Aug. 9, 1938. R. W. DOIDGE 2,125,995

CIPHERING MACHINE

Filed March 3, 1937 4 Sheets-Sheet 1

Fig. 1.

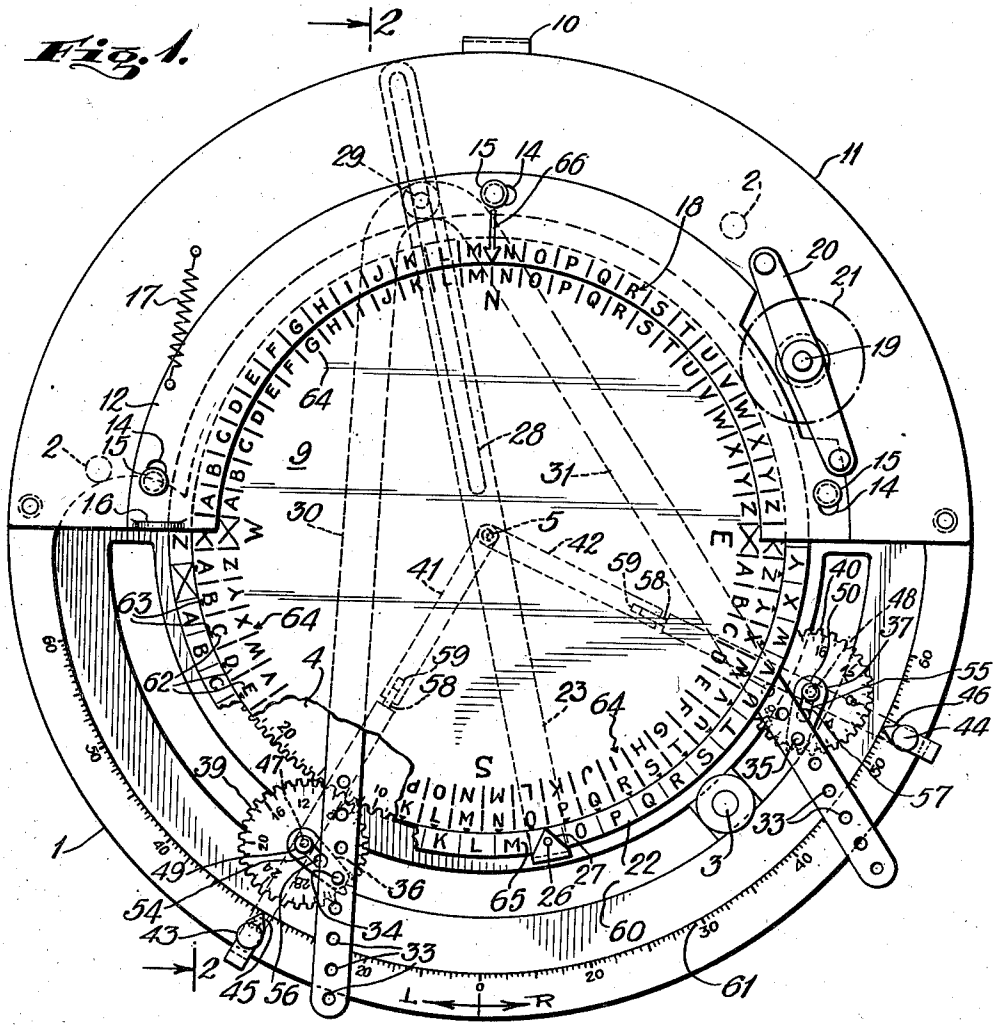
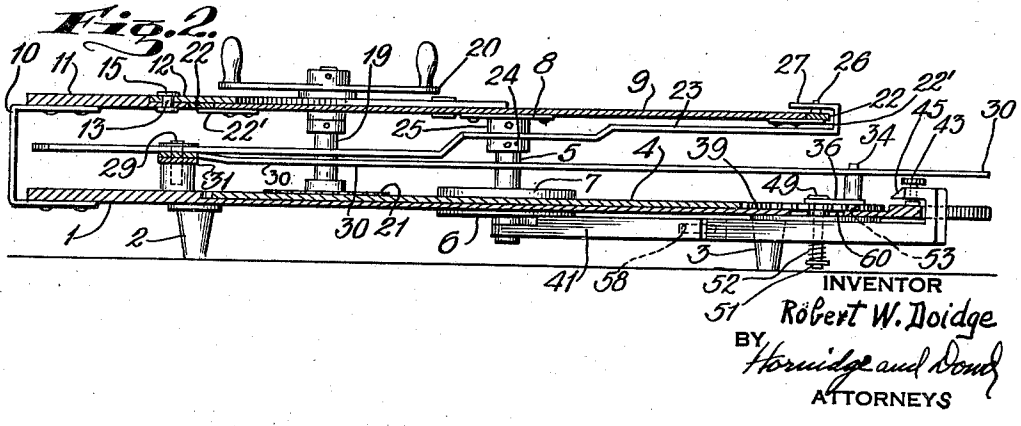


Fig. 2.



