No. 709,158. Patented Sept. 16, 1902.

E. E. KLEINSCHMIDT.

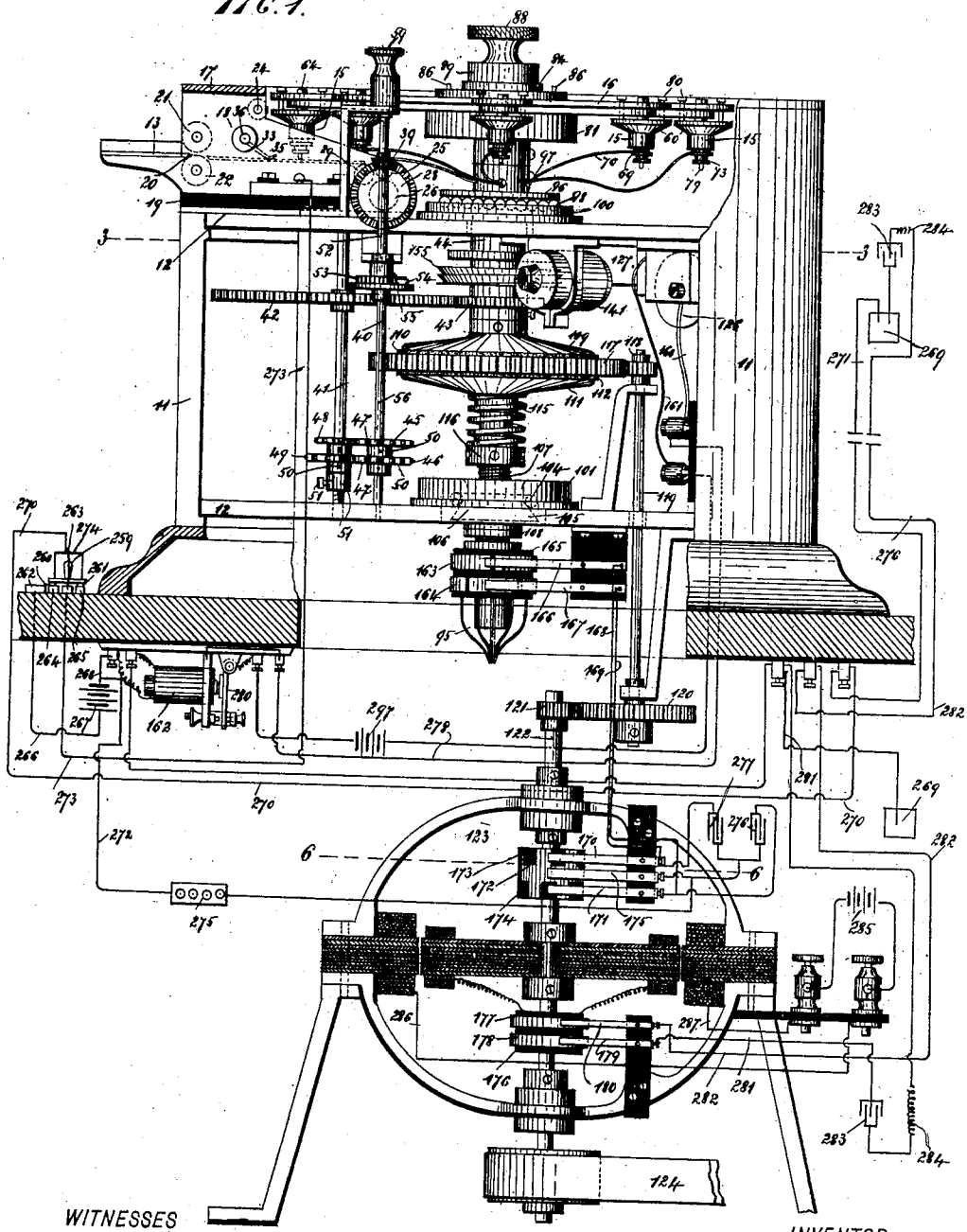
FACSIMILE TELEGRAPH.

(Application filed Nov. 6, 1899.)

(No Model.)

10 Sheets—Sheet 1.

FIG. 1.



WITNESSES

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Fig. 2.

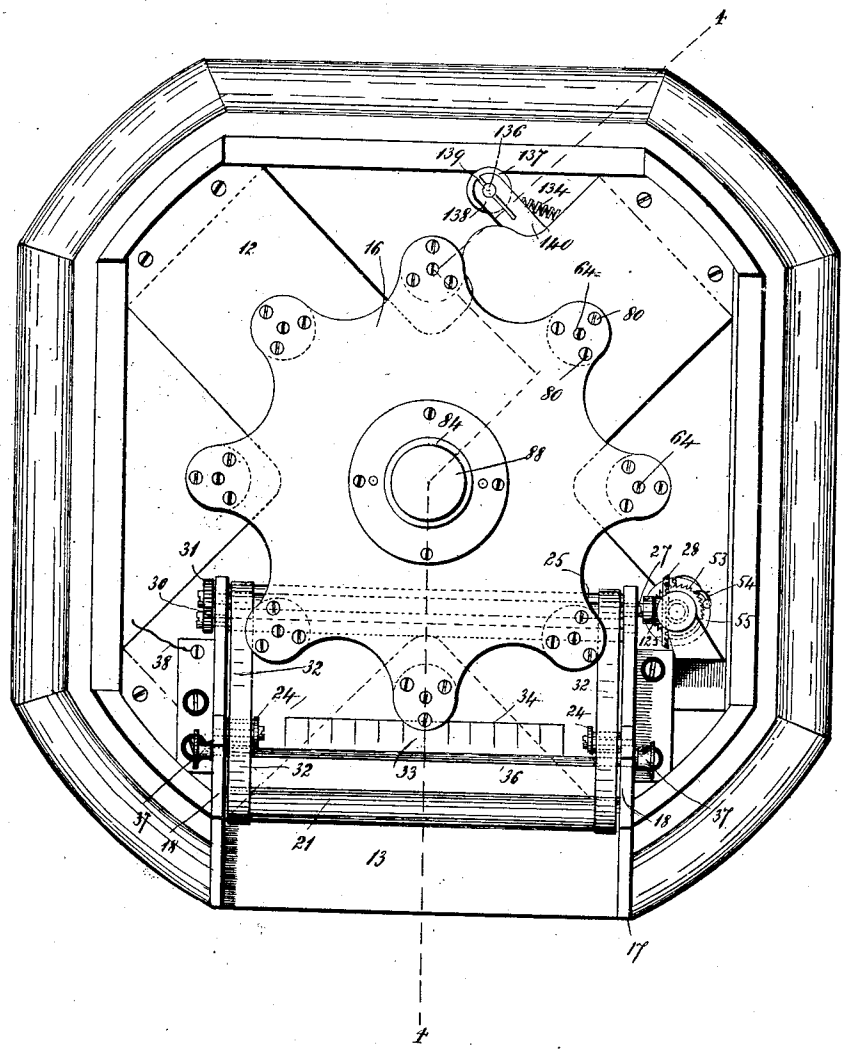

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FIG. 3.

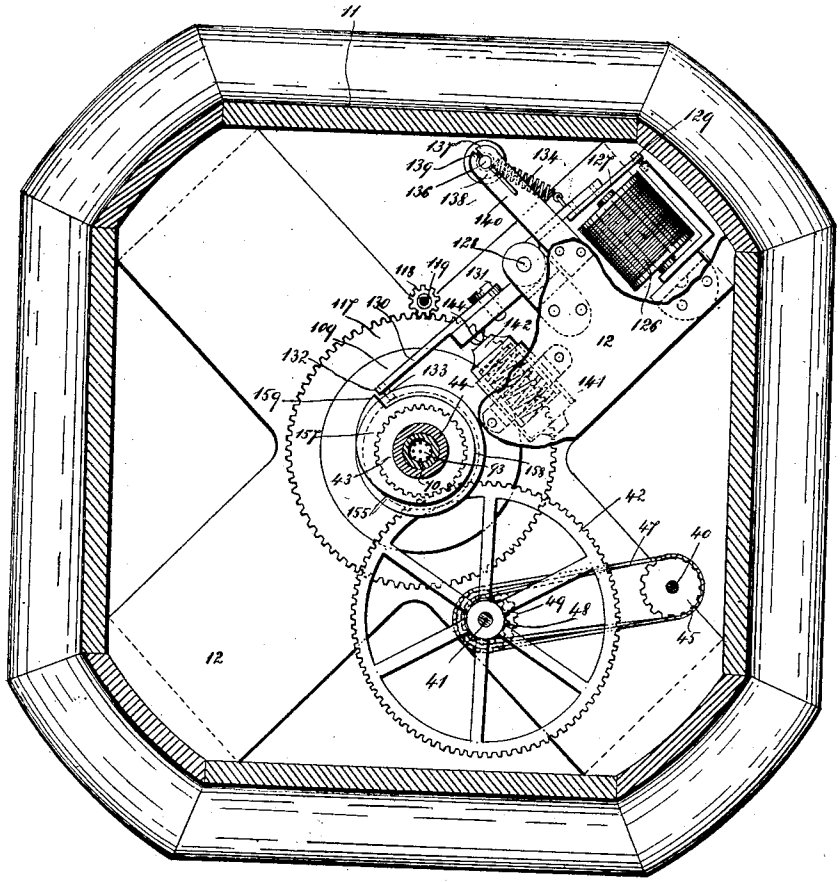

FIG. 5.

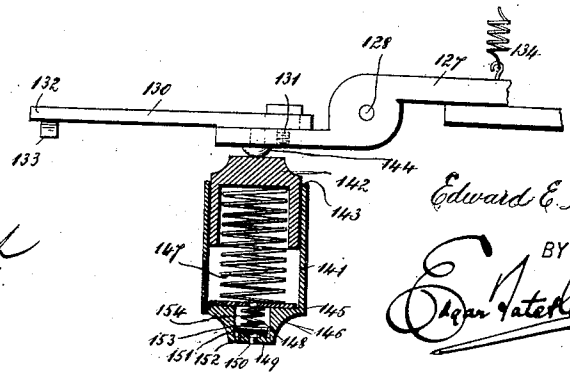

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FIG. 4.

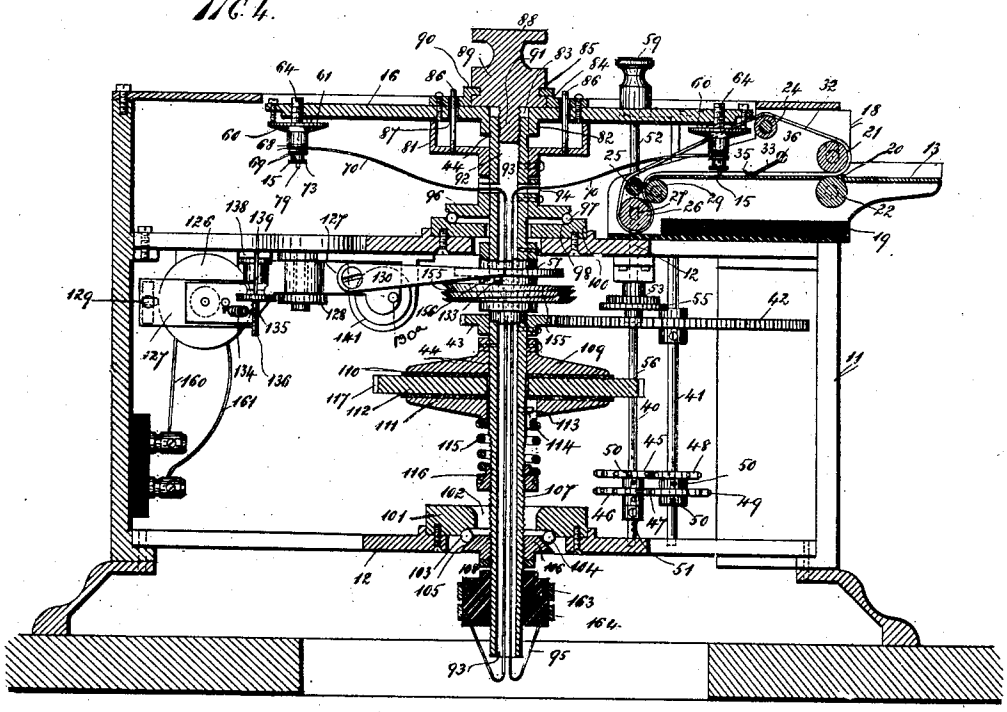

FIG. 6.

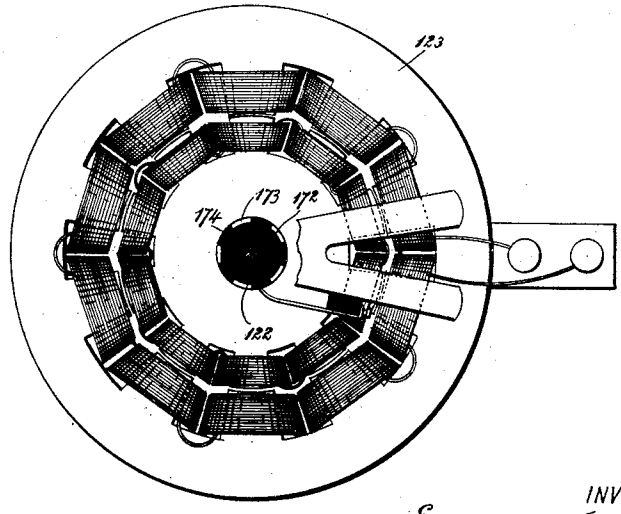

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FIG. 7.

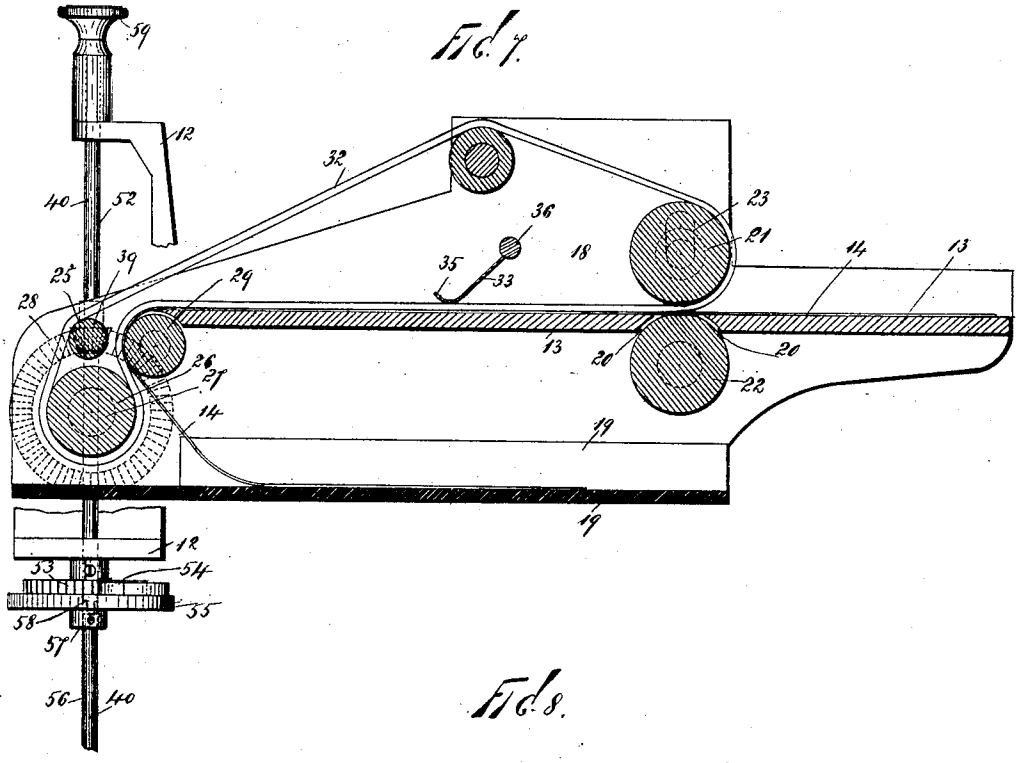
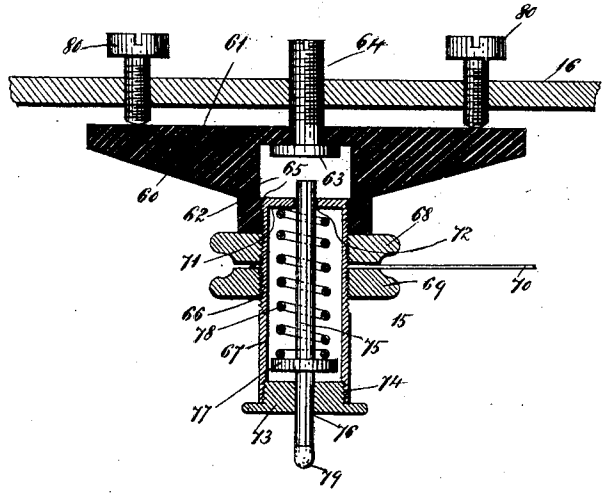


FIG. 8.



