A. N. HOVLAND.

SIGNAL SYSTEM.

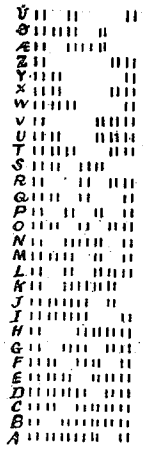
APPLICATION FILED JAN. 27, 1909.

1,073,130.

Patented Sept. 16, 1913.

8 SHEETS—SHEET 1.

Fig. 1a



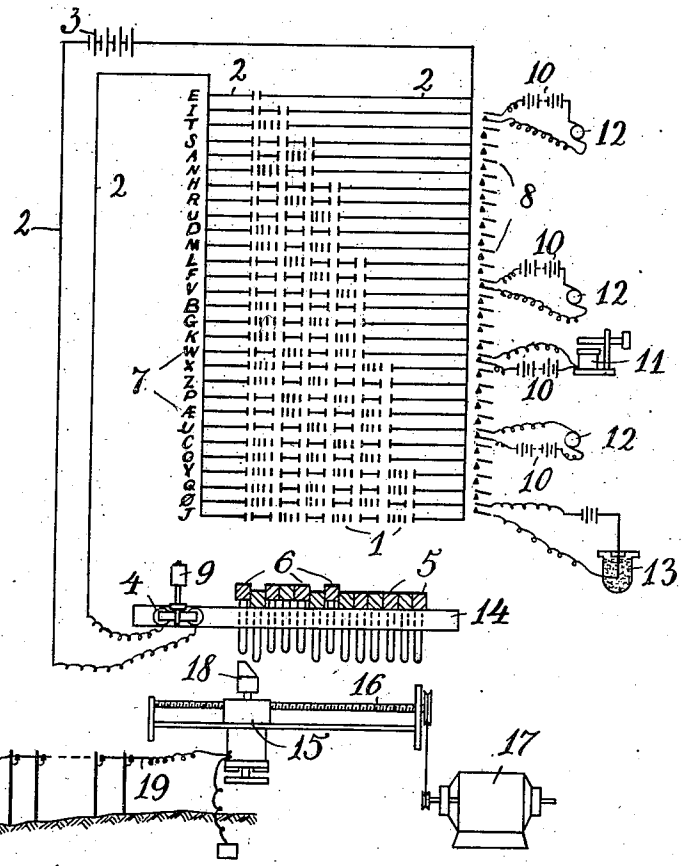
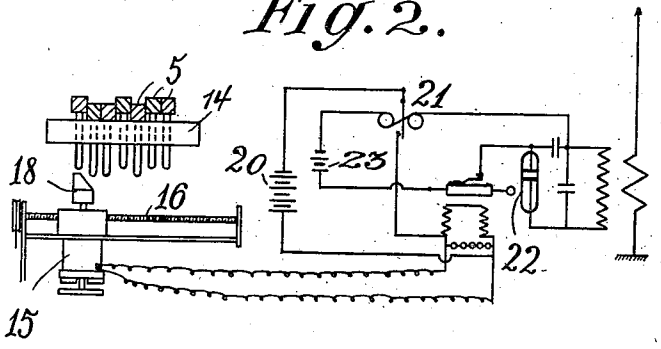


Fig. 1.

Fig. 2.



Witnesses.

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SIGNAL SYSTEM.

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1,073,130.

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8 SHEETS—SHEET 2.

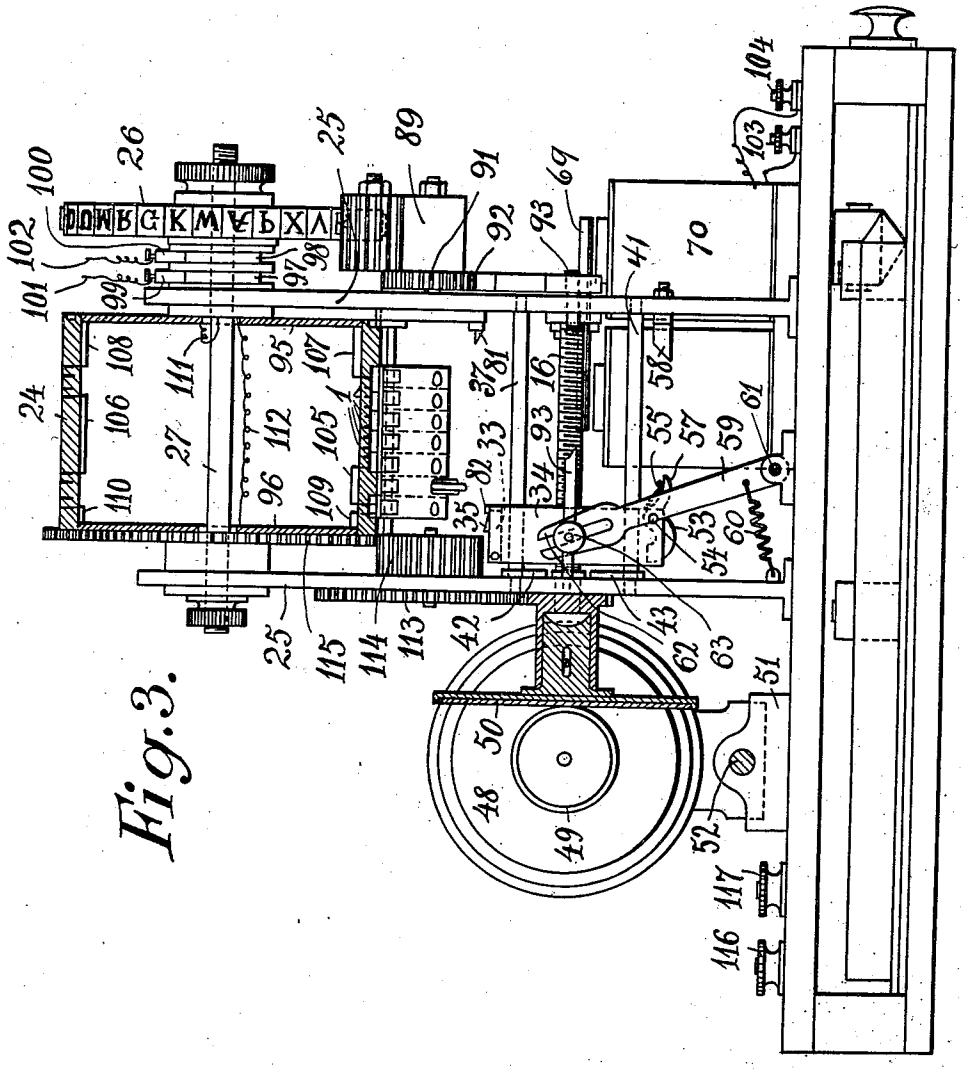


Fig. 3.

Witnesses.

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SIGNAL SYSTEM.

APPLICATION FILED JAN. 27, 1909.

1,073,130.

Patented Sept. 16, 1913.

8 SHEETS—SHEET 3.

Fig. 5.

