

(No Model.)

4 Sheets—Sheet 1.

W. E. M. JACKSON.
ELECTRICAL SIGNALING APPARATUS.

No. 536,210.

Patented Mar. 26, 1895.

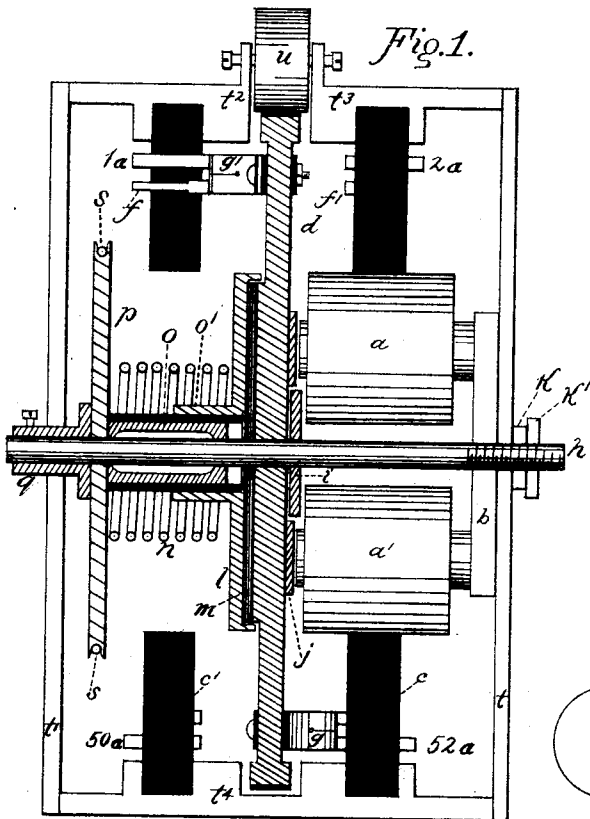
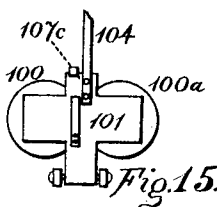
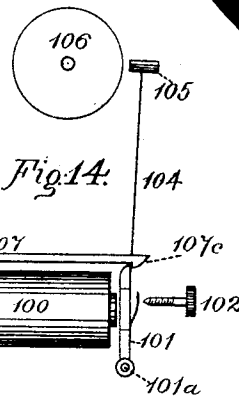
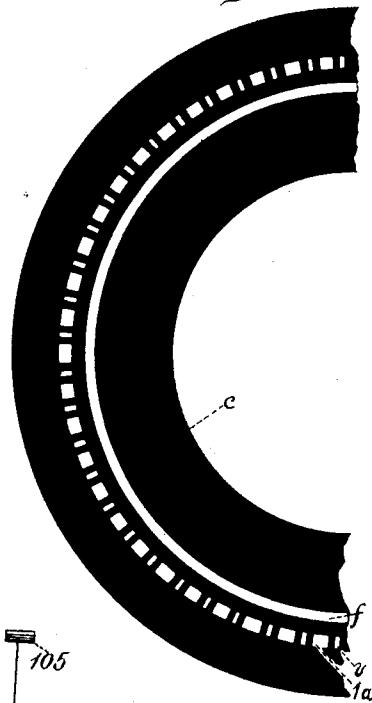


Fig. 2.



Witnesses:

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(No Model.)

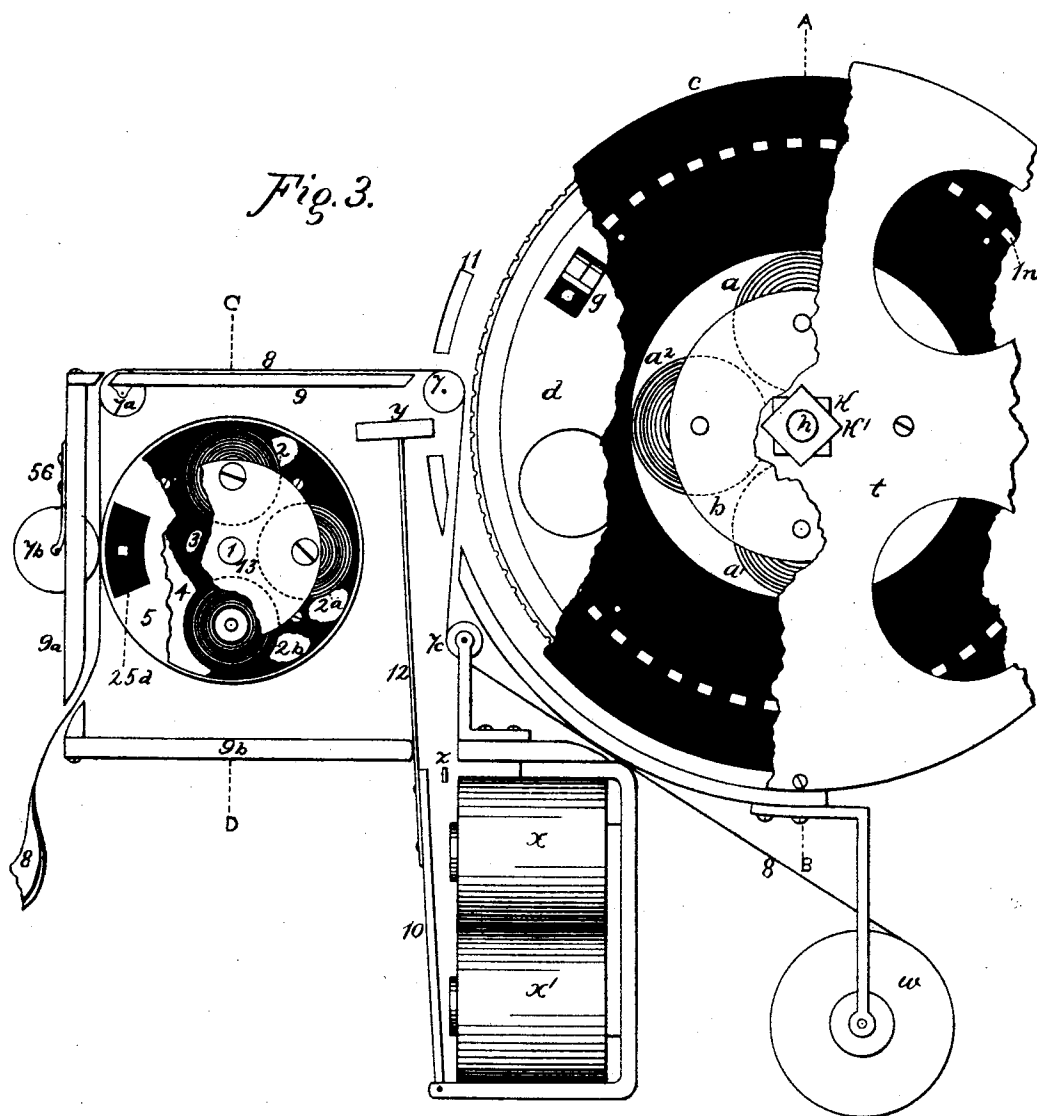
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No. 536,210.