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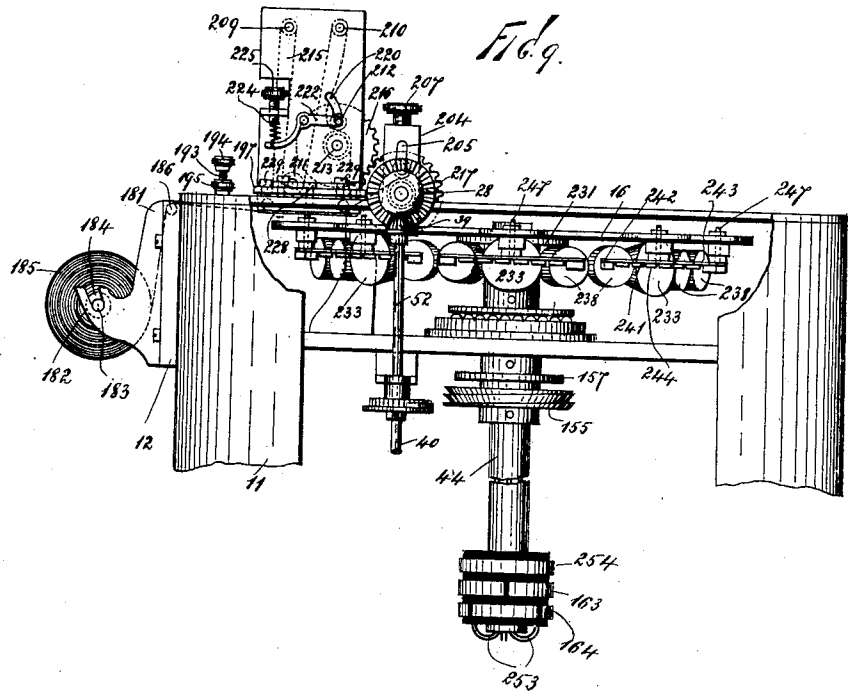

Fig. 9.

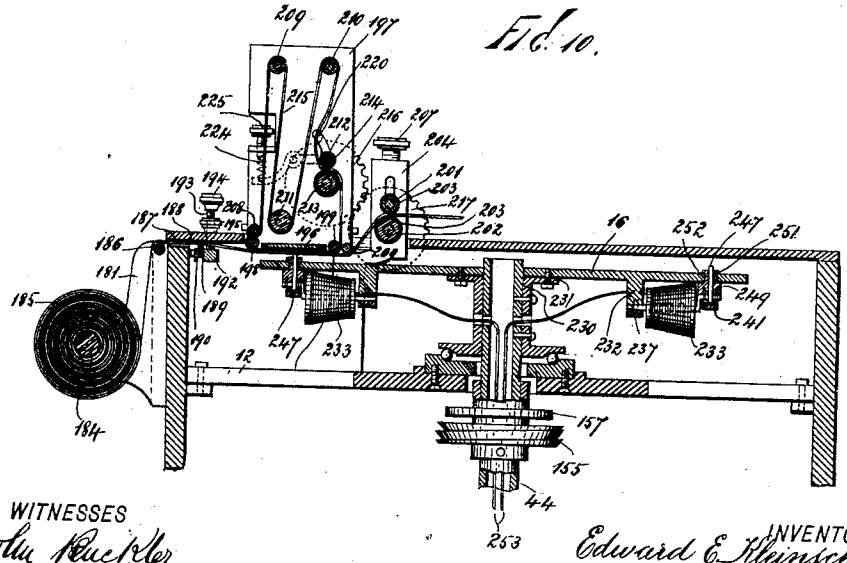

Fig. 10.

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FIG. 11.

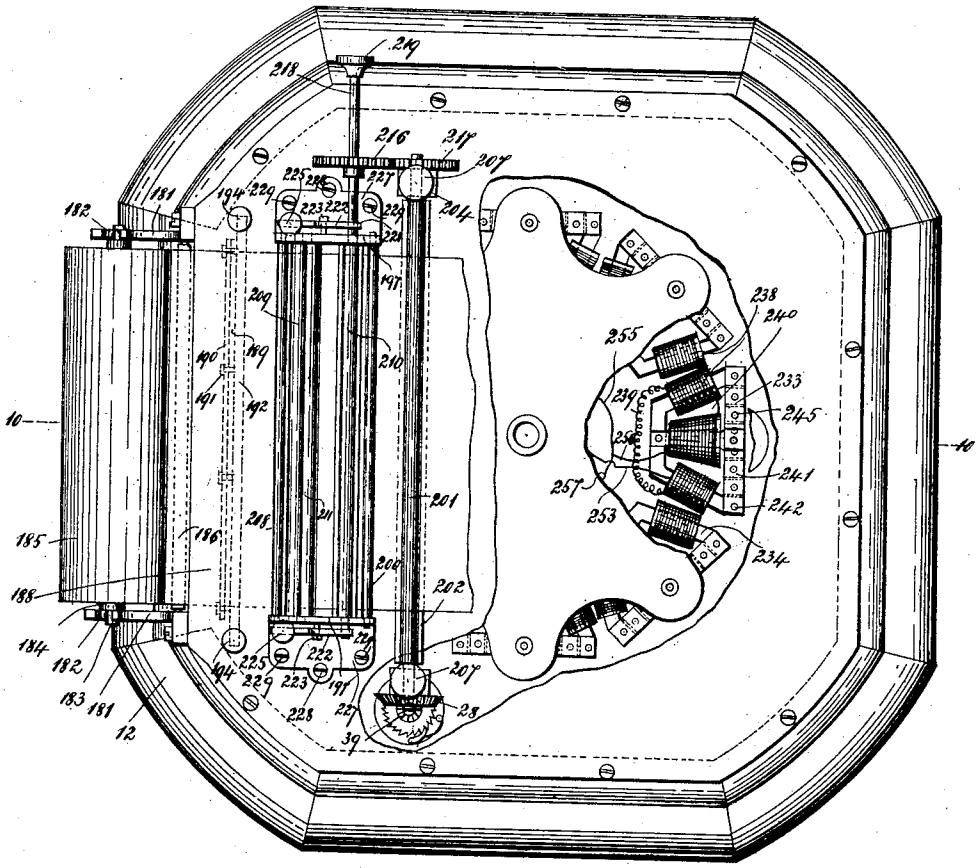

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Fig. 12.

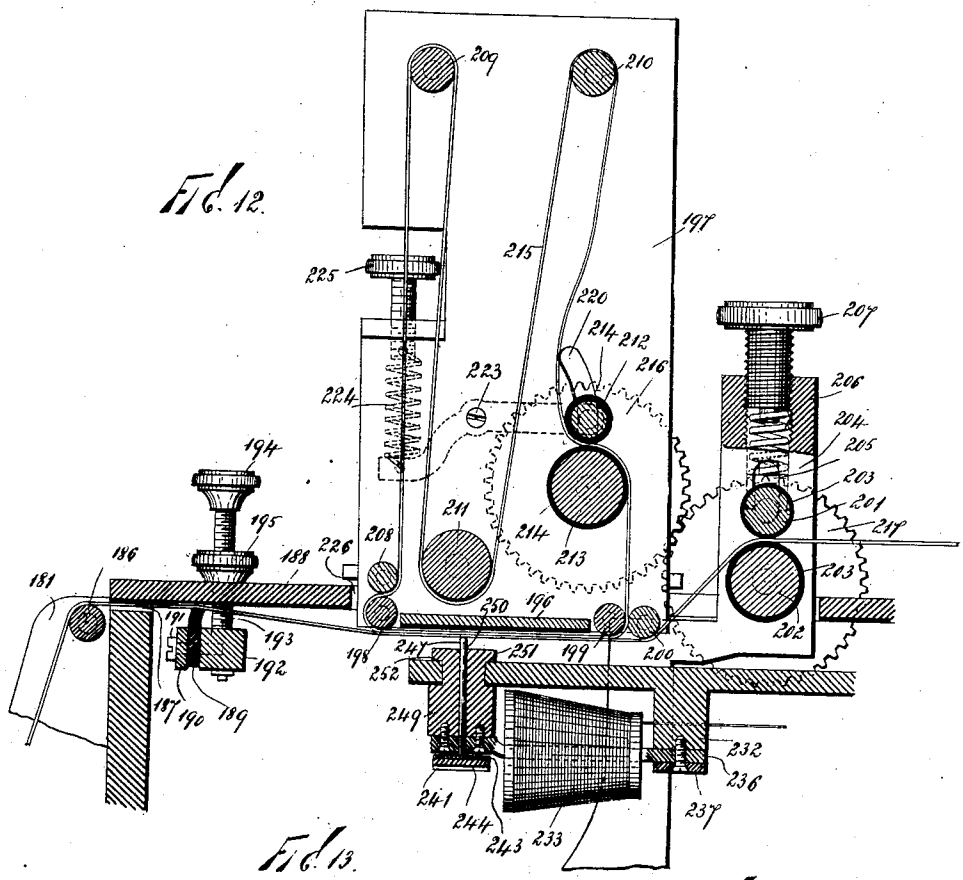


Fig. 13.

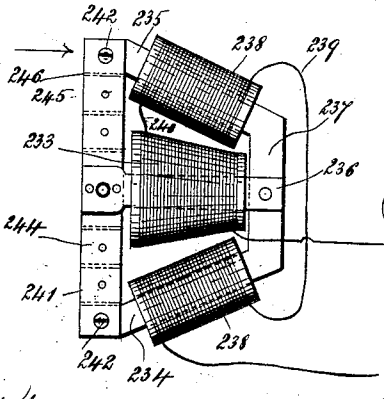
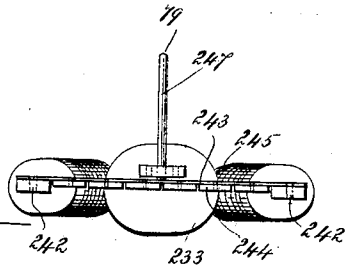


Fig. 14.



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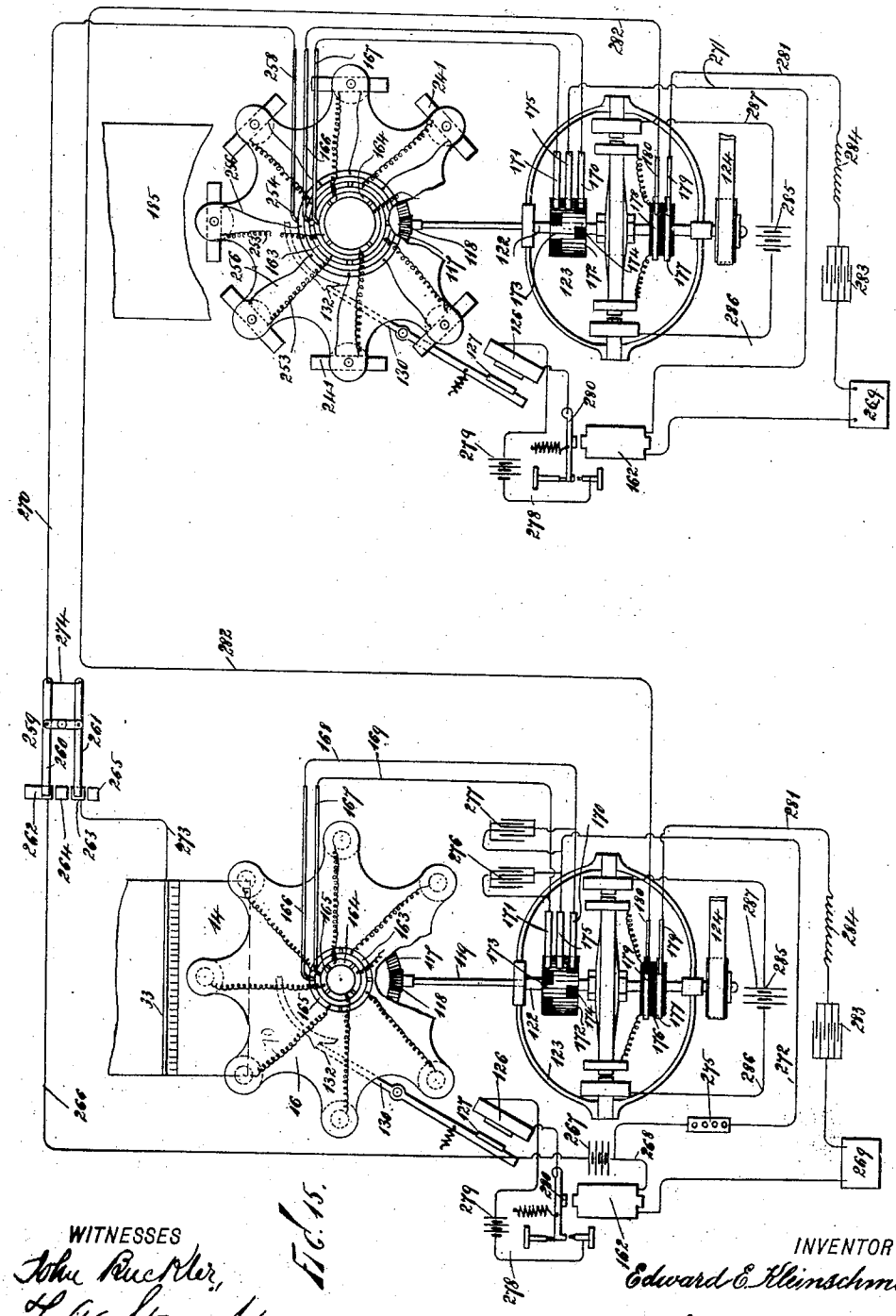

FIG. 15.

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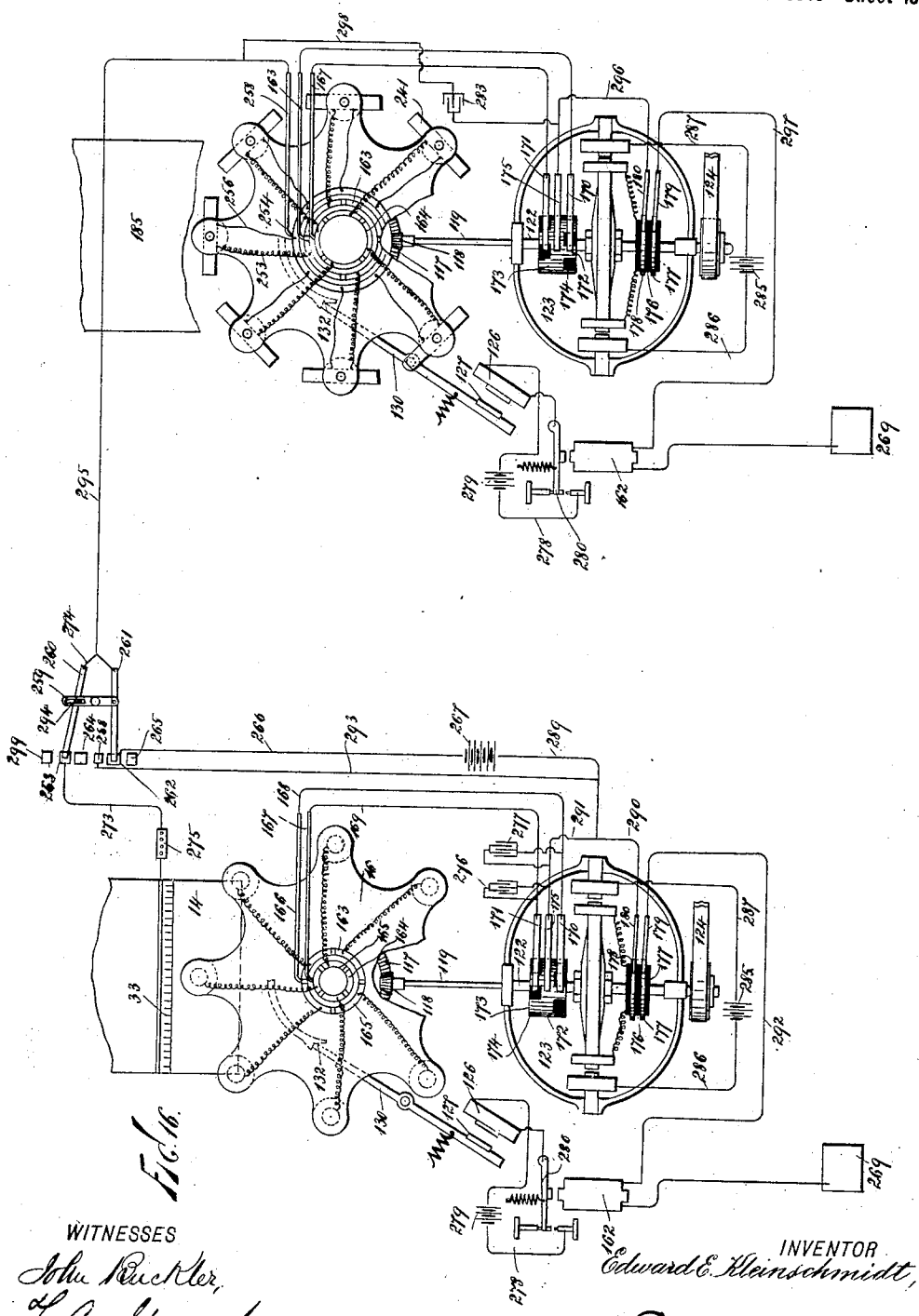

FIG. 16.

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UNITED STATES PATENT OFFICE.

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FACSIMILE-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 709,158, dated September 16, 1902.

Application filed November 6, 1899. Serial No. 735,938. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. KLEINSCHMIDT, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Facsimile-Telegraphs, of which the following is a full and complete specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates to facsimile-telegraphs of that class which embody in the transmitting machine or apparatus a stylus which contacts with a metal-foil sheet on which the message or picture to be transmitted is written or drawn with an insulating-ink, whereby the line-circuit is opened and closed and causes a corresponding actuation of a similar stylus in the receiving machine or apparatus, whereby the said latter stylus will mark or record a facsimile impression of the transmitted message or drawing.