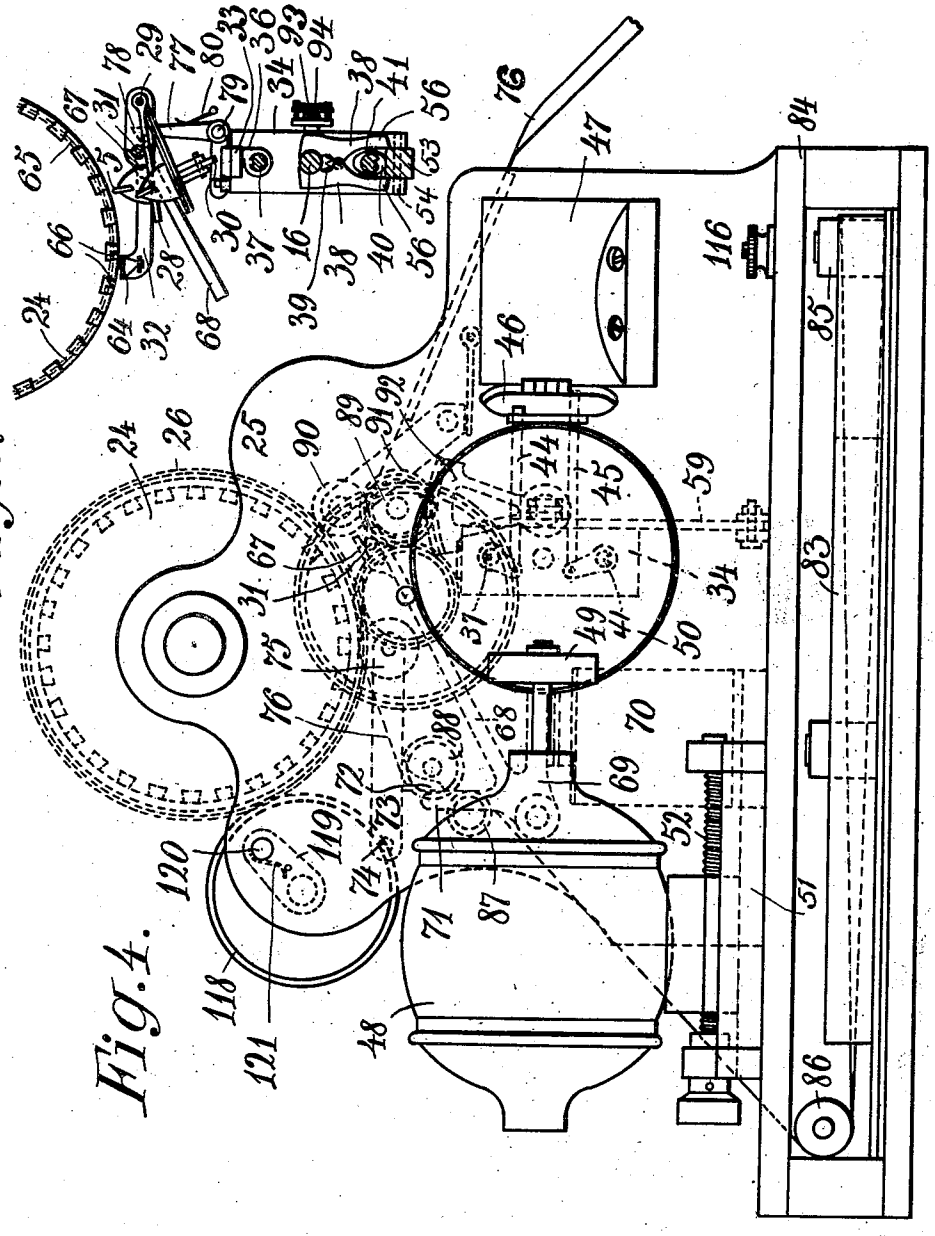


Fig. 4.

Witnesses.

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[illegible]

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by [illegible]

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SIGNAL SYSTEM.

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8 SHEETS—SHEET 4.

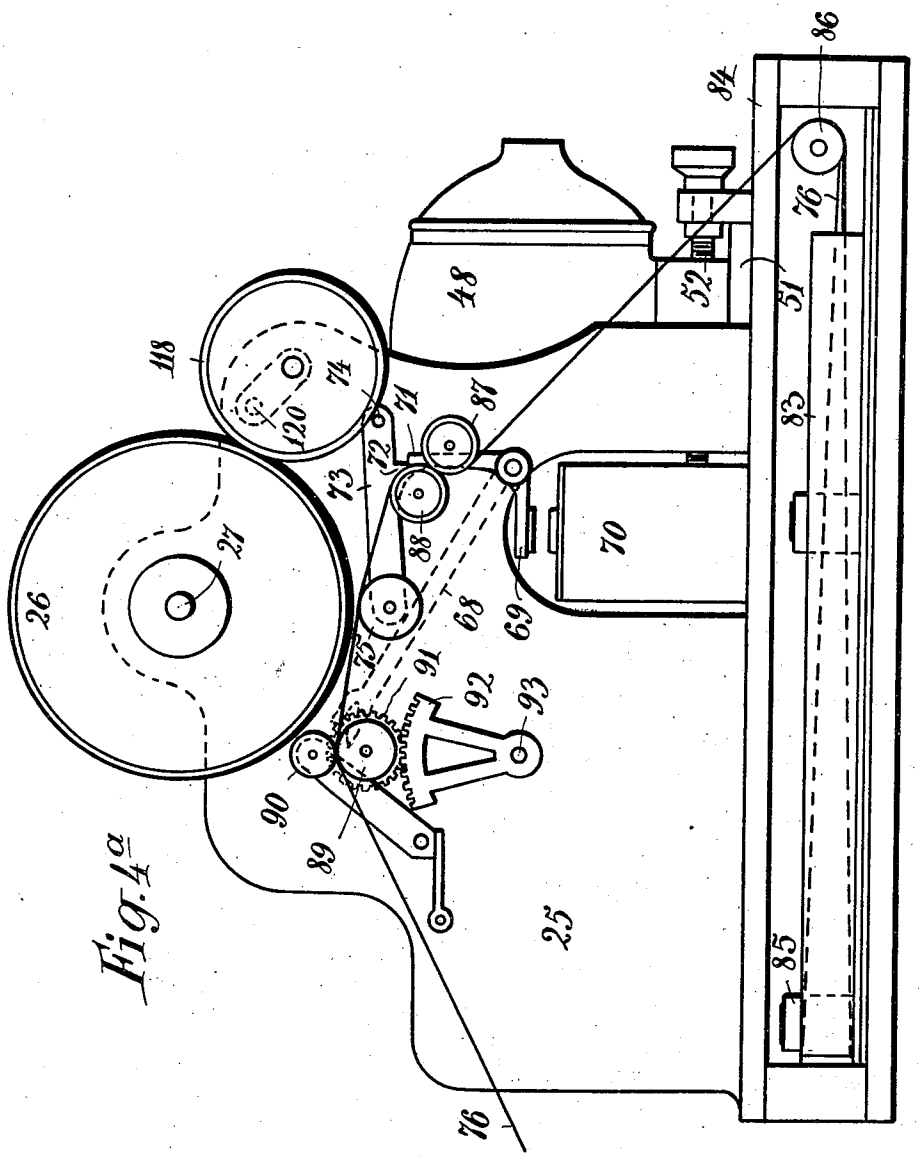


Fig. 4a

Witnesses.
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SIGNAL SYSTEM.

APPLICATION FILED JAN. 27, 1909.

1,073,130. Patented Sept. 16, 1913.

8 SHEETS—SHEET 5.

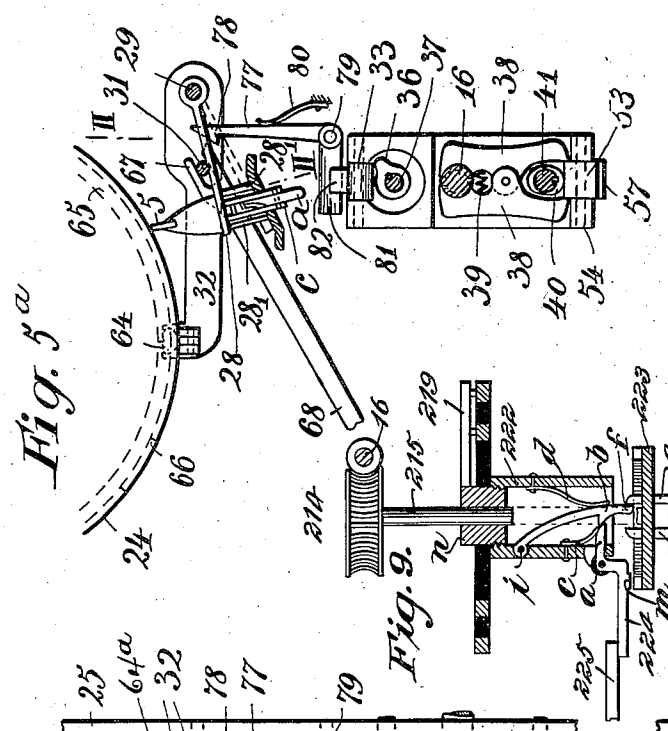


Fig. 5a.