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CIPHERING MACHINE

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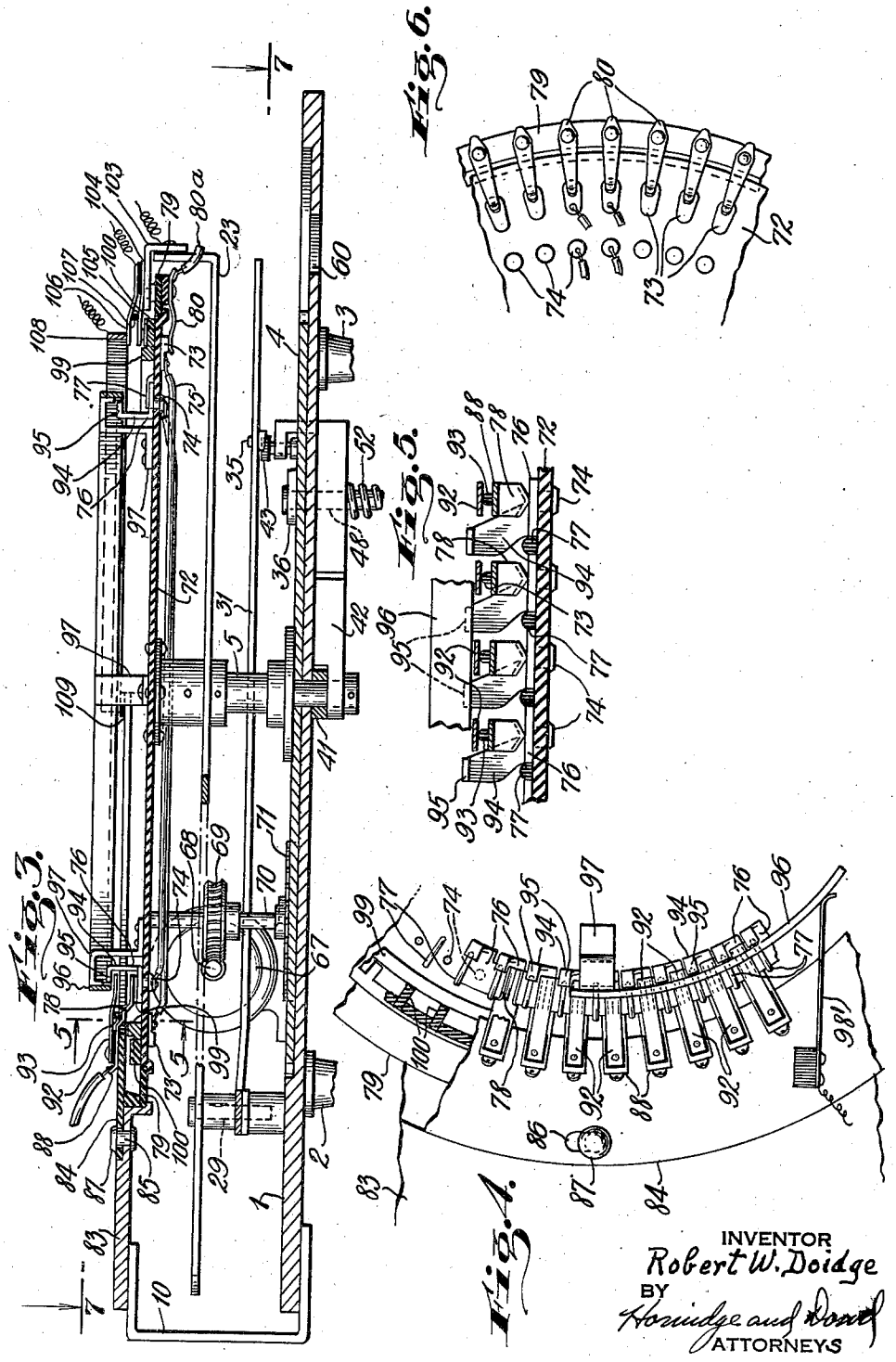

Fig. 3.

Fig. 6.

Fig. 5.

Fig. 4.

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CIPHERING MACHINE

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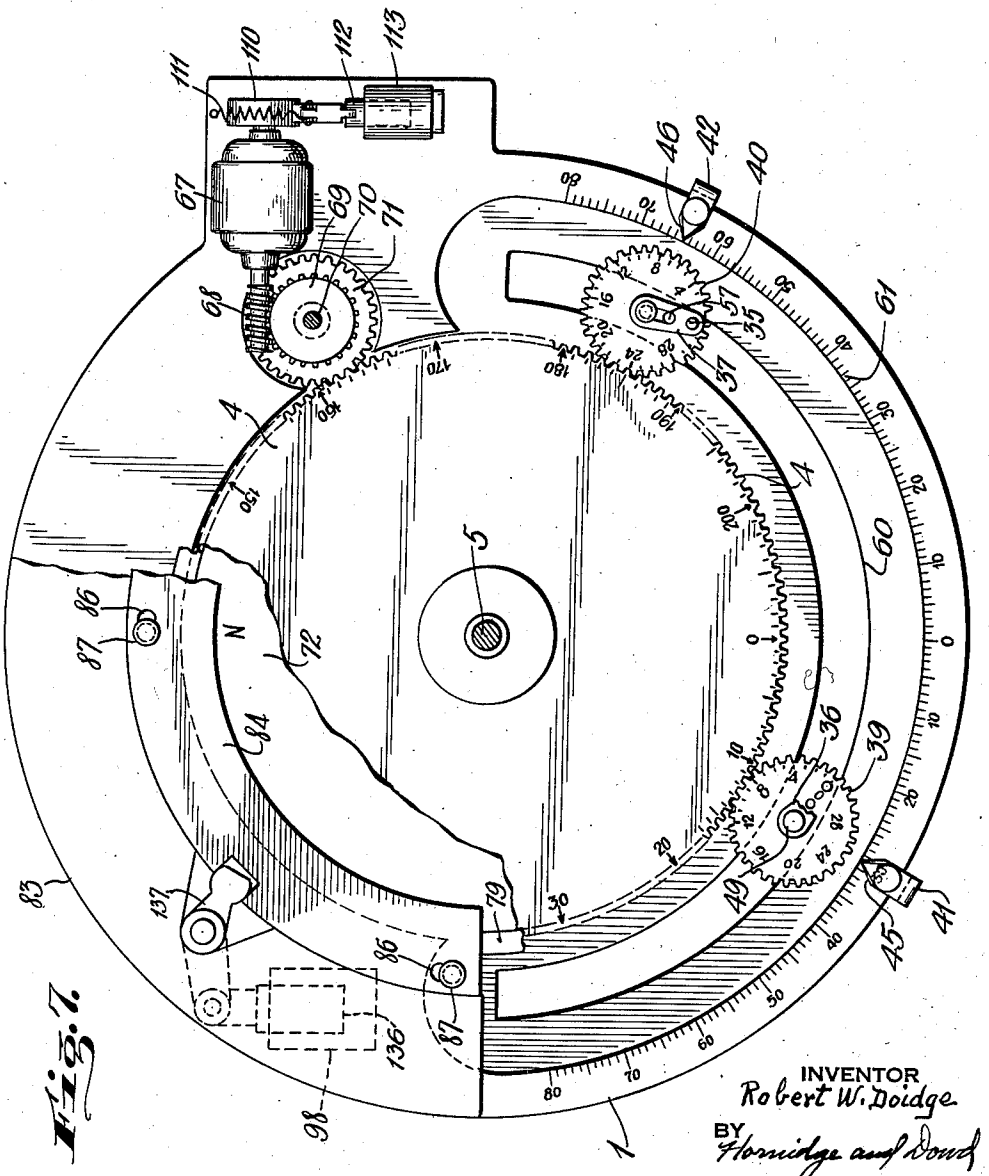

Fig. 7.