The object of my invention is to produce an improved facsimile-telegraph which will be exceedingly simple in construction and mechanism, rapid and effective in operation, and convenient and inexpensive in use, and in which facsimile writing or pictures can be very rapidly transmitted continuously and in any desired length or extent without occasion for stopping the operation of the apparatus for the application at frequent intervals of the matter to be transmitted.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of my improvement are designated by the same numerals of reference in each of the views, and in which—

Figure 1 is a general side elevation, partly in section and with parts of the inclosing casing broken away, illustrating the transmitting machine or apparatus embodied in my invention. Fig. 2 is a top or plan view of said transmitting mechanism, parts of the top of the casing being removed. Fig. 3 is a horizontal transverse sectional view taken through the transmitting mechanism on the line 3 3 of Fig. 1. Fig. 4 is a vertical transverse sectional view of the transmitting-machine, taken on the line 4 4 of Fig. 2. Fig. 5 is a detail sectional view illustrating the spring and air-cushion resistance device for the armature of the unison-magnet. Fig. 6 is a top or plan view of the generator or motor mechanism, the view being taken on the plane of the line 6 6 of Fig. 1. Fig. 7 is a detail sectional view on a vertical plane through the feed mechanism for carrying the metal foil-paper. Fig. 8 is a detail vertical sectional view taken through one of the transmitting-styluses. Fig. 9 is a side elevation of the top portion of the receiving machine or mechanism as comprised in my invention, illustrating the receiving or recording stylus devices and the adjacent parts, part of the casing or framework being broken away. Fig. 10 is a vertical transverse sectional view of the top portion of the receiving mechanism, taken on the line 10 10 of Fig. 11. Fig. 11 is a top or plan view of the receiving mechanism, part of the top portion of the inclosing casing being broken away. Fig. 12 is a detail vertical sectional view illustrating the paper and carbon ribbon carriage mechanism of the receiving mechanism. Fig. 13 is a detail plan view of one of the recording-stylus devices removed from the stylus-carrier. Fig. 14 is a detail edge view of one of said recording-stylus devices. Fig. 15 is a diagrammatic plan view illustrating the general relative arrangement of the transmitting and recording mechanisms and of the circuit connections relating to and between the same, a two-wire line-circuit being shown; and Fig. 16 is a diagrammatic plan view corresponding to that shown in Fig. 15 and illustrating a single-wire line-circuit.

Referring to the drawings, 11 designates the casing of the transmitting or sending machine, said casing being of any suitable or convenient construction and being carried upon a framework 12, which may likewise be of convenient or adapted construction. I will now proceed to particularly describe said transmitting-machine as comprised in my invention.

At the front and top of the transmitting-machine is provided a horizontal table or platen 13, over which the metal-foil paper, as represented at 14, upon which the message or picture is written or drawn in insu-

lating-ink is adapted to travel in a continuous movement. A plurality of styluses 15 are carried upon a revolving plate 16, said styluses being arranged in a circular series, so that their points describe an arc over the surface of the metal-foil paper and contact with the same.

The carriage mechanism for effecting the continuous feed of the metal-foil paper comprises a suitable framework 17, embodying side plates or pieces 18, between which is carried the table or platen 13, said framework being secured to the main frame or casing of the machine, but being entirely insulated therefrom, as at 19. The table 13 has a transverse slot 20, immediately above and beneath which are mounted transverse rollers 21 and 22, respectively, having their bearings in the sides 18 of the frame 17. The upper one of these rollers 21 preferably has a vertical elongated bearing, as at 23, Fig. 7, whereby automatic adjustment of the space between said rollers is permitted. Above and in rear of the roller 21 are provided idlers or rollers, as at 24 24, journaled in the sides 18, and in rear of the table 13 is provided a roller 25, beneath which is a roller 26, said roller 25 being journaled in the sides 18 and the roller 26 being carried upon a shaft 27, having at one end a bevel-gear 28. Immediately in front of the roller 25 and at the rear end of the table 13 is provided a transverse roller 29, journaled in the sides 18 and carrying a gear 30, meshing with a gear 31, Fig. 2, upon the shaft of the roller 26. At opposite sides of the paper-carriage mechanism are provided elastic or friction bands 32, which form endless belts passing over the idler 24 downwardly to and around the roller 25 at the rear thereof, downwardly under the roller 26, upwardly between the rollers 26 and 29 and in rear of the latter, thence forwardly over the table 13, and upwardly and around the front of the roller 21, and thence rearwardly and upwardly to the idler 24. These elastic bands or belts 32 travel in a continuous movement, in which the portion resting immediately over the table 13 moves rearwardly, and in this connection it will be understood that the movement of the elastic band or belt tends to draw the main top feed-roller 21 downwardly in its elongated bearing with relation to the bottom main feed-roller 22, so that proper frictional conditions exist between said rollers. The elastic bands or belts 32 also serve to carry the metal foil-paper 14 rearwardly in a continuous uniform movement upon and over the table 13, said table being arranged between the sides 18 of the carriage-frame 17 and passing between the main feed-rollers 21 and 22, under the bands 32, around the rear roller 29, and between the same and the band, it being understood that the relative construction and arrangement is such that the free front end of the paper 14 will be fed in a return movement forwardly from the roller 29, under the table 13, and out again at the front end of the frame 17. The bands 32 clamp or bind the paper with a sufficient tension to maintain it properly upon the table 13 and at the same time feed it uniformly with relation to the action of the styluses. The bands 32 derive their motion from the band-roller 26, and the gear connection 30 and 31 between the rollers 26 and 29 gives a positive action to said roller 29 to aid in maintaining the positive feed of the metal foil-paper which is carried between said roller 29 and the band 32.

33 designates a brush which extends transversely across and above the paper-feed table 13 and forms the contact with the metal-foil top surface of the paper 14. This brush preferably consists of a flat metallic spring-plate having its lower edge provided with a series of parallel slits, as at 34, extending in a transverse plane with respect to the length of the brush-plate and operating to enhance the flexible bearing action of the same upon the foil-paper. The lower edge of the brush is preferably curved or turned upwardly, as at 35, so that it presents a smooth contact-surface to the paper, and the brush is carried upon a transverse rod 36, which passes at its ends through the sides 18 of the paper-carriage frame 17 and is provided upon its projecting ends with thumb-nuts 37, adapted to be tightened against the outer faces of the sides 18 to maintain the brush securely in the position in which it is adjusted in the regulation of its contact with or pressure upon the foil-paper. In this connection it will be understood that the brush is fixed upon the rod 36 and that when said rod is turned the adjustment of the lower edge of the brush with relation to the paper is effected, it being simply necessary for purposes of adjustment and securing of the carrying-rod 36 to operate the thumb-nuts 37. The brush normally projects in an inclined position in the direction of the line of travel of the foil-paper.

As above stated, the entire carriage-feed frame and mechanism is properly insulated from the main frame 11 and 12, and said frame and mechanism is comprised in the line or writing circuit, connection being made with one pole of the writing or line circuit by means of a wire in contact with any suitable portion of the paper-carriage frame—for instance, as indicated at 38 in Fig. 2. It will be clearly understood, however, that, if desired, only the contact-brush 33 need be comprised in the writing or line circuit, connection being made in any suitable manner with said brush and the brush being insulated from the paper-feed frame, in which case it would of course be unnecessary to insulate said frame and paper-feed mechanism from the main parts of the machine; but I prefer for purposes of more positive and absolute contact to have the whole paper-feed-frame mechanism comprised in circuit. The con-

nection with the other pole of the writing or line circuit exists through the styluses when they are in contact with the metal-foil top surface of the paper 14, the circuit being completed by the contact of the brush 33 with said surface.

From the foregoing description it will be understood that the metal-foil paper upon which writing or drawings or any desired markings have been made with insulating-ink can be fed in a continuous movement through the paper-feed mechanism and under the styluses, which latter are carried upon a revoluble plate and describe in a continuous successive movement a contact-arc with the foil-surface of the paper as the paper travels under the styluses, whereby the operation of the machine will be continuous with respect to any desired length of paper—for instance, a roll may be used—and no stoppage of the machine at frequent intervals is necessary.

The paper-feed mechanism is actuated by engagement of its bevel-gear 28 upon the shaft 27 of the main rear feed-roller 26 with a pinion 39 upon a shaft 40, extending vertically or at right angles to the roller-shaft 27 and having suitable bearings in the general framework 12 of the machine. Said shaft 40 is provided at its lower portion with a connection with a supplementary shaft 41, operating in suitable bearings in the framework 12 and carrying a gear 42, meshing with a gear 43, fixed upon a vertical revoluble shaft 44, which is centrally arranged in the machine and carries the stylus-plate 16. Said gears 42 and 43 are of relative sizes adapted to impart to the paper-feed mechanism a proper relative speed or movement with respect to the revolution of the shaft 44 and the stylus-plate 16, the gear 43 being preferably of considerably smaller diameter than the gear 42. The connection between the shafts 40 and 41 is preferably adjustable or variable, so that the speed of the paper-feed mechanism may be varied and regulated as desired with respect to the speed of revolution of the shaft carrying the stylus-plate and styluses. This connection may be effected by means of any suitable or adapted mechanism; but I have herein shown one form of mechanism for accomplishing it. The illustrated mechanism comprises two sprocket-gears 45 and 46, respectively fixed on the shaft 40 and individually connected by chains 47 with sprocket-gears 48 and 49, respectively, of different diameters, upon the shaft 41. The sprocket-gears 48 and 49 are loose upon the shaft 41, but may be tightened thereon by means of set-screws 50, passing through their hubs. Thus when the gear 48 or 49 is not tightened up upon the shaft 41 it will simply revolve thereon and will not operate to actuate the shaft 40; but when one or the other of said gears 48 and 49 is tightened up upon its shaft it will cause the shaft 40 to revolve. The lower sprocket 49 may be sustained by a set-collar 51, placed beneath it on the shaft 41, when said sprocket is loose, while the upper sprocket 48 will be sustained when loose by resting upon the sprocket 49.

I provide a mechanism whereby the paper-carriage mechanism may be operated by hand to feed the foil-paper, especially in the initial introduction of the latter between the main front feed-rollers 21 and 22 and beneath the bands 32, independent of any revolution of the main operating-shaft 44. This independent action is preferably accomplished by means of the mechanism illustrated in the accompanying drawings, in which the shaft 40 is divided into an upper and lower section having a pawl-and-ratchet coupling. In this construction the upper section 52 of the shaft 40 carries at its lower end a ratchet-disk 53, which is engaged by a spring-actuated pawl 54, carried upon a top plate or disk 55 on the lower section 56 of the shaft 40. The top end of the lower section 56, as shown at 57, Fig. 7, preferably enters a corresponding recess 58 in the upper section 52 of the shaft, whereby a convenient and effective joint between said sections of the shaft is formed. The sprocket-gear mechanism between the shaft 40 and the shaft 41, which latter derives its revolution from the main operating-shaft 44, is upon the lower shaft-section 56, so that when said lower shaft-section is revolved its pawl 54 will engage with the ratchet 53 upon the upper shaft-section 52 and cause the latter to correspondingly revolve and operate the foil-paper-feed mechanism; but when the lower shaft-section 56 is not revolving (by reason of the stationary condition of the main operating and stylus-carrying shaft 44 and the consequent stationary position of the connecting-shaft 41) there will of course be no revolution of the upper shaft-section 52; but said upper shaft-section is free to turn by independent power to cause the actuation of the foil-paper-feed mechanism, in which turning movement the ratchet 53 will simply slide past the pawl 54. This independent turning of the upper shaft-section 52 to operate the paper-feed mechanism, as hereinbefore mentioned, can be conveniently effected by hand by means of a knob or head 59, provided at the top end of said shaft-section 52 and preferably projecting at the top of the casing of the machine, as illustrated in Figs. 1 and 4.

From the foregoing description it will be understood that the foil-paper is fed continuously and relatively to the movement of the styluses whenever the styluses are describing their movement over and in contact with said paper, but that when the styluses are at rest the foil-paper can still be fed to effect its adjustment as desired.

The main central operating-shaft 44 carries at its top end the plate 16, which carries the styluses 15, said plate being in the form of a disk, as herein shown, or a suitable framework, as preferred. The plate 16 carries a set of styluses projecting from its under side

and arranged in a circular series. I prefer to employ eight styluses, as herein illustrated, though any suitable or desired number representing corresponding multiples may be employed. The sending-styluses 15 respectively embody a base portion or body 60, which forms the top portion of the stylus member and may be constructed of vulcanized rubber or other suitable non-conducting or insulating material. The top surface 61 of the base member 60 is preferably in the form of a circular disk and flat. The member 60 is provided centrally and in its under side with a cylindrical recess 62, accommodating the head 63 of a securing and set screw 64, which projects upwardly through the plate 16 and is adapted to be turned to adjust the stylus device in a vertical plane, and thus control its pressure upon or contact with the top foil surface of the paper 14, it being understood at this point that the table 13 virtually forms a platen upon which the foil-paper rests when it receives the pressure or contact of the stylus-point. The stylus device 15 is thus connected with its carrying-plate 16 by the main central screw 64, which latter has the further office of an adjusting means. The recess 62 is interiorly threaded, as at 65, and this threaded bore receives the top exteriorly-threaded end 66 of a tube or cylinder 67, carrying the stylus-point proper. The cylinder 67 may be vertically adjusted by means of this screw connection to effect the main or initial vertical adjustment of the stylus device with relation to the table or platen, and it is securely retained in position by means of a jam-nut or disk 68, operating upon its exterior threads 66 and bearing tightly against the bottom side of the top base-piece 60. Another jam or lock nut or disk 69 is mounted upon the exterior threads 66 of the cylinder 67, below the nut 68, and serves to lock or tighten the latter in position, and the wire, as represented at 70, connecting the stylus with one pole of the writing or line circuit preferably has its end secured in connection with the stylus device by simply binding the same between the nuts 68 and 69. It will be understood that the whole stylus device below the non-conducting or insulating base 60 is in circuit, by reason of the wire connection 70, when the stylus-point is in contact with the foil-paper. The cylinder 67 is provided with a closed inner or top end 71, having an opening 72, and its outer or bottom end is closed by a thumb-nut 73, engaging interior threads 74 in the cylinder. The stylus proper consists of a rod 75, which is adapted to have a vertical sliding movement within and through the top opening 72 and an opening 76 in the bottom nut 73, it being firmly guided in said openings. This rod carries a cross shoulder or stop 77 at its bottom portion within the cylinder 67, between which shoulder or projection and the top 71 of the cylinder is interposed a coiled spring 78, surrounding the rod and controlling its vertical yielding movement.

It will be understood from the structure just above described that the stylus proper, 75, and its spring 78 are detachable from the cylinder 67, that said cylinder is detachable from its carrying-base 60, and that the whole stylus device is detachable from the carrying-plate 16, all of which can be conveniently and quickly effected whenever desired for purposes of substitution or repair. It is also evident that convenient and material adjustment or variation in the vertical position of the stylus can be effected.

The projecting lower or bottom end of the stylus-rod 75 carries the contact-point 79, which passes or slides over the top foil surface of the paper 14, this contact-point being preferably rounded, as shown. I prefer to construct the stylus of non-corrosive metal and to form the tip or contact-point 79 of a very hard substance—such as, for instance, iridium. To enable adjustment of the stylus in a horizontal or lateral plane to effect the precise and proper contact of its point 79 as desired, I provide set-screws 80, which are arranged in a circular series with relation to the top disk surface 61 of the stylus-base 60 and operate in the plate 16, from which latter they project downwardly with their lower ends in contact with said top surface 61 of the stylus-body 60 near the outer edge or periphery thereof. These screws thus form a brace, by reason of their relative arrangement with respect to the stylus device operating with respect to or in conjunction with the central securing and adjusting-screw 64, to maintain the stylus device in rigid or perfect adjustment; but by operating said screws 80 the adjustment of the stylus device in a horizontal or lateral plane may be conveniently effected, as will be well understood, there being sufficient yielding or play of the stylus-base 60 around the central screw 64 to permit of the slight adjustment necessary through the operation just stated. The relative construction and arrangement are such that two styluses will be simultaneously in contact with the foil-paper in the operation of the machine.

The connection of the stylus-plate 16 with the shaft 44 is preferably such that said plate may be adjusted in a vertical plane upon said shaft and carry the whole set of styluses in such vertical adjustment for the purpose of lifting the styluses above the plane of contact with the foil-paper, so that the latter can be inserted or removed without contact with the styluses or for other purposes when and as desired. It is desirable to provide for the convenient and rapid operation of this vertical adjustment by which the stylus-plate is moved to bring the stylus-point down to or up from the plane of their normal contact with the foil-paper, and for this purpose I preferably employ the structure herein illustrated, in which the shaft 44 is provided at its top end with a laterally-extending hub 81, upon which the plate

16 rests. The plate 16 is further provided with a downwardly-projecting annular flange 82, surrounding a central opening 83, which flange embraces and is adapted to slide upon the extreme top end of the shaft 44. On top the plate 16 and surrounding the opening 83 is secured an annular plate or ring 84, provided at its inner edge with an inwardly-projecting flange 85. The hub 81 carries upwardly-projecting pins or studs 86, occupying diametrically opposite positions with respect to the shaft 44 and extending through corresponding openings 87 in the plate 16 and its ring 84. These pins thus serve to lock the plate 16 in connection with the shaft 44, so that it will be carried in the rotary movement of said shaft; but they will at the same time, while they always maintain this locking connection, permit vertical movement or adjustment of the plate 16 with respect to the shaft. This vertical movement is effected by a thumb-screw or revoluble cap-piece 88, having an enlarged base 89, provided with a circular annular groove 90, corresponding to the flange 85 upon the ring or plate 84 and receiving the same, so that the member 88 turns upon said flange 85 and in its vertical movement carries the plate 16 by reason of its engagement with said flange. From the under side of the base 89 of the thumb-screw 88 projects a threaded stem 91, which engages interior threads 92, provided in the open top end or bore of the shaft 44. By reason of the construction and arrangement just described it will be understood that by merely turning the cap-piece 88 the whole stylus mechanism can be instantly raised or lowered, a very slight turning movement being all that is necessary to effect the requisite degree of adjustment.