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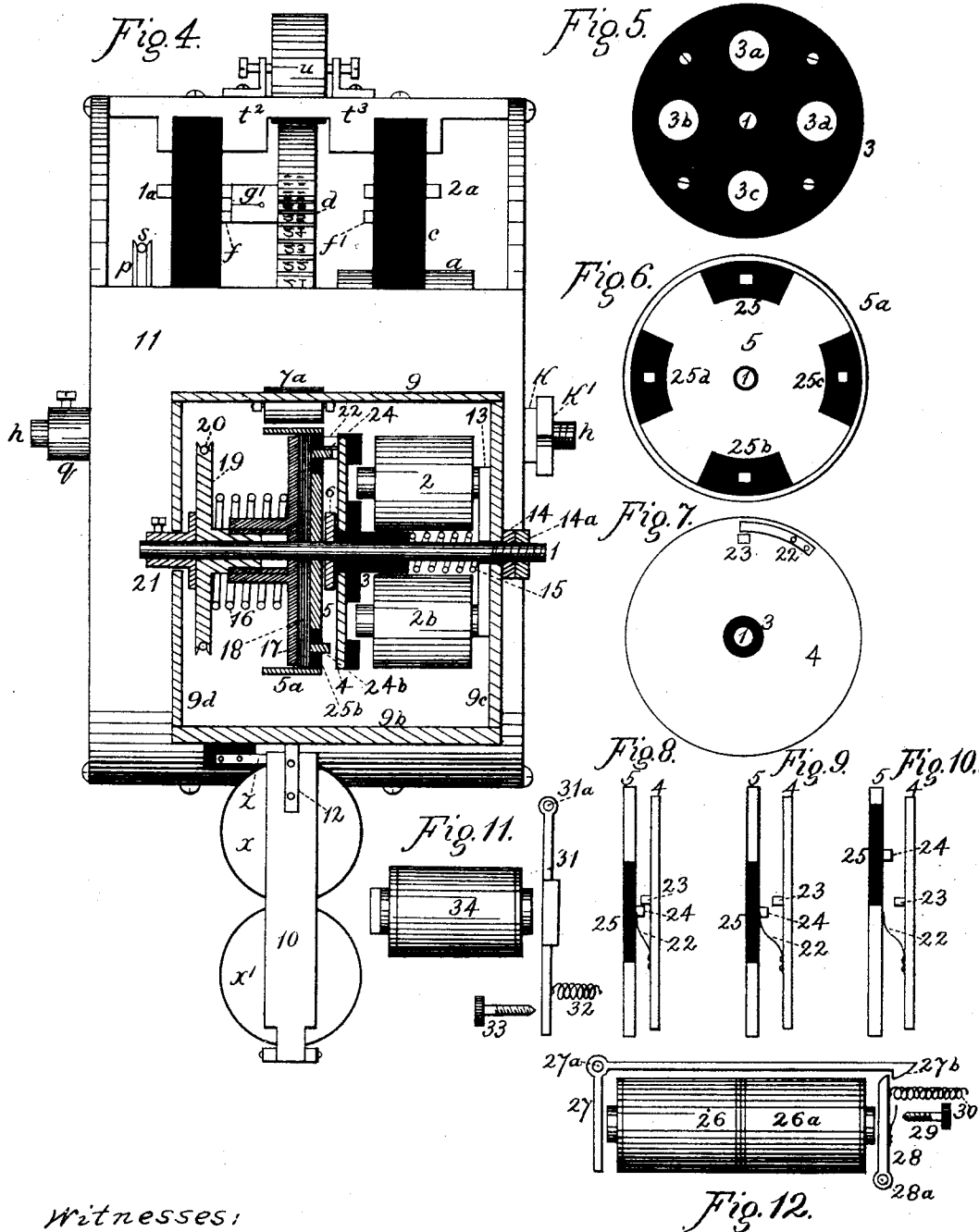
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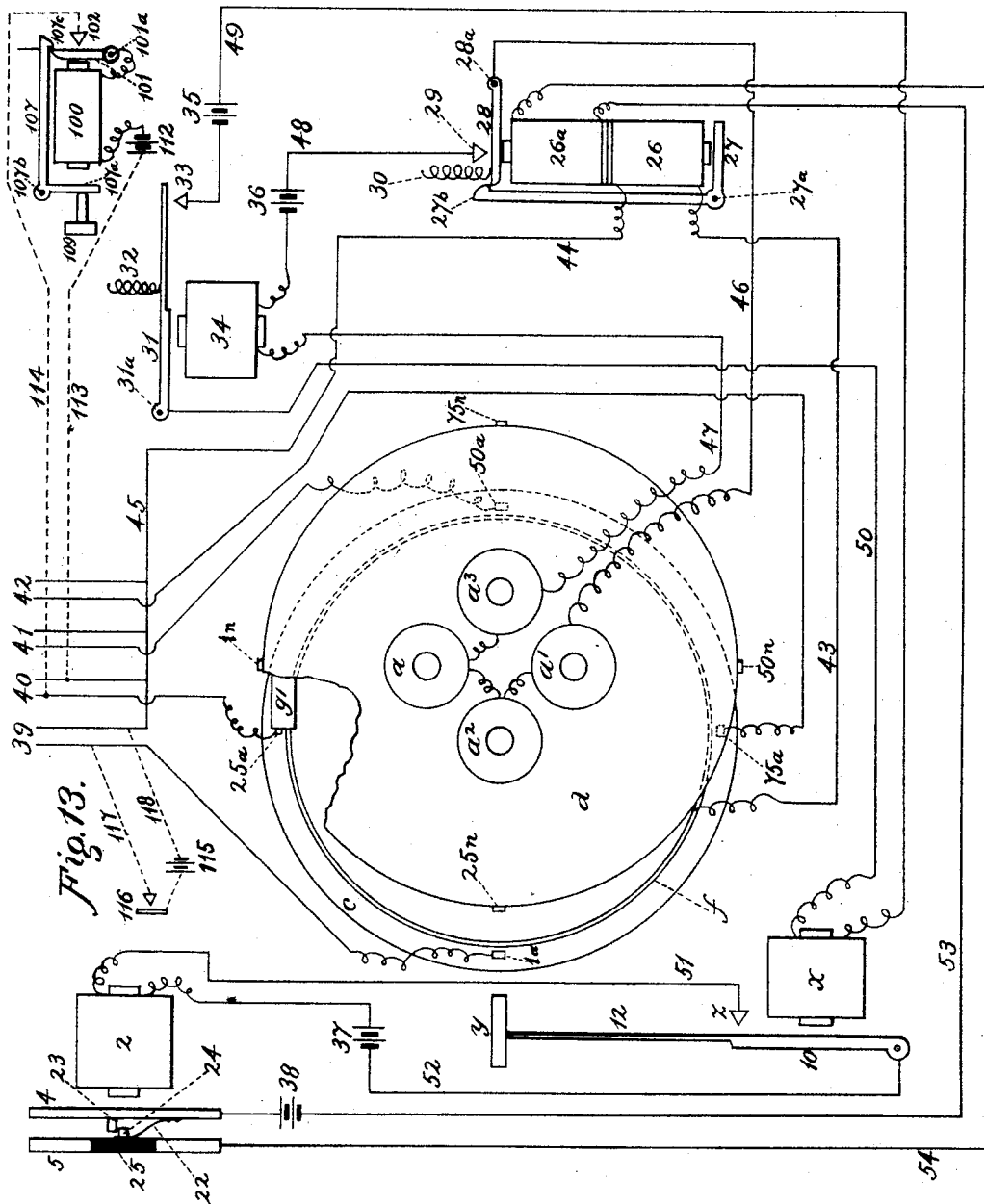
4 Sheets—Sheet 4.

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Patented Mar. 26, 1895.



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ELECTRICAL SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 536,210, dated March 26, 1895.

Application filed June 8, 1893. Serial No. 477,014. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. M. JACKSON, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Electrical Signaling Apparatus, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates specially to that character of signaling apparatus in which the signals are sent electrically from stations to a common or receiving instrument, each station having a given number or character and the receiving instrument operating so as to apprise a person located near it of the number or character of the station signaling. It is especially adapted for making a printed record of the signals received, but by modifications, which will be indicated in this specification, such signals may be otherwise visually, or audibly indicated. It would be most useful in telephone exchange central offices, fire or police alarm signaling, messenger service call receiving apparatus and in hotel and building annunciator systems, but can be applied to other uses, such as signaling observations or a printing telegraph, and I therefore do not restrict myself to its application to any special character of electrical signaling.

Figure 1 is a sectional view of the type wheel movement through the line A, B, in Fig. 3. Fig. 2 is a face view of part of one of the commutators. Fig. 3 is a side view of the whole receiving apparatus, except the relays, with parts broken away to better illustrate the relative arrangement. Fig. 4 is a sectional view, through the line C, D, in Fig. 3, of the paper movement, with a front view of the type wheel, commutators, printing magnet, &c., in the background. Fig. 5 is a view of the face of the armature 4, in Fig. 4, which is exposed to the action of the electromagnets in the paper movement, showing the insulating facing thereon. Fig. 6 is a face view of the wheel, 5, in Fig. 4. Fig. 7 is a view of the armature, 4, on the opposite side to that shown in Fig. 5. Fig. 8 represents the relative positions of the wheel, 5, and the armature, 4, when the paper movement is at rest. Fig. 9 represents the relative positions of the

same parts immediately after the electromagnets of the paper movement have been energized. Fig. 10 represents the relative positions of the same parts, when the paper movement is in position to close the circuit actuating the replacing magnet. Fig. 11 is a view of an ordinary relay used, in connection with the double relay, to close the circuit actuating the printing magnet. Fig. 12 represents the double relay used for receiving the signals and returning the apparatus to normal position after a signal has been registered. Fig. 13 is a diagram of the circuits, showing such parts of the whole apparatus as are necessary to make the operation understood. Fig. 14 is a side view, partly in section, of one form of signaling apparatus to be used at sending stations. Fig. 15 is an end view of parts of the same, showing the form of armature.

Like parts are indicated by the same letters and figures of reference in all the drawings.

I will first describe each separate part and explain the simple movements which they perform, and then the relative arrangement and combined operation of all the parts.

Referring to Figs. 1, 2 and 3, the type wheel, *d*, which is preferably made of metal, flanged, as shown in Fig. 1, and with holes punched through unnecessary parts to attain lightness, as shown in Fig. 3,—is free to revolve upon the shaft, *h*, and normally is continually in motion, power being communicated to it by means of the pulley, *p*, and the belt, *s*, (which connects with a suitable motor or power device, of any well known kind and therefore not shown on the drawings) through the frictional gearing device, as follows: The pulley, *p*, revolves freely upon the shaft at all times, and carries with it the thimble, *o*, over which fits another thimble, *o'*, which is attached to, or forms part of, the disk, *l*, and which is feathered on *o*, so that when *o*, in conjunction with the pulley, *p*, revolves, it carries with it *o'* and the disk, *l*. On that face of the type wheel, *d*, which is opposite the disk, *l*, is attached the frictional washer, *m*, made preferably of oiled leather, and the disk, *l*, presses against the exposed face of this washer, and by friction carries the type wheel, *d*, with it when revolving, the pressure being maintained by the spring, *n*, confined between the

pulley, p , and the disk, l . On the opposite side the pulley, p , is kept in place by the thimble, q , which is secured to the shaft, h , by a set screw or other suitable device, and by means of which the pressure of the spring, n , can be regulated. On the opposite side of the type wheel, d , the washer, i , which is rigidly attached to the shaft, h , holds the type wheel from moving in that direction. I am aware that frictional gearing devices somewhat similar to this have been used in other machines and make no specific claim on this part of the mechanism, except in combination.

Attached to the other side of the type wheel is a soft iron, flat ring armature, j . With the poles in close proximity to this armature, are the electromagnets, a , a' , a^2 and a^3 (see also Fig. 13) the opposite poles being connected to the pole-piece, b , which is fastened to the side of the frame, t , thus holding the magnets rigidly in one position.