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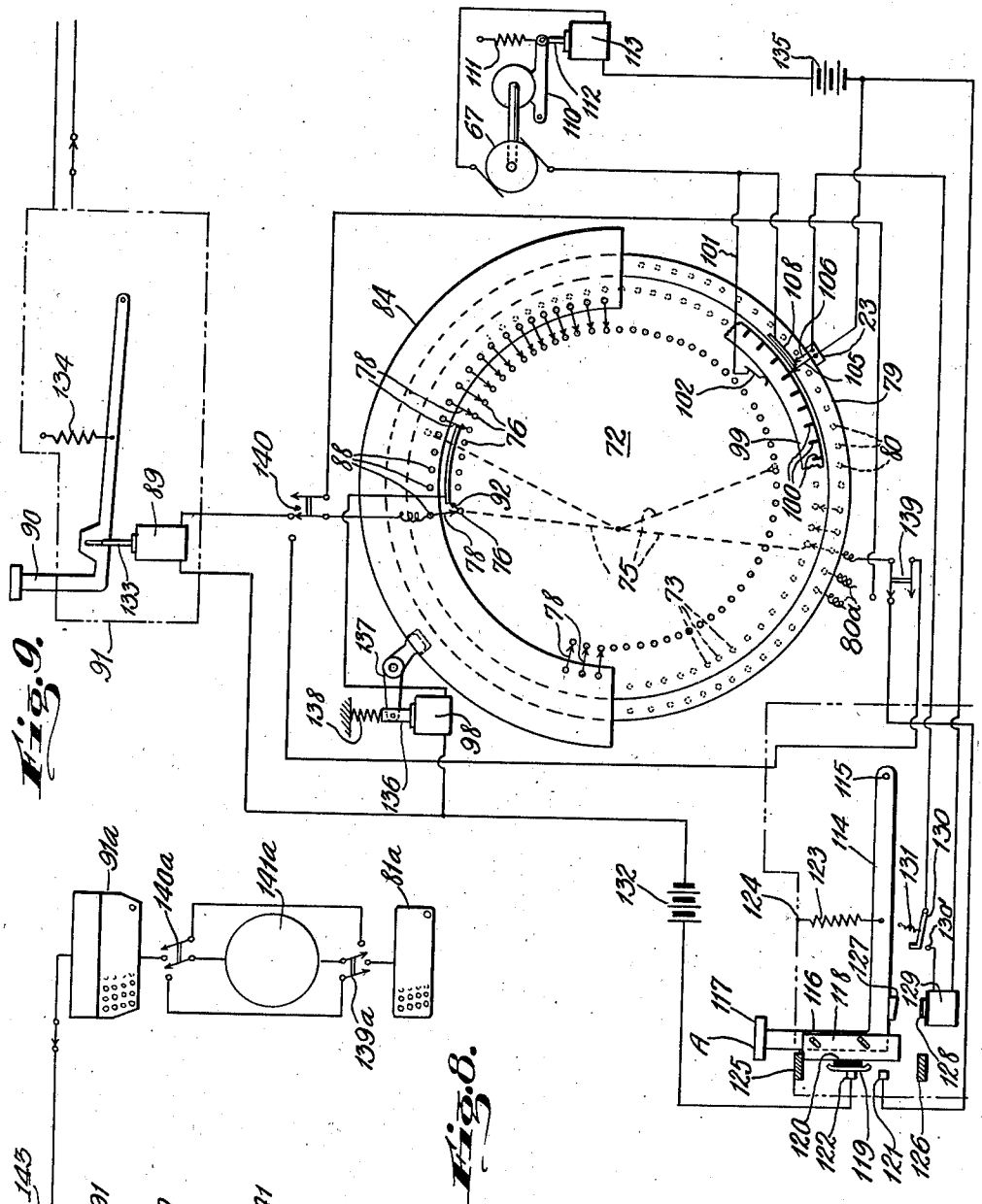

Fig. 9.

Fig. 8.

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UNITED STATES PATENT OFFICE

2,125,995

CIPHERING MACHINE

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Application March 3, 1937, Serial No. 128,758

11 Claims. (Cl. 35—3)

This invention relates to a substitution letter enciphering and deciphering machine for creating "cyphergrams" in which the various letters forming the words of the actual message are brought in an irregular sequence into register with the letters of multiple conventional or shuffled alphabets for the encipherment of the message and has for one of its objects to provide such a machine in which the rate of movement of one set of letters with respect to the other is variably affected by the use of an adjustable toggle whereby a high degree of irregularity between the letters of the original message and the enciphered message is achieved so as to upset the calculation or count of letter frequencies used in mathematical deciphering and at the same time the enciphered message may be readily and accurately deciphered by the use of the same or a similar machine in the hands of an authorized addressee operator.

Another object of the invention is to provide an electrically operated enciphering and deciphering machine whereby the typing of a message in conventional language with a manually operated keyboard will cause said message to be written in cipher, and in its enciphered form to be transmitted by wire or radio to a distant point where it will be automatically written in deciphered form as for instance, by the use of said machine, in combination with a "teletype" machine.

Other objects and advantages of the invention will be apparent from the following description of it and by reference to the accompanying drawings in which:

Fig. 1 is a plan view of the invention.

Fig. 2 is a cross sectional elevation of the same along the line 2—2 of Fig. 1.

Fig. 3 is a cross-sectional elevation of the invention for operation electrically.

Fig. 4 is a plan view of a portion of the device of Fig. 3 showing the switching mechanism between the normally fixed member and the rotating member of the invention, with a part cut away.

Fig. 5 is a cross-sectional elevation along the line 5—5 of Fig. 3.

Fig. 6 is a plan view of the under side of portions of the rotating member and the oscillating member of the invention showing the switch connections between them.

Fig. 7 is a plan view along the line 7—7 of Fig. 3 with parts cut away.

Fig. 8 is a diagrammatic representation of the invention in conjunction with teletyping means for enciphering, transmitting and deciphering a message in type.

Fig. 9 is a representation, in part diagrammatic, of the electrical operation of the device.