The main central shaft 44 is tubular or hollow or provided with a continuous longitudinal bore, as at 93, which enables a light construction and also provides for the simple and convenient carriage of the line-wires of the styluses to their point of connection with the commutator rings and brushes. In this connection I may mention that all features of construction and parts of the apparatus are designed to be of light weight and to be of simple construction and operation to facilitate the high speed or rapidity and continuous movement desirable in the operation of the apparatus. For instance, the stylus-carrying plate 16 is preferably constructed of aluminium and may be of web form. The wires 70, which individually extend from the transmitting-styluses 15 and connect the same with the writing line-circuit, are carried inwardly to and through lateral openings 94 in the walls of the shaft 44 at a point beneath the top hub 81, which openings intersect the central bore or opening 93 of the shaft, there being sufficient slack left in the wires to enable the vertical adjustment of the stylus mechanism hereinbefore referred to. From the openings 94 the wires 70 (which are of course insulated between their point of contact with the respective styluses and throughout their passage or contact with relation to the shaft 40) extend downwardly through the bore 93 of the shaft 44 and project from the lower end of the latter, from which point they are carried, as at 95, to commutator devices, which will be hereinafter described and which are mounted and secured upon the lower end of the shaft 44.

The main shaft 44 is preferably sustained by and operates upon ball-bearings, a convenient arrangement of said bearings being illustrated in the accompanying drawings. In the illustrated construction the top portion of the shaft is provided with a lateral circumferential flange 96, having a beveled under edge 97, which bears upon a set of balls 98, traveling against a shoulder or groove 99 in the top of a bearing-plate 100, which is sustained upon a part of the main frame 12 and through which passes the shaft 44. At the lower portion of the main frame 12 is carried a bearing plate or block 101, having a central opening 102, through which the lower portion of the shaft 44 passes, this opening being also of sufficient diameter to permit the passage of a set-nut and spring involved in a frictional connection mechanism by which the main shaft is revolved and which will be hereinafter described. In the under side of the bearing-plate 101 is provided a shoulder or groove 103, against which bears a set of balls 104, which also have their lower portions bearing against a beveled edge 105 upon a collar 106, mounted upon the lower portion of the shaft 44. This collar is preferably longitudinally adjustable upon the shaft by means of a threaded connection with an exteriorly-threaded lower end portion, as at 107, upon the shaft, by means of which adjustability the bearing-collar 106 can be operated to tighten or loosen both the lower and upper set of ball-bearings, as will be readily understood. A jam-nut 108 is preferably provided upon the threaded portion 107 of the shaft 44 and tightens against the bottom of the bearing-collar 106 to secure the latter in position. The shaft 44 is operated by a frictional connection with its motor source, so that when said shaft is locked against revolution (by means of certain automatic and electrically-actuated mechanism, which will be hereinafter described and which forms an important feature of my invention) the motor source or power through which said shaft is normally revolved can continue in its movement. It is thus not necessary to stop the main operation of the power mechanism to cause a stoppage or cessation of the movement of the stylus mechanism and of the foil-paper-feed mechanism, both of said latter mechanisms which are concerned in the electrical facsimile transmission being capable of independent stoppage and starting without relation to the motor source by which the main shaft 44 is revolved. The frictional connection just above mentioned is preferably

effected by means of the structure shown in the accompanying drawings, which is intermediately arranged between the upper and lower ball-bearings of the main shaft and comprises an upper friction-disk 109, secured to the shaft 44 and circumferentially projecting therefrom. This friction-disk carries a frictional bottom surface 110, formed of felt or other suitable or adapted material. A similar under or bottom friction-disk 111 is provided, which, while it is locked against rotary movement upon the shaft 44, is designed to have a spring-actuated sliding movement, and it is similarly provided with a top friction-surface 112. The under friction-disk 111 is secured against turning movement upon the shaft 44 by means of a pin or stud 113, projecting laterally from the shaft and received in a corresponding groove 114 in the disk or plate 111, said groove extending on the longitudinal plane of the shaft, whereby the pin will operate to guide the disk in its sliding movement or adjustment and at the same time retain the same in its relative connection with the shaft. Upon the shaft 44, beneath the disk or plate 111, is mounted a coiled spring 115, the upper end of which bears against the disk, while its lower end bears against an adjustable nut 116, which operates upon the lower threaded portion 107 of the shaft. By adjusting this nut the tension of the spring can be regulated as desired, and it will be understood that the action of the spring is to cause the slidable under disk or plate 111 to operate as a clamp in connection with the fixed upper disk 109. The lower threaded portion 107 of the shaft 44 is of sufficient extent and is designed to carry the nut 116 and the bearing-collar 106 in their full limit of longitudinal adjustment, and the lower end portion of the shaft beneath its threaded portion 107 is preferably of a sufficiently-reduced diameter to enable the placing of the threaded members 106 and 116 upon the shaft and into engagement with the threaded portion thereof, and, as above mentioned, the opening 102 in the bearing-plate 101 is of sufficient diameter to also enable the passage of the nut 116 and the spring 115 into their proper positions.

It will be noted that the construction and arrangement above set forth provides for the convenient attachment and detachment of the various parts constituting the mechanism for any desired purpose.

117 designates a main operating-gear, by which the shaft 44 is adapted to be revolved. This gear is loosely mounted upon the shaft between the friction disks or plates 111 and 109, and it is adapted and designed to be firmly clamped between said plates, so that by frictional contact of its faces with the respective friction-faces 110 and 112 of said clamping-plates it will be connected up with the shaft and will operate to revolve the same. However, when the shaft is firmly locked against revoluble movement said gear 117 will turn upon the shaft and cannot actuate the same. The gear 117 meshes with a pinion 118 upon a shaft 119, having its bearings in the main framework 12 of the machine and carrying a gear 120, meshing with a pinion 121 upon the main shaft 122 of an electrical motor or generator 123, which may be of suitable or adapted construction and is conveniently arranged with relation to the transmitting-machine forming the subject-matter of the foregoing description. This motor or generator 123 will in its characteristics and features be hereinafter more fully described. If it is running simply as a generator, a suitable source of power will be connected to its main shaft 122, as indicated by the belt connection at 124 in Fig. 1; but if it is running as a motor it will be operated in the usual manner by an electric current, and the independent motor-power connection, as at 124, will be dispensed with. The use of the generator or motor 123 as a motor or as a generator or alternately as both a motor and a generator will be hereinafter referred to.

From the foregoing description it will be understood that the only parts of the general mechanism or machine which are comprised in an electric circuit are the foil-paper-carriage mechanism (the brush of which mechanism is the only part which need essentially be in circuit) and the stylus devices. To complete the insulation of the paper-carriage mechanism from the general framework of the machine, the shaft 27 of the roller 26, which carries the gear 28, meshing with the gearing 39 upon the shaft 40, is insulated, as represented at 125 in Fig. 2, at a point between the gear 28 and the main portion of said shaft 27.

I provide for automatic stoppage of the revolution of the main shaft 44 by electrical action with relation to the general operation of the machine in its transmitting function by means of the mechanism which I will now proceed to describe. The electrical connection and adjustment of such mechanism with relation to the writing or line circuit is such that while the styluses are passing over the foil surface of the paper which carries an insulating-ink the electrically-actuated shaft-stopping mechanism will not operate to stop the shaft 44; but when the styluses reach a part of the foil surface of the paper which contains no insulating-ink and travel of the styluses upon such non-insulated surface of the foil-paper is maintained for any material distance then the main-shaft-stopping mechanism will automatically operate. The function and operation of this stop mechanism is important in my invention, inasmuch as its main purpose is to automatically insure the corresponding and uniformly instantaneous stoppage and starting of both the transmitting and recording machines at the respective ends of the line, it being thus an important element in the perfect synchronizing of the machines and apparatus, which is so essential in facsimile-telegraphs of this character. This is especially important with relation to the

starting of the machines, it being particularly necessary that the machines shall both start at the same instant and with perfect synchronism and be thereafter maintained in step during the operation of the apparatus. The automatic stopping mechanism comprises a unison-magnet 126, preferably mounted upon the main framework 12 and having its armature 127 fulcrumed upon the framework, as at 128, so that it forms a lever, it being movably retained or held in connection with the magnet-frame in any suitable manner, as at 129. This armature carries at its outer end portion an arm 130, which is pivotally mounted at its inner end upon the armature, as at 131, so that it can move or swing in a plane at right angles to the swinging or pivotal movement of the armature. The relative construction and arrangement of the armature mechanism with respect to the main vertical shaft 44 is such that the armature swings in a horizontal plane with respect to said shaft, while the pivoted arm or extension 130 swings in a vertical plane with respect to the shaft. The arm 130 in its normal position rests upon a pin 130^a upon the armature 127, and the arm tends toward its normal position in virtue of its weight. The outer end 132 of the pivoted arm 130 is adapted to form a stop by contact with the devices hereinafter described, and from said outer stop end there projects downwardly and inwardly a finger 133, which is preferably beveled and is adapted to engage a worm device carried upon the shaft 44, which worm device will be hereinafter fully described. The armature 127 is retained in withdrawn position with respect to the unison-magnet by means of a coiled spring 134, which is preferably adjustable. The adjustment of this spring may be effected conveniently by having its outer end connected to a thread 135, which will wind upon a turn post or shaft 136, carrying an operating disk or thumb-piece 137 and having its end clamped between spring-jaws 138, formed by bifurcating, as at 139, the end of a plate or arm 140, projecting from and secured to the main framework 12. The free end of the armature 127 beyond its fulcrum 128 is acted upon by an air and spring cushion device, against the force of which the armature acts when it withdraws from the magnet 126 and which accelerates the movement of the armature when it is attracted by the magnet. This spring and air cushion device preferably consists of a cylinder 141, suitably mounted upon the main framework 12 and carrying a plunger 142, which fits neatly within the open front end 143 of the cylinder and bears against the free end of the armature 127, the point of contact between the piston and armature being preferably effected by means of a rounded head or knob, as at 144, which may be carried by a screw engaging the armature. Within the cylinder at its rear end or base is mounted a movable plate or disk 145, having a central opening 146, between which plate and the inner portion of the piston or plunger 142 is arranged a coiled spring 147. Opening from the main chamber of the cylinder at the rear end is a supplementary chamber 148, into which the opening 146 of the plate 145 leads, and the rear or outer wall 149 of this supplementary chamber 148 is provided with an air opening or vent 150. Within the rear end or base of the supplementary chamber 148 is mounted an elastic washer 151, which has a sharp and effective valve-seat against an annular rib or projection 152, extending inwardly from the wall 149. Said elastic washer preferably carries a metallic plate 153 at its inner face, between which plate and the opposite face of the main plate 145 is interposed within the supplementary chamber 148 a light coiled spring 154. The device and mechanism as herein just described and which is particularly illustrated in Fig. 5 constitutes an air and spring cushion resistance for the armature of the unison-magnet, and while I prefer to employ the construction as shown it will be understood that any other suitable or adapted resistance device may be used.

Upon the main shaft 44 is secured a worm disk or collar 155, which is beveled, as at 156, to correspond to the bevel of the finger 133 of the arm 130, the relative construction being such that when said finger is in engagement with the worm it will travel upwardly thereon, and at a slight distance above the worm 155 the said shaft is also provided with a circumferential ring or flange 157, having an eccentric periphery 158, terminating in an abrupt shoulder or stop 159, the relative distance between the flange 157 and the worm 155 being such that when the finger 133 arrives at the top of the worm the stop end 132 of the arm 130 is on the plane of the periphery of the disk 157 and its shoulder 159. It will be understood that the worm and engaging stop mechanism are arranged upon the shaft 44 at a point above its frictional connection with the source of power or between such frictional power connection and the stylus mechanism, this being the preferred arrangement. The unison-magnet is connected by the usual wires, as shown at 160 and 161 in Fig. 4, in an individual circuit, which is operated by a unison-relay, (represented at 162 in Fig. 1,) as will be hereinafter described, said unison-relay being in connection with the main-line circuit.

The commutator-rings carried by the main shaft 44 (preferably at its lower end) for the connection of the wires of the styluses 15 with the writing or line circuit consist of two independent sets, as at 163 and 164, each set consisting of separate segments 165. The segments of each set have contact with a brush from which extends a wire connection, said brushes and wire connection being respectively shown at 166 and 167 and 168 and 169 in Fig. 1. The wires 168 and 169, respectively, lead to brushes 170 and 171, which are comprised in what I denominate a "select-

ing-commutator" 172, having two sets of commutator-segments, as at 173 and 174, respectively, arranged with relation to the brushes 170 and 171, this selecting-commutator being preferably arranged upon the shaft 122 of the generator or motor 123, as shown in Fig. 1 of the drawings. Comprised in the selecting-commutator is another brush, as shown at 175, which does not contact with the commutator-segments 173 or 174, but contacts with an intermediate or middle ring or continuous part of the commutator which is in connection with the segments 173 and 174. The generator-commutator is shown at 176 mounted on the shaft 122 and comprising two continuous commutator-rings 177 and 178, respectively, in contact with which are brushes 179 and 180, respectively. For convenience and simplicity in construction the middle ring or continuous portion of the commutator and the segments 173 and 174 may be made integral, as shown.

I have herein illustrated a set of eight transmitting-styluses, and my description of the connections and related parts will be hereinafter made with reference to this number of styluses; but it will be understood that any suitable or desired number of styluses may be employed, the specific preferred arrangement being such that two or more styluses are simultaneously in contact with the foil surface of the paper 14 for purposes of greater speed and more perfect or effective operation. It will be apparent, however, that in its mechanical structure the machine is perfectly adapted with suitable manifest variation for facsimile telegraphic transmission if only a single stylus were used. The commutator-segments 165 of the respective sets 163 and 164 upon the shaft 44 are four in number, and the wires 70 from the respective styluses 15 are connected, respectively, to the eight commutator-segments 165, which are arranged, as before described, in separate sets of four each. The styluses are connected thus in alternation—that is to say, the wire 70 from one stylus will be connected to a commutator-segment 165, comprised in the set 163, while the next adjoining or following stylus will have its wire 70 connected to the commutator-segment 165 in the other set 164, the general relative arrangement being accordingly such that the two styluses which are in direct diametric plane across the stylus-plate 16 and are thus at opposite sides thereof will be both connected to segments 165, comprised in the same set or series, so that when one of said styluses is in contact with the foil-paper the opposite stylus will be out of contact; but the respective pairs of styluses which are adjoining or which follow one after the other and which are simultaneously in contact with the foil-paper will be in connection, respectively, with the segments 165 of the different sets 163 and 164. The separate sets of segments 173 and 174 of the selecting-commutator, which sets are respectively in connection, by means of the brushes 170 and 171 and the wires 168 and 169, with the brushes 166 and 167 of the respective stylus commutator-segment sets 163 and 164, are five in number, as indicated in Fig. 6.

I will now proceed to describe the recording or receiving machine, which is arranged at the other end of the line and in connection with the transmitting-machine.

The recording-machine embodies the same general framework and structure as the transmitting-machine, has the same arrangement of alternating-current generator or motor, the same connections between its "selecting-commutator" and the commutator to which the recording styluses are connected, the same arrangement of unison-magnet relay, the same arrangement of unison-magnet in connection therewith, the same arrangement of automatic electrically-actuated stop mechanism, and the same general arrangement of power-transmission to effect the revolution of the main stylus-carrying shaft. I have therefore not duplicated the illustration of these general structural features which are common to both the transmitting and recording machines, nor will it be necessary to duplicate the specific description of said general structure which is common to both, the illustration and description of the recording-machines being confined to the stylus mechanism, the carbon-ribbon and recording-paper feed mechanism, and the structural features in which said machines differ in their adaptation to the respective offices which they perform in the general and complete operation of my improved facsimile telegraph apparatus. Corresponding parts which are in the main structurally indentical are designated by the same numerals of reference in the illustration of both the transmitting and the recording machines.

