a blower unit consisting of a motor **217** and an exhaust fan casing **218**. A flexible tube **219** connects the elbow **216** to the inlet of the fan casing. The exhaust outlet **220** of this casing extends into the pan **14** where it connects with a pipe **221** of a foraminous tray **222** which contains a suitable filter medium **223** such as charcoal. The tray **222** forms a partition which divides the pan **14** into a lower chamber **224** and an upper chamber **225**. The pipe **221** has holes **226** through which the chamber **224** communicates with the exhaust outlet of the blower.

As shown in Fig. 3, the pan **14** is provided inside with a rectangular channeled frame **227** secured in place by screws or welding, and this frame has a narrow upper flange **228** and a wider lower flange **229**. These flanges preferably run along the four sides of the pan and thereby constitute two rectangular supporting ledges. A cover plate **230** is situated on the upper ledge **228** and the filter tray **222** rests on the lower ledge **229**. The tray **222** and the cover **230** are held in place by screws so as to be easily removable. When the cover **230** is taken off, the filter tray **222** can be lifted out past the narrow ledge **228**. In this way the filter is easily replaced by a fresh one when necessary.

In the operation of the blower unit **217—218**, the underpressure created in channel **212** sucks the fumes or smoke appearing at the stylus points into the channel, whence they are drawn through the pipe **215** into the fan casing and through the holes **226** into the fan chamber **224**. From here the fumes are forced through the filter tray **222** which absorbs them and the smoke-free air passes from chamber **225** through holes **231** (Fig. 3) into the open.

Operation of the machine

Assuming that the belt drive motor **48** and the paper feed motor **132** are running, the styluses **45** on the lower loop of belt **42** sweep in succession across the paper **101** in platen **100**, each stylus making one line of recording from right to left. The fixed guide rail **92** insures the even spacing of the successive lines made by the styluses. The paper is fed down at a rate that gives the required number of lines to the inch, usually one hundred. For this purpose, the motor **132** runs at one revolution per minute. The spacing of the styluses is such that as one stylus leaves the paper at the left hand side, the next stylus engages the paper at the right hand side.

As each stylus moves down over the idle pulley **41** on the right, it strikes a rotary bristle brush **232** (Fig. 14) which knocks off any particles clinging to the stylus, so that each stylus enters upon the paper with a clean point. The platen **100** is so hung that the styluses on the upper run of the belt are clear of the paper (Fig. 13). The position of the gate **33** is so adjusted by means of the screw **39** (Fig. 2A) that the engagement of the styluses with the paper causes only a very small movement of the platen at each scanning stroke, and this slight movement of the platen is allowable because of the compensating action of the weighted arm **108** in the rear of the platen. In other words, the scanning plane of the stylus points is so adjusted with respect to the paper surface that only a minimum of platen bounce results as one stylus is about to leave the paper and the other makes contact with it.

Since the recording is done from right to left on the downwardly moving paper, the record thus made is up-

side down on the hanging sheet before it is cut off. This arrangement permits the mounting of the knife **180** below the recording head so that the cut-off sheets can drop into the casing **200** for easy removal through the front door **15**. This practical advantage is not present in those prior page type stylus recorders where the paper is moved up and the recording is from the conventional left to right.

When the proper length of paper has been fed out during a recording cycle, the switch **155** is automatically operated by the timing gear **148** (Fig. 12) to stop the paper feed motor **132** and energize the knife motor **170**. The hanging message **101'** is now cut off and it drops into the compartment below for removal through the door **15**. When the knife **180** after cutting off the message returns to normal position, the switch **189** is operated to stop the knife motor **170** and light the lamp **210** as a signal that the illuminated compartment contains a telegram. When the door **15** is opened to remove the message, the lamp **210** goes out, and the machine is completely shut down ready for the next message from the main office.