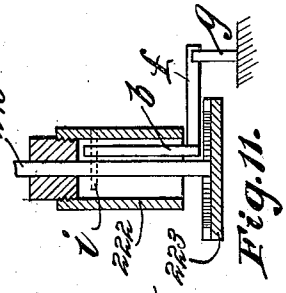


Fig. 11.

Fig. 9.

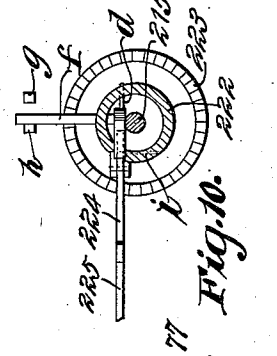


Fig. 10.

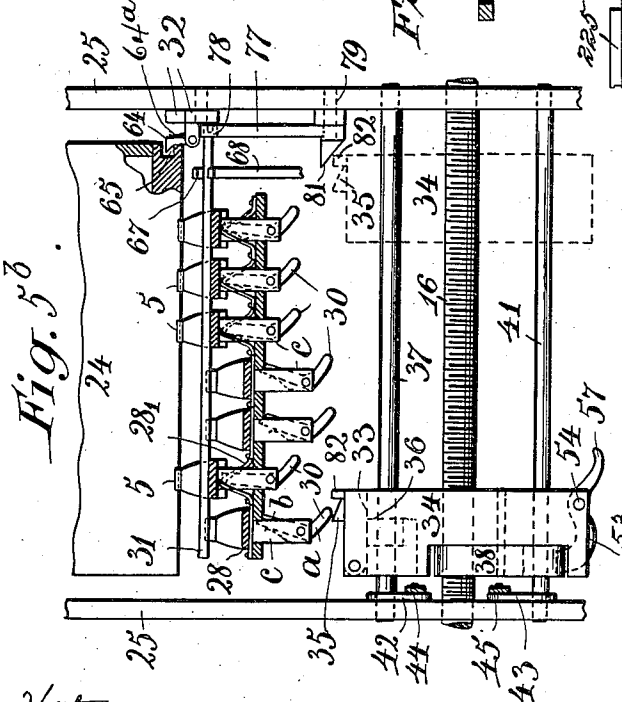


Fig. 5b.

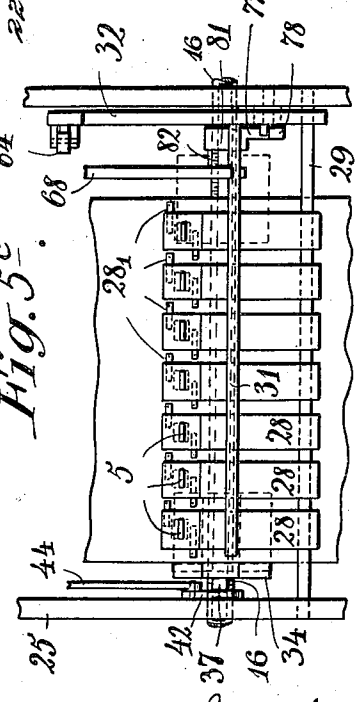


Fig. 5c.

Witnesses.

P. Dommers

M. H. Darg.

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By Henry Orth & Co. Atty.

A. N. HOVLAND.

SIGNAL SYSTEM.

APPLICATION FILED JAN. 27, 1909.

1,073,130.

Patented Sept. 16, 1913.

8 SHEETS—SHEET 6.

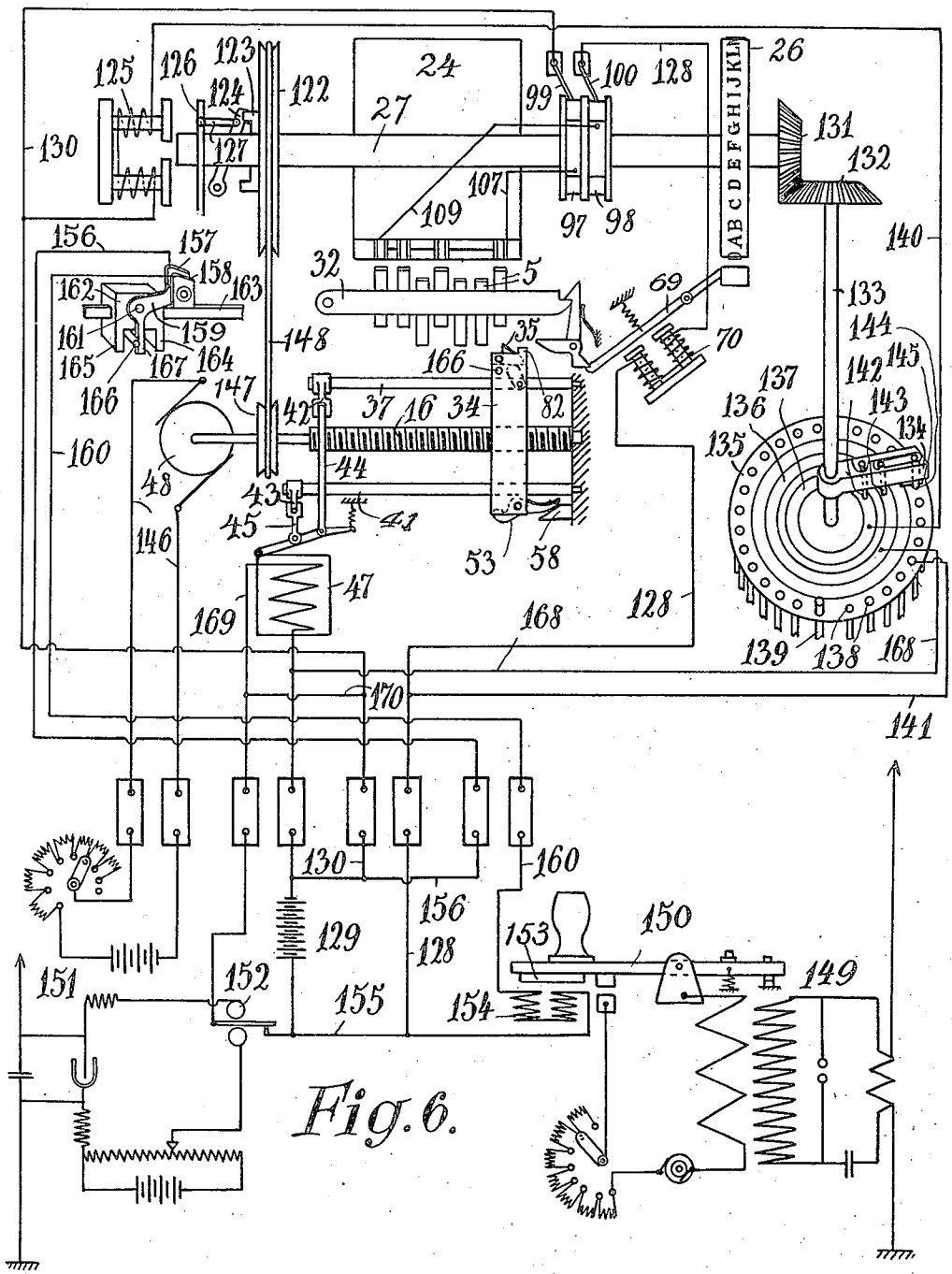


Fig. 6.

Witnesses.

Jesse N. Sutton.

C. B. Sommers

Inventor.

Abraham Nilsen Hovland

by Young & Co. Atty.

A. N. HOVLAND.

SIGNAL SYSTEM.