The recording-paper feed mechanism of the recording or receiving machine comprises brackets 181, projecting from the general framework 12 of the machine, preferably at the front and top portion, which brackets are provided with slots 182, in which are set the ends or gudgeons 183 of a shaft 184, carrying a web or roll of paper 185. The feed end of said paper-web is passed upwardly and over a transversely-extending idler-roller 186, which preferably has bearings in the brackets 181, and from thence it passes through a slot 187 in the framework 12, just beneath a top plate 188, comprised in the machine-framework. It then passes beneath said plate 188 and is frictionally held or retained in contact with the under side of the plate by means of an upwardly-projecting elastic strip 189, preferably formed of rubber, which is secured or clamped by a cross-piece 190, held by screws 191, entering a vertically-adjustable cross-bar 192. Said cross-bar 192 is carried upon a threaded stem or rod 193, projecting upwardly through the plate 188 and carrying a thumb-piece or head 194 at its

top end, by the adjustment of which threaded rod the cross-bar 192 may be regulated in position vertically to govern the pressure of the top edge of the elastic strip 189 upon the paper 185. The threaded rod 193 is secured in adjusted position by means of a jam-nut 195, working upon said rod and bearing against the top of the plate 188. From its frictional retainer 189 the paper passes within the machine and under a table or platen 196, comprised in and carried by a vertically-adjustable framework 197, which is carried by the framework 12 of the machine and projects at the top of the latter, said table or platen 196 being at the lower end or bottom of the frame 197 and extending transversely across the same. At either end of the platen 196 is arranged a transverse roller or idler 198 and 199, respectively, with relation to which the paper bears and is guided, (the carbon ribbon intervenes between said rollers and the paper 185, as will be hereinafter described,) which rollers have their bearings in the ribbon-carrying frame 197. In rear of the roller 199 is arranged a similar roller or idler 200, having bearings in the frame 197, beneath which roller the paper 185 passes, and from thence it is carried upwardly and rearwardly between two main feed-rollers 201 and 202, respectively, arranged one above the other and preferably having an elastic frictional surface, as at 203, for the purpose of better retaining the paper in proper position and insuring the uniform and positive feed of the same. These main feed-rollers 201 and 202 are carried by and have bearings in a supplementary frame 204, carried upon the top of the machine. The bottom roller 202 maintains a non-adjustable position, while the top roller 201 has an elongated or vertically-sliding bearing at 205, guided in the sides of the frame 204 and connected with a coiled spring 206, which is mounted within said frame and is in turn connected with a set or thumb screw 207, operating in said frame, by the adjustment of which set-screw the tension of the spring 206 may be regulated and the position of the roller 201 with relation to the bottom roller 202 so governed that it will have an effective flexible or yielding movement with respect to the feed of the paper. A system of rollers is provided within the supplementary frame 197 for the purpose of carrying an endless ribbon of carbon or other suitable material adapted for marking the paper 185 when the carbon and paper are pressed into contact between the platen 196 and the recording-stylus. While I have herein shown an endless-ribbon arrangement, I may of course employ any other suitable or adapted means or mechanism whereby the paper 185 may be marked through the action of the stylus. The mechanism herein illustrated comprises an idler or roller 208, arranged immediately above the roller 198, and at the top of the frame 197 are a pair of idler-rollers 209 and 210, respectively, arranged one in rear of the other. In rear of the rollers 208 and 198 is an idler-roller 211. These rollers 208, 209, 210, and 211 extend transversely in the frame 197 and have their bearings in the side portions thereof. At the rear lower portion of the frame 197, above the rollers 199 and 200, are mounted two friction-rollers 212 and 213, respectively, arranged one above the other, these rollers preferably having an elastic contact-surface, as at 214, formed of rubber or other suitable material. The endless carbon ribbon or belt 215 engages and is guided in its continuous travel by the set of rollers, the ribbon being mounted so that it passes downwardly from the front top roller 209 at the rear of the front lower roller 208, forwardly between the latter and the roller 198, in front of said roller 198, thence rearwardly across the platen at the under side thereof and between the same and the paper 185, thence upwardly in rear of the roller 199 and between the same and the guide-roller 200, thence at the rear of the friction-roller 213 and between the top of the same and the upper friction-roller 212, thence in front of the latter and upwardly at the rear of and over the rear top roller 210, thence downwardly to the rear of and under the intermediate bottom roller 211, and from thence upwardly to the rear of and over the front top roller 209. It will be understood that the carbon ribbon is clamped between the friction-rollers 212 and 213 with sufficient pressure to enable a proper slack requisite for the easy running of the ribbon, while at the same time it is retained in taut position at the portion traversing the platen and is accurately fed by action of said feed-rollers 212 and 213. The relative arrangement and gearing of the feed-rollers 212 and 213 for the carbon ribbon and the feed-rollers 201 and 202 for the paper is such that the revolution of said rollers will carry both the ribbon and paper in the same direction of travel and in a corresponding uniform movement, this being effected by providing a gear 216 upon the shaft of the under ribbon-feed roller 213, which meshes with a gear 217 upon the shaft of the under paper-feed roller 202. The shaft of said roller 202 carries the bevel-gear, (shown at 28), which meshes with the bevel-pinion (shown at 39) upon the upper section (shown at 52) of the divided shaft 40 with the pawl-and-ratchet coupling, which transmits rotary motion from the main stylus-operating shaft 44 to operate the paper and ribbon feed mechanism.

To enable the operation of the paper and ribbon feed mechanism by hand and independent of its normal operation by connection with the main shaft 44 in a manner similar to that provided for the transmitting paper-feed mechanism in the transmitting-machine for the purpose of enabling the convenient insertion and starting of both the paper 185 and the carbon ribbon or the feed and travel of the same when desired independent of any operation of the recording-styluses,

the shaft of the under ribbon-feed roller 213 is extended at one end, as at 218, and provided with an operating-head or thumb-piece 219, by which it may be conveniently turned. The gear 216 is carried upon said shaft extension 218, so that by turning the latter by hand both the under ribbon-feed roller 213 and the under paper-feed roller 202 are operated in a movement entirely independent of the power operation of the connection-shaft 40, this independent movement being permitted by the coupling device between the sections of said latter shaft.

It will be understood that the ribbon-feed rollers have their bearings in the side portions of the frame 197, and for the purpose of permitting a suitable flexible or yielding movement of the upper ribbon-feed roller 212 its shaft has elongated bearings in upwardly-extending slots 220 in the sides of the frame 197, and pivotally connected to the ends of the shaft of said roller 212, as at 221, are levers 222, fulcrumed, as at 223, upon the side portions of the frame 197 and connected at their free ends by coiled springs 224, extending upwardly to and connected with adjusting or thumb screws 225, operating in the framework 197. By adjustment of said thumb-screws the pressure of the roller 212 with relation to the roller 213 can be regulated and will be governed by the tension of the springs 224.

The whole ribbon-feed-mechanism frame 197, with the table or platen 196, which it carries, is vertically adjustable with relation to the main frame 12 of the machine and with relation to the recording-styluses, whereby it may be moved to or from said recording-styluses to govern or regulate the pressure of the same with respect to the paper and ribbon and platen. I have herein illustrated one preferred manner of adjusting the frame 197 vertically. In this construction the lower portion of said frame is received within a corresponding slot or opening 226 in the top plate 188 of the machine-frame 12, and the sides of said frame 197 are provided near their base with laterally-projecting plates or flanges 227, which rest upon the top plate 188 and serve to mount and sustain the frame 197 in position. From these plates or flanges 227 extend securing-screws 228, which enter the top plate 188, and at opposite sides of said securing-screws, on a plane extending in the direction of travel of the paper 185, are provided adjusting or set screws 229 229, which pass downwardly through the plate 227 and bear upon the top of the main top plate 188. By adjusting the set-screws 229 it will be apparent that the frame 197 can be tilted or inclined on both transverse and longitudinal planes, there being sufficient play between the securing-screw 228 and the plate 227 to permit of the slight adjustment necessary, and in this adjustment of the frame 197 the platen 196, carried thereby, will of course be correspondingly adjusted so that its position with respect to the projection of the recording-styluses can be set or adjusted as desired.

The main shaft 44 of the recording or receiving machine corresponds to the same shaft in the transmitting-machine and embodies the same general structural features, such as the worm 155 and the cam-disk 157. It carries at its top end the stylus-plate 16, which is similar to the stylus-plate on the transmitting-machine except that in the case of the recording-stylus mechanism said plate is not adjustable with relation to the shaft 44, but is maintained in fixed position thereon, its connection with the shaft being preferably formed by means of a collar 230, secured to the shaft 44 and having a laterally-projecting circumferential flange 231, upon which the stylus-plate 16 rests and to which it is secured. In the recording-stylus mechanism the styluses proper project upwardly and through the plate 16 (this being the construction and arrangement which I prefer) in lieu of projecting downwardly from and beneath said plate, as in the case of the transmitting-stylus mechanism. The recording-styluses correspond identically to the transmitting-styluses in number and in their relative arrangement in a circular series, and they are mutually connected electrically to their corresponding transmitting-styluses in a manner which will be hereinafter described. Each recording-stylus comprises a frame 232, carrying a magnet 233, said frame being suitably secured to the under side of the stylus-carrying plate 16. I preferably employ a frame embodying three arms, as at 234, 235, and 236, which are connected at their inner end by a cross-piece 237. The intermediate arm 236 carries the magnet 233, and upon the outer arms 234 and 235 are supplementary coils 238 238, the magnet and its coils being connected in series by wires, as shown at 239 and 240 in Figs. 11 and 13. By this construction I am enabled so to divide the magnet-coils that they are conveniently distributed in position and arrangement in lieu of having one larger coil. The armature 241 spans the space between the outer frame-arms 234 and 235 at the side opposite from the cross-piece 237 and may be connected at its ends, as at 242, to said outer arms, leaving its central portion free to operate flexibly as it is attracted by the magnet 233 or slightly withdraws from the same by reason of its inherent spring quality. The armature preferably consists of a magnetic diaphragm or strip of thin iron or metal 243, spanning the space between the carrying-arms of the frame and possessing a high degree of flexibility, said thin strip carrying a series of small metallic or iron blocks or pieces 244, arranged on one of its faces in such a manner that the magnetic capacity of the armature is increased without reducing or affecting its flexibility. The blocks or pieces 244 may be arranged on either face or on both faces of the strip 243, and instead of a series only one

of such blocks may be used. To effect the result just above stated, the blocks or pieces 244 are secured only at their center by means of a pin or rivet 245, leaving their portions at each side of said central securing pin or rivet free from attachment to the thin armature-strip 243, and said blocks or pieces are also in their arrangement in series placed so that their adjoining edges do not abut, but a suitable intervening space, as at 246, exists between the opposite edges of said blocks or pieces. Thus when the strip or plate 243 moves flexibly when the armature is attracted or withdraws from the magnet it can bend or operate flexibly independent of said blocks or strips 244 except at the one point where the connecting pins or rivets 245 exist, a full and free movement of the armature with a high degree of flexibility being thus attained. This desideratum in respect to the attainment of a high degree of flexibility in the armature 241 is important, for the reason that the recording-stylus proper, 247, is carried by said armature and must have a perfect and at the same time relatively delicate movement to insure its accuracy of pressure upon the recording-paper 185. Said stylus proper simply consists of a rod similar to the stylus-rod 75 of the transmitting mechanism and is preferably correspondingly provided with a contact-point 79, which directly bears upon the paper 185. The rod is connected at its lower end to the armature 241 and is braced and guided in an opening formed through the outer end of the magnet-arm 236 and through a front cross-piece 249, comprised in the stylus-frame 232, as clearly shown in Fig. 12. The top or outer end of the styus-rod 247 projects through and above the stylus-carrying plate 16, the construction being preferably such that the top end portion of the stylus passes through an opening 250 in a bushing 251, in which the stylus-rod is thus housed and protected, said bushing being secured in an opening 252 in the stylus-plate 16. It will be understood that when the armature 241 vibrates the stylus-rod 247 will slide in a corresponding movement within its guide-channel formed by the openings. One terminal of the magnetic coils of the respective recording-stylus mechanisms is connected with the commutator at the lower portion of the shaft 44 by means of wires, as at 253 in Fig. 11, these wires being extended through the central bore of the hollow shaft 44 and respectively connected with the segments of the two different series in the same manner that the wires from the respective transmitting-styluses are connected with the segment-plates comprised in separate series, as hereinbefore described. The magnets of the respective recording-stylus devices are likewise alternately connected with the commutator-segments of the two separate series in a manner corresponding identically with the arrangement above described with relation to the transmitting-styluses, and the relative arrangement between these correspondingly-wired sets of transmitting-styluses and recording-styluses is therefore such that when any pair of transmitting-styluses are in operating relation to the foil surface of the message-paper 14—that is to say, are in contact with such surface—the armatures of the corresponding pair of recording-styluses will be withdrawn or away from their magnets and the stylus-rod proper, 247, will be retained down out of pressure-bearing against the recording-paper 185, so that no mark or impression will be produced thereon; but when the transmitting-styluses in their passage over the foil-paper, as just stated, contact with the insulating-ink thereon the armature of the corresponding recording-stylus will be attracted by its magnet, and thus raise the stylus-rod proper, 247, so that it will bear with pressure upon the recording-paper 185 and cause a mark or impression thereon, produced by the carbon-ribbon intervening between the platen and said paper, corresponding in extent and duration identically with the mark or portion in the insulating-ink over which the transmitting-stylus is passing. An exact or facsimile reproduction of the markings in insulated ink on the foil-paper is thus produced on the recording-paper, it being of course understood that the relative coaction of the corresponding transmitting and recording styluses is caused by electrical impulses sent over the line by reason of the making and breaking of the circuit as the transmitting-stylus contacts with the foil surface of the message-paper and with the insulated parts thereon. For purposes of greater speed the recording-styluses when in operative position with respect to the platen are preferably always in light contact with the recording-paper, but not in pressure-contact; otherwise if the stylus were held away from normal light contact the length of movement required for its operative projection would decrease the possible speed of operation of the machine. In the case of the recording-stylus mechanism the other terminal of the wire coils of the magnets of the respective stylus devices, which is not in connection with the respective commutator segments of the two separate series carried at the lower end of the main shaft 44, is connected to a continuous commutator-ring, as illustrated at 254 in Fig. 9, the corresponding wire terminal of all of the magnets of the whole set of recording-styluses being connected in series by wires, as at 255, to said commutator-ring 254. The wires 255 may consist of branches, as at 256 in Fig. 11, extending from the corresponding wire-terminals of each magnet and connected in series to a common wire 257, extending around the whole set of recording-stylus magnets and carried as a single wire down through the tubular main shaft 44 and then connected with the commutator-ring 254, which construction and arrangement is preferred; but, if desired, the wires 255

may consist of a separate wire extending from the wire-terminal of each recording-stylus magnet down through the tubular shaft 44, all of said separate wires being then connected in common with said commutator-ring 254. This commutator-ring 254 is preferably comprised in the same commutator device as are the two separate sets of commutator-segments which are connected with the respective stylus devices, said commutator-ring 254 being preferably intermediately arranged between said segmental sets and being connected in circuit by a brush 258, comprised in the writing or line circuit.

In Fig. 15 I have shown a diagram illustrating the general arrangement of the complete apparatus in connection with two line-circuits, one for the impulses which produce the corresponding operation of the styluses in the transmitting and recording machines and which I term the "writing-circuit" and for which is employed a direct current, and the other for producing perfect synchronism between the two machines, and which I designate the "synchronizing-circuit" and for which I employ an alternating current. In this arrangement I use a switch, as at 259, comprised in the writing-circuit and embodying two arms 260 and 261, respectively, and four contacts, one of which, as at 262, being designated as the "line-battery contact," another, as at 263, being designated as the "foil-paper-brush contact," and the two others, as at 264 and 265, respectively, being "blank" contacts. Starting at the line-battery switch-contact 262 the line-wire of the writing-circuit extends, as at 266, to one pole of the line-battery 267. From the other pole of the battery 267 the writing-circuit extends to and through the unison-relay 162 of the transmitting-machine, as at 268, and to the ground, (represented at 269.) Starting at the arm 260 of the switch 259, the line-wire of the writing-circuit extends, as at 270, to the commutator-brush 258 of the recording or receiving machine, and from thence the circuit is continued through the continuous ring 254, comprised in the commutator carried at the lower end of the main shaft 44 of the recording-machine, through the wire 255 to one coil-wire terminal of the series of magnets comprised in the recording-stylus mechanism and from thence through the medium of the wire connections 253 from the other wire-terminal of the respective stylus-magnets to the respective commutator-segments of the two sets comprised in the commutator at the lower end of the main shaft and through the respective commutator-brushes contacting with said respective sets of commutator-segments and through the wires extending from said brushes to the two respective commutator-brushes which contact with the respective sets of segments comprised in the selecting-commutator on the shaft of the motor or generator 123 of the recording-machine and from thence through the brush 175 of said selecting-commutator to a wire, as at 271, extending to and through the unison-relay 162 of the recording-machine and to the ground 269. The main writing-line circuit is thus completed, and it will be understood that it derives its direct current from the writing-line battery 267. A local short circuit exists in connection with the writing-line circuit through the transmitting-machine and the transmitting-stylus mechanism as follows: A wire, as at 272, is extended from the writing-circuit line-wire 268 at a point between the battery 267 and the unison-relay of the transmitting-machine to the brush 175, comprised in the selecting-commutator device of the transmitting-machine, the circuit being continued through the sets of segments of said selecting-commutator and the brushes respectively contacting therewith and the respective wires extending to the respective brushes which respectively contact with the respective sets of commutator-segments which are carried upon the main shaft of the transmitting-machine and which are respectively connected with the respective transmitting-styluses by means of the wires 70. The said local circuit of the transmitting-machine comprises another wire, as at 273, extending from the foil-paper-brush contact 263 of the switch 259 to the foil-paper brush 33, (or to the foil-paper-feed-mechanism frame when said whole frame is comprised in circuit.) This local circuit of the transmitting-machine is completed by a wire, as at 274, extending between the arms 260 and 261 of the switch 259 and through the medium of the foil-paper when the latter is in circuit with the transmitting-stylus. In the operation of the circuits as above set forth it will be understood that when the arms 260 and 261 of the switch 259 are respectively in contact with the writing-line-circuit battery-contact 262 and the foil-paper-brush contact 263 and the transmitting-stylus is in contact with the foil surface of the message-paper, which latter is in contact with the brush 33, the writing-circuit current from the line-battery 267 will be short-circuited through the switch 259 and the wire 274 connecting the arms thereof, so that it will merely pass around and through the transmitting-machine and its stylus mechanism and no current or impulses will pass over the writing-circuit line-wire 270 to the recording-machine; but when said local circuit of the transmitting-machine is broken by the contact of the transmitting-stylus with the insulating-ink upon the foil message-paper the main writing-line circuit is of course thrown into operation and an impulse will pass through the arm 260 of the switch 259 and over the wire 270 to the recording-machine and the stylus mechanism thereof and will operate the recording-stylus corresponding to the transmitting-stylus which is in contact with the insulating-ink in a movement corresponding in extent and duration to said insulated period in the operation of the

transmitting-stylus. I prefer to provide a non-inductive resistance, as at 275, in the wire 272 of the local circuit of the transmitting-machine at a point between the line-circuit battery and the selecting-commutator connection, which will operate to prevent an excess of current through said local circuit of the transmitting-machine to prevent the line-battery from running down when on the local transmitting-machine circuit. The full battery impulse is, however, of course permitted over the writing-circuit main line when the local circuit of the transmitting-machine is broken. I also prefer to arrange condensers, as at 276 and 277, in circuit with the brushes 170, 171, and 175 of the selecting-commutator of the transmitting-machine to prevent sparking at the contacts, and I may of course arrange condensers or other adapted governing devices or apparatus at any suitable points in the circuits or lines for utilitarian purposes or to produce more perfect or effective results. The unison-magnets 126 of the transmitting and recording machines are respectively comprised in a separate individual circuit, as at 278, having its own battery, as at 279, and arranged to be opened and closed by the movement or vibrations of the armature 280 of the unison-relay. The synchronizing-circuit comprises a wire, as at 281, extending from the brush 179 of the generator or motor commutator 176 to the ground 269, this arrangement being duplicated in the generators or motors of the transmitting and recording machines. From the brush 180 of the generator or motor commutator 176 of the transmitting-machine extends a synchronizing-circuit line-wire, as at 282, to the corresponding brush 179 of the generator or motor commutator 176 of the recording-machine. In the wires 281 of the respective generators or motors between the commutator 176 and the ground I preferably arrange a condenser, as at 283, whereby interference between the writing-circuit and the synchronizing-circuits through the ground connections will be obviated, and between the condenser and generator or motor commutator 176 I also preferably arrange an inductive resistance-coil, as at 284. At 285 is represented a battery for the generator or motor field, this being connected in the usual manner by means of wires, as at 286 and 287, with the generator or motor.