As previously explained, when the switch **155** is operated at the close of a message cycle, it stops the paper feed motor **132** and energizes the knife motor **170**. These circuits are indicated in Fig. 23 where the source of power is represented by the leads A and B which may be connected to a local 115 volt A. C. house lighting circuit. Normally the switch **155** closes the contact **233** but the paper feed motor **132** does not start operating until a certain moment as determined by special relay control circuits in the system in which this recorder is used. Those control circuits form no part of the present invention and are schematically indicated by the rectangle **234**.

We are to assume in Fig. 23 that the paper feed motor **132** has been set in operation by the relay control circuits of the system. After the prescribed length of paper for a message has been fed out, the switch **155** is automatically operated to open the contact **233** and close the contact **235**, whereby the circuit of the paper feed motor **132** is broken and the circuit of the knife motor **170** is closed. A relay **236** is energized simultaneously with the motor **170** and locks through its closed contacts **237** which keep the motor circuit closed through the knife switch **189** when the switch **155** flips back to normal position as shown in Fig. 23. The reclosing of contact **233** does not reenergize the paper feed motor **132** which remains inoperative until the next recording cycle begins.

When the knife switch **189** is operated by the crank **174** (Fig. 10) upon the return of knife **180**, the normally closed contact **238** of switch **189** is opened and the other contact **239** is closed. As a result, the knife motor **170** and the relay **236** are deenergized and the lamp **210** lights up the compartment of the machine as a signal that a telegram has been received. A relay **240** is operated at the same time to keep the lamp circuit closed through the contacts **241** when the switch **189** goes back to normal position after its momentary operation. The lamp **210** stays on until the attendant opens the door **215** to obtain the message, whereupon the switch **208** opens and breaks the circuit of lamp **210** and relay **240**.

As pointed out in connection with the switch **67** (Fig. 5), its function is to phase the recorder with the connected transmitter at the main office at the beginning of each message cycle. This phasing operation and the apparatus that accomplishes it do not belong to the present machine and so it will suffice to say that the switch **67** periodically interrupts a battery circuit at the transmitter (Fig. 25) to create the phasing pulses. When the "no paper" switch **157** is closed, it shorts out the commutator switch **67** so that no phasing pulses are generated at the transmitter and the recorder can not be connected. In other words, the exhaustion of paper automatically disables the recorder until a new supply roll has been inserted.

The drawings were made from an actual machine equipped with electrical parts provided for connecting the machine with a transmitter at the main office. Some of those parts have been shown in the drawings but it will not be necessary to describe them because they are not included in the present invention. Suffice it to mention merely that on the back of the supporting stand MS is mounted a relay assembly RS (Figs. 6 to 9), and behind the stand on base **13** is an amplifier unit PL (Fig. 7). Other electrical parts are contained in the hollow base **13** of the machine.

It will be understood that the features of novelty contained in our invention are not restricted to the structural details shown, for various changes and modifications are possible within the scope of the appended claims.

We claim as our invention:

1. In a facsimile recorder, a pair of spaced vertical plates arranged transversely of the recorder, a removable hinge pin carried by the left plate, a gate hinged on said pin, stylus recording mechanism mounted on said gate, manually operable screw means for releasably locking the right hand end of the gate to the right hand plate, a sheet holding platen supported in operative relation to said mechanism when the gate is locked, and an adjustable threaded stop mounted on the right hand plate for engaging the corresponding end of the gate when the recording mechanism is in correct alignment with said platen.

2. A facsimile recorder provided with a frame, a horizontal gate hinged to said frame and movable to open and closed positions, recording mechanism carried by said gate, a platen supported on said frame behind said gate for holding a sheet of paper in scanning position, said recording mechanism being in operative relation to said platen when the gate is closed, a pair of feed rollers carried by said frame for feeding paper downward over the platen from a continuous supply roll, one of said rollers being movable away from the other when the gate is open, means for holding said movable roller in withdrawn position for the easy insertion of paper down through the platen from a new supply roll, and means automatically actuated by the closing movement of the gate for releasing the withdrawn roller from the said holding means into feeding position.