The electromagnets are arranged around the shaft, as shown partly in Fig. 3, the shaft, h , passing through the pole-piece, b , and through the side of the frame, t , screwing through both, and being held on the outside of t by the nuts, k and k' . The thimble, q , on the other end of the shaft, passes through the other side of the frame, t' , but is not attached. By means of the two nuts, k and k' , forming a locking device, and the threaded end of the shaft passing through b and t , the shaft, h , carrying with it the type wheel and the frictional gearing device, can be regulated lengthwise and then held rigidly in position. As the electromagnets are rigidly attached to the side of the frame, t , it is plain that by thus regulating the shaft, the distance between the armature, j , and the poles of the electromagnets can be regulated, but such regulation will be always very slight, as the poles of the magnets should be almost touching the armature, j .

The operation, simply of the type wheel is as follows: The pressure of the disk, l , on the frictional washer, m , is so regulated by means of q that when the pulley, p , revolves it carries with it the type wheel, d , but this pressure is not so great but that d can be easily arrested and held in a fixed position while the pulley and the disk, l , continue to revolve. The electromagnets, being quite powerful, and having their poles very close to the armature, j , attached to the type wheel, will, when a current passes through them, instantly arrest the motion of the type wheel and hold it rigid until the current ceases, when the type wheel will again revolve by means of the frictional arrangement as described.

On each side of the type wheel are placed the rings, c and c' , made of insulating material and supported rigidly by attachment to the cross pieces of the frame, t^2 , t^3 and t^4 . Set in the face of each of these insulating rings, exposed to the type wheel, are the metallic rings, f and f' , (see Fig. 2,) which need not

pass through the insulating rings, but should have one or more connecting pins or screws passing through from each, so as to make electrical connection conveniently from the opposite side; also set into the rings, c and c' are the metallic contact pieces, 1^a , 2^a , 50^a and 52^a , *et al.*, arranged at equal distances apart and passing through the insulating rings, so that connecting wires can be attached to each on the other side. The rings, f and f' , and the contact pieces project beyond the faces of the insulating rings, c and c' , slightly and exactly the same distance.

It is well known that, in a commutator, if the contact points are faced on the same level with the insulating material between them, the action of the brush or spring, used for passing over the contact points, will wear off the insulating material and also the contact points, carrying in time a film of the material of each over the other, so that good insulation cannot then be obtained in such a combination. By raising the contact pieces above the surface of the insulating material, this objection is overcome.

Attached to the type wheel, d , in such a manner as to be insulated therefrom, are the contact-makers, g and g' , one on each side, made preferably in the form of a V or U from a strip or spring metal, with one end split, as shown. These contact-makers, when revolving with the type wheel, will make connection between the rings, f and f' , and the contact pieces, 1^a , 2^a , *et al.*, consecutively, being so adjusted in position that when g' makes a connection between f and a contact piece on that side g will be between two contact pieces on the other side and although in contact with f' will not be in contact with a contact piece, thus allowing for contacts to be made consecutively and alternately, first by g' and then by g , and so on. As the contact-makers follow around on the commutators it is obvious that they would spring in between the contact pieces, and thus create a clicking noise during motion, and to do away with this I arrange between the contact pieces smaller pieces, as at v , Fig. 2, projecting equally from the insulating rings with the rings, f , f' , and the contact pieces. The contact makers will then rest upon these intermediate pieces while passing from one contact point to another, and an almost noiseless operation be thus effected.

The operation, simply, of the commutators, in connection with the other parts described, is briefly explained as follows: If one pole of a battery be connected to a contact piece, say 1^a , and the other pole be connected, through the electromagnets, to the ring, f , it is evident that the type wheel will revolve, as already described, until it carries the contact-maker, g' , to 1^a , when the circuit will be immediately completed from 1^a to the ring, f , through g' , and the electromagnets energized. If, then, the battery is sufficiently strong, the electromagnets will overcome the adhesion of the disk, l , to the washer, m , and stop the type

wheel, as before explained, and the type wheel will be thus held until the circuit is broken, say at the battery, when the type wheel will revolve again, and will continue to revolve until the circuit is again closed at the battery and 1^a in contact with *g'*. Now, if any number, or all of the contact points are likewise connected with batteries, the circuit through the electromagnets and the rings, *f* and *f'*, forming a common return circuit, it is evident that the type wheel will be stopped similarly, as the contact-maker reaches a contact point, to resume its motion again when the exterior circuit is broken, and so on for each contact point on which the exterior battery circuit is complete. The type wheel will be stopped in a different position for each contact point.

To explain the relation of the contact points to the type on the type wheel I will now refer to that part of Fig. 13 which represents diagrammatically the type wheel, *d*, and one of the commutator rings, *c*. On *d* four type are represented, 1^a, 25^a, 50^a, and 75^a, with 25ⁿ shown in position to print. On *c* four corresponding contact points are represented, 1^a, 25^a, 50^a and 75^a, with the contact maker, *g'*, resting on 25^a. If *d* makes one quarter of a revolution to the right, *g'* will rest upon 50^a and 50ⁿ will be in position to print. If a half revolution is made, contact will be made on 75^a and 75ⁿ will be in position to print; and a similar relation will obtain between any number of contact points and the same number of type, arranged symmetrically.

An ink wheel is shown at *u*, Figs. 1 and 4. It consists of a padded roller, mounted so as to be easily replaced, and in such position that the type on the type wheel come in contact with and revolve it so as to continually present a fresh inking surface.

Referring to those parts of Figs. 3 and 4, which represent the paper movement, the shaft, 1, with adjusting or locking nuts, 14 and 14^a, on one end, with adjustable thimble or washer, 21, on the other end, the pulley, 19, belt, 20, disk, 17, frictional washer, 18, and spring, 16, are similar in their construction to parts of the same character on the type wheel movement, and, in conjunction with the wheel, 5, and the stop washer, 6, form a frictional gearing device similar to that described for the type wheel movement, except that the parts are not so large. A further description of this portion will therefore be unnecessary. The electromagnets, 2, 2^a, 2^b, &c., (only three of which are shown in any of the views, but four of which are preferably used) connected to the pole-piece, 13, are also similar to those described for the type wheel movement, except that they may be of smaller size, as their function is different.

Referring to Fig. 6, giving a face view of wheel 5, as well as to the sectional view of this wheel shown in Fig. 4,—it consists of a metallic disk, free to revolve upon the shaft, 1, with a flange, 5^a, and four insulating pieces,

25, 25^b, 25^c and 25^d, set in near the periphery, and, set one in each of these insulating pieces, four projecting teeth, two of which, 24 and 24^b, are shown in section in Fig. 4.

Referring to Figs. 4, 5, and 7, the armature wheel, 4, consists of a soft iron disk, mounted on an insulating disk and thimble, 3, in which are the holes, 3^a, 3^b, 3^c and 3^d (see Fig. 5) in which the poles of the electromagnets fit, and which expose the soft iron disk to the action of these magnets. At no time are the poles of the magnets withdrawn from the holes in 3, so that the armature cannot revolve, as the magnets are fixed. The disk, 3, expands in the form of a thimble on the shaft, 1, projecting slightly beyond the opposite face of the armature disk, one way, so as to rest against the stop washer, 6, and prevent the armature coming in contact with this stop-washer,—and in the other direction forming a stop for the spring, 15, which keeps the armature wheel normally away from the electromagnets, in the position shown in Fig. 4. The armature wheel is free to move upon the shaft, but, on account of the poles of the electromagnets projecting in the holes 3^a, 3^b, &c., can only have a lateral motion, in the direction of its axis, and this motion is limited on one side by the stop-washer, 6, and on the other side by the armature coming in contact with the poles of the electromagnets.

To insure the armature wheel being insulated from the body of the machine, the exposed portions, shown as 3^a, 3^b, 3^c, and 3^d, Fig. 5, are coated with insulating varnish, or covered with paper, so that they cannot make electrical contact with the poles of the electromagnets. To accomplish the same result the motion of the armature wheel on the shaft can be so limited by stops as to prevent the magnet poles quite touching the armature. On the opposite side of the armature wheel (shown in Fig. 7) is a tooth, 23, which engages with the teeth on wheel 5. More than one tooth can be used but I prefer to use only one. Attached near the tooth, 23, is a trailer, 22, which is constructed of thin elastic metal, such as phosphor-bronze or spring brass, and is limber enough to allow the end to rest upon the face of wheel 5 at all times, even when the armature is attracted by the electromagnets. This is more clearly shown in the diagrammatic side views of wheel 5, and the armature wheel, 4,—Figs. 8 and 9. Fig. 8 shows the trailer, 22, in the position it would occupy when the electromagnets are not energized and the armature is in the position shown in Fig. 4. Fig. 9 shows the trailer with the end still in contact with wheel 5 when the armature is attracted toward the electromagnets and the teeth are disengaged.

Referring to Figs. 3 and 4,—7, 7^a, 7^b, and 7^c are small pulley wheels, or rollers, mounted on easy bearings and forming guides for the paper, 8, which may be mounted upon any well known form of paper wheel, as shown

at *w*. The roller, 7^b, is held under pressure against the flange, 5^a, of wheel 5, by a suitable spring bearing, as shown at 56.

9, 9^a, 9^b, 9^c and 9^d are parts of the retaining frame of the paper movement, which is attached to the apron, 11, covering part of the type wheel movement. In 9, 9^a, 9^b and 11 apertures are left, as shown in Fig. 3, for the paper, 8, to pass through. Between the rollers 7 and 7^a the paper passes closely over the top of the frame, 9, so that that part of the paper in this position can be written upon, which arrangement would be specially convenient when the whole apparatus is set into a table, or shelf, to the level of the upper surface of 9.