In Fig. 16 I have illustrated an arrangement of the complete mechanism and appatus on a single circuit in which the direct writing-circuit and the alternating synchronizing-circuit are arranged on a single line-wire. In this arrangement the switch 259 is in general of the same construction as that employed in connection with the separate writing and synchronizing circuits, as illustrated in Fig. 15, and it has four similar contacts, one of which, 263, is the foil-paper-brush contact, another of which, 262, is the line-battery contact, while the other two, 264 and 265, are blank contacts; but in this arrangement there is provided another switch-contact 288, which I denominate the "generator" or "motor" contact, and another blank-contact 299. In this arrangement the line-circuit comprises the wire 266, extending from the battery-contact 262 to one pole of the line-battery 267, and from the other pole of said battery extends a wire, as at 289, to both the generator or motor 123 and the "selecting commutator" of the transmitting-machine by means of a branch wire, as at 290, extending to the brush 180 of the generator or motor commutator 176, and a branch, as at 291, extending to the brush 175 of the selecting-commutator upon the shaft of the motor or generator. From the other brush 179 of the generator or motor commutator of the transmitting-machine the line-circuit extends by means of a wire, as at 292, to and through the unison-relay 162 of the transmitting-machine and to the ground 269. The local circuit of the transmitting-machine comprises a wire 273, extending from the foil-paper-brush contact 263 to the brush 33. A wire, as at 293, extending from the generator or motor switch contact 288 to the wire 289 beyond the battery 267 forms an independent line-circuit connection for the generators of the transmitting and recording machines through the branch wire 290, whereby the line-battery for the direct writing-circuit current may be thrown out of connection with the line-circuit when the stylus mechanisms are not operating; but the alternating synchronizing-current will be at the same time maintained. In this arrangement when the arm 260 of the switch 259 is in contact with the foil-paper-brush contact 263 and the arm 261 of the switch is in contact with the line-battery contact 262 the line-battery will be short-circuited (the switch-arms being connected by the wire 274) over the local circuit of the transmitting-machine, (when the transmitting-stylus is in contact with the foil surface of the message-paper,) and the transmission of impulses over the main line will be regulated and effected in the same manner as that hereinbefore described with relation to the separate writing and synchronizing circuit arrangement as shown in Fig. 15.

In the single-line circuit, as illustrated in Fig. 16, the arrangement of the unison magnet-circuits, the antisparking condensers 276 and 277, and the battery and wire connections for the generator-field are the same as in the two-circuit arrangement illustrated in Fig. 15; but in the single-circuit arrangement, as illustrated in Fig. 16, I prefer to arrange the non-inductive resistance 275 of the local circuit of the transmitting-machine in connection with the wire 273, extending between the foil-paper brush 33 and the foil-paper-brush switch-contact 263. For purposes of convenience the switch employed in connection with the single-line circuit shown in Fig. 16 preferably has its arm 260 mounted in an elon-

gated bearing, as at 294, so that it can be independently moved with relation to the switch-contacts 263 and 264 without moving its arm 261 from the contact 262. The single-circuit line-wire, as at 295, extends from connection with the two arms of the switch, preferably by connection with the wire 274, to the commutator-brush 258 of the commutator carried at the lower end of the main shaft of the recording-machine, and from thence through the hereinbefore-described commutator-brushes and wires through the recording-stylus mechanism and to the selecting-commutator of the recording-machine. The single circuit is completed by a wire, as at 296, extending from the brush 175 of the selecting-commutator of the recording-machine to the brush 180 of the generator-commutator 176 of the recording-machine and by a wire, as at 297, extending from the other brush 179 of said generator-commutator to and through the unison-relay 162 of the recording-machine and to the ground 269. In this single-line-circuit arrangement I prefer to arrange the condenser 283 in connection with a wire, as at 298, extending from the main-line wire 295, which connects the transmitting and recording machines to the wire 296, which connects with the brush 175 of the selecting-commutator of the recording-machine, said wire 298 thus forming a connection which divides the synchronizing-current through the recording-stylus mechanism and said condenser and operates to insure a sharper action of the recording-styluses.

In the single-circuit arrangement, as illustrated in Fig. 16, it will be understood that both the writing and synchronizing line-currents will pass over the single-line connecting-wire 295, the synchronizing-current which proceeds from the generators being divided and passing through the line-battery and through the transmitting-stylus mechanism when the switch is on the contact 262 and passing independently over the wire connection 293 when the switch is on the contact 288.

It will of course be understood that if a metallic return is used in the two-circuit arrangement illustrated in Fig. 16 the writing and synchronizing currents will be entirely separated and the employment of the condensers 283 or any other means for separating the currents will be unnecessary.

The operation and advantages of my invention will be readily understood by those skilled in the art to which it appertains. It is simply necessary to mark any desired matter which is to be transmitted in facsimile on the metal-foil paper and insert the same in the paper-feed mechanism of the transmitting-machine, this being done by merely turning the cap or thumb piece 59 of the coupled shaft 40, when the foil-paper will be carried into the machine by action of the rollers and bands of the feed mechanism. When the foil-paper has been brought to a point over the platen where the insulated marking of the same is almost up to the arc or line of travel described by the styluses, the motor mechanism is started and the automatic operation of the apparatus commenced. Before inserting the foil-paper the styluses are raised by merely turning the thumb-screw or cap-piece 88, so that they will not interfere with or tear the foil-paper in the operation of initially introducing the same into position under the styluses, and when the foil-paper is thus passed under the styluses they are then lowered by adjustment of said thumb-screw 88 until they come into direct contact with the foil surface of the paper. It will be understood that at this point while the motor and generator mechanism is running the main shafts of the stylus mechanisms of the transmitting and recording machines are stationary, being locked by the unison-magnet mechanism, the armatures of which are then in withdrawn position by action of their governing-springs. The switch 259 being then in its normal position, with its arms on the blank contacts 264 and 265, (so that the line-writing circuit is entirely open,) is operated so that its arm 260 is brought onto the writing-circuit battery-contact 262, (which is preferably lengthened or extended, as shown in Fig. 15, so that the arm 260 of the switch will remain on said contact 262 when the arm 261 is alternated between the blank contact 264 and the foil-paper-brush contact 263,) and its arm 261 is brought onto the blank contact 264. This closes the direct-current writing-circuit, so that the full impulse of the battery 267 is sent over said circuit, thus causing the unison-relays 162 of both machines to attract their armatures and close the individual circuits comprising the unison-magnets, which latter simultaneously attract their armatures at the same instant, and thus release the stop mechanism of both the transmitting and recording stylus mechanisms. The machines are thus simultaneously and correspondingly started at the same instant in step, and synchronism is maintained at all times thereafter during the operation of the complete apparatus, the unison-relay and unison-magnet mechanism controlling the stop action being an important factor in the synchronizing of the two machines and operating to control their action in unison, as will be hereinafter more specifically described. The stylus mechanism of both machines will now revolve in unison by reason of the synchronizing-current from the generators, and the switch is maintained in the position last described, with the writing-line circuit closed and with the local circuit of the transmitting machine open, until the first line or portion of the insulated-ink marking upon the foil-paper is within a short space—say about one-eighth of an inch—of the arc or line of travel described by the transmitting-styluses. The switch is then operated to bring its arm 261 to the foil-paper-brush contact 263, while

its arm 260 will still remain upon the writing-circuit battery-contact 262, and the switch is maintained in this position until the full matter in insulating-ink on the foil-paper sheet has been transmitted. It will be understood that when the switch is in its normal position on the blank contacts and the writing-line circuit is thus entirely open the transmitting-styluses may be raised or lowered from or to contact with the foil-paper without sending any impulses over the line-wire 270, and when the styluses have been lowered into contact with the foil-paper and the switch-arms are on the contacts 262 and 264 the battery-impulses will pass over the line-wire 270, the writing-circuit being then entirely open and will not of course be affected by the contact of the styluses with the foil-paper. When the switch has been brought into the described position in connection with the writing-circuit battery-contact 262 and the foil-paper-brush contact 263, (and the revolving transmitting-styluses are in contact with the foil-paper,) this closes the local circuit of the transmitting-machine and takes the current from the line-battery 267 off the main-line circuit, causing the unison-relays 162 of both machines to release their armatures, thus opening the circuit of the unison-magnets and permitting their armatures to recede, so that their points 133 enter into engagement with the lower portion of the worms on the main stylus-mechanism shafts. The worm then operates to slowly carry the stop-arm of the unison-magnet armature upward toward the shouldered stop-disk on the shaft, and if said stop-arm reaches this shoulder the stylus mechanism of the machines would be locked against further revolution; but the insulated-ink marking on the foil-paper will as soon as the transmitting-styluses begin to contact with the same (which will occur in the present instance after the set of styluses has made about one complete revolution and before the shafts of the machines have been stopped) operate to open the local circuit of the transmitting-machine, and thus send an impulse over the line. This impulse will cause the unison-magnets to attract their armatures, and thus withdraw their stop devices from engagement with the worm before they have reached the top of the latter, and the stylus mechanisms will thereafter continue their revolution uninterruptedly until all the message matter upon the foil-paper has been transmitted, this being effected by reason of the fact that the unison-magnets will retain their armatures as long as the transmitting-styluses are intermittently contacting with the insulated ink without a sufficiently long intervening space or interval to permit automatic action of the stop mechanism, the impulses being so frequent that action of the unison-relays and unison-magnet mechanisms will not be permitted, as will be hereinafter more specifically described. It will be understood that these impulses thus sent over the line will operate the corresponding recording-stylus mechanism to exactly the same extent and duration as that concerned in the action of the transmitting-stylus mechanism, and thus produce exactly corresponding markings, through the medium of the carbon ribbon, upon the recording-paper which is passing through the recording-machine. When the transmitting-styluses continuously pass over an unbroken or uninsulated portion of the foil surface of the message-paper, after the portion carrying the insulated ink has been passed for a sufficiently long continuous period of time, the local circuit of the transmitting-machine will of course be closed and continuously maintained so until by the action of the unison-relays and unison-magnet mechanisms the stop devices carried by the armatures of the unison-magnets travel the full extent of the worm and engage the shoulder of the stop-disk upon the stylus-mechanism shaft, and thus lock the latter against further movement. The automatic stoppage of the machines is thus effected simultaneously and in unison as soon as the last part of the insulated-ink message has been transmitted, and they are also automatically started simultaneously and in unison, as hereinbefore described, at the commencement of the transmission, while the generator or motor mechanism continuously operates, (if desired,) and maintains synchronism, this being permitted by reason of the frictional connection between the motor devices and the stylus-mechanism shafts, as hereinbefore described.

It will be understood that the motor or generator devices of the respective machines can be both run as generators for the alternating-current synchronizing-circuit or that one may be run as a motor and the other as a generator. Perfect synchronism between the two machines is augmented by having the alternating-current generators, which are included in a single circuit, one at each end of the line, run by motive powers which are approximately equal in strength and speed, so that said generators will at once synchronize and send current to the line in parallel. Thereby a small synchronizing and balancing current, electrically termed a "wattless" current, will be set up, and this current will keep the machines in perfect synchronism. I may employ various methods of synchronism in connection with the general structure and arrangement of my improved facsimile-telegraph.

The operation when a single circuit is employed, as illustrated in the diagram in Fig. 16, is substantially the same as that hereinabove described, the difference existing in the fact that both the writing-circuit and the generator synchronizing-circuit are connected in series and passed over the same line. In this arrangement, I prefer to have the writing-current of a higher voltage than the alternating current generated by the gener-

ators, and it is also important to have the motor-power connected with the two generators as nearly equal as possible. In this single-circuit arrangement, when the arms of the switch are on blank contacts, the line-circuit is open. When the arm 261 of the switch is on the line-battery contact 262 and its other arm 260 is on the blank contact 264, the line-circuit will be closed and the full battery-current will pass over the line, as will also the alternating current from the generators, the latter current passing through the line-battery. When the arm 261 of the switch is on the line-battery contact 262 and the other arm 260 is on the foil-paper-brush contact 263, the direct battery-current will be short-circuited over the local circuit of the transmitting-machine and direct-current battery impulses will only be sent over the line when the local circuit of the transmitting-machine is broken by the action of the transmitting-styluses with respect to the insulating-ink, as hereinbefore described; but while the direct battery-current is thus short-circuited over the local circuit of the transmitting-machine the alternating generator-current will still pass over the line and through the line-battery 267. It will not pass in any appreciable measure over the local circuit of the transmitting-machine, it being of less voltage than the battery-current, nor will it for the same reason affect the desired action of the unison-relay and unison-magnet stop mechanism. When the switch is adjusted so that its arm 261 is on the generator or motor contact 288 and the arm 260 is on the blank contact 299, the battery-current will be entirely cut off from the line, but the line-circuit will be closed for the transmission of the alternating generator-current.

I will now more specifically describe the operation or action of the unison stop mechanism in conjunction with the unison magnets and relays and writing impulses. When the first battery-current impulse is sent over the line, the unison-relays attract their armatures, the impulse being of long duration by reason of the fact that it is governed by the extent of the non-insulated surface of the foil-paper in its relative position of adjustment at that time and by the operation of the switch instead of by the contact of the transmitting-stylus with a narrow line of insulating-ink. Positive attraction of the armatures of the unison-relays at this point in the operation of the apparatus is thus insured. This action of the unison-relays closes the circuits of the unison-magnets, so that they positively attract their armatures, and therefore release the stop mechanism, permitting the stylus mechanism to rotate. The impulse which is now sent over the line will be of the same duration as the time occupied by the operator at the transmitting-station in bringing up the insulated inked part of the foil-paper message-blank to within a short distance of the line of travel of the transmitting-styluses. Then when the switch is again adjusted to contact with the line-battery and foil-paper-brush contacts, and thus direct the battery-current to the local circuit of the transmitting-machine, the long impulse just mentioned is broken, and the instant the transmitting-styluses contact with parts of the insulating-ink corresponding short impulses are sent over the line and also, of course, through the unison-relays. These impulses being exceedingly short and minute will cause a certain amount of induction to be set up in the relay-magnet, the effect of which will be to hold the relay-armature to the magnet-core, and thus retain the unison-magnet circuit closed, so that its armature stop mechanism is retained from engagement with the shaft of the stylus mechanism. Should, however, the impulses become longer and of less frequency, the relay will vibrate its armature and of course make and break the circuit of the unison-magnet. This making and breaking of the unison-magnet circuit will, being sufficiently frequent, not afford sufficient time for the vibration of the unison-magnet armature. In other words, quick and short impulses will not result in vibration of the relay-armature and will accordingly not open the unison-magnet circuit, while longer and less frequent impulses will cause vibration of the armature of the relay and the making and breaking of the unison-magnet circuit, but will not, unless of considerable relative duration, afford time for the positive action of the armature of the unison-magnet; but if such impulses are of considerable duration and infrequency both the armatures of the relay and unison magnets will positively operate, and the stop mechanism carried by the unison-magnet armature will engage the worm devices upon the shaft 44; yet unless this positive operation of the unison-magnet is of sufficiently long duration to correspond to the period of travel of the engaging devices to the full extent of the worm the machines will not be stopped, the release of said engagement being automatically effected before actual stoppage of the shaft ensues. To further resist vibratory action of the armature of the unison-magnet caused by infrequency or relatively long duration of the impulses, (which impulses are of course governed by the degree of space separating the insulating-ink contacts upon the message-paper,) I provide the air and spring resistance device hereinbefore described. The piston or plunger of this device presses against the armature of the unison-magnet, and this pressure is maintained by the comparatively strong spring 147. Now when said armature is attracted by its magnet the piston or plunger 142 follows the movement of the same very quickly. This action of said piston is augmented by the spring-and-valve mechanism at the rear end of the cylinder in which said piston moves, the action being such that when the large spring 147 pushes

the piston outwardly the valve mechanism is open, and there being a vacuum within the cylinder caused by the outward movement of the piston air enters freely through the valve mechanism and accelerates the quick outward stroke of the piston. At the instant the circuit of the unison-magnet is opened and its armature thus released the piston resists quick action of said armature by reason of the fact that the inward action of the piston closes the valve mechanism at the rear of the cylinder and the inward movement of the piston is resisted by the cushion of air which is thus then retained in the cylinder, the only point of escapement for the air being the small or close space existing between said piston and the surrounding walls of the cylinder at the front end portion of the latter. The rearward movement of the plunger is thus comparatively slow, and it accordingly operates as an effective resistance to govern slow movement of the armature of the unison-magnet when the same is released. Therefore by reason of this special construction and arrangement the armature of the unison-magnet quickly acts in its movement when it is attracted by reason of the closing of the unison-magnet circuit by operation of the relay to release the locking mechanism from the shaft; but it operates very slowly in its movement when it is released and withdraws from its magnet to bring the locking mechanism into engagement with the shaft. The desired effect, as just described, is further augmented by having the spring 134 of the armature of the unison-magnet of a somewhat stronger tension than the main spring 147 of the air and spring cushion mechanism.