3. In a facsimile recorder, a frame comprising a pair of spaced vertical plates arranged transversely of the recorder, a gate hinged to one of said plates and adapted to be releasably secured to the other plate so that said gate can be swung to open and closed positions, recording mechanism mounted on said gate, a depending platen supported by said frame for holding a sheet of paper in scanning relation to said mechanism when the gate is closed, a pair of feed rollers carried by said frame for feeding paper downward through the platen from a continuous supply roll, one of said rollers being movable away from the other when the gate is open, means for holding said movable roller in withdrawn position, a pair of members mounted on said plates in operative relation to said movable roller, and means whereby said gate when closed automatically actuates said members to release the withdrawn roller for return to paper feeding position.

4. In a facsimile recorder, the combination of a recording device having a plurality of styluses that travel successively in a flat fixed scanning path from right to left, a sheet metal platen hinged at the top and hanging down in a floating position to hold a sheet of paper for scanning, an insulating strip mounted on the lower edge of the platen in line with the stylus scanning path, a floating weighted arm pressing continuously against the back of the platen to urge the same toward the styluses which thereby make positive recording contact with the paper, said insulating strip back of the paper holding the same firmly against the scanning track of the stylus, and means for feeding a definite length of paper from a continuous supply roll downward over the platen during a recording cycle.

5. In a facsimile recorder, the combination of a recording device having a plurality of styluses that travel successively in a fixed scanning path from right to left, a platen hinged at the top and hanging down in a floating position to hold a sheet of paper for scanning, a floating weighted arm pressing continuously against the back of the platen to urge the same forward against the styluses which thereby make positive recording contact with the paper, means for feeding a definite length of paper from a continuous supply roll downward over the platen during a recording cycle, said length of paper being uniform for each recorded message, and a knife automatically operated by a motor when said prescribed length of paper has been fed through the platen to cut off the recorded message.

6. A facsimile recorder having a stylus recording device, a sheet metal platen for supporting a sheet of paper in operative relation to said device, mechanism for feeding paper downward over said platen during recording thereon, automatic means for stopping said mechanism when a prescribed length of paper has been fed out of said platen during a recording cycle, said length of paper being the same for each recorded message and hanging down below the platen, a pivoted knife mounted below the platen, motor driven connections automatically actuated upon the stopping of said paper feed mechanism to swing the knife forward to cut off the hanging length of paper, and means automatically operative by said motor driven connections during the return swing of said knife to deenergize the driving motor.

7. A facsimile recorder comprising a base, a casing mounted on said base to provide a message compartment, a stand secured to said base and extending around said casing, a frame mounted on said stand, said frame having a bottom plate and two sides, a depending platen supported on said frame and adapted to hold a flat sheet of paper for downward movement, means mounted on said frame for feeding paper from a continuous supply roll down through the platen, said bottom plate having a slot for passage of the paper into said compartment, recording mechanism carried by said frame and having a plurality of styluses movable in a scanning track along the lower edge of said platen, a knife mounted below said plate and movable parallel thereto along a line adjacent to said slot, a motor for operating said knife to cut off the recorded message hanging in the compartment, and means controlled by said paper feed means for automatically energizing the knife motor when a predetermined length of paper has been fed into said compartment.

References Cited in the file of this patent

UNITED STATES PATENTS

1,251,762	Esterline	Jan. 1, 1918
1,469,988	Bryce et al.	Oct. 9, 1923
1,637,852	Brandenburg	Aug. 2, 1927
2,172,539	Kimmich	Sept. 12, 1939
2,391,765	Artzt	Dec. 25, 1945
2,437,242	Cole et al.	Mar. 9, 1948
2,511,892	Wise	June 20, 1950
2,520,918	Elarde	Sept. 5, 1950
2,529,907	Blakeslee et al.	Nov. 9, 1950
2,540,081	Alden	Feb. 6, 1951
2,543,779	Hester et al.	Mar. 6, 1951
2,575,959	Hogan	Nov. 20, 1951
2,613,124	Covely et al.	Oct. 7, 1952
2,614,902	Barvitius	Oct. 21, 1952
2,639,211	Hallden et al.	May 19, 1953
2,651,561	Benham	Sept. 8, 1953