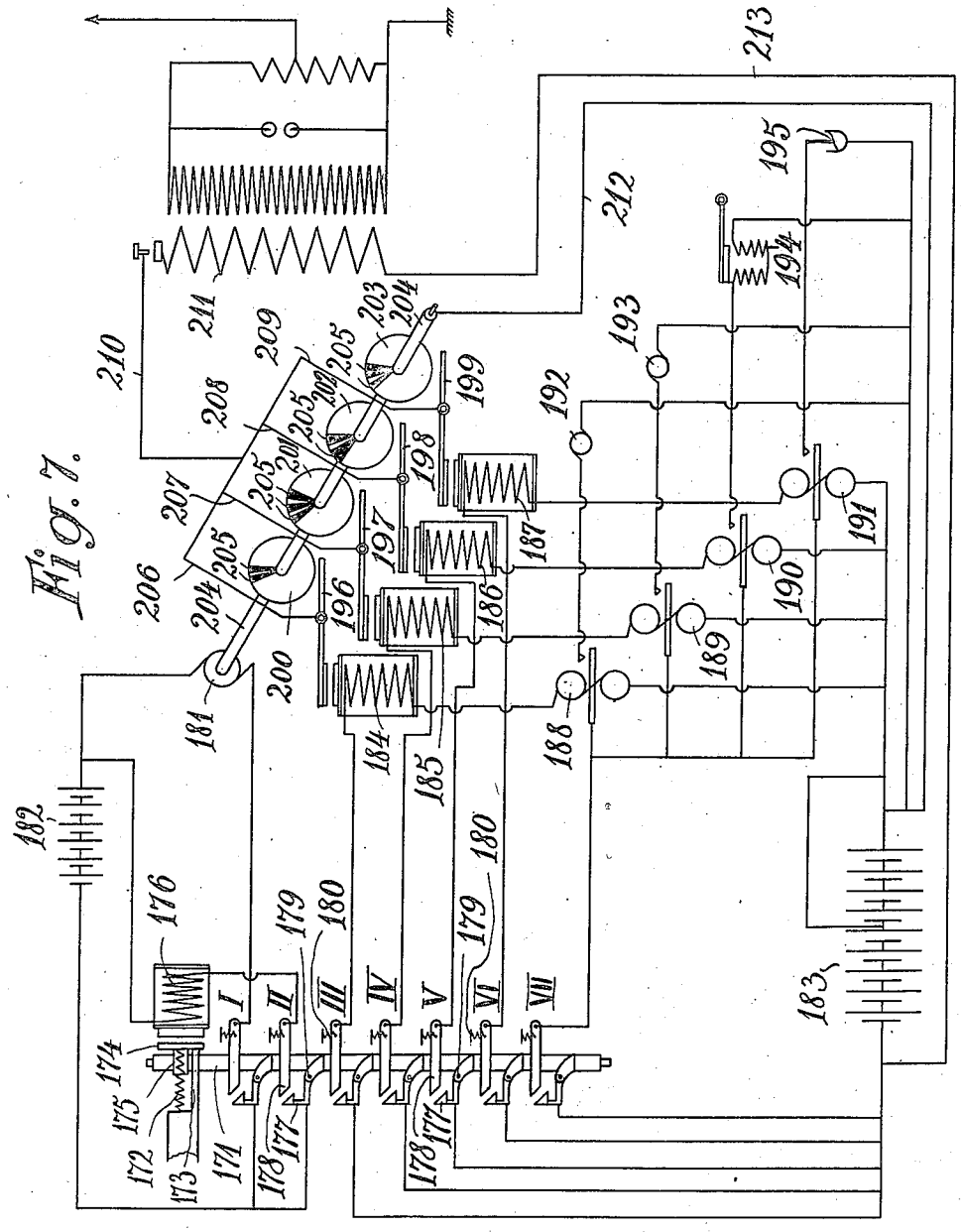
APPLICATION FILED JAN. 27, 1909.

1,073,130.

Patented Sept. 16, 1913.

8 SHEETS—SHEET 7.

Fig. 7.



Witnesses.

Jesse N. Litton.

C. B. Sommers

Inventor

Abraham Nilsen Hovland

by Henry Orth & Co

Attys

A. N. HOVLAND.

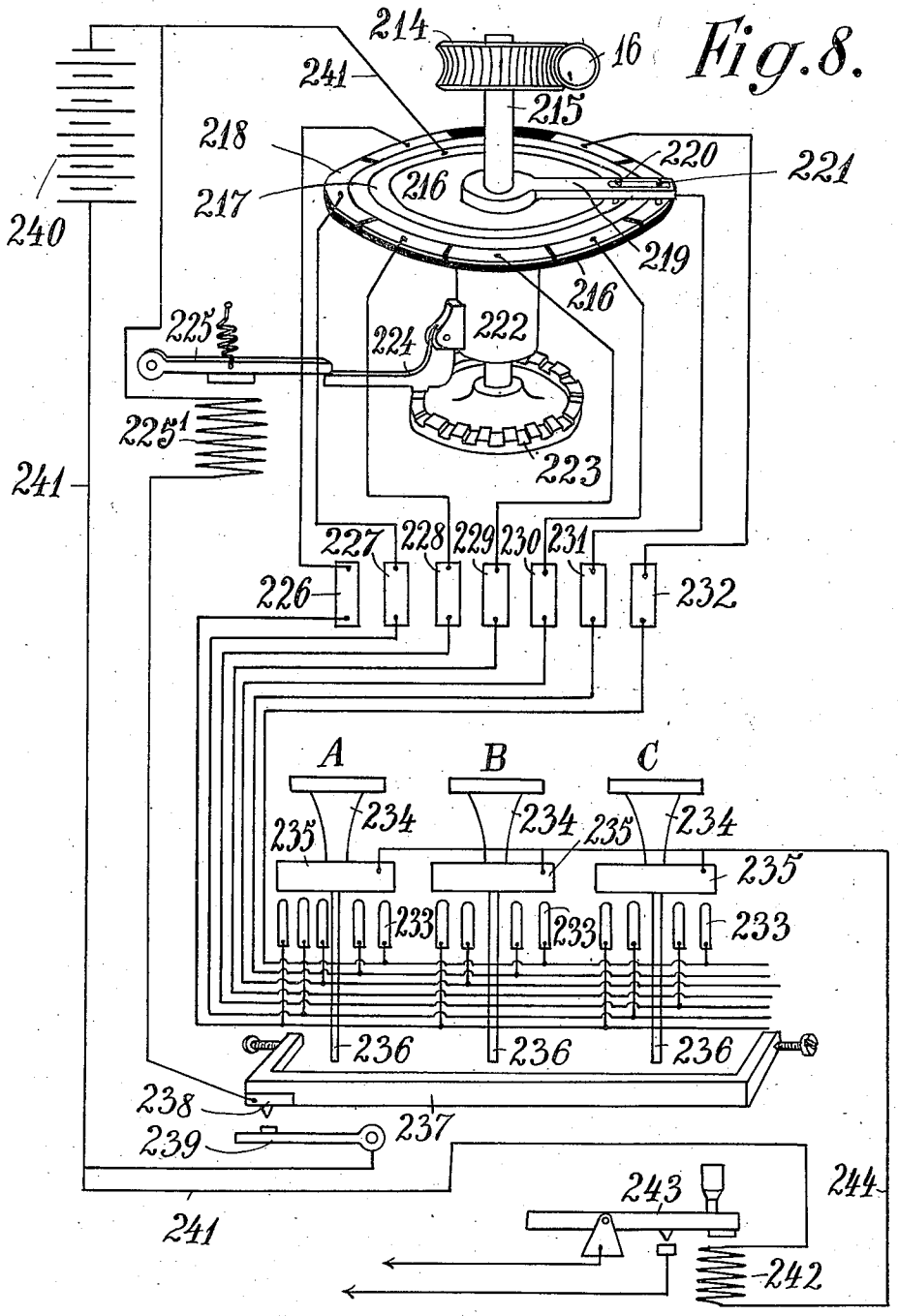
SIGNAL SYSTEM.

APPLICATION FILED JAN. 27, 1909.

1,073,130. Patented Sept. 16, 1913.

8 SHEETS—SHEET 8.

Fig. 8.



Witnesses.

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R. V. Sommers

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Abraham Nilsen Hovland

by Young Orth & Co Atty.

UNITED STATES PATENT OFFICE.

ABRAHAM NILSEN HOVLAND, OF MELSOMVIK, NEAR STAKKE, NORWAY.

SIGNAL SYSTEM.

1,073,130. Specification of Letters Patent. Patented Sept. 16, 1913.

Application filed January 27, 1909. Serial No. 474,490.