The operation, simply, of the paper movement is as follows: The pulley, 19, revolves constantly and carries with it the disk, 17, which is kept under pressure against the frictional washer, 18, this washer being attached to the surface of wheel, 5, and constantly tending to carry the latter with it. Wheel 5, however, is held by the engagement of one of the teeth thereon, as 24, with the tooth 23, on the armature wheel, the latter being held by the engagement of the poles of the electromagnets with the edges of the holes, 3^a, 3^b, 3^c and 3^d, in the insulating piece, 3. Consequently the disk, 17, slides upon the frictional washer, 18, without moving it. If, now, the electromagnets are energized, the armature, 4, is attracted, the tooth, 23, on the armature wheel, is disengaged from the tooth, 24, on the wheel 5, and this wheel, being now free to revolve, is carried around by the frictional gearing, until the armature wheel is released by the circuit on the electromagnets being broken, when the spring, 15, forces it back to its original position and the tooth, 23, will then engage with one of the teeth on the wheel 5 and the latter will be again held. The paper, passing between the roller, 7^b, and the flange, 5^a, of wheel 5, and being in close contact with 7^b and 5^a on account of the pressure exerted by spring, 56, will, when the wheel 5 revolves, be carried forward and the distance it is so carried will be dependent upon the amount of movement allowed for wheel 5, or the time during which the electromagnets are energized. To better insure the movement of the paper without slipping the peripheries of 7^b and 5^a can be roughened or covered with rubber or other suitable material. If, now, the movement of the wheel 5 when it is released should be made to open the circuit passing through the electromagnets as soon as the wheel 5 has made, say, one eighth of a revolution, the armature wheel will resume its original position immediately after the teeth, 23 and 24, have passed each other, and the next tooth on wheel 5 will be in the path of tooth 23 and will stop the motion of wheel 5 after it has made one quarter of a revolution,—the teeth on wheel 5 being four in number, equidistant. This quarter of a revolution will move the paper forward a distance equal to one quarter the circumference of 5^a. The breaking of the circuit, as

presumed above, is accomplished indirectly by means of the trailer, 22, in connection with the relay shown in Fig. 12, and will be described after an explanation has been made of other parts and the circuit,—necessary to make this action understood.

The printing hammer mechanism is shown from the side in Fig. 3. *x* and *x'* show a common horseshoe pattern electromagnet, mounted in connection with the frame, as shown. In front of the poles is placed the armature, 10, pivoted at the lower end. At the upper end of this armature, the extension piece, 12, thin and limber, is attached, and to the top of this the printing hammer, *y*. When the armature, 10, is attracted by the electromagnet the hammer, *y*, is carried forward and delivers a sharp stroke against the paper, 8, and through it against that type on the type wheel which is in position to print, and thus an impression of this type is taken on the paper. The relation of the armature to the poles of *x* and *x'* is so adjusted, and the weight of *y* and limberness of 12 so related that, if the armature were brought slowly against the poles of the electromagnet, the hammer would not strike the type, but when the armature is attracted quickly the momentum of *y* will be sufficient to bend 12 and allow the hammer to strike a sharp blow, but to immediately rebound by the elasticity of 12. Placed in the path of movement of the armature is the contact piece, *z*, also shown in Fig. 4, which is mounted on an insulating base and is made in the form of a flat spring. This contact piece closes a local circuit when the hammer has struck, as will be explained hereinafter and also serves as a spring to throw the armature back into normal position, it only being necessary to exert a small force to do this, as when pushed just beyond the perpendicular the force of gravity carries it the balance of the way.

The relay shown in Fig. 11 is a simple relay of any well known pattern, and is designed, when the electromagnet, 34, is energized, to attract the armature, 31, which is normally held back by the spring, 32, and make contact between it and the set screw, 33, so as to close a circuit which may be connected at 31^a and 33. This relay may be located at any convenient place, or can be attached to the frame of the main apparatus. Its use will be made evident in the explanation of the circuits shown in Fig. 13. The spring, 32, can be dispensed with, if gravity is made to act as the retractile force.

The double relay shown in Fig. 12 is of peculiar construction, but is similar in some parts to a well known form of telephone annunciator. Two electromagnets, 26 and 26^a, are used, placed end to end. The armature, 27, in front of the pole of 26, has attached to it at right angles a long arm with a hooked end, 27^b. The right-angled piece so formed is pivoted at 27^a. In front of the pole of the magnet, 26^a, is placed the armature, 28, which

is pivoted at 28^a and normally is caught at the upper end by the hook, 27^b. The motion of 28 is limited outwardly by the set-screw, 29, against which it is drawn by the spring, 30, when released from the hook, 27^b.

The action, simply, is as follows: The parts being normally in position as shown in Fig. 12, when the magnet, 26, is energized the armature, 27, is attracted and the hook, 27^b, raised, releasing the armature, 28, which is then drawn by the spring, 30, into contact with the set-screw, 29, and, if a local circuit is connected to 29 and 28^a, such circuit will then be closed. If, now, the armature, 27, is released by the circuit in 26 being broken, the hook, 27^b, will fall by gravity, but the end of armature 28 will not be caught by the hook as the rounded outside portion of the hook will rest upon the end of 28, which is rounded on the inside corner, as shown. The contact between 28 and 29 will therefore remain, even when 27 is released. If, now, the magnet, 26^a, is energized, it will attract the armature, 28, drawing it away from the screw, 29, and bring the end again under the hook, 27^b, as, the ends of 27^b and 28, being rounded off, the motion of 28, when attracted, will force 27^b upward until the hook is passed, when 27^b will fall and hold 28, all parts then being again in normal position, as shown in Fig. 12. It is assumed that this relay will be so placed that the force of gravity can be used to bring the end, 27^b, normally down, and the armature, 27, normally away from the magnet 26, as is customary in telephone switchboard annunciators, where a similar device is used, but it is obvious that, by using a retractile spring, the same result could be obtained and the relay could then be placed in any position.

This relay also can be placed wherever convenient or can be attached to the frame of the main apparatus. Its use, also, will be made evident in the explanation of the circuits shown in Fig. 13.

The circuits and connected operation of the whole apparatus are explained as follows, special reference being made to Fig. 13, in which the different parts are shown diagrammatically, some of the parts which are compounded, as the double electromagnets, only being shown single, for the sake of simplicity: Metallic circuits, leading from sending stations or instruments, are represented by 39, 40, 41 and 42. One wire of the circuit from each station is connected to the common wire 45 and 44. From 44 a circuit is taken through the electromagnet, 26, and continued along line 43 to the ring, *f*, on the commutator. The other wire of the circuit from each station connects with one of the contact pieces, 1^a, 25^a, 50^a and 75^a, according to the number of the station. Taking, for example, circuit 40: a signal is sent in by transmitting a current, from a battery located at the station, through the circuit for a specified time, say four seconds. One side of the circuit will end at the contact point, 25^a and the other side at the ring,

f, on the commutator, which being normally unconnected would leave a gap in the circuit between them. The type wheel, *d*, carrying the contact-maker, *g'*, is revolving at, say, a rate of once in four seconds, and therefore, before the current at the station has ceased to be sent on the lines, *g'* will be brought in contact with 25^a, and, being already in contact with *f*, will bridge the gap and complete the circuit. The armature, 27, will then be attracted by the magnet, 26, and the armature, 28, released and drawn by the spring, 30, against the contact point, 29. This will close a local circuit as follows: from 29 through line 48, local battery, 36, electromagnet, 34, line, 47, electromagnets *a*, *a'*, *a*² and *a*³, line, 46, to 28^a and through armature, 28, to the starting point, 29. The electromagnet, 34, of the relay shown in Fig. 11, and *a*, *a'*, *a*² and *a*³ (being the stop magnets of the type wheel) will thus be energized. The action of the latter will be to instantly arrest the motion of the type wheel in the position shown in Fig. 13, with *g'* resting upon 25^a, and corresponding type, 25^a, in position to print. The action of the relay magnet, 34, will be to close another local circuit as follows: from contact point, 33, through local battery, 35, line 49, electromagnet, *x*, of the printing hammer, line 50, to point 31^a and thence through the armature, 31, to the starting point, 33. The electromagnet, *x*, of the printing hammer, will thus be energized and the hammer, *y*, will strike as already explained, making an impression from the type opposite (which has been inked by passing under the ink roller, *u*) upon the paper; and at the same time the armature, 10, will make contact with the point, *z*, closing another local circuit, as follows: from the contact point, *z*, along line 51, through electromagnet, 2, of the paper movement, local battery, 37, line 52, and thence through armature, 10, to the starting point, *z*. The electromagnets of the paper movement will thus be energized, the armature, 4, attracted and the tooth 23 released from the engaging tooth on the wheel 5, say, 24, allowing the wheel 5 to start revolving, as already explained. The province of the trailer, 22, attached to the armature, 4, can now be explained. The end of 22 rests normally upon one of the insulating pieces, 25, 25^b, 25^c and 25^d, shown in Fig. 6, this being the position as shown in Fig. 8, when the teeth are engaged. Armature, 4, being attracted and the teeth disengaged, wheel 5 revolves until the teeth are well cleared from each other and the trailer, 22, is also clear of the insulating piece and resting upon the metallic body of the wheel, as shown in Fig. 10. The following circuit will then be closed: from the trailer, 22, through armature, 4, local battery, 38, line 53, electromagnet, 26^a, line 54, thence through the shaft of the paper movement and the body of the wheel 5, in contact therewith, to the starting point, 22. The electromagnet, 26^a, forming part of the relay shown in Fig. 12, will then be energized,

armature, 28, will be attracted, breaking contact with 29 and allowing the hooked end, 27^b, to fall into its normal position and hold 28 in place, as shown in Fig. 13. Circuit 29, 48, 36, 34, 47, *a*, *a'*, *a*², *a*³, 46, 28^a and 28 will then be broken, magnets *a*, *a'*, *a*² and *a*³, cease to be energized, releasing the type wheel, which will start revolving again, and magnet, 34, will also cease to be energized, releasing the armature 31, which will break contact with 33 and open circuit 33, 35, 49, *x*, 50, 31^a and 31. Magnet, *x*, will then cease to be energized, armature, 10, released and contact with *x* broken, thus opening circuit *x*, 51, 2, 37, 52 and 10. Magnet, 2, will then cease to be energized and thus release armature 4, when the next tooth on wheel 5 will catch on tooth 23, and the paper movement restored to and held in its normal position. All parts will then be in the same condition as before the signal was received and ready for the registering of another signal. An impression of the type opposite the printing hammer when it struck will have been made on the paper and the paper will have been moved forward so as to bring this impression over the part, 9, of the frame work, where it can be easily seen and where rotations can be made opposite. The number or character so recorded will be that of the sending station.