Referring to Figs. 1 and 2, 1 is a circular base plate supported on three feet two of which such as 2 are fixed approximately 120 degrees apart and the third foot 3 is adjustable; 4 is a gear in the form of a flat disc provided with teeth about its periphery slidably positioned upon the base plate 1 upon which it is free to rotate. Said gear 4 is secured to the vertical shaft 5 between the flanges 6 and 7 attached to said shaft 5. The upper end of the shaft 5 terminates in the flange 8 to which is secured concentrically with the gear 4 the circular disc 9. Mounted on said base plate 1 and substantially in the plane of the disc 9 by means of brackets such as 10 is the semicircular plate 11 disposed concentric with the disc 9 and with its inside periphery adjacent the outer periphery of the disc 9. Slidably supported on said plate 11 and concentric therewith is a second semi-circular plate 12 with its inside margin overlapping for a short distance the outer margin of the disc 9 and with sufficient space between them for clearance. Said plate 12 is held to plate 11 by the vertical studs 13 attached to the plate 11 which extend through the slots 14 in the plate 12 and are provided at each end with flanged heads 15 in loose contact with the plates 11 and 12 so that the latter may be temporarily moved from its normally fixed position a short circular distance limited by the lengths of the slots 14 upon exerting a pull upon the upright lug 16 formed at one end of the plate 12 and against the tension of the spring 17 attached at one end to the plate 11 and at the other to the plate 12. When the pull is released the plate will resume its former position. The upper surface of said plate 12 along its inner margin is divided by radial lines into twenty-six equal spaces each containing a different letter of the alphabet which alphabet is referred to as 18 on Fig. 1 of the drawings.

Journaled in the semi-circular plate 11 and the base plate 1 is a vertical shaft 19 to the upper end of which is attached the crank 20, and upon said shaft adjacent the base plate 1 is mounted the gear 21 in mesh with the gear 4 so that by turning the crank 20 the gear 4 carrying with it the disc 9 will be caused to rotate. Concentrically mounted in the same plane with the disc 9 is a flat ring 22 with its inner edge adjacent the outer edge of the disc 9. Said ring 22 is rotatably supported upon outwardly extending flat metal plates 22' attached to the underside of the plate 9 at different points about its circumference upon which plates the flat ring 22 is free to slide. 23 is a lever arm pivotally

mounted on the shaft 5 between the collars 24 and 25. One end of the lever arm is securely attached to the flat ring 22 by means of a rivet 26 in the end of said arm which is turned over upon the upper surface of said flat ring 22 in the form of a pointer 27. Said lever arm 23 in the portion thereof on the opposite side of the shaft 5 is formed with a longitudinal slot 28 to receive and guide the pin 29 forming the hinge of the toggle arms 30 and 31. Thus any movement of the pin 29 transversely of the lever arm 23 caused by actuating the toggle arms 30 and 31, will give a rotary motion to the flat ring 22 and the pointer 27 attached thereto while any movement of the pin 29 longitudinal of the lever arm 23 will cause the pin 29 to travel along the slot 28 in which it in free to slide. The said toggle arms 30 and 31 are formed for a distance towards their outer ends with a series of perforations 33 to receive the vertical studs 34 and 35 attached to the outer ends of the crank plates 36 and 37 which are adjustably connected to the gears 39 and 40 rotatably mounted in mesh with and driven by the gear 4 as hereafter described.

Arms 41 and 42 are pivotally attached at their inner ends to the shaft 5 beneath the base plate 1 and extend radially to the outer periphery of said base plate to which they may be locked at any desired degree of angularity with respect to each other by the set screws 43 and 44 which are threaded into the turned over end portions thereof, which are formed at their extremities with pointers 45 and 46. In each of said arms 41 and 42 are slidably positioned in holes therein the vertical pins 47 and 48 extending therethrough and formed at their upper ends with flanged heads 49 and 50, and at their lower ends said pins are each fitted with a cotter-pin held washer such as 51 constituting a seat for the spring 52 held in compression between said washer and the under side of each of the arms 41 and 42. Said pins 47 and 48 form spindles on which the gears 39 and 40 rotate carrying with them the crank plates 36 and 37 which are operatively connected to said gears by the insertion of an extension of each of the studs 34 and 35 on the under side of the crank plates 36 and 37 into perforations in the sides of the gears 39 and 40 as at 53 and by the spring actuated flanged heads 49 and 50 of the pins 47 and 48 by which said crank plates are held tightly in close contact with the upper sides of said gears. Said crank plates are provided towards their inner ends with longitudinal slots 54 and 55 instead of a hole to receive the pins 47 and 48 so that the effective length of said crank plates may be selectively shortened by the insertion of the under side extension of the studs 34 and 35 in the perforations 56 and 57 in the sides of the gears 39 and 40 located nearer the axes of said gears.

Each of the arms 41 and 42 is made in two parts joined together by a tenon 58 formed in the end of one part slidably fitted into a conforming socket 59 in the adjacent end of the other whereby the gears 39 and 40 may be withdrawn out of mesh with the gear 4, and moved into mesh with said gear at different locations, thus changing the angular relation of the pivoted arms 41 and 42, the base plate 1 being provided with the semi-circular slot 60 to permit such pivotal movement of the arms 41 and 42 and the gears 39 and 40 carried thereon. Said slot 60 is also of such width as to permit the use of gears 39 and 40 of different sizes. One of the supporting feet 3 is slidably mounted in said slot so that it may be moved to a position free of interference with the angular adjustment of the arms 41 and 42. Said slot 60 is of sufficient width to permit the gears 39 and 40 to be withdrawn out of mesh with the gear 4 and at the same time not permit the tenons 58 to be fully withdrawn out of the sockets 59. Calibrations 61 along the outside periphery of the base plate 1 in cooperation with the pointers 45 and 46 denote the exact positions at which the gears 39 and 40 may be located in mesh with the gear 4.

It will be thus seen that by rotating the gear 4 by turning the crank 20 the gears 39 and 40 will also rotate carrying with them the vertical studs 34 and 35 which by engagement with the toggle arms 30 and 31 respectively will through the hinge pin 29 of the toggle moving in the slot 28 impart a pivotally oscillating motion to the lever arm 23 and the flat ring 22 attached thereto. It will be seen also that the extent of the oscillating movement will depend upon and may be greatly varied by the size of the gears 39 and 40, the angle formed by the arms 41 and 42, by the effective length of each of the toggle arms 30 and 31 as determined by the particular perforations 33 therein whereby the said toggle arms are respectively connected to the studs 34 and 35, and by the radial distance of the said studs from the axes of the gears 39 and 40 respectively.