To all whom it may concern:

Be it known that I, ABRAHAM NILSEN HOVLAND, a subject of the King of Norway, residing at Melsomvik, near Stakke, Norway, have invented certain new and useful Improvements in Signal Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The present invention relates to a system and means for transmitting signals and producing other actions with or without the use of wires and aims at producing out of several actions produced at a practical distance one particular action, by means of some novel characteristic arrangements through the agency of short or long impulses of current or through combinations of the same. Thus the production at a distance of some desired motion or other, such as the steering of a torpedo, a submarine boat, a vessel, etc., the ignition of a particular mine of a field of mines, the production of a particular optical, acoustic or electric signal, the drawing of figures, printing of letters and so on can be effected by closing for instance a certain circuit, according to the combination of current impulses chosen.

The invention also relates to arrangements, by means of which from the distant place or apparatus, where the distant motion is to be effected, controlling signals can be automatically produced, warning the operating person at the transmitting station when the circuit breaker for the proper distant motion is ready to be closed. When such operation is desired, with the aid of electric waves, a transmitting apparatus for electromagnetic waves must be placed at the receiving station, the torpedo, the mine or the like, if the signaling or the like is to be effected without the use of a wire.

An embodiment of the invention is shown in the annexed drawings.

Figures 1, 1ª and 2 are diagrams illustrating the principle of the invention. Fig. 3 is a sectional view of a form of telegraph receiving apparatus with type-printing device. Fig. 4 is a side elevation of the same apparatus partly in section. Fig. 4ª is an elevation of the opposite side of the apparatus from that shown in Fig. 4. Fig. 5 is a detail view of the apparatus. Fig. 5ª is a view similar to Fig. 5 with the parts in different position. Fig. 5ᵇ is a section on line II—II of Fig. 5ª. Fig. 5ᶜ is a plan of Fig. 5ª. Fig. 6 is a diagrammatic view of a combined transmitting and receiving apparatus, likewise intended for transmitting printed signals. Fig. 7 is a diagram illustrating an arrangement for transmitting control signals at the receiver station. Fig. 8 is a modified form of transmitting apparatus. Fig. 9 is a longitudinal section through some of the parts shown in Fig. 8. Fig. 10 is a plan, partly in section, of the lower part of Fig. 9. Fig. 11 is a vertical section at right angles to the view shown in Fig. 9.

The principle of the invention will be first briefly explained, reference being had to Figs. 1, 1ª and 2. On a disk of any suitable form, a drum, or the like are placed several rows of metal strips or contacts 1 arranged in groups, Fig. 1, so that each row forms a contact combination or signal, for instance Morse signal, different from those combinations of the other rows. The short groups correspond for instance to a short impulse of current or to a dot, the long groups to a long impulse of current or to a dash. In each dot-group two or more metal strips are made use of, in each dash-group a greater number is used according to the length of the dash. The strips of each group are insulated from each other; but the extreme strips of the different groups in the same row are electrically connected with each other. The two extreme strips of each row are connected by conductors 2 with a source of current 3, such as one or more galvanic cells, and with one or more electro-magnets 4. Thus across each row of metal strips there can be closed by suitable means a circuit consisting of the contact groups 1 of the row in question, the source of current 3 and one or more electro-magnets 4. As long as not all the several metal strips in the row are in metallic connection with each other, there will, however, be breaks in the circuit, the breaks being formed between the different insulated metal strips. If now across such a row there is passed one or more metal pieces 5, which together cover or connect all the metal strips 1 in the row, the circuit of the row in question will be closed and the armatures of the magnet or magnets will be attracted. The said metal

pieces 5 can now be arranged as a kind of type 6, so that the latter will correspond exactly to the groups in the row which it has to cover, and such a form or length be given to the other rows that the type formed does not cover or connect all the metal strips in these rows. Thereby it is attained that a certain (Morse) type can only close the circuit across a certain row, the groups of which correspond to the projecting metal portions of the type in question. If such a type is passed across all the rows, the circuit of the electro-magnet 4 will, consequently, not be closed, until the type covers the row that has a group arrangement corresponding to the type. If now for each row there be arranged a letter type 7 or a circuit breaker 8 and the electro-magnet 4 be caused to move together with the Morse type 6 across the row, the electro-magnet will act on its armature 9, which is formed as a hammer, and cause it to strike just as the type 6 passes the row corresponding to the same. It can be so arranged that the hammer 9 strikes down over the letter type 7 corresponding to the row and prints the same onto a paper strip, or strikes against the corresponding breaker 8 and closes the same. If now the circuit breaker belongs to another circuit with source of current 10, electro-magnet 11, motor 12, electric igniting cartridge 13 or the like, a certain circuit can be closed to produce a certain motion or effect a certain object, for instance to act on the rudder of a torpedo, to discharge a mine or the like. In Fig. 1 there is shown a Morse type 6 corresponding to the international r — signal (.—.). The closing of the contact can also be effected by causing the drum or the like with the contact rows to glide across the Morse type 6, when the same has been formed, while this Morse type and the magnet 4 retain their position. When the Morse type meets the corresponding row of contacts, the hammer 9 will strike down and print from the letter type. If the contact rows are arranged around the circumference of a drum, the latter may be caused to rotate about its axis, when the Morse type 6 has been formed. On the whole, it is entirely immaterial, whether the contact rows are caused to move and the Morse type to remain fixed, or vice versa; it is likewise immaterial whether the contact drum and the Morse type are placed in a vertical, in an inclined, or in a horizontal position.

In an apparatus intended for closing different circuits the more suitable arrangement is that in which the contact rows with the circuit breakers are stationary, while the Morse type moves around; all the lines can then be coupled to the circuit breakers that are to be closed. The installation of such a Morse type or the like can be effected in various ways. It may be formed as a positive or negative type. The several metal pieces 5 may for instance be arranged in a frame or slide 14, Figs. 1 and 2, and these metal pieces 5, which are hereinafter called type pieces are arranged one alongside the other and in such a way as to enable them to be pushed upward, be turned to one side, or be pulled down, and then be retained in their new position. To push the type pieces 5 upward there may for instance be used an electro-magnet 15, which is moved with an adjusted, constant velocity along the underside of the type pieces by means of a screw 16 capable of being driven in a known manner by an electromotor 17, a clockwork, or the like. The armature 18 of the electro-magnet, which is used to push the elements upward, to pull them down, or the like, can, especially in receiving apparatus, be acted upon by means of impulses of current through the coils of the magnet. These current impulses may for instance at a receiving station be produced from a transmitting station, either through an ordinary telegraph line or by electric-waves. In a wire telegraph the line 19 may be connected directly with the electro-magnet, as shown in Fig. 1. In a wireless telegraph the electro-magnet is connected with a battery 20 and a relay 21 which is, in usual manner, inserted in a circuit with wave indicator 22 and source of current 23, as shown in Fig. 2.

Many kinds of apparatus, receiving as well as transmitting apparatus, can be constructed all of which are based on the above principle. In Figs. 3, 4, 5, 5^a, 5^b and 5^c a form of receiving apparatus has been shown as an example. In explaining the apparatus and its manner of operation, reference being had to the said figures, the presumption is that a wire telegraph is made use of.