The whole operation as thus described would be very quick. Magnets, 26, 34, *x* and 2, would act in such quick succession as to be almost simultaneous, while the type wheel magnets, *a*, *a'*, *a*² and *a*³ would act at the same instant as the relay, 34. The action of magnet, 26^a, and consequently the releasing of all the other magnets from circuit, would not, however, take place until a certain time had elapsed after magnet 2 was energized, and this time would be dependent upon the speed of the driving device, or disk 17, of the paper movement, as the action of the magnet 26^a is controlled by the contact made between the metallic portion of the wheel 5 and the trailer 22, when the teeth are disengaged and this wheel is revolving. The speed of disk 17 can, of course, be regulated to suit conditions, but ordinarily it is only necessary to have the time taken by the trailer to reach the metallic portion of the wheel 5 sufficient to allow for the proper action of the printing hammer.

Any signaling device at a sending station, which will send a current over the line capable of energizing the receiving magnet, 26, and which will continue the current a sufficient time to allow a full revolution of the type wheel, can be used. Many devices for serving this purpose will answer, the simplest of which would be the well known push button with local battery, contact to be made by the push button for a specified time,—as shown in connection with circuit 39, where 116 represents the push button, 115 the local battery, and 117 and 118 the lines leading to the main circuit. The well known forms of magneto signaling devices can also be used.

In any device a ratcheted lever, similar to that used in the familiar district messenger call boxes, can be utilized to hold the contact for the requisite time.

The apparatus and circuits so far described are applicable to a signaling system where the signals are not received very frequently.

In a system where several signals may be sent at the same time or closely following each other there is a remote chance that one or more will not be registered, as will now be explained. Assuming, for illustration, that the type wheel revolves once in four seconds, then the current sent from the signaling station should last four seconds, as the maximum time the current will have to wait to have the circuit completed through the receiving magnet, 26, will be when the contact maker, *g'*, has just passed the contact point on which current is waiting, or a little less than four seconds. If, however the contact-maker is just approaching a contact point on which current is waiting, for instance, if it has to make only one quarter of a revolution before reaching it, the time consumed will be only one second before the apparatus will act. In this case when circuit in magnet, 26^a, is closed by the trailer, there will still be circuit on magnet 26, thus holding the hook, 27^b, up,—but armature, 28, when attracted by 26^a, breaks contact with point 29, opening the local circuit including the stop magnets of the type wheel, and the type wheel will then start revolving, breaking contact between *g'* and 25^a and opening circuit in magnet 26, so that before armature 28 is released, by the trailer, 22, coming in contact with insulating piece, 25, on wheel 5, it will be caught by the hook 27^b. All parts will then be normal and the type wheel will have started on another revolution and by the time *g'* again comes in contact with 25^a the current from the sending station will have ceased. If current from the sending station is kept on the line a trifle over time it might cause the registering of the signal twice, which would, however, be but a slight objection; but, if a signal is sent on line 40 when the contact maker is just past contact point, 25^a, and if at the same time, or closely following, signals are sent on lines 39, 41 and 42, the contact-maker will have to stop on contact points 50^a, 75^a and 1^a before reaching 25^a, and, as the registering of these three signals will take an appreciable amount of time, by the time the contact-maker has reached 25^a the current on line 40 will have ceased and the signal will not be registered. Such a failure would be an extreme case, and very unlikely to occur, but on account of this objection and also to do away with the necessity for making a contact for a specified time at a sending station, I have devised a special form of sending apparatus, represented in Figs. 14 and 15.

An ordinary electromagnet is shown as 100 and 100^a, with an armature, in the shape of a cross shown as 101. The lower branch of

the armature is pivoted, or hinged, at 101^a, and to the top branch is attached the flexible wire, or strip, 104, with clapper, 105, on the end, arranged to strike the gong, or bell, 106, when a sudden motion is given to the armature. Over the electromagnet is placed the trigger, 107 and 107^a, made in the form of a right angle, pivoted at 107^b and with a hook, or catch, 107^c, at the extremity. This hooked extremity is similar to that described in connection with the double relay shown in Fig. 12, and operates, in connection with the top branch of the armature, 101, in the same manner as the hook, 27^b, does with armature 28. The push button, 109, is shown as set into the casing, part of which is represented at 108. The stem, 110, of this push button rests against the end of 107^a. The spring, 111, returns the push button to its normal position after it has been pressed. The set screw, 102, serves as a contact point for the armature, 101, or a spring connected therewith, to rest against when released by the trigger. When pressure is exerted for an instant upon the push button the hooked end, 107^c, of the trigger is raised, releasing the armature, which falls away by gravity and makes contact with 102. If, while the armature is in this position, a current is sent through the electromagnet, 100 and 100^a, the armature will be attracted, the upper branch will be caught by the hook, 107^c, and at the same instant the impulse given to the clapper, 105, on account of the flexibility of the wire or strip, 104, will cause it to strike the gong, 106, and thus give an audible signal. The circuits on this sending apparatus are shown in Fig. 13, to which reference is now again made, the connections with circuit 40 being shown by dotted lines, 113 and 114, and a local battery being indicated at 112.

The operation, in connection with the circuits of the receiving apparatus is as follows: When a signal is to be sent the push button is pressed for an instant, which will release the armature, 101, and bring it in contact with the contact point, 102, and thus throw current from local battery on the partial circuit as follows: from contact point, 102, through line 114 to contact point, 25^a, on the commutator; from ring, *f*, on the commutator, through line, 43, receiving magnet, 26, lines 44 and 45, line 113, battery 112, magnet 100, at the signaling station, armature 101 and connections and thence to contact point, 102. The circuit will then be closed to actuate the receiving magnet, except for the gap between 25^a and *f*, which will be closed when the contact-maker, *g*', comes in contact with 25^a and the circuit completed. The operation of the apparatus at the central or receiving station will then be exactly as already described. When *g*' completes the circuit it not only actuates the receiving magnet, 26, but also the magnet, 100, at the signaling station, when the armature, 101, will be attracted and restored to its normal position, the signal bell, 106, struck

and the circuit last described again opened by the armature, 101, leaving contact point, 102. Therefore, when a signal is sent from a station so equipped, the current is ready for the contact-maker, *g*', when it reaches the proper point, no matter what time it takes to reach such point; also, as soon as *g*' reaches the proper point the current from the signaling station ceases, so that the type wheel can immediately revolve again, after the operation of recording the signal has been completed without any chance of a double record being taken from one signal. The operation of the receiving apparatus will thus be entirely independent of the time current is sent from a station,—or rather will regulate such time automatically.

If signals are sent in rapid succession, or even several at the same instant, they cannot interfere with each other, but will be taken up by the contact-maker, *g*', in consecutive order, but not necessarily in the order in which the signals have been sent. This last fact, will, however, detract little if any from the value of the system for rapid signaling, as, when the apparatus is working rapidly the delay can only be very slight.

While I have shown the parts of the apparatus which constitute the principal portions of my invention as associated with the particular forms of the other parts of the apparatus which are shown in the drawings and described in the specification herein, I do not limit myself to their use in such connection, but intend to claim each novel feature both when used in connection with other devices such as herein described and shown, and when used in connection with any other mechanism with which they are operative.

It is evident that numerous modifications may be made both in the construction of the different parts and in the combined relative arrangement of the parts, without departing from the spirit of my invention.

While I have designated the signal holder as a type wheel, a series of characters to be read off direct can be substituted for the type, doing away with the necessity for the printing hammer, ink wheel and paper movement.

A subsidiary holder may be used to indicate visually directly the same characters which the regular holder registers, the two holders being arranged to move in unison; or the same result can be attained by having characters, to be read visually directly, on the side of the same holder that carries the type on the periphery, or both the type and characters can be arranged on the periphery, or both on the side, of the holder.

Such modifications can be made that the shaft may be either stationary or revoluble; that the stop magnet may consist of one or more electromagnets; that the stop magnet may be rigidly fixed or movable; that the armature may form part of the type wheel or be separable from it; that the armature may or may not be revoluble; that the armature may

or may not be movable longitudinally on the shaft, and that the stoppage of the type wheel may be accomplished by other means than the attraction of an electromagnet for its armature, the so called stop magnet then serving more the purpose of a release magnet.

The contact pieces can be set in one series, or two or more concentric series, opposite one side or opposite each side of the type wheel, or in one circle surrounding the periphery of the type wheel, the contact-makers being arranged to correspond in position and number, and in the last case the type, of course, occupying positions on one or both sides of the type wheel.