The upper surface of the disc 9 along its peripheral margin is divided by short radial lines into a sufficient number of equal spaces containing therein the letters of two alphabets and two space indications arranged consecutively in a circle which alphabets are designated as 62 in Fig. 1. The radial dimension of said spaces is slightly less than the width of the overlapping margin of the plate 12. Beneath each of said letters and midway of the width of each space is placed along the circumferential edge of the disc 9 a triangular dot such as 63 with which the pointer 27 on the flat ring 72 may be brought into exact register with any of the letters or divisions of said alphabets 62.

Concentric with and disposed within the circle formed by said alphabets 62 on the disc 9 and radially in line therewith there is another series of circumferentially arranged equal spaces containing the letters of two alphabets 64 arranged consecutively but in the opposite order to those of the alphabets 62. The upper surface of the oscillating flat ring 22 likewise is divided for a distance somewhat more than half of its circumference into equal spaces in which are contained the various letters of the alphabet designated in Fig. 1 by the numeral 65. The division lines between the letters on each of the alphabets contained on the semi-circular plate 12, disc 9 and the flat ring 22 are of the same angular distance apart from each other so that the letters of the alphabets 62 and 64 on the plate 9 may be brought into exact register with the letters of the alphabet 18 on the plate 12 and the letters of the alphabet 65 on the flat ring 22 respectively. Disc 9 is also marked with four equi-distant points designated in Fig. 1 by the initials of the four cardinal points of the compass, N, E, S and W, while one of the division lines between the letters on the plate 12 is in the form of an arrow 66. The teeth of the gear 4 and the spaces between the teeth of the gears 39 and 40 are numbered as indicated in Fig. 1 so that gears 39 and 40 may be meshed with gear 4 in accordance with any predetermined arrangement.

The operation of the machine for enciphering a message is as follows: With the parts in operative relationship, the crank 20 is turned, for ex-

ample, to the right until for instance the line marked by the compass point N comes into line with the arrow 66. The gears 39 and 40 are then meshed with the gear 4 and a note made of the numbers of the two teeth on the gear 4 and the numbers of the respective spaces between the teeth on the gears 39 and 40 with which they are meshed as well as the calibrated numbers 61 at which the pointers on the ends of both the arms 41 and 42 are set. The machine is then ready to encipher the message. A note is also made of whether the crank plates 36 and 37 are set on the gears 39 and 40 at their long or short radii and the particular perforation on each of the toggle arms 30 and 31 placed over the studs 34 and 35 respectively. The crank 20 is then turned, for example, to the right until the pointer 27 on the oscillating flat ring 22 reaches a center dot 63 of one of the letters of the alphabets 62 and 64 whereupon the letter of the alphabet 18 on the plate 12 immediately opposite the first letter of the message as contained in the alphabet 64 will be its cipher letter. The crank 20 is again turned in the same direction until the pointer 27 on the flat ring 22 reaches the next center dot of the letters of the alphabet 62 whereupon the letter on the plate 12 immediately opposite the second letter of the message as contained in the alphabet 64 will be its cipher letter. This operation is repeated until the entire message has been enciphered.

It will be noted that due to the oscillating movement of the flat ring 22 there will usually be a continual change in the amount of relative movement between the disc 9 and the flat ring 22 in order to bring the pointer opposite each succeeding dot 63 on the disc 9 thus changing the relative relationship between the letters of the alphabets 64 on the disc 9 to those of the alphabet 18 so that any regular easily calculable frequency or fixed relationship between the letters of the message and their cipher letters is prevented.

Because of the toggle operation of the oscillating flat ring 22, it is obvious that when the pointer 27 on the said flat ring 22 comes to a center dot 63 of a letter of the alphabet 62 on the plate 9, it may happen that the letters of the alphabet 18 will not always be in exact line opposite the letters of the alphabet 64 on the disc 9 but may straddle the division line between two adjacent letters. It may be understood between the sender and recipient of the message that in such a case the letter of the alphabet 18 straddling the right hand division line of the letter of the alphabet 64 to be enciphered is its cipher letter. To avoid any misunderstanding in the cipher interpretation, however, the operator will in such a case, by means of the lug 16 pull the plate 12 around to the left a short distance until the division lines of both said alphabets come in line immediately opposite each other whereupon the letters of the two alphabets will then be in register with each other and the cipher letter of the message determined as above described.

The enciphered message thus formed letter by letter may readily be deciphered by the one receiving it who is provided with a duplicate machine and has been advised of the starting position of the disc 9 which in the above example was with the arrow 66 pointing to the letter N on the disc 9 as well as the positions of the arms 41 and 42, the radius of each of the crank plates 36 and 37, the particular perforations in the toggle arms 30 and 31 used on the studs 34 and 35, the location of the enmeshment of the gears 39 and 40 with the gear 4 as determined by the tooth and space numbers thereon and the direction of rotation of the crank 20. Such information may be conveyed in any agreed upon form either communicated separately in advance or it may comprise the first word or words of the cipher message using a particular letter to signify each of the details comprising said information. With these elements of the machine then placed in the same operative relationship and by proceeding as before the successive letters of the original message will appear on the disc 9 immediately opposite their cipher letters on the plate 12.

In the above example of one form of enciphering a message no use was made of the alphabet 65 on the flat ring 22 or of the outer circle of alphabets 62 on the disc 9, but they may be used, for instance, by selecting a letter on the flat ring 22 instead of the pointer 27, and the steps between enciphering each letter of the message may be determined by bringing any such letter on the flat ring 22 opposite certain letters of the alphabets 62 in any agreed upon sequence. Many other schemes of enciphering a message will readily suggest themselves to anyone using the machine. For instance, the letter on the plate 12 may be used for the actual message and the letters on the disc 9 coming into position opposite them will constitute their corresponding cipher letters.

Figs. 3 and 9 inclusive are illustrative of the machine adapted for electrical operation which embodies the principal elements hereinabove described with reference to Figs. 1 and 2 as indicated by the same reference numerals being used to denote similar parts. Instead, however, of the gear 4 and the other cooperating elements being driven by a hand crank, an electric motor 67 is used. A worm 68 on the shaft of the motor drives the gear 69 attached to the shaft 70 and the gear 71 also attached to said shaft 70 drives the gear 4. No alphabetical letters appear on the surface of the stationary, rotating and oscillating elements since no visual alignment of the various points located on said elements is necessary in the enciphering or deciphering operation, said operations being effected by an arrangement of switches whereby electrical circuits are variably established between the keys of a keyboard containing the letters, spaces and characters of a message and either the type bars which will print the varying cipher letters corresponding thereto or the keys of a teletype machine which will not only print the cipher letters but transmit them to a distant point where they may be automatically translated into the original letters of the message.