24 designates a drum of wood, ebonite, or the like, rotatably mounted in a frame 25, and with as many rows of metal pieces 1 sunk into its circumference as there are letter types to be used. The letter types are placed on a special type wheel 26 mounted on the shaft 27 of the drum, so as to enable it to be stopped for quite a short time during the rotation of the shaft. Under this contact drum a series of contacts or type pieces 5, Figs. 5 to 5^c have been arranged on spring arms 28 acting in an upward direction and mounted on a rod 29. These type pieces 5 are retained in the lower position, shown in Fig. 5, by hooklevers 30, which, when they are acted upon in an upward direction, will release the arms 28, so that the latter can swing upward into the upper position, shown in Fig. 5, in which position they are stopped at some distance from the drum by a bar 31 mounted in a frame 32 pivoted on the rod 29. The arms 28 are released from their lower position by

means of an arm 33 pivotally secured to a block 34 mounted on the screw 16, which arm 33 is provided with an inclined lug 35, Figs. 3 and 5[b] adapted to engage the hook-levers 30. An eccentric disk 36 in the block 34, is by means of groove and tongue slidably mounted on and rotatable with a rod 37 which is mounted in the frame 25 and extends through the block 34, and will, when said rod is rotated, press the arm 33 upward thereby causing the lug 35 to engage the lever 30 and release the arms 28, which are then forced upward. In Fig. 5[b] the 2nd, 5th, 6th, and 7th metal pieces are shown in their raised position after having been carried upward. Thus these four metal pieces form the Morse type which is here taken as an example. As will be seen from Figs. 5[a] to 5[b] each metal piece 5 at its lower end terminates in a forked extension *c* extending through a perforated plate 28′. Between the tines of the forked portion *c* there is pivotally mounted the two armed lever 30, the upper longer arm *b* of which engages the plate 28′ through which the forked member extends. A small plate spring (shown to the left of the arm *b*) tends to force the arm *b* over to the right so as to make it normally engage the underside of the plate, whereby the metal piece 5 is secured in its lowermost position. If now the arm *b* is forced so far to the left as to make it pass through the hole in the plate (*i. e.* when it occupies the same position as the sides of the fork), then the metal piece 5 will be forced somewhat upward by the spring 28, belonging thereto. The lever arm *b* is forced to the left each time the arm 33 is turned upward by a lug 82 engaging the arm *a* of lever 30 which then moves upward, the arm *b* simultaneously moving to the left. The arm 33 is raised each time the rod 37 rotates, and this occurs, when an impulse of current passes through the electro-magnet 47 (Fig. 4). Those metal pieces 5, which are engaged in transmitting letters or the like (in the example chosen No. 2, 5, 6, and 7), will not, however, get into contact with the contact drum 24 at once, because they are retained by the rod 31, as hereinafter described.

The block 34 can be coupled to the threads of the screw 16 by means of tongs 38 mounted in the block, the jaws of which tongs are provided with female threads and are kept open by means of a spring 39, and they can be pressed against the screw by means of an eccentric disk 40 pivotally placed in the block 34; this disk 40 is slidably but not rotatably mounted on a rod 41 which is journaled in the frame and extends through the block and the eccentric disk 40. The rods 37 and 41 are provided with arms 42, 43 respectively and connected by links 44 and 45, with the armature 46 of an electro-magnet 47, so that, when this magnet is excited, the rods 37 and 41 will be rotated with their eccentric disks. The armature is provided in a well known manner with a releasing spring.

The screw 16 is moved with uniform velocity by an electromotor or a clockwork 48 in a well known manner, for instance by means of friction disks 49, 50, and to enable the revolving velocity of the screw to be controlled, the motor 48 is slidably mounted in a guide 51 in which it can be adjusted by a screw 52, so that the friction disk 49 can be brought nearer to or farther from the center of the friction disk 50.

In the block 34 is provided an arm 53 pivoted on a pin 54 and acted upon by a spring 55 (Fig. 3) which arm, as soon as the jaws 38 of the tongs have been forced by the eccentric disk 36 against the screw 16, will be acted upon by the spring 55 in such a manner that its rear end will be brought in between the arms 56 of the tongs and hold the tongs in engaging contact with the screw, even after the magnet 47 has ceased to act. The tongs will be disengaged from the screw 16, when the block 34 has moved so far that the foremost end 57 of the arm 53 engages a lug 58 on the frame, which lug raises the foremost end of the arm thereby removing its rear end from the arms of the tongs, so that the tongs will be opened by the spring 39. The block 34 is then moved quickly backward by a lever 59 which is pivoted at 61 and acted upon by a spring 60, said lever having a bifurcated portion 62 engaging a projection 63 on the block.

The above-mentioned frame 32 is provided with a lug 64 (Figs. 5 to 5[c]) which is adapted to be swung laterally and is acted upon by a spring 64[a] which lug is just opposite a groove 65 in one end of the drum 24, the lug being able to enter the said groove through a slot 66 in the drum outside the first row of contacts, when the frame is swung upward. When the frame 32 has been swung up, so that the lug 64 rests in the groove 65, the released type pieces 5 will follow on so as to rest with a suitable pressure against the drum surface and its rows of contacts.

The rod 31 in the frame 32 is engaged by the bifurcated end 67 of an arm 68 extending from the armature 69 of the electro-magnet 70. This armature, which is provided in a well known manner with a releasing spring, not shown, also carries an arm 71 engaging a lug 72, Fig. 4[a], on an arm 73 pivotally mounted at 74 and carrying a roller 75 over which runs a paper strip 76. The bifurcated end 67 of the arm 68 and the frame 32 are retained in the position shown in Fig. 5 by a hook 78, on one arm of a bell crank lever 77 catching

the bifurcated end 67. The bell crank lever is pivoted on a pin 79 and retained by a spring 80 in the engaging position. The other end of this bell crank lever has an inclined nose 81 against which a lug 82 on the block 34 strikes, when the block has reached its extreme position on the right hand side; the lever 77 is thereby swung so as to cause its hook 78 to disengage the bifurcated end 67 which, under the action of the spring of the armature 69, will then force the frame 32 with the lug 64 up against the drum, so that the lug on reaching the slot 66 will enter the groove 65 and allow the frame to swing up so as to cause the type pieces 5, to glide on the drum surface.

The paper strip 76, Fig. 4[a] is wound on a drum 83 which is disposed in the base 84 of the apparatus and said strip is passed from the drum across guide rolls 85, 86, 87, 88 to the roller 75 from which it enters between feed rollers 89, 90, the first of which is coupled by a pinion 91 on the shaft of the roller 89, which pinion engages a toothed segment 92. The shaft of this segment has an extended portion 93 which extends through a corresponding aperture in the portion 94, Fig. 5, of the block 34. During the reciprocating motion of the block on the screw 16 the toothed segment 92 and with it also the pinion 91 will therefore be moved alternately in opposite directions and by means of any well known mechanism not shown located between the pinion 91 and the roller 89, movement of the pinion 91 in one direction, will be imparted to the roller 89, while the latter will remain stationary during the movement of the pinion in the opposite direction so that the roller 89 with its clamp roller 90 will be moved and pull the paper strip 76 forward a certain distance each time the block 34 is moved from the left to the right on the screw 16. The end disks 95, 96, Fig. 3, of the drum 24 are of metal and are insulated on the drum shaft 27 which also carries insulated metal disks 97 and 98 connected through contact brushes 99 and 100 and conductors 101, 102 with a source of current (not shown) and the pole screws 103, 104 of the magnet 70.

105, 106 designate conductors which connect the extreme contacts of the groups of contacts with each other, and the extreme contacts in each row are connected through conductors 107, 108 and 109, 110 with the end plate 95 and the end plate 96 respectively, each of which is again connected through conductors 111, 112 with one of the metal disks 97, 98. The drum is driven by means of toothed gearing 113, 114, 115 from the screw 16. The magnet 47 may be connected directly with the telegraph line through the contact screws 116, 117.

118 designates an ink roller mounted in arms 119 which are pivoted on pins 120 in the frame and are acted upon by a spring 121 so as to make the said roller engage the letter types on the type wheel 26.