While I have shown a pulley wheel and belt as the power transmitting device, it is obvious that a toothed gearing or a frictional gearing would answer the same purpose. A convenient arrangement of the power device, where a number of the receiving instruments are located in a line or adjacent to each other, would be a long shaft carrying all the belts, or being geared to each instrument by toothed wheels or friction wheels. Where electric power is available small electric motors can be used for each instrument, or one larger motor can turn a shaft supplying all the instruments with power. If the instruments are arranged so that the shaft of the type wheel revolves this shaft can be continuous through all the instruments if set in line, and power transmitted direct thereto. A train of clock work can be used for each instrument. These remarks apply also to the power device for the paper movement. The latter can also receive power by being geared to the device used for moving the type wheel.

By arranging the parts suitably therefor an ink ribbon can be used as the inking device. If a powerful impulse is given the printing hammer and the type are sharply cut, the impression can be taken on the paper by indentation and the inking device dispensed with, in which case the striking end of the hammer should be shod with rubber or similar material.

Various means of regulating the distance of the poles of the stop magnets from the type wheel armature may be applied, such as having the magnets arranged with their pole piece separate from the frame and regulating the distance between the pole piece and the frame by set screws. It is also plain that if the type wheel is made of suitable material the magnets can act directly thereon without the intervention of the armature attached thereto.

In place of two wires from each sending station one wire can be used with the other side of the circuit grounded. In this case line 114 would be grounded at the sending station and line 45 grounded at the receiving station.

The word "battery" as used herein is intended to signify a source of electrical energy.

It is intended to adapt the apparatus as

far as possible to be operated by suitably distributing current from the leads of one or more dynamos or motor-generators. In every case where the word "magnet" is used herein it signifies an electromagnet and these electromagnets may be either single, compound, or in sets, as suitable. Where the words "wire" or "line" are used they signify any suitable conductors of electricity.

The term "paper" is intended to include any surface suitable for taking an impression which may be applied. While I have shown the paper in the form of a continuous roll, or ribbon, I do not confine myself to its use in this form nor to its movement in the direction as shown, but may employ a broad sheet and move it laterally, or in two directions, or cut strips or pieces of paper, or cards.

I do not limit myself to the same construction of apparatus as that herein shown and described but intend to include within my claims every device and contrivance whatsoever substantially equivalent in this art to the several structures or the constituent elements or relative arrangements thereof herein claimed.

I claim—

1. In an electrical signaling system several sending devices and a receiving device, with an electrical circuit from each sending device to the receiving device, said receiving device comprising a normally continuously revolving signal holder, or type wheel, an electro-magnetic stop mechanism, operative by the closure of a circuit at a sending device, a relay controlling said stop mechanism and a make and break switch controlling the release of said relay, combined substantially as described.

2. In an electrical signaling system several sending devices and a receiving device, with an electrical circuit from each sending device to the receiving device, said receiving device comprising a normally continuously revolving signal holder, or type wheel, a circuit closer, an electro-magnetic stop device, operative by the closure of a circuit at a sending device, a relay controlling said stop mechanism and a make and break switch controlling the release of said relay, and each sending device comprising a return signal indicator, operative by the closure of the circuit by the circuit closer on the receiving device, and a circuit closer, combined substantially as described.

3. In an electrical signaling system, a receiver comprising a normally continuously revolving type wheel, an impression device, a stop device in operative relation with said type wheel, and one or more circuit closing devices; a transmitter comprising a circuit closer and a signal indicator; a main electrical circuit, one or more local circuits, a prime motor and one or more sources of electrical energy; said stop device and impression device at the receiver being operative by the closure of the main circuit at the transmitter, and said sig-

nal indicator at the transmitter being operative by the closure of the circuit by a circuit closer on the receiver, combined substantially as described.

5 4. In an electrical signaling system a receiver comprising a normally continuously revolving type wheel, a prime motor, a selective device, a stop device, an impression device, one or more circuit closing devices and one or
10 more local circuits; one or more transmitters each comprising a circuit closing device and a signal indicator; an individual main electrical circuit from each transmitter to the receiver, each such main circuit being normally
15 open at the transmitter and the receiver; and one or more sources of electrical energy; at the receiver the stop device being operative through the selective device by the closure of a main circuit at a transmitter, and the im-
20 pression device and paper moving device being operative by the closure of a local circuit, or circuits, controlled by the selective and stop devices; and at a transmitter the signal indicator being operative by the closure of its
25 individual main circuit both on the selective device at the receiver and by the circuit closer on the transmitter, combined substantially as described.

5 5. In an electrical signaling system a receiving device comprising a revolving type wheel, a stationary series of terminal contact plates, a contact maker revolving in unison with said type wheel and playing upon said contact plates, an electromagnetic stop device
35 for said type wheel, a printing magnet and platen, a paper movement controlled electromagnetically, a common relay and a compound relay consisting of two electromagnets and two armatures; several transmitters, each
40 comprising a circuit closer, a circuit breaker and a return signal; and individual main circuits connecting each transmitter to the receiving device,—combined substantially as described.

45 6. In an electrical signaling system a receiving device comprising a normally revolving type wheel, a stationary series of terminal contact plates, a contact maker revolving in unison with said type wheel and playing upon
50 said contact plates, a compound relay device comprising two electromagnets and two armatures, a printing magnet and platen and a paper movement; several transmitters each comprising a circuit breaker, a circuit maker and
55 a return signal, and individual main circuits connecting each transmitter to the receiver, combined substantially as described.

7. In an electrical signaling system several sending devices and a receiving device, with
60 electrical circuits connecting individually each sending device with the receiving device, each sending device comprising a circuit closer, a signal indicator and a source of electrical energy, and said receiving device com-
65 prising a signal recorder and a successive non-interference device, said non-interference device comprising a commutator device, a relay

device and a circuit interrupting device, combined substantially as described.

8. In an electrical signaling system several
70 sending devices and a receiving device with an independent electrical circuit from each sending device to the receiving device, each sending device comprising a circuit closer and a signal indicator, and the receiving de-
75 vice comprising a normally continuously revolving signal indicator or recorder, a stop device, a prime motor and a non-interference device, said non-interference device comprising a successive contact making device, or
80 commutator, a relay device and a circuit interrupting device, combined with the necessary sources of electrical energy and the necessary local circuits substantially as described.

85 9. In an electrical signaling system several sending devices and a receiving device with a main circuit from each sending device to the receiving device, each sending device comprising a circuit closing device a return sig-
90 nal device and a source of electrical energy, and said receiving device comprising a normally continuously revolving type wheel, a stop device, an impression-taking device, a prime motor, a paper moving device, one or
95 more relay devices, one or more local circuits, one or more sources of electrical energy and a non-interference device, said non-interference device comprising a successive contact-making device, a relay device and a circuit
100 interrupting device, combined substantially as described.

10. In an electrical signal receiving device the combination of the double relay device, with two electromagnets and two armatures,
105 a trigger, a back contact and one or more retractile springs,—with a revoluble type wheel, a stop device, impression device and successive contact-making device, in operative relation with said type wheel, substantially as de-
110 scribed.

11. In a signal selective device the combination of a series of contact plates, each forming the terminal of a normally discontinuous main line, a moving contact-maker playing on
115 said plates and connecting with the common return of said main lines, and a double relay device with two electromagnets and two armatures, one electromagnet being in circuit with the common return and the other con-
120 trolling one or more local circuits, substantially as described.

12. In an electrical signal receiving device a stationary shaft, a friction clutch freely mounted thereon and continuously revolved
125 by a prime motor, a type wheel freely mounted on the shaft in operative relation with the friction clutch, an armature attached to said type wheel and a stationary electromagnet adapted to hold said armature, combined sub-
130 stantially as described.

13. In an electrical signal receiving device, a normally continuously revolving type or signal holder, an armature attached to or

forming part of same, an electromagnet arranged to act upon said armature, one or more commutators and one or more contact makers; controlling said electromagnet, combined substantially as described.

14. In an electrical signal receiving device a normally continuously revolving type or signal holder, one or more stationary commutators and one or more contact makers attached to or revolving in unison with said type or signal holder; and a relay controlled by said contact-maker and controlling said type wheel, combined substantially as described.

15. The combination of the stationary adjustable shaft, the revolving friction clutch and engaging type wheel mounted thereon, an armature attached to said type wheel and a stationary electromagnet adapted to hold said armature and type wheel against the engagement and motion of the friction clutch, substantially as described.

16. The combination of a shaft, a friction clutch and type wheel mounted thereon, a thimble with set screw to adjust said clutch, a casing, and a fixed washer—a screw thread and lock nuts on said shaft adapted to adjust the position of said type wheel and gearing in said casing, substantially as described.

17. In a noninterference device, a double relay with two armatures, the first armature normally holding the second armature in place and the second armature operating, in connection with a contact, as a circuit closer, a series of contact pieces forming the ends of normally discontinuous circuits, a contact-maker, normally in motion and arranged to play upon said contact pieces, a stop mechanism, a signal recording device and a circuit interrupting device; said stop mechanism, when actuated, operating to arrest the motion of said contact maker and being controlled in its action by the second armature on the relay in conjunction with the contact series and contact-maker, said circuit interrupting device being controlled by the action of said signal recording device and said second armature being restored to normal position by the action of said circuit interrupting device; constituting a successive noninterference device; combined substantially as described.

18. In a signal transmitting device, an electromagnet, an armature, a trigger device for releasing said armature, a screw or adjustable contact for limiting the motion of said armature, a push button device for operating said trigger device and a signal operated by said electromagnet; combined substantially as described.

19. In a signal transmitting device, an electromagnet, an armature, a trigger device for releasing said armature, an adjustable contact for limiting the motion of said armature, a mechanical device for operating said trigger, a signal operated by said electromagnet, a source of electrical energy and an electric circuit connecting the transmitting device to

a receiving device; combined substantially as described.