With reference to the circuit connections, as illustrated in Fig. 15, in which a ground return is used for the separate direct writing-current and alternating synchronizing-current, it will be noted that in following up the writing-circuit, starting at the battery, it passes over the line and through the receiving-styluses and unison-relay mechanism of the recording-machine to the ground. It then has two paths over which it may travel—one back to the battery and transmitting-machine through the ground and the other by way of the synchronizing-circuit.

In order to prevent the return of the writing-current through the synchronizing-circuit in the system, as shown in Fig. 15, condensers of suitable capacity are arranged in series with the generator, the effect of the condenser being to minimize the extent of passage of the writing-current over the synchronizing-circuit and at the same time allow the alternating synchronizing-current to pass over it by induction. The effect of a condenser on alternating-current systems being to distort the current-wave, I counteract this effect of the condenser on the current by placing in the system shown in Fig. 15 an inductive resistance, as at 284, in series with the condenser, the effect of an inductive resistance being to neutralize the wave distortion of the condenser, it being understood that the condenser and inductive resistance are properly balanced. In practice, however, no material ill effect will be experienced if part of the current passes to and over the synchronizing-circuit. While the passage of part of the synchronizing-current over the writing-line circuit will not affect or interfere with the proper working of the recording-styluses, I prefer to minimize this action of the synchronizing-current. This is effected as follows: The synchronizing-circuit, it will be noted, extends from the generator to the inductive resistance and condenser and to the ground. Here the alternating synchronizing-current will be separated, so that the major part will pass through the ground to the transmitting-machine and a small part will pass through the writing-circuit of the recording-machine; but it will here be noted that in passing through the writing-circuit the synchronizing-current encounters the self-induction of the unison-relay, for which purpose the relay should be of such an adapted construction as will afford a large measure of self-induction, which will operate not only to retard the synchronizing-current, (which is of high frequency,) but also to prevent its armature from following up the quick make and break in the writing-circuit. This self-induction and resistance, together with the resistance of the recording-stylus magnets and the excessive resistance of the line over that of the ground, will permit very little of the synchronizing-current to pass between the machines by way of the writing-circuit line, and the major part of said current will be forced to the ground-passage. The self-induction of the unison-relay is so regulated that it will not be sufficiently high to lengthen out any of the short writing impulses.

The arrangement of the transmitting-styluses and their circuit connections is such that only the two styluses which are traveling over the foil surface of the message-paper are in circuit. This result is attained by having the pairs of styluses alternately connected to their respective segments of the two separate sets upon the commutator at the lower end of the main shaft. These segments of the two respective sets are arranged so that the segments of one set 163 have their terminal ends at a plane intersecting the center of the segments of the other set 164, whereby in the parallel and corresponding arrangement of the respective brushes 166 and 167 the brush upon the segment connected with the transmitting-stylus which is at the center of the foil message-paper will be at the center of said segment, while the other brush will be just starting upon the segment which is connected with the next following transmitting-stylus, which latter is then just starting upon the foil-paper. The throwing of each respective transmitting-stylus into and out of circuit exactly at the points where it starts upon the

foil-paper and leaves the same is thus effected by its relative arrangement of the segments of the separate sets 163 and 164 in alternative position, even though the styluses are alternately connected. The same alternative connection of the styluses also of course exists in the recording-machine, except that the set of recording-styluses have their respective magnets essentially connected in series on one terminal of the magnetic coils by the third commutator-ring 254 upon the commutator at the lower end of the main shaft, while the corresponding circuit connection for the transmitting-styluses will of course exist through the contact with the foil-paper. It would be undesirable to have the full set of recording-styluses continuously in circuit connection by changing the respective segments 163 and 164 of the two sets into continuous commutator-rings, for the reason that the magnets involved in the recording-stylus mechanism would cause the loss of too large a measure of current. The operative arrangement of the transmitting and recording styluses is of course relatively identical, so that when the operating pair of transmitting-styluses are in circuit the corresponding operating pair of recording-styluses will be in circuit. Now in using two styluses simultaneously in contact with the foil-paper (for the purpose of more rapid operation and increase of speed in the transmission of the message than would be the case if only one transmitting-stylus was in action at one time) it is of course necessary that each one of said pair of operating transmitting-styluses should transmit its impulses only to the corresponding one stylus of the pair of recording-styluses which are in operation. For instance, the transmitting-stylus which is at the center of the foil-paper must transmit its impulse to the recording-stylus which is at the same instant at the center of the recording-paper, and the transmitting-stylus that has just entered upon the foil-paper must transmit its impulse to the recording-stylus that at the same instant occupies a relatively identical position with respect to the recording-paper. For this purpose the two sets of impulses from the respective styluses of the pair in operation are alternatively connected with the line-wire, this being the office of the "selecting-commutator" mechanism which is arranged between the commutator upon the lower end of the main shaft and the writing-circuit line-wire connection, the line-wire being connected to the brush 175, which contacts with the continuous commutator-ring 172 of the selecting-commutator. The brush connections 166 and 167 of the respective sets of commutator-segments which are involved in the alternate connection of the pairs of styluses in either the transmitting or recording stylus mechanisms are connected by the respective wires 168 and 169 with the brushes 170 and 171, which respectively connect with the two separate sets of segments 173 and 174 on the selecting-commutator. Therefore as the only connection between the line and the styluses is through the separate sets of segments of the selecting-commutator and each one of the pair of transmitting or recording styluses which are in operative position are respectively connected to said separate sets of the selecting-commutator and as the respective brushes 170 and 171 alternately contact with the segments 173 and 174 of the respective sets upon the selecting-commutator each one of the pair of operating transmitting-styluses is alternately thrown into and out of circuit, thus sending impulses to its corresponding recording-stylus at the other end of the line, the separate sets of segments of the selecting-commutators being identically arranged for both the transmitting and recording stylus mechanisms. To cause the alternative operation of each stylus of the pair which are in operative position, the segments 173 and 174 of the separating selecting-commutator sets are relatively arranged in respect to the parallel and correspondingly-arranged brushes 170 and 171, so that the segments 173 of one set occupy the plane of the intermission or intermediate space between the segments 174 of the other set and correspond in extent or circumference therewith. Thus when an impulse is being sent from one of the pair of transmitting-styluses which are in circuit connection and operative position with relation to the foil-paper it will actuate only its identical corresponding recording-stylus, and no impulse will be sent from the other transmitting-stylus of the pair which are in operative position. The gear connection between the main shaft 44, which carries the commutator by which the pair of styluses are jointly maintained in circuit, and the shaft which carries the selecting-commutator is such that the selecting commutator shaft makes very many more revolutions than the main shaft 44. For instance, the selecting-commutator shaft will in practice make forty revolutions to one of the main shaft 44. Therefore while only one of the pair of styluses which are in operative position can send its impulse at one time the alternation of the impulses of the pair of operating-styluses is so rapid that no appreciable effect will be produced in the complete transmission of facsimile markings corresponding in character and extent exactly to the insulated ink-markings upon the foil-paper. By means of the construction and arrangement as just above described I am therefore enabled to keep two styluses simultaneously in operation for purposes of speed in transmission and at the same time so divide the two styluses of the operating pair that impulses are only sent by one at one time. The number of segments comprised in the separate sets of the selecting-commutator may be varied as desired; but I preferably employ five segments to a set, as herein illustrated, in cases where eight styluses are used in a set. In the alternative arrangements above described it will be noted

that the respective brushes of the stylus-commutator carried by the main shaft 44 contact with the commutator-segments in exactly the same manner as the styluses contact with the foil-paper, so that at said commutator there will be two entirely separate sets of impulses, and these two sets of impulses are taken from said commutator by means of the separate wire-brush connections 168 and 169 to the selecting-commutator, by which each respective set of impulses is split up again into a series of impulses sent between the individual styluses of the transmitting and recording machines, the arrangement being precisely the same in this connection with respect to both machines. The separation of the respective impulses of the pair of operating-styluses may be effected by other well-known methods in lieu of the selecting-commutator arrangement herein illustrated.

It will be understood that the construction and arrangement comprised in my invention are perfectly adapted for the employment of a number of styluses greater than two in simultaneous operative connection with the foil-paper, in which case it would simply be necessary to have as many brushes and sets of segments on the selecting-commutator as there are styluses in simultaneous operative contact with the foil-paper. The set of recording-styluses being fixed in an absolutely positive relative position with respect to each other and with respect to their carrying-plate 16, any necessity for adjusting them laterally or in a horizontal plane is entirely obviated if they are set in an exactly-measured relative position with precisely the same number of degrees distance from each other when in their circular series. Therefore provision for the adjustment laterally or in a horizontal plane of merely the transmitting-styluses will enable the individual and corresponding styluses of both the transmitting and recording sets to be always absolutely set in the same precise relative or corresponding position with respect to the message-paper and recording-paper, whereby absolute facsimile reproduction will be insured. The recording-styluses embody, by reason of the plural arrangement, as hereinbefore set forth, three coils, the two outer ones (carried upon the frame-arms 234 and 235) being preferably of similar polarity, while the center one, carried upon the center arm 236, is of the opposite polarity, in which arrangement the two outer magnetic coils will be connected together and one of said coils connected to the center one, while the wire extending to the commutator-brush 258 will extend from the free terminal of the wire of the center coil and the individual-stylus wire extending to the respective segment of the stylus-commutator will extend from the terminal of the wire of the outer coil which is not directly connected to the center one. The side edges of the table or platen 196 of the recording-machine may be beveled to any suitable extent which will facilitate the free passage of the recording-stylus point 79 into position for its positive bearing contact with the under side of said platen without any direct engagement of the side edges of the latter, it being understood that the transmitting-rods are normally projected, so that they will lightly travel against the surface of the recording-paper 185, the marking upon said surface being produced by further projection and pressure of the stylus-point with respect to the carbon ribbon and platen when the flexible armature 241 is attracted by its magnet. The rollers 199 and 200, which are respectively arranged to carry the recording-paper 185 and the carbon-ribbon, are so arranged relatively, it will be noted, that they separate the ribbon and paper in rear of the table or platen 196 and direct said ribbon and paper, respectively, toward their feed-rollers, whereby any liability of the paper taking up carbon from the ribbon by positively-maintained pressure is obviated.

It will be apparent that my facsimile-telegraph apparatus can effectively operate in identically the same manner as in respect to the use of metal-foil paper, upon which the marking is in insulated ink if an ordinary non-conducting message-paper is employed and the markings thereon are made with a conductive substance, in which latter instance the electrical action of the stylus mechanisms will simply be the reverse of that performed when metal-foil paper and insulated ink is used. It is also obvious that my improved apparatus is adapted for effective operation in duplex or multiple over the same line. I therefore do not, in view of the manifest variations and modifications which may be resorted to, confine myself to the precise features of construction and arrangement as herein illustrated and described, but reserve the right to all such variations and modifications in the detail structure of the machine and in the relative arrangement of both mechanisms and circuits as properly fall within the spirit and scope of my invention and the terms of the following claims.

Having fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In a facsimile-telegraph, a message-paper-feed mechanism embodying a flat table or platen over which the message-paper is adapted to pass in a continuous movement, said message-paper-feed mechanism being insulated from the remainder of the machine, a constantly-rotating stylus-carrier having styluses bearing with relation to said table or platen and maintained in continuous contact with the surface of the message-paper during its passage over the platen, and a contact device mounted in relation to the said platen and adapted to bear upon the surface of the message-paper.

2. In a facsimile-telegraph, a message-paper-feed mechanism, embodying a flat table

or platen over which the message-paper is adapted to pass in a continuous movement, rollers mounted with relation to the said platen, means whereby the said rollers may govern the movement of the said paper, a constantly-rotating stylus-carrier provided with styluses bearing with relation to the said table or platen, means for maintaining the styluses normally in contact with the message-paper during its passage over the platen, means for elevating the said styluses out of contact with the message-paper, a contact device mounted with relation to the table or platen normally contacting with the surface of the message-paper, and means for turning the rollers of the message-paper-feed mechanism independently of the operation of the telegraph-machine, whereby when the styluses are raised out of contact therewith the message-paper may be manually adjusted.

3. In a facsimile-telegraph, a message-paper-feed mechanism, transmitting devices comprised in an electric circuit and adapted to contact with the message-paper during the movement thereof through said feed mechanism, means for continuously operating said feed mechanism in unison with said transmitting devices, means for raising the transmitting devices out of contact with the message-paper, means for operating the feed-paper mechanism independently of movement of the transmitting devices and a contact device mounted in normal contact with the message-paper and having a vertically-movable relation thereto.

4. In a facsimile-telegraph, the combination, with a message-paper mechanism embodying a table or platen over which the message-paper sheet or blank is adapted to pass, of a plurality of continuously-rotating stylus devices comprised in an electric circuit and arranged in a set or series and adapted to have an arc or line of travel across said message-paper, the relative arrangement being such that a plurality of said stylus devices will simultaneously contact with said message-paper; and means for commutating the contacting stylus devices to the line separately and successively.

5. In a facsimile-telegraph, means for advancing the message-paper sheet or blank in a continuous movement and a rotary plate or frame carrying a plurality of constantly-rotating transmitting stylus devices comprised in an electric circuit and equidistantly arranged in a circular series, the relative arrangement being such that two or more of said stylus devices will simultaneously be in contact with the message-paper sheet or blank during the transmitting operation; and means for commutating the contacting stylus devices to the line separately and successively.

6. In a facsimile-telegraph, a series of styluses comprised in an electric circuit and divided into pairs or sets, the styluses of said respective pairs or sets being adapted to conjointly operate, means for conjointly operating the stylus devices of said respective pairs or sets, and means for commutating said stylus device of the respective pairs or sets to the line-circuit during their conjoint operative movement.

7. In a facsimile-telegraph, a stylus-carrier, comprising a constantly-rotating plate, a plurality of stylus devices mounted thereon, each of which is comprised of a frame having an upper surface upon a plane substantially parallel to the plane of the carrier, and a stylus centrally mounted therein, a fastening device connecting the center of the frame to the stylus carrier or plate and capable of adjustment, whereby to govern the distance of the stylus device from the carrier, and a plurality of separate adjusting devices mounted in said carrier or plate and bearing upon the upper surface of the stylus device or frame at different points.

8. In a facsimile-telegraph, a stylus-carrier and one or more stylus devices mounted thereon, an insulating head or body upon the top of said stylus devices, an adjustable fastening device connecting the said insulating-head centrally to the stylus-carrier, and a plurality of separate adjusting devices mounted in the stylus-carrier and bearing upon the upper surface of said insulating-head at different points.

9. In a facsimile-telegraph, a stylus-carrier comprising a constantly-rotating plate, a plurality of stylus devices connected therewith, each of which is comprised of an upper body or head centrally apertured, means for adjustably connecting said head with the stylus-carrier to regulate both its distance from and its horizontal angle to said stylus-carrier, a cylinder adjustably mounted centrally in said head, means for retaining the same in its adjusted position, and a stylus yieldingly mounted in said cylinder.

10. In a facsimile-telegraph, the combination with a constantly-rotating stylus-carrier having a plurality of stylus devices connected therewith, and a message-paper-feed mechanism operatively connected with the said stylus-carrier, whereby they move in unison; of means for raising and lowering said stylus-carrier and means for adjusting the stylus devices both vertically and laterally with respect to said stylus-carrier and the message-paper.

11. In a facsimile-telegraph, a stylus device comprised in an electric circuit and embodying a cylinder or casing carrying a projecting stylus-rod and adjustably connected with said casing; and a circuit-wire-clamping device adjustably mounted relatively to the said cylinder or casing and adapted to conjointly hold the said cylinder or casing in its adjusted position and the said circuit-wire in connection therewith.

12. In a facsimile-telegraph, a stylus device comprised in an electric circuit and embodying a base or body by which it is mounted in position, a cylinder or tubular casing adjust-

ably connected with said base and carrying a projecting stylus-rod, a set-nut operating upon said casing and binding against said base, and an auxiliary set-nut operating upon said casing and between which and the main nut the circuit-wire is adapted to be bound.

13. In a facsimile-telegraph, a stylus-carrier adjustable in a longitudinal plane with relation to the plane of operative projection of the stylus device, and a stylus device comprised in an electric circuit and carried by said stylus-carrier and independently adjustable with relation thereto both in a longitudinal and lateral plane with relation to its plane of operative projection.

14. In a facsimile-telegraph, a stylus-carrier, a stylus device comprised in an electric circuit and embodying a disk or base, a device centrally connecting said base with the stylus-carrier, and set-screws operating between said carrier and base at points outside said central connection.

15. In a facsimile-telegraph, a constantly-rotating stylus-carrier carrying stylus devices, a plurality of which are constantly in contact with the message-paper, a rotary shaft connected centrally with said stylus-carrier, and exteriorly carrying an electric commutator divided into a plurality of segments arranged to severally connect with the styluses, whereby to commutate the contacting styluses to the circuit-line and circuit connections from the said commutator interiorly of the said shaft to the said stylus devices.

16. In a facsimile-telegraph, stylus-operating mechanism, and means actuated by the actual writing impulses over the transmitting or writing circuit for stopping and releasing said mechanism.

17. In a facsimile-telegraph, a stylus-operating mechanism, and means actuated by the actual writing impulses over the transmitting or writing circuit for starting said machine and for stopping said mechanism by the absence of such writing impulses.

18. In a facsimile-telegraph, the combination with the mechanism for operating the styluses, of a unison-magnet comprised in an electric circuit, and having its armature adapted to operatively connect with said mechanism to stop or release the same; and means, for actuating said unison-magnet, whereby the actual writing impulses sent over the line will start or release the mechanism and the absence of said impulses will operate to cause said magnet to stop the machine.