The above-described receiving apparatus operates in the following manner: First the motor 48 is started so as to rotate the screw 16 with a certain velocity. At the transmitting station is telegraphed for instance the signal b (.—) in accordance with the alphabet (Fig. 1[a]). As soon as the first impulse of current passes through the electro-magnet 47 the armature 46 will be attracted, so that the rods 37 and 41 will be rotated by means of the links 44, 45. The block 34 will first be coupled to the screw 16 through the above-mentioned devices 40, 38, and the arm 53 will by its spring 55 be forced in between the arms 56 of the tongs and hold the latter closed; at the same time arm 33 with the lug 35 is raised by means of the members 37, 36, so that the lug 35 during the movement of the block to the right will strike against the lever 30 of the first type piece 5, whereby the latter springs up into the uppermost position, shown in Fig. 5, in which position it is stopped by the frame 32. In the meantime the block 34 is moved on. As soon as the first impulse has ceased, the armature 46 of the electro-magnet will be moved back by its spring; the rods 37 and 41 will be rotated in the opposite direction to the one mentioned above; the arm 33 with the lug 35 will again fall down, while the tongs will continue their grip on the screw 16, the arm 53 still retaining the tongs in this position. After this first impulse of current an interval now occurs corresponding to the interval of time between a dot and dash. The block 34 is now moved past the next type piece without raising it. When the interval has passed, the next, longer impulse of current is produced. The armature 46 will again be attracted and the arm 33 with the lug 35 be raised releasing the third and fourth type pieces and so on, as it will remain in the raised position as long as the impulse of current lasts. When the impulse ceases, the last type piece will be forced up, and the block 34 will then have moved on so far, that the lock arm 53 will glide up with its foremost end onto the inclined lug 58, so that the opposite end of the arm will be moved out of its position between the arms of the tongs whereupon the tongs are opened by the spring 39, so that the block 34 will be released and moved back quickly into its initial position by the arm 59 acted upon by the spring 60. The type corresponding to the transmitted signal (.—) has now been formed. The letter type corresponding to this Morse type is now printed in the following manner: As long as the motor and the screw are in action, the contact drum 24 is rotated. The frame 32 and the lug 64 in

the meantime are during the setting up of the Morse type held free of the contact drum by means of the bifurcated member 67 of the arm 68 and the hook 78 of the bell crank lever 77. But as soon as the said type has been set up and the block 34 has reached its extreme position, the hook is brought out of its engagement with the bifurcated member in the manner above described by the lug 82 on the block 34 striking against the inclined nose 81 of the bell crank lever 77; the bifurcated member 67 with the frame 32 and the row of type pieces are then released and the lug 64 will be pressed against the drum. When now the slot 66 comes on a line with the lug 64, the latter enters the groove 65 through the slot 66, and the raised type pieces are pressed against the drum. When the row of contacts on the drum corresponding to the type meets the latter, the circuit through the magnet 70 will be closed, whereby the armature 69 is attracted, so that the arm 71 of the latter will act upon the lever 73 with the roller 75 and swing it up against the paper strip and the type in question on the letter type wheel 26, whereby the letter is printed on the paper strip. Simultaneously herewith the fork 67 connected with the armature 69 will press the rod 31 with the frame 32 down, so that the lug 64 will, owing to its beveled face engaging the edge of the groove 65 swing to one side and be pulled out of the groove 65, while the frame will take the raised type pieces 5 down into their lowest position (shown in Fig. 5), in which position they are again locked by the arm *b* of lever 30. The hook 78 will now again engage with the fork 67 thereby retaining the same and the frame 32.

It will be understood, that the Morse type is pulled off from the drum simultaneously with the stroke of the pressing roller 75, so that the possibility of a closing of contact with the next row of contacts on the drum is quite out of the question, and the pressing roller 75 will snap back immediately after the stroke of the current through the magnet 70 is broken, when the contact with the drum of the type set up ceases. The feeding of the paper strip has taken place during the setting up of the type, and now it remains at rest during the return movement of the block 34 to be pulled anew forward a certain distance, when the next type is set up.

Fig. 6 is a diagram showing how an apparatus constructed in accordance with the above-described principle for example can be adapted for transmitting as well as for receiving signals and the like. This apparatus is shown in combination with a system of conductors for transmitting the signals by electro-magnetic waves. 24 designates the contact drum, on the shaft of which is mounted a loose rope pulley 122 normally connected by a coupling 123, 124 with the shaft 27. This coupling is adapted to be released by means of an electro-magnet 125 acting on the armature 126 connected by a link 127 with the coupling member 124. The coupling member 124 is forced in a well known manner by a spring not shown up against the coupling member 123 on the rope pulley. The drum shaft 27 also carries two metal disks 97, 98, which are insulated from the shaft and each disk is connected by conductors 107, 109 with one of the extreme contacts of the contact rows on the drum. One of these disks 98 is connected through the contact brush 100 and the conductor 128, in which the printing magnet 70 is cut into connection with one pole of the source of current 129, the other disk 97 being connected through the contact brush 99 and the conductor 130 with the other pole of the same source of current. The drum shaft 27 also carries a letter type wheel 26 and a bevel gear wheel 131 gearing with a bevel gear wheel 132 on a shaft 133 carrying an arm 134 extending across three metal rings 135, 136, 137. In the ring 135 is a series of holes 138 corresponding to the number of contact rows on the drum; and through these holes metal pins 139 can be pushed up in a well known manner. From the metal ring 137 a conductor 140 leads through the magnet 125 to the conductor 130 between the brush 99 and one pole of the source of current 129; and from the ring 135 a conductor 141 leads to the conductor 128 between the other contact brush 100 and the other pole of the source of current 129. In the arm 134 there is provided above each of the rings 135, 136, 137 a contact member 142, 143 and 144 respectively. The former two of these contact members slide on their respective rings, the third one 144, which is electrically connected to the contact piece 143 is adapted to close contact with the metal pins 139, when the latter has been pushed up. At the same time the pin in question strikes against a downward extending metal plate 145 on the arm 134, which metal plate is connected with the contact 142, and thereby the movement of the said plate is stopped. The relative position of the pins 139 in the ring 135 is such as to bring about the said stoppage at the moment when the contact row on the drum corresponding to the mark or letter of the key is on a line with such parts of the apparatus as are to coöperate with the contact row in question. Under the drum 24 a row of type pieces 5 is provided in a frame 32 for instance in the manner shown in Fig. 5; and under this row of type pieces is disposed a block 34 provided with releasing device 35 for the type pieces, which block is reciprocated in above-described manner on a screw 16 driven from the electromoter 48 inserted in a circuit 146. On the screw 16, which is driven from the electromotor 48

a rope pulley 147 has been provided from which a rope 148 passes around the rope pulley 122 on the drum shaft.

149 is a transmitting circuit with operating key 150 for electromagnetic waves and 151 a similar receiving system with relay 152. On the rear arm of the transmitting key 150 is an armature 153 intended to be acted upon by an electromagnet 154 connected on one hand through a conductor 155, the source of current 129 and a conductor 156 with a metal piece 157 secured to and insulated from a bell crank lever 159 and on the other hand said electro-magnet is connected through a conductor 160 with another of these metal pieces 158 which is insulated from the piece 157. The lever 159 is pivoted on a pin 161 in a slide 162 movable on a rod 163, which slide has two ribs 164, 165 extending downward. This slide, during the use of the apparatus as a transmitting apparatus, is placed on its rod under the drum, where the frame 32 is now shown, in such a manner as to make the metal pieces 5 extend closely up to the contact rows of the drum; and a reciprocating movement of the slide 162 on the rod 163 is imparted to the slide by a projection 166 on the block 34. This projection enters between the downwardly-extending ribs 164, 165 of the block to the left of the lower end 167 of the lever 159 and will, therefore, during the movement of the block 34 to the right on the screw 16, first strike against the lower end 167 of the arm and swing the same, so that the metal pieces 5 will get into contact with the surface of the drum and the contacts of the same; then it will strike against the rib 164 of the slide and move the latter to the right. Throughout this movement the metal pieces are in contact with the contact row in question on the drum. When the block 34, in a well known manner, is moved back, the lever 159 is first released, so that the metal pieces 157, 158 will pass clear of the drum, and then the projection 166 engages the rib 165 of the slide and moves it back into its initial position. The slide with the metal pieces 157, 158, Fig. 6, is used in transmitting signals and the like. The magnet 47 is inserted in a circuit 168, 169, 170, 130, 129, 155, 128, 141, which can be closed by the contact members 143, 144.