20. In an electrical signaling system a sending device comprising an electromagnet, a signal operated by said electromagnet, a push button, or make and break device, and a source of electrical energy; a receiving device comprising a commutator, or series of contacts on which the circuits from sending stations end, such circuits being normally open at said commutator, a revolving signal-holder, with contact-maker attached, an electromagnet for arresting the motion of said signal holder and a source of electrical energy; and an electric circuit connecting said sending device with said receiving device; all arranged so that normally the said circuit is open at the sending device but when the push button is pressed said circuit is closed at said sending device and then remains so closed until the electromagnet is energized, and said circuit is also normally open at the receiving station until, while closed at the sending station, the contact-maker comes in contact with the contact on which said circuit ends, when the circuit shall be completely closed and shall cause to be energized the electromagnet for arresting the motion of the signal holder and also the electromagnet for operating the signal at the sending station;—combined substantially as described.

21. In an electrical signaling system a sending device comprising an electromagnet, a signal operated by said electromagnet, a make and break device and a source of electrical energy; a receiving device comprising a normally continuously revolving type wheel, an electromagnet, or series of electromagnets, acting on an armature attached to or forming part of said type wheel, one or more commutators, or series of contacts forming the ends of lines from sending stations, one or more contact-makers attached to or revolving in unison with said type wheel, an inking device, a printing hammer device, a paper-holder and guides, suitable paper, a paper moving device, one or more power devices, one or more adjustable clutches, one or more suitable relays, suitable means for adjusting the relative positions of the parts, one or more sources of electrical energy and one or more local circuits; and a main circuit between the sending and the receiving device; all arranged so that when a signal is sent from the sending station the main circuit shall be closed at said station and shall so remain until the contact-maker at the receiving device shall pass over the contact on the commutator which connects with said circuit, when the main circuit will be closed throughout, causing the signal to be recorded at the receiving device and a return signal to be sent to the sending station;—combined substantially as described.

22. In an electrical signal receiving device a normally revolving type wheel, or signal holder, an armature attached to or forming

part of said type wheel, one or more stationary electromagnets with poles in close proximity to said armature, means of adjusting the distance of said poles from said armature, and a local source of electrical energy for said electro magnets, and a local source of electrical energy, combined substantially as described.

23. In an electrical signaling system the revoluble type wheel, the frictional gearing device and electromagnetic stop device in operative relation therewith, the contact-maker attached to said type wheel but insulated therefrom, a series of contact plates, several transmitters each connected by an individual circuit to one of said contact plates, and a contact ring forming the common return for said transmitter circuits, combined substantially as described.

24. The combination of a central signal recording apparatus with several main circuits each controlled by a transmitter; each such transmitter comprising an electromagnet and its armature, a back contact, a trigger device and a push button; substantially as described.

25. In an electrical signal receiving device, a stationary shaft, a normally continuously revolving pulley, or other means of transmitting motion, a type wheel normally revolving upon said shaft, a frictional bearing or gearing for transmitting motion from said pulley to said type wheel, a stop washer, pin, or other suitable device, attached to said shaft to hold said type wheel in position against the frictional gearing, an armature attached to or forming part of said type wheel, one or more stationary electromagnets arranged with poles in close proximity to said armature, means of adjusting the position of the pulley on the shaft, the pressure of the frictional bearing and the distance between the armature and the poles of the electromagnets, one or more contact-makers attached to but insulated from said type wheel, one or more commutators or series of contacts, each contact forming the end of a normally discontinuous line from a sending station, one or more metallic rings arranged concentrically with the series of contacts, the said rings and said series of contacts being in the line of motion of the contact-makers, one contact-maker making contact with one of said rings and one of said contact points at the same time, and consecutively with each contact point of a series; an ink-wheel or other suitable device for inking the type on the type wheel, a printing hammer, receiving its stroke or motion from the attractive force exerted by an electromagnet upon a pivoted armature to which armature said hammer is suitably attached, a paper holding device, with paper guided in front of the type wheel and between said type wheel and said printing hammer, a suitable frame for holding the several parts in proper relation to each other, a source of energy or motion for revolving

the type wheel and a source or sources of electrical energy for energizing the electro magnets;—combined substantially as described.

26. The combination of a central signal recording apparatus and several main circuits each controlled by a transmitter; each transmitter comprising a circuit closer, and an electromagnetic circuit opener controlled automatically by the central recorder; substantially as described.

27. In a commutator, a series of contact pieces, attached to or set into an insulating plate or base, with the ends slightly projecting beyond the surface of said base, dummy contact pieces attached to or set into the same insulating base alternately with the regular contact pieces, and with the ends projecting from said base the same distance as the regular contact pieces, the regular contact pieces and the dummy contact pieces being each electrically insulated from each other, and each from all others, a metallic ring, or rings, attached to or set into the same base, concentric with the series of contact pieces and projecting the same distance from the surface of said base, and insulated from all the contact pieces, and conductors attached to said regular contact pieces and said ring;—combined substantially as described.

28. In a commutator, one or more series of contact pieces, each series ranged in circular form and attached to or set into an insulating plate or base, one or more series to each of said bases, the ends of the contact pieces slightly projecting beyond the surface of said bases, dummy contact pieces attached to or set into the same insulating bases, alternately with the regular contact pieces and with the ends projecting from the bases the same distance as the regular contact pieces, the regular contact pieces being electrically insulated from each other and from the dummy contact pieces, one or more metallic rings attached to or set into the same bases, one or more rings for each series of contacts and concentric with such series of contacts, each ring electrically insulated from all the contact pieces and projecting the same distance from the bases as the contact pieces, this distance to be the same for each series of contacts and the corresponding ring, or rings, conductors connected to the regular contact pieces and also to said rings; one or more contact-makers attached to, but electrically insulated from a revolving wheel, each contact-maker arranged so that the end plays upon and makes contact with a contact piece and its corresponding ring or rings, so as to electrically connect them, and consecutively with each contact piece in the series, alternately a regular and a dummy contact, the bend, or tread, of the contact-maker being so proportioned to the distance between the contact pieces that said contact-maker shall rest upon a dummy contact piece before leaving entirely a regular

contact piece and therefore shall not drop between them and cause a clicking noise; combined substantially as described.

29. In an electrical signal receiving device, 5 a signal holder normally revolving, two contact makers attached one on each side of said signal holder, and two stationary commutators, one on each side of said signal holder, said commutators consisting of a series of in- 10 sulated contact pieces forming the ends of normally discontinuous lines, arranged in circular form, with or without dummy contact pieces between, and with or without a continuous contact ring arranged concentrically 15 with each series of contact pieces, said contact pieces being so arranged that a contact piece on one commutator shall have opposite it on the other commutator an intermediate blank space or a dummy contact piece, so that 20 if the contact-makers are attached to the signal holder on the line of the same diameter of said signal holder, one contact-maker shall be in contact with a regular contact piece while the other contact-maker is on an intermediate space or a dummy contact piece; so 25 that both contact-makers shall not be in contact with regular contact pieces at the same time, but shall alternately make contact with such contact pieces;—combined substantially as described. 30

30. In a paper movement, a stationary shaft, a pulley, or other means of transmitting motion, mounted on said shaft and normally revolving, means for regulating the position of 35 said pulley on said shaft, a wheel mounted on said shaft and free to revolve thereon when released, a frictional bearing or gearing device for transmitting motion from said pulley to said wheel, a stop washer, pin, or other 40 suitable device, rigidly attached to said shaft, for holding said wheel in proper position against said frictional gearing, and means for regulating the pressure of said frictional gearing device, all arranged so that said wheel 45 shall be held normally by a stop, or stops, or other suitable extraneous device while the frictional bearing connecting said wheel with the revolving pulley shall slip, or slide, but shall revolve said wheel when the stops holding 50 said wheel shall be withdrawn or disconnected;—combined substantially as described.

31. In a paper movement, a normally revolving pulley, or other means of transmitting motion, mounted upon a stationary shaft, a 55 wheel connected to said pulley by a frictional bearing or gearing device, a stop washer, or pin, to hold said wheel in position, means of adjusting the relations of said pulley, wheel and frictional gearing, an armature mounted 60 on said stationary shaft, but electrically insulated therefrom, in such a manner as to allow a limited movement of said armature in the direction of the axis of said shaft but no revolving motion, one or more stationary elec- 65 tromagnets with poles arranged so as to attract said armature, means of regulating the

distance between said magnet poles and said armature, a spring to return said armature to normal position after being attracted by said 70 electromagnets, one or more guide rollers or pulleys for the paper, one or more of which is held by elastic pressure against the perimeter of said wheel, or a flange attached thereto, in such a manner that when the paper is 75 between said roller and said flange the motion of said wheel will move the paper, a source of electrical energy for magnetizing said electromagnets, a source of power for revolving said pulley and a suitable framework for holding the parts of the apparatus in 80 proper relation;—combined substantially as described.

32. In a paper movement, a flanged wheel, another wheel or roller bearing against said 85 flanged wheel under elastic pressure, with the paper between, said flanged wheel being under continual tension to revolve, one or more electromagnets, an armature placed so as to be acted upon by said electro magnets on the 90 one side and on the other side with one or more teeth or catches attached, arranged to engage with one or more similar teeth attached to said flanged wheel, said armature being normally electrically insulated from all 95 other parts, a trailer attached to said armature and making contact at all times with the face of said flanged wheel and normally resting upon the insulating medium surrounding a tooth on said wheel and when said wheel is 100 in motion making contact with the metallic portion of said wheel for a limited time, a plate covering the face of said armature in such a manner as to expose the armature, through apertures in the plate, to the poles of 105 said electromagnets, but so as to surround said poles in such a manner as to prevent said armature revolving, a spring for returning said armature to normal position, means of 110 adjusting the relation of the different parts and a suitable frame for containing the apparatus;—combined substantially as described.