19. In a facsimile-telegraph, a plurality of styluses, mechanism for operating the styluses, an electromagnet, devices operated by the armature of the latter, guide devices comprised in said stylus-operating mechanism and adapted to guide said armature-operated devices in their operative contact, and stop devices comprised in the stylus-operating mechanism and relatively arranged at the terminal of said guide devices and adapted to be engaged by said armature-operated devices.

20. In a facsimile-telegraph, a plurality of styluses, a rotary shaft for operating the styluses, an electromagnet mounted in adjacent relation to the said shaft, and an arm pivotally mounted upon the armature of said magnet and adapted to engage said shaft to stop the same.

21. In a facsimile-telegraph, a plurality of styluses, a rotary shaft for operating the styluses, spiral guide devices provided upon said shaft, an electromagnet mounted in adjacent relation to the said shaft, and an arm pivotally connected to the armature of said magnet in a plane at right angles to the vibratory plane of action thereof, said arm being adapted to engage the guide devices upon the shaft to stop the same.

22. In a facsimile-telegraph, a plurality of styluses, mechanism for operating the same, stop devices comprised in said mechanism, means for engaging said stop devices, means actuated by the actual writing impulses sent over the line, whereby to start or release the mechanism by said writing impulses and to stop the mechanism by the absence of said writing impulses, and means for prolonging the actual engagement of the operating means with the stop devices after the former is thrown into operative position, whereby the mechanism will not stop until after a continuous predetermined absence of writing impulses.

23. In a facsimile-telegraph, a plurality of styluses, mechanism for operating the styluses, stop devices comprised in said mechanism, vibratory operating devices adapted to engage said stop devices, and intermediate means arranged to be first engaged by said vibratory devices and adapted to guide the same to said stop devices in a prolonged period of movement.

24. In a facsimile-telegraph, a plurality of styluses, the combination of mechanism for operating the styluses, an electromagnet and its vibrating armature, means actuated by said armature for engaging and stopping the stylus-operating mechanism, and means for retarding the action of said mechanism in effecting said engagement.

25. In a facsimile-telegraph, a plurality of styluses, the combination of mechanism for operating the styluses, an electromagnet and its vibratory armature, mechanism operated by said armature and adapted to engage the stylus-operating mechanism to stop the same, and independent means for quickening or accelerating the disengaging movement of said stop mechanism.

26. In a facsimile-telegraph, a plurality of styluses, mechanism for operating the styluses, electrically-actuated mechanism comprised in an individual circuit and arranged in operative relation to said stylus-operating mechanism to stop the same, means for prolonging the action of said stop mechanism af-

ter it is thrown into operative position, and electrically-actuated mechanism comprised in the main transmitting or writing circuit and operating to open and close said individual circuit.

27. In a facsimile-telegraph, a plurality of styluses, mechanism for operating the styluses, an electromagnet comprised in an individual circuit and having its armature in connection with mechanism adapted to be brought into operative position to stop said stylus-operating mechanism, means for prolonging the action of said stop mechanism after it has been thrown into operative position by the vibratory movement of the armature, and a relay comprised in the main transmitting or writing circuit and arranged in operative relation to said individual circuit to open and close the same.

28. In a facsimile-telegraph, a set of stylus devices arranged in a successive series, a commutator provided with two separate sets of individual segments, and circuit connections between said stylus devices and said segments, said connections extending alternately from the successive stylus devices to the different sets of segments and successively from the alternate stylus devices to the successive segments of the respective sets.

29. In a facsimile-telegraph, a set of stylus devices arranged in series, means whereby two different styluses will always be in operative contact with the message-paper, a commutator having separate sets of segments, said sets being made up of a series of separate segments and individual circuit connections extending from the respective stylus devices to such respective segments in such manner that each of the actually-contacting styluses will be connected to the same set of segments as the second stylus following it.

30. In a facsimile-telegraph, a set of constantly-rotating stylus devices, means for bringing a plurality of said stylus devices simultaneously in contact with the message-paper, and means for successively and individually circuiting said plurality of styluses.

31. In a facsimile-telegraph, a set of constantly-rotating electrically-actuated styluses, means for simultaneously bringing a plurality of said stylus devices into contact with the message-paper, and means for separately and individually actuating said plurality of stylus devices.

32. In a facsimile-telegraph, a plurality of stylus devices, the "selecting-commutator" device comprising separate sets of segments, the segments of each set being alternatively arranged and the segments of the different sets being in alternative relative position, and means for connecting said respective sets of segments with the individual stylus devices.

33. In a facsimile-telegraph, a plurality of stylus devices, the stylus-commutator divided into separate sets of individual segments which are individually connected to said stylus devices, in combination with the "selecting-commutator" divided into separate sets of alternatively-arranged segments with the segments of its different sets alternatively arranged in relative position, and the circuit connections between said commutators, for the purpose set forth.

34. In a facsimile-telegraph, a plurality of stylus devices, means for bringing a plurality of stylus devices simultaneously in contact with the message-paper, and means for alternating the action of said plurality of styluses while they are in said simultaneous contact.

35. In a facsimile-telegraph, a recording message-paper-feed mechanism, comprising a platen, a plurality of rollers mounted above said platen, a continuous carbon-ribbon mounted upon the said rollers and traversing the platen, a message-paper holder, guide devices for carrying the said paper over the platen in contact with the carbon-ribbon, means for adjusting the platen, means for regulating the tension of the carbon-ribbon, and means for tightening the guide devices upon the message-paper.

36. In a facsimile-telegraph, the combination, with the main frame of the machine having an opening, and stylus mechanism operating within said frame, of a carbon-ribbon-carrying frame mounted upon said main frame and embodying a table or platen arranged with relation to said stylus mechanism, said carbon-ribbon-carrying frame being received within the opening of the main frame.

37. In a facsimile-telegraph, the combination of a recording paper-feed mechanism, a carbon-ribbon-feed mechanism, means for operating said ribbon and paper mechanisms in unison, and tension devices for tightening and adjusting the paper with relation to its unison movement with the ribbon.

38. In a facsimile-telegraph, a constantly-rotating stylus-carrier, carrying a series of transmitting stylus devices which successively pass over the message-blank, a corresponding series of recording stylus devices, circuit connection between said respective series of transmitting and recording stylus devices, means for maintaining a plurality of said transmitting stylus devices and recording stylus devices in operative correlative position at the same time; and means for commutating the said transmitting devices to the writing-circuit.

39. In a facsimile-telegraph, the combination with a pair of alternating generators, and a constantly-closed line-circuit connecting the same, of transmitting and recording facsimile-telegraph mechanisms respectively connected to the said generators to be thereby synchronously operated, the transmitting devices being comprised in an individual circuit which is alternately opened and closed during the transmission of the message; and means for causing the current of the said individual circuit to pass over the main line as message impulses.

40. In a facsimile-telegraph, the combina-

tion with a pair of alternating generators and a constantly-closed circuit connecting the same, of transmitting and recording facsimile-telegraph instruments connected respectively with the said generators to be synchronously operated thereby; the writing mechanism of the recording instrument being comprised in the line-circuit, and the transmitting devices being comprised in an individual short circuit which is connected with the line and normally separated therefrom; and means for opening the said individual short circuit when the transmitting writing devices transmit message impulses, whereby said impulses will be sent over the line.

41. In a facsimile-telegraph, the combination with a pair of alternating generators connected by a constantly-closed circuit, of transmitting and recording facsimile-telegraph instruments connected respectively with the said generators to be synchronously operated thereby, stylus devices comprised in the said instruments and thereby caused to travel over a message-paper; the recording-stylus devices being comprised in the main circuit; and the transmitting-stylus devices being comprised in an individual short circuit which is connected with the line, and which is completed when the stylus devices are in contact with the message-blank; and means for breaking the said individual short circuit when the stylus is in contact with the message matter to be transmitted, whereby such opening of the short circuit will send message impulses over the line.

42. In a facsimile-telegraph, the combination with a pair of alternating generators, and a constantly-closed line-circuit connecting the same, of transmitting and recording facsimile-telegraph mechanisms connected respectively with the said generators to be synchronously operated thereby, stylus devices comprised in the said instruments and thereby caused to travel over a message-paper; the recording-stylus devices being comprised in the main circuit and the transmitting-stylus devices being comprised in an individual circuit which is connected with the line but which contains an individual source of electrical energy, which source of energy is short-circuited from the line when the stylus devices are in contact with the message-blank, and the current of which is sent over the line when the stylus is in contact with the message matter to be transmitted.

43. In a facsimile-telegraph, a constantly-closed main circuit, including the operating mechanisms of the instruments, which circuit is operated by an alternating synchronizing-current; and an individual circuit comprising the transmitting devices and embodying a direct-current source of energy which is short-circuited from the main line when the instrument is not transmitting message matter, but which is sent over the line when the writing devices are transmitting message matter.

44. In a facsimile-telegraph means for synchronizing the instruments with an alternating current over a constantly-closed main circuit and means for sending direct-current message impulses over the said circuit, at the same time with the synchronizing alternating current.

45. In a facsimile-telegraph means for synchronizing the instruments by a small or balanced alternating current over a constantly-closed main circuit, and sending heavier direct-current message impulses over the said closed circuit, at the same time with the synchronizing alternating current.

46. In a facsimile-telegraph means for synchronizing the instruments by an alternating current over a constantly-closed line-circuit in which the recording writing devices are included, an individual direct-current circuit, and means for sending the said direct current intermittently over the closed circuit including the transmitting devices as message impulses, at the same time with the synchronizing alternating current.

47. In a facsimile-telegraph means for maintaining a constantly-closed synchronizing-circuit in which the operating mechanisms of the instruments are included and in which the recording writing mechanism is also included, and an individual circuit including the transmitting devices the current of which is connected with and sent over the closed main circuit intermittently as message impulses.

48. In a facsimile-telegraph, the combination with a pair of alternating generators and a constantly-closed line-circuit connecting the same, of transmitting and recording facsimile-telegraph mechanisms respectively connected to the said generators to be thereby synchronously operated, the transmitting devices being comprised in an individual circuit which is intermittently opened and closed during the transmission of the message; means for causing the current of the said individual circuit to pass over the main line as message impulses when the transmitting writing devices are in contact with the message matter; means for stopping the transmitting devices when they are in contact with the message-blank; and means for suspending the action of the said stop means until the writing devices have traversed a predetermined amount of message-blank.

49. In a facsimile or other synchronous telegraph, a constantly-closed main circuit including the operating mechanism of the instruments and which circuit is operated by the alternately-synchronizing current; and an individual circuit comprising the actual transmitting devices and embodying a direct-current source of energy which is short-circuited from the main line when the instrument is not transmitting message matter, but

which is sent over the line when message matter is being transmitted.

50. In a synchronous telegraph means for synchronizing the instruments with an alternating current over a constantly-closed main circuit, and means for sending direct-current impulses over the said circuit at the same time with the synchronizing alternating current.

51. In a facsimile-telegraph, the combination, with the line-circuit and the transmitting and recording machines, of mechanism for automatically stopping and starting said machines in unison, and means for operating said mechanism through the writing or message electrical impulses over the line-circuit.

52. In a facsimile-telegraph, the combination, with the line-circuit and the transmitting and recording machines, of electromagnet devices operating to automatically stop and start said machines in unison, and means for operating said electromagnets by the writing or message electrical impulses over the line-circuit.

53. In a facsimile-telegraph, transmitting-stylus mechanism, recording-stylus mechanism, a line-circuit connection between said mechanisms, synchronously-actuated motor mechanisms respectively operating the transmitting and recording stylus mechanisms and having a line-circuit connection, and electrically-actuated means controlling the starting and stopping of the transmitting and recording stylus mechanisms in unison and actuated by the message impulses over the line-circuit.

54. In a facsimile-telegraph, transmitting-stylus mechanism, recording-stylus mechanism, a line-circuit connection between said mechanisms, continuously-operating motor mechanisms for the respective transmitting and recording stylus mechanisms, said motor mechanisms having a line-circuit connection and being synchronously actuated, electrically-actuated means for stopping and releasing the respective transmitting and recording stylus mechanisms in unison independently of the continuously-operating motor mechanisms, and means for actuating said stop and releasing means by the message impulses.

55. In a facsimile-telegraph, the combination, with stylus-operating mechanism, of mechanism for stopping and releasing said stylus-operating mechanism, and means for operating said stop and release mechanisms automatically by the action of the writing or transmitting impulses of the line-writing circuit.

56. In a facsimile-telegraph, the combination with stylus mechanism, of an automatic electrically-actuated stop and release mechanism for the stylus mechanism, actuated only by the electrical writing or transmitting impulses of the line-writing circuit.

57. In a facsimile-telegraph, the combination of stylus mechanism, comprised in an electric circuit and adapted in its operation to send electrical impulses over the writing or transmitting line-circuit, and electrically-actuated mechanism automatically controlling the stopping of said stylus mechanism and in operative circuit connection with said writing or transmitting circuit, whereby said stop mechanism is operated by the writing or transmitting electrical impulses.

58. In a facsimile-telegraph, a unison synchronous stop mechanism for the transmitting and recording machines, comprised in an electric circuit and adapted to stop and release the stylus mechanism, said stop mechanisms being in circuit connection with the writing or transmitting line-circuit and operated by the writing or transmitting electrical impulses sent over said line-circuit, whereby message impulses will release the machine and the continuous absence of message impulses will stop the machine.

59. A facsimile-telegraph comprising a disk rotating on an axis carrying a series of transmitting-points, a platen mounted in a plane perpendicular to the axis, a transmitting paper-feed comprising a pair of rolls at the end of the platen and a roll above the platen geared therewith, substantially as described.

60. A facsimile-telegraph comprising a disk rotating on an axis, a set of recording-points on the disk, magnets for operating the recording-points, and a paper-feed in a plane perpendicular to the axis for coöperating with the points, substantially as described.

61. A facsimile-telegraph comprising a disk rotating on an axis, a set of recording-points on the disk, magnets for operating the recording-points, and a paper-feed in a plane perpendicular to the axis, having means for moving carbon-paper, and means for moving ordinary paper, each paper to coöperate with the points, substantially as described.

62. A facsimile-telegraph comprising a disk rotating on an axis, a set of recording-points on the disk, magnets for operating them, a feed for carbon-paper and a feed for ordinary paper for drawing the papers over a platen to coöperate with the points, substantially as described.

63. A facsimile-telegraph comprising a disk rotating on an axis, a set of recording-points on the disk, magnets having armatures for operating the recording-points, and a paper-feed in a plane perpendicular to the axis for coöperating with the points substantially as described.

64. A facsimile-telegraph comprising a disk rotating on an axis carrying a series of transmitting-points, a metallic platen in a plane perpendicular to the axis, a set of springs connected to a rod and means for turning the rod to press the springs against the platen for conveying current to the transmitting-paper, substantially as described.

65. A facsimile-telegraph comprising transmitting-points and receiving-points, each mounted to rotate about an axis, paper-feeds in planes perpendicular to these axes, a single main line connecting them, means for

sending electrical currents of one kind for writing purposes and means for sending currents of another kind for synchronizing purposes.

66. A facsimile-telegraph comprising a disk mounted to rotate about an axis, a double series of transmitting-points thereon each controlling a single main line, a source of electrical energy and means for throwing this source to one or other set of the points in rapid alternation, and thereby sending pulses corresponding to one or other series of transmitting-points onto the line.

67. A facsimile-telegraph comprising a rotating disk, a double series of transmitting-points thereon each controlling a single main line and a pair of brushes bearing on break-wheels having their insulations in a staggered relation for supplying current to one or other of the sets of points in rapid alternation.

68. A facsimile-telegraph comprising a rotating disk mounted to rotate about an axis, a double series of transmitting-points thereon, another disk mounted to rotate about an axis, a double series of recording-points thereon, a single main line, a source of energy at the transmitting-station, means for throwing the source respectively to one or other sets of transmitting-points in rapid alternation and means at the receiving-station for operating the sets of recording-points alternating in synchronism therewith.

69. A facsimile-telegraph comprising a disk mounted to rotate about an axis, a double series of transmitting-points thereon, two commutators having their plates connecting respectively to the two sets of points, brushes bearing on these commutators connecting to other brushes bearing on break-wheels having their insulations in a staggered relation, and an electrical connection from the break-wheels to the transmitting-points completing the circuit.

70. A facsimile-telegraph comprising transmitting-points and receiving-points each mounted to rotate about an axis, paper-feeds in planes perpendicular to these axes, a single main line connecting them, an electric motor for driving the respective points, means for sending electrical currents of one kind for writing purposes and means for sending electrical currents of another kind for synchronizing the motor.

71. A facsimile-telegraph comprising transmitting and receiving points, each mounted to rotate about an axis, paper-feeds in planes perpendicular to these axes, a single main line connecting them, a unison device controlled by an electromagnet, a local circuit for this magnet, a high-resistance relay controlling the local circuit, and means for sending a prolonged high-tension current over the line to operate this relay to bring the transmitter and receiver into unison.

72. A facsimile-telegraph comprising a disk rotating on an axis, a double series of receiving-points mounted on said disk, operating means for said receiving-points, two commutators connected symmetrically to the said operating means, a double series of transmitting-points, two commutators connected symmetrically to said series of transmitting-points, paper-feeds in planes perpendicular to the two series of points and coöperating respectively therewith, a single main line, and means for throwing either one or other series of points into coöperative relation with the line in rapid alternation.

73. A facsimile-telegraph comprising a disk rotating on an axis, a series of receiving-points mounted on said disk, operating means for said receiving-points, a commutator on the axis connected to the means for operating the receiving-points, a series of transmitting-points, a commutator connected to the transmitting-points and paper-feeds in planes perpendicular to the two series of points for cooperating respectively therewith.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 4th day of November, 1899.

EDWARD E. KLEINSCHMIDT.

Witnesses:

FREDK. KLEINSCHMIDT,

PERCY T. GRIFFITH.