The only visual indications required and present are those by which the relative position of the movable elements may be determined at the start of the enciphering and deciphering operations which as in the case of the manually operated form of the machine hereinabove described, consist of calibrations 61, the numbers of the teeth of the gear 4, the numbers of the spaces between the teeth of each of the gears 39 and 40, an arrow 66 on the plate 84, and the initials of the four cardinal points of the compass such as N on the disc 72.

Referring to Figs. 3 to 9 inclusive, 72 is a circular disc mounted on the upper end of the shaft 5 and rotated with the gear 4. Said disc is made of non-conducting material and carries

on its underside adjacent its periphery a series of seventy-two equally spaced apart terminal points 73 representing two alphabets, two sets of numbers from 1 to 9 and two spaces. Also located on the underside of the disc 72 is another series of seventy-two terminal points 74 circumferentially arranged in radial alignment with but on a shorter radius than the terminal points 73. Each of the terminal points 73 is connected by an insulated wire such as 75 to a different one of the terminal points 74 on the opposite semi-circular portion of the disc 72. The terminal points 74 are individually connected to a series of brass contact plates 76 arranged in a circle directly above them upon the upper side of the disc 72 and separated from each other by narrow strips 77 of hard insulating material such as fiber which extend a slight distance above the level of the upper surface of the contact plates 76 with their tops rounded along their length so as to cause the contact fingers 78 to rise and fall as said separating strips 77 and said contact plates 76 rotate beneath them as hereinafter described.

Each of said contact plates 76 is formed with an upright portion 94 and a horizontal portion 95 extending therefrom and offset a slight distance laterally so as to come directly above the insulating strip 77.

Concentrically mounted adjacent the outer periphery of the disc 72 and in the same plane therewith is the oscillating flat ring 79 likewise made out of non-conducting material. Said flat ring 79 is supported by an annular flange portion on disc 72 extending beyond the periphery of the disc 72 upon which flange it is free to slide, and is caused to oscillate by means of the lever arm 23 rigidly connected thereto by the angular member 103, said lever arm in turn is operated by the toggle arms 30 and 31 which are driven by the gears 39 and 40 and the crank plates 36 and 37 attached thereto substantially the same as hereinabove described with respect to the machine illustrated in Figs. 1 and 2. Attached to the underside of the flat ring 79 is a series of thirty-six inwardly extending spring contact members 80 arranged thereon in a semi-circle and so disposed as to establish an electrical connection between them and thirty-six of the terminal points 73 respectively when they move into a position in line with each other as a result of the rotation of the disc 72. Each of these spring contact members 80 represents a letter of the alphabet, a number or a space and is electrically connected by a lead 80a to its proper key such as A of a keyboard 81. Supported by brackets such as 10 at a level a short distance above that of the disc 72 and concentric therewith is a fixed semi-circular plate 83. In a depressed portion of the upper surface of said plate 83 along its inner margin is slidably mounted concentric therewith a second semi-circular plate 84 made out of suitable non-conducting materials. Said plate 84 is held to plate 83 by the vertical studs 85 attached to the plate 83 and extending through the slots 86 in the plate 84 and provided with flanged heads 87 in loose contact with the plate 84 so that the latter may be moved a short circular distance limited by the length of the slots 86 as hereinafter described. Attached to the upper side of said semi-circular plate 84 are a series of thirty-six spring contact members 88, the free end of each of which terminates in a downwardly extending contact finger 78 the bottom of which is formed with oblique sides terminating in a narrow ridge and adapted to make a sliding contact with the contact plates 76 on the upper side of the disc 9 and to be lifted by and ride over the insulating strips 77. Each of these spring contact members represents a letter of the alphabet, a number or a space and is connected to a solenoid 89 adapted to operate one of the keys 90 of the keyboard of a teletype machine 91. Mounted directly above each of the said spring contact members 88 and insulated therefrom, is a second spring contact member 92. Said spring contact members 88 and 92 are held apart by a block of insulating material 93 so positioned that when the contact finger 78 rides up upon one of the insulating strips 77 the free end of said contact member 92 will be pressed up into contact with the upper horizontal portion 95 of the contact plate 76 and the under surface of the brass ring 96 concentrically supported above the disc 72 by a series of brackets 97 and rotated with said disc 72.

An electrical connection between said brass ring 96 and one end of the winding of the solenoid 98 is constantly maintained by a brass spring 98' (Fig. 4) pressing against the outer side of said ring 96 as it revolves with the disc 72.

Attached to the upper side of the disc 72 along its peripheral margin is an annular flat brass plate 99 formed with seventy-two radial slots along the outer half of its width. Said slots are so positioned that they are in vertical alignment with the terminal points 73 respectively. In each of said slots is fixed a narrow strip 100 of hard insulating material which extends a slight distance above the level of the upper surface of said plate 99 and with its top rounded along its length. An electrical connection is constantly maintained between a lead 101 from the motor 67 and said plate 99 by means of the contact spring 102 pressing against the inner periphery of said plate 99.

104 is an inwardly extending flat brass spring attached at one end rigidly to the upper side of the angular connecting member 103 and with the other and free end terminating in the contact finger 105 exactly similar in form and construction to the contact fingers 78. Said spring 104 is positioned midway between two of the contact members 80 and so disposed that the contact finger 105 rests upon and makes a sliding contact with the outer and slotted portion of the annular plate 99 and is lifted by the insulating strips 100 as the contact members 80 come into contact with the terminal points 73. Mounted on the connecting member 103 directly above the spring 104 and parallel thereto is a second flat brass spring 106, which is insulated from the spring 104 and said member 103 and held a fixed distance above the spring 104 by the block 107 of hard insulating material so that as the contact finger 105 is lifted by the passage underneath it of the insulating strips 100 an electrical contact is established between the free end of the spring 106 and the rigid semi-circular brass bar 108 which is supported at either end on the semi-circular plate 83 as at 109.

110 is a brake operating upon the shaft of the motor 67 and when the motor circuit is open it is held in a set condition under the tension of the coil spring 111 but when said circuit is closed said brake is released by the movement of the armature 112 attached thereto into the energized solenoid 113 which is included in the motor circuit.