33. In a paper movement, a flanged wheel 115 impinging upon the paper, under continual tension to revolve, one or more teeth attached to said wheel in such a manner as to be insulated therefrom, an armature mounted opposite 120 said wheel, normally insulated from all other parts and having only a motion to and from said wheel, one or more teeth attached to said armature and arranged to engage normally with the teeth on said wheel, a trailer 125 attached to said armature and arranged to make contact at all times with the face of said flanged wheel, one or more electromagnets arranged to attract and move said armature, a spring to hold said armature normally away 130 from said electromagnets, a source of motion and a suitable transmission device for keeping the flanged wheel under tension to revolve, a source of electrical energy and suitable connection with a signal receiving device; combined substantially as described.

34. In a relay, a double electromagnet with exposed poles in opposite directions, an armature at each end of said electromagnet, each armature pivoted or hinged, one armature having a long arm or lever set on or attached to the body of said armature at right angles thereto, said arm having a hooked end to engage with and hold the other armature, said hooked end being kept normally down by the force of gravity or a spring; the other armature being under continual tension to move away from the pole of the electromagnet by a retractile spring, but being held normally close to said pole by engagement with said hooked end, a contact point or screw to limit the motion of said armature and two independent sources of electrical energy; all arranged so that when the first armature is acted upon by the energizing of its electromagnet the arm attached thereto is raised and allows the second armature to become disengaged from the hooked end and make contact with the contact point, thus closing a local circuit, and when the second armature is acted upon by its electromagnet it is drawn away from said contact point and re-engaged with the hooked end;—combined substantially as described.

35. In an electrical signal receiving or recording device, a stationary shaft, a normally revolving pulley, or other means of transmitting motion, mounted upon said shaft and adjustable thereon, a frictional gearing or bearing device, connected with said pulley and adjustable in its relation therewith, a type wheel mounted on said shaft, adjustable thereon and normally revolving in unison with said pulley, to which it is connected by means of said frictional gearing device, an armature attached to or forming part of said type wheel, one or more stationary electromagnets with exposed poles in close proximity to said armature and adjustable in relation thereto, one or more commutators each comprised of a series of insulated contact pieces with intermediate dummy contact pieces and a contact ring concentric with said series, said ring being also insulated, one or more contact makers attached to but electrically insulated from said type wheel each contact-maker bearing upon one series of contact points with its contiguous concentric ring and arranged so that only one contact-maker shall be in contact with a regular contact piece at the same time, one or more ink wheels, or other suitable device for inking the type on said type wheel, an electromagnetic device with an armature pivoted or hinged at one end and with a printing hammer connected by a flexible arm or strip to the other end, a flexible contact piece insulated and mounted in the path of motion of said armature, a paper wheel or drum, suitably mounted, one or more guide rollers for the paper, a supply of suitable paper, a suitable paper moving or shifting device, suitable

frame or frames for holding the parts in proper relation, a suitable source or sources of power, suitable source or sources of electrical energy, one or more suitable relays, one or more local circuits, and suitable connections or conductors for attaching circuits from sending stations; combined substantially as described.

36. In an electrical signaling system the combination of a transmitter comprising a circuit closer and an electromagnetic circuit opener, and a receiver comprising a revolving type wheel, a stationary sunflower of terminal contact plates and a trailer bearing thereon, substantially as described.

37. The combination with an electrical receiving device of one or more main circuits, each connecting with a sending device, one side of each such circuit being connected to a contact piece on a commutator and the other side of all such circuits being continuous through an electromagnet coil, or coils, to a contact ring on a commutator, each of said main circuits being normally open between said contact piece and said contact ring; a local circuit, controlled by one or any of said main circuits, extending from a relay armature through the coil, or coils, of an electromagnet, or set of electromagnets, through the coil, or coils, of a relay electromagnet, through a source of electrical energy and to a contact point, being normally open between said relay armature and said contact point; a second local circuit, controlled by the first local circuit, extending from a relay armature through the coil, or coils, of an electromagnet, through a source of electrical energy and to a contact point, being normally open between said relay armature and said contact point; a third local circuit, controlled by the second local circuit, extending from an armature, through a source of electrical energy, and the coil, or coils, of an electromagnet, or set of electromagnets, to a contact point, being normally open between said armature and said contact point; and a fourth local circuit, controlled by the third local circuit, extending from a trailer through an armature, through a source of electrical energy, through the coil, or coils, of a relay electromagnet, or electromagnets, through a shaft and the metallic body of a wheel, being normally open between said trailer and said metallic wheel body; substantially as shown.

38. In an electrical signaling system, the combination, with a sending device and a receiving device, of a main circuit, one side of which extends from a contact piece on a commutator at the receiving device through the coil, or coils, of an electromagnet and the armature of said magnet, at the sending device and the other side of which extends from a contact point at the receiving device, through a common conductor, or ground, through the coil, or coils, of an electromagnet, or electromagnets, and to a common contact ring on said commutator, at the receiving station, said circuit being connected to, or having included

in it, a source of electrical energy, and said circuit being normally open between said contact point and said armature at the sending device, and between said contact piece and said contact ring at the receiving device, and arranged so as to be intermittently closed at said receiving device and closed at will at said sending device; a local circuit, extending from a relay armature, through the coil, or coils, of an electromagnet, or electromagnets, through the coil, or coils, of a relay electromagnet and to a contact point, said local circuit being connected to, or having included in it, a source of electrical energy, and being normally open between said relay armature and said contact point, and said local circuit being arranged so that the closure of the main circuit shall operate to close the local circuit; a second local circuit, extending from a relay armature, through the coil, or coils, of an electromagnet, to a contact point, said second local circuit being connected to, or having included in it, a source of electrical energy and being normally open between said relay armature and said contact point, and arranged so that the closure of the first local circuit shall operate to close the second local circuit; a third local circuit, extending from an armature through the coil, or coils, of an electromagnet, or electromagnets, to a contact point, said third local circuit being connected to, or having included in it, a source of electrical energy, and being normally open between said armature and said contact point, and arranged so that the closure of the second local circuit shall operate to close said third local circuit; and a fourth local circuit, extending from a trailer, through an armature and through the coil, or coils, of a relay electromagnet, and through a shaft and the metallic body of a wheel, said fourth local circuit being connected to, or having included in it, a source of electrical energy and being normally open between said trailer and said metallic wheel body, and arranged so that the closure of the third local circuit shall operate to close said fourth local circuit, and the closure of said fourth local circuit shall operate to open said first local circuit, the opening of said first local circuit shall operate to open said second local circuit, the opening of said second local circuit shall operate to open said third local circuit, and the fourth local circuit shall open automatically and be kept open by the opening of said third local circuit, presupposing the circuits thus opened to have been closed at the points between which they were indicated as normally open, and arranged, relative to said main circuit, so that the closure of said main circuit at said sending device and said receiving device shall operate to immediately open said main circuit at said sending device, and so that the opening of said first local circuit shall operate to open said main circuit at the receiving device; substantially as described.

39. The combination of a revoluble type wheel, a plurality of contact makers connected thereto, a series of terminal contact plates for each contact maker, and a plurality of main electrical circuits each connecting with a contact plate, said contact makers adapted to close at the contact plates but one circuit at a time, substantially as described.

40. The combination with an electrical signal sending device of a main circuit connecting with a receiving device, said circuit, when closed, being continuous through a local source of electrical energy, the coils of an electromagnet, the body of an armature, and a back contact, but normally broken between said armature and back contact, substantially as described.

41. In a circuit controller, the combination of an electromagnet, an insulated armature, a retractile spring, a tooth and a trailer attached to the armature, a segmental wheel under continual tension to revolve, and insulated teeth attached to said wheel, the tooth on the armature normally engaging with one of the teeth on the wheel, substantially as described.

42. In a signal selective device, a series of terminal contact plates, a moving contact maker playing thereon, a double relay with two armatures, the first armature normally holding the second armature in place and the second armature operating in connection with a contact as a circuit closer; and an electromagnet, an insulated armature normally retracted therefrom, a segmental wheel under tension to revolve, a trailer to connect the armature with the metallic segments of said wheel, a tooth attached to said armature, and insulated teeth attached to said wheel one of which normally engages with the armature tooth, combined substantially as described.

43. In a circuit controller, an electromagnet, an armature normally retracted therefrom, a wheel under tension to revolve with alternate segments of insulating and conducting material, a tooth in each of said insulating segments, an engaging tooth attached to the armature and a trailer to make connection from said armature to said conducting segments,—adapted to open a main circuit when the magnet is de-energized and the teeth are engaged and to close said circuit when the magnet is energized, the teeth disengaged and the trailer on a metallic segment, combined substantially as described.

44. In an electrical signaling system a non-interference device comprising a successive contact making device, a stop device therefor, a relay controlling said stop device and controlled by the signaling circuits conjointly with the successive contact making device, and a circuit interrupting device controlling the resetting of said relay, combined substantially as described.

45. In an electrical signaling system, a transmitter comprising a trigger device, an

electromagnet and its armature and a back
contact, and a receiver comprising a success-
ive contact-making device, a type wheel, a
stop device therefor, a relay controlling said
5 stop device and a circuit interrupting device
controlling the resetting of said relay, com-
bined substantially as described.

In witness whereof I have hereunto signed
my name in the presence of two subscribing
witnesses.

WILLIAM E. M. JACKSON.

Witnesses:

SUSETTE B. MEAD,
W. H. SMYTH.