The machine is operated by depressing selectively any of the thirty-six keys of a keyboard each bearing a letter of the alphabet, a number or a space which may be readily understood by reference to the diagrammatic arrangement shown in Fig. 9, in which, for purposes of clarity, there is shown but one key A and the electrically operated arrangement to produce the depression of the key 90 forming one of the keys on the keyboard of a standard teletype machine equipped with a key for each letter of the alphabet, number or space, it being understood that all of the keys of the respective keyboards are of similar construction and are operated in precisely the same manner as the keys A and 90. Said key A consists of a horizontal arm 114 pivoted at 115 and having an upright portion 116 surmounted with a button 117 upon which is printed a letter of the alphabet, for example the letter B. 118 is a plate slidably mounted on the side of the upright portion 116 and loosely held thereto by headed pins passing through oblique slots in the said plate 118. Said plate carries on its forward edge a contact strip 119 insulated from said plate by a strip of insulating material 120. Said contact strip is of sufficient length so that in the downward movement of the upright portion of the key A it will serve to make electrical contact with both of the contact points 121 and 122. Said key is normally held in its upper position as shown in Fig. 9 by the tension of the coil spring 123 attached at one end to the horizontal arm 114 and at the other to the upper portion of the casing 124. 125 is an upper stop which by engagement with the upper edge of the sliding plate 118 causes the contact strip to be moved to a forward position towards the contact points 121 and 122 when the key is returned from its downward stroke, while 126 is a lower stop which by engagement with the lower edge of the sliding plate 118 causes the contact strip 119 at the end of the downward stroke to recede from such position so that it will not make contact with said points 121 and 122 during the upward movement of the key. 127 is a soft iron armature attached to the lower side of the horizontal arm 114 of the key A and adapted to contact with the core 128 of the solenoid 129 at the end of the downward stroke of said key. 130 is a pivoted switch arm which will be forced into contact with the switch point 130' by the horizontal arm 114 of the key as the key A descends and will be moved out of such contact by the pull of the coil spring 131 when the key ascends.

When the said key A is pressed downward, the contact strip 119 causes an electric current to flow from the battery 132 across the switch points 121 and 122 and thence to the particular one of the spring contact members 80 on the oscillating flat ring 79 with which said key is operatively associated. Assuming that the movable parts of the machine are in such position that the contact members 80 are in contact with terminal points 73, the current will thence flow to one of the outer terminal points 73 on the disc 72 and thence by the connecting wire 75 to one of the inner circle of terminal points 74 on the opposite side of the disc 72 and through one of the spring contact members 88 in contact with one of the plates 76 on the upper side of the disc 72 and thence through the solenoid 89 back to the battery 132 whereby the key 90 being one of the keys comprising the keyboard of a teletype machine is pulled down by means of the armature 133 attached to said key and sliding in the hollow core of the solenoid 89, thus printing on the teletype machine the letter of the alphabet associated with said key 90. As the contact strip 119 in the downward movement of the key which carries it is pressed back out of contact with the switch points 121 and 122 by the engagement of the lower stop 126 with the lower edge of the sliding plate 118, said circuit is broken and the solenoid 89 deenergized with the result that the key 90 of the teletype machine returns to its former position under the pull of the coil spring 134. At the same time the horizontal arm 114 of the key A presses the pivoted switch arm 130 into contact with switch point 130' and since the flat spring 104 and the contact spring members 80 on the oscillating flat ring 79 are so disposed that when the said contact spring members 80 on the oscillating flat ring 79 are in contact with the terminal points 73, the contact finger 105 is resting upon one of the insulating strips 100 in the slotted brass plate 99 whereby the flat spring 106 is pressed upwards into contact with the semi-circular bar 108 which is elecelectrically connected by a flexible cable to the motor 67. This closes the motor circuit from the battery 135 and the current flows from said battery through the solenoid 113 releasing the brake 110, through the motor 67 causing it to drive the rotating disc 72 and the oscillating ring 79, across the semi-circular bar 108 and flat spring 106 and through the solenoid 129 which maintains the key A in its down position for a short interval until by the relative movement of the disc 72 and the oscillating ring 79 the contact finger 105 descends into contact with the brass plate 99 thus breaking the contact between the flat spring 106 and the semi-circular bar 108 and deenergizing the solenoid 129 and permitting the key A to return to its upward position. At the same time, however, the motor circuit itself remains closed with the current flowing from the battery 135 in the same way through the motor, the lead 101 and the spring contact 102 to the brass plate 99 and thence through the contact finger 105 and the flat spring 104 back to the battery. The motor will thus continue to operate until the contact finger 105 comes into contact with and is lifted by the next adjacent insulating strip 100, when the circuit will be broken and the motor will stop. This cycle will be repeated by again pressing down the key A (or any other key of the keyboard 81) and an operating impulse communicated to one of the keys 90 of the keyboard 91 of the teletype machine.

Because of the irregularity of the relative movement between the disc 72 and the oscillating flat ring 79 there will be no constant easy calculable frequency relationship between the keys of the keyboard 81 and those of the keyboard of the teletype machine 91 so that the extent of revolution of the disc 72 between successive depressions of the keys of the keyboard 81 will vary in practically every instance depending upon the direction and extent of the oscillating movement imparted to the flat ring 79 by the toggle arms 30 and 31 and because such movement is not in step with the rotation of the disc 72, it will sometimes happen that when in the course of the relative movements of the disc 72 and the flat ring 79 the contact finger 105 has come to rest upon one of the insulating strips 100 with the spring contact members 80 in contact with the terminal points 73, the contact fingers 78 may not be resting upon the plates 76 but in-

stead may be resting on the insulating strips 77 in which case no current will flow to a solenoid 89 to operate a key of the keyboard of the teletype machine 91. In such event, however, the contact fingers 78 will be in an uplifted position with the spring contact members 92 pressed upwards against the upper horizontal portions 95 of the contact plates 76 and the brass ring 96, thus forming a circuit whereby the solenoid 98 is energized by the battery 132 when the key A is pressed down and closes the circuit across contacts 121 and 122 permitting the current to flow from one of the spring contact members 80 to one of the contact plates 76 and thence through the brass ring 96 to one end of the winding of the solenoid 98, the other end of said winding being connected directly to the battery 132. The said solenoid thus energized exerts a downward pull upon the armature 136 attached by a bell-crank 137 to the semi-circular plate 84 and causes it to be moved a short distance limited by the length of the slots 86 but sufficient to cause the contact fingers 78 to move from their position on the insulating strips 77 and fall into contact with the plates 76 thus permitting the current to flow into a solenoid 89 and operate its related key 90. Thereupon the circuit across the brass ring 96 and the contact plate 76 is broken by the fall of the contact fingers 78, and the solenoid 98 deenergized so that the semi-circular plate 84 gradually resumes its former position by reason of the tension of a suitable coil spring 138 exerted upon the armature 136.

To decipher a message thus printed in cipher upon a teletype machine it is only necessary to arrange the adjustable parts of the machine, or of a duplicate machine, so that they will occupy the same relative positions as at the start of the ciphering operation and by suitable switches such as 139 and 140 transpose the connecting leads from the spring contact members 80 and 88 respectively so that the keys of the keyboard 81 are operatively associated with the spring contact members 88 and the keys of the keyboard of the teletype machine 91 are operatively associated with the spring contact members 80 each of said spring contact members 80 and 88 representing the same letter on the keyboards as before. Thus by typing the enciphered message on the keyboard 81 the message will be deciphered and appear printed in its original form on the teletype machine 91, which has a cut-off switch 143 to prevent sending while deciphering.

The message as enciphered on the teletype machine 91 may as indicated in Fig. 8 (in which the enciphering and deciphering machine exclusive of the keyboard 81 and the teletype machine 91 is referred to generally by the numerals 141 and 141*a*) may be by wire or radio electrically transmitted to another teletype receiving machine 91*a* located at distant points which through the operation of its keyboard by the electrically transmitted impulses will print the message in cipher, after which it may be deciphered by means of the keyboard 81*a* and the teletype machine 91*a* through the machine 141*a* with the connections transposed as above explained for the deciphering operation, or the message may be automatically deciphered by the electrical impulses constituting the transmitted cipher message being used to operate the keyboard 81*a*.

It is obvious that many changes may be made in the machine as above described without departing from the spirit of the invention as defined in the appended claims.

What I claim is:

1. In a machine of the class described, a stationary member, a rotatable member and an oscillating member, means for bringing different fixed points located on each of said members into substantial register with one another in an irregular sequence, said means including a toggle-joint operatively connected to said rotatable member and said oscillating member.

2. In a machine of the class described, a stationary member, a rotatable member and an oscillating member, means for bringing different fixed points located on each of said members into substantial register with one another in an irregular sequence, said means including a toggle-joint provided with adjustable arms and operatively connected to said rotatable member and said oscillating member.

3. In a machine of the class described, a stationary member, a rotatable member and an oscillating member, means for rotating said rotatable member, a gear driven by said rotatable member, a crank-pin mounted on said driven gear and engaging an arm of a toggle-joint the hinge of which is operatively connected to said oscillating member whereby different fixed points located on each of said members may be brought into substantial register with one another in an irregular sequence.

4. In a machine of the class described, a stationary member, a rotatable member and an oscillating member, means for rotating said rotatable member, two gears driven by said rotatable member, a crank-pin mounted on each of said driven gears and engaging the respective arms of a toggle-joint the hinge of which is operatively connected to said oscillating member whereby different fixed points located on each of said members may be brought into substantial register with one another in an irregular sequence, and means for varying the distance between the said two driven gears.

5. In a machine of the class described, an adjustable member, a rotatable member and an oscillating member, means for bringing different fixed points located on each of said members into register with one another in an irregular sequence, said means including a toggle-joint opertively connected to said rotatable member and said oscillating member.

6. In a machine of the class described, an adjustable member, a rotatable member and an oscillating member, means for bringing different fixed points located on each of said members into register with one another in an irregular sequence, said means including a toggle-joint provided with adjustable arms and operatively connected to said rotatable member and said oscillating member.

7. In a machine of the class described, an adjustable member, a rotatable member and an oscillating member, means for rotating said rotatable member, a gear driven by said rotatable member, a crank-pin mounted on said driven gear and engaging an arm of a toggle-joint the hinge of which is operatively connected to said oscillating member whereby different fixed points located on each of said members may be brought into register with one another in an irregular sesuence.

8. In a machine of the class described, an adjustable member, a rotatable member and an oscillating member, means for rotating said rotatable member, two gears driven by said rotatable member, a crank-pin mounted on each of said driven gears and engaging the respective

arms of a toggle-joint the hinge of which is operatively connected to said oscillating member whereby different fixed points located on each of said members may be brought into register with one another in an irregular sequence, and means for varying the distance between the said two driven gears.

9. In a machine of the class described, a rotatable member provided with two sets of terminal points disposed adjacent its periphery, individual conductors connecting terminal points of one set to terminal points of the other set located on the opposite side of said rotatable member, an oscillating member carrying a plurality of contactors adapted to make contact with said terminal points of one set, an adjustable member carrying a plurality of contactors adapted to make contact with said terminal points of the other set, key operated means for actuating said rotatable member and bringing said contactors successively in an irregular sequence into contact with various of said terminal points and for passing an electrical current from one of said contactors carried by said oscillating member to one of said contactors carried by said adjustable member.

10. In a machine of the class described, a rotatable member provided with two sets of terminal points disposed adjacent its periphery, individual conductors connecting terminal points of one set to terminal points of the other set located on the opposite side of said rotatable member, an oscillating member carrying a plurality of contactors adapted to make contact with said terminal points of one set, an adjustable member carrying a plurality of contactors adapted to make contact with said terminal points of the other set, key operated means for actuating said rotatable member and bringing said contactors successively in an irregular sequence into contact with various of said terminal points and for passing an electrical current from one of said contactors carried by said oscillating member to one of said contactors carried by said adjustable member, said means including a toggle-joint operatively connected to said rotatable member and said oscillating member.

11. In a machine of the class described, a rotatable member provided with two sets of terminal points disposed adjacent its periphery, individual conductors connecting terminal points of one set to terminal points of the other set located on the opposite side of said rotatable member, an oscillating member carrying a plurality of contactors adapted to make contact with said terminal points of one set, an adjustable member carrying a plurality of contactors adapted to make contact with said terminal points of the other set, key operated means for actuating said rotatable member and bringing said contactors successively in an irregular sequence into contact with various of said terminal points and for passing an electrical current from one of said contactors carried by said oscillating member to one of said contactors carried by said adjustable member, said means including a toggle-joint provided with adjustable arms and operatively connected to said rotatable member and said oscillating member.

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