The mode of operation of this apparatus will now be described, the presumption being first that the slide 162 with the metal pieces 157, 158 are in operating position under the contact drum. The motor 48 is first started, and the screw 16, the drum 24 and the arm 134 will then be rotated with uniform velocity. If now a key, for instance the one corresponding to the letter A, be pressed, the metal pin 139 in question will be raised. Then, when the plate 145 on the arm 134 strikes against this pin, the arm and with it the contact drum will be stopped; at the same time circuit 140, 130, 129, 155, 128, 141 is closed in the first place by means of the contact pieces 142, 144 and the pin 139, the magnet 125 attracts its armature 126 and releases the coupling 123, 124, while the screw 16 continues its rotating movement; thereupon the circuit 168, 169, 170, 130, 129, 155, 128, 141, 139 for the magnet 47 is closed by the contact pieces 143, 144, the pin 139 and the rings 135, 136, which magnet 47 through its armature and link belonging thereto revolves the rod 41 so that the block 34 will be coupled to the screw and begin to move to the right on the same. According as now the metal pieces 157, 158 simultaneously touch one of the contacts 1 in the row on the contact drum, the circuit 156, 129, 155, 160 through the magnet 154 will be closed, the telegraph key 150 will be acted upon, so that the transmitting circuit 149 will be closed and a train of electric waves will be transmitted. The wave-trains thus transmitted will then correspond to the signal for the letter A. When the block 34 has reached the end of its path, it will be released and, in the above-described manner, be moved back into its initial position, whereupon a fresh signal can be transmitted in the same manner. As a receiver this apparatus operates in the following manner: The frame 32 then occupies its operative position instead of the slide 162. A wave-train acting on the relay 152 in the receiver system 151 will then, at each impulse, close the circuit 169, 129 of the magnet 47 thereby first coupling the block 34 to the screw and then, according as the latter is moved to the right, releasing type pieces in the frame 32, until the block has reached the end of its path. The frame 32 is then raised in the manner described above with reference to Figs. 4 and 5, and when the set up type strikes the corresponding contact row on the drum, the circuit 107, 97, 99, 130, 129, 128 magnet 70, 128, 100, 98, 109 is closed through the magnet 70 which, in the manner hereinbefore described causes the letter type or the like to be printed on the paper strip and the frame 32 and the type pieces 5 to be moved back.

The present system renders a secret transmission of signals possible in various ways. Thus various kinds of signals differing from the usual Morse signals can be formed, as shown in Fig. 1a. These signals can be composed in different ways, and their signification may be chosen at pleasure, so that each country or the like can set up their own system of signals different from others.

If the usual Morse code is used in telegraphing, a correspondence with secret code or secret cipher can be established in the manner hereinafter described, provided that, at the transmitting station, common code is

changed into secret code by a certain system with key words, letters, or the like. Whether this is effected by hand or automatically by means of some apparatus or other is of no consequence to the receiver apparatus, but preferably a transmitting apparatus, like the one above described, is used. If now at the receiver station the same key word, letter, or the like, be used as at the transmitting station and the apparatus are adjusted in accordance therewith, the secret code will automatically be changed into clear code. If, for instance, the letters have been exchanged so as to make the letter type A correspond to the contact row X on the drum and X with A (see Fig. 1), and an X be transmitted from the transmitting station a Morse type corresponding to the mark or letter —..— (Fig. 1) will first be formed, and this Morse type will then find its corresponding X on the drum. But now the letter type A will be on a line with the row —..— and the letter A will be printed on the paper instead of X. In this manner letter by letter will be changed automatically from secret to clear code.

An arrangement for transmitting automatically controlling signals or the like from the receiver station by means of electromagnetic waves is shown diagrammatically in Fig. 7. 171 is a rod pivotally mounted and held in the position shown in the drawing by a spring 172 and a stationary member 173 both of which act on an armature 174 disposed on an arm 175 on the rod. Opposite the armature 174 is an electromagnet 176 which, when excited, will attract the armature and rotate the rod 171. Alongside the rod are arranged a series (here seven) of circuit breakers I, II, III, IV, V, VI, VII, each consisting of a yielding hook 177 and a portion 178 formed as a magnet armature. The breaker I is located in the circuit of a motor 181 which receives its current from a source of current 182. The breaker II is inserted in the circuit of the above-mentioned magnet 176. The breakers III–VI are arranged each in one of the circuits from a battery 183 through electro-magnets 184, 185, 186, 187 and the relays 188, 189, 190, 191 which on being excited will close circuits of the electromotors 192, 193, the electro-magnet 194, and the igniting cartridge 195 respectively which latter four circuits moreover are controlled by the breaker VII. Each of the electromagnets 184, 185, 186, 187 has its armature located on one end of levers 196, 197, 198, 199 respectively the opposite ends of which are of conducting material and may by means of the respective electro-magnets be pressed against metal disks 200, 201, 202, 203 respectively disposed on the shaft 204 of the electromotor 181 which metal disks are in conducting connection with said shaft and have their circumferences provided with insulating pieces 205 of such a shape, extent and arrangement as to make each disk represent for instance a particular Morse signal. The conducting ends of the arms 196, 197, 198, 199 are connected through conductors 206, 207, 208, 209 and a conductor 210 with one end of the primary winding 211 in a transmitting circuit for electromagnetic waves, and the shaft 204 is connected through conductors 212, 213 with the source of current 183 and the other end of said primary winding. If in this instance the breaker I is first closed from a transmitting station, a current will pass from the source of current 182 through the motor 181 which will then rotate the shaft 204 with the disks. If thereupon for instance the breaker III be closed, a current will pass from the source of current 183 through the electro-magnet 184 and the relay 188; the contact arm 196 will be pressed up against the disk 200 and the controlling signal in question will be transmitted. When now the person operating the transmitting apparatus has received the controlling signal, he will know that the circuit through the motor 192, which may for instance be intended to produce the movement of a torpedo in the starboard direction (to the right), is ready to be closed. He now transmits a signal by which the breaker VII is closed and thereby the motor 192 is made to rotate. When the torpedo has taken the desired course, the letter or the like corresponding to the breaker II may be transmitted whereby the current will be closed through the magnet 176 which will rotate the rod 171 and thereby cause all the breakers to be opened. In the same manner the other motor 193, the magnet 194, and the igniting cartridge 195 can be acted upon and so on, as a greater number of different apparatus can be inserted. It will thus be possible to produce at a distance any desired motion after having first received a control-signal indicating that the proper circuit is ready to be closed.

Referring again to the transmitting apparatus I shall now proceed to describe a new form of execution similar to that shown in Fig. 6 but differing in some respects from this. Fig. 8 is a diagrammatic view of this modified form of the transmitting apparatus. 16 is the screw which moves the electro-magnet 15 (in Figs. 1 and 2) with an adjusted, constant velocity. The end of this screw moves a worm wheel 214 on the top of a rod 215 which goes through a disk 216. The number of teeth of the wheel 214 is so chosen in proportion to the screw that the wheel 214 will make one revolution in the same space of time which the electro-magnet 15 (in Figs. 1 and 2) should use to move from the start to the end position, that is to

say—in the same time which will be used to set up a Morse type. The disk 216 consists of an insulating material and carries two metal rings 217 and 218, one of which (218) is divided into eight pieces of equal length, one of which pieces is made of an insulating material, while the others are of some metal and are insulated from each other. Over the rings is placed an arm 219 which carries two contacts 220 and 221, which are metallic combined and which lie close on to the rings and make contact between them. The arm 219 is attached to a cylinder 222 which by some known means can be connected to the rod 215 during one revolution of the latter.

The devices provided for actuating the arm 219 and the lever 224 are the following: The shaft 215, which is constantly rotated by a motor or the like, carries at its lower end a toothed disk 223. The contact arm 219 is fast with the sleeve *n* which is connected with the hollow sleeve 222. The stop lever 224 at the inner side of the pivot pin has a tooth or an arm *a* (Fig. 9) which is pressed downwardly by the spring *c*. When the stop lever 224 with its left hand end is pressed downwardly by the electro-magnet armature 225, its tooth *m* will be pressed down between two teeth of the toothed disk 223. The right hand end of the lever 224 will then get above the hook *b* which will retain it in this position until the arm *f* of the hook *b* (Figs. 9, 10 and 11) toward the end of the revolution strikes against a fixed pin *g* (Figs. 10 and 11) which raises the arm *f* thereby releasing the lever 224, so that the latter will be forced by the spring *c* out of engagement with the toothed disk 223. On account of friction between the shaft 215 and the sleeve *n* (Fig. 9), which as already stated, is connected with the sleeve 222, the latter will be further rotated for a distance, until the arm *f* strikes against another pin *h* which stops it. Thereby the contact arm 219 gets back to its initial position. The lever 224 at the same time gets under the armature 225. On this being again attracted the arm *a* will push the hook *b* a little distance backwardly and upwardly, thereby raising the arm *f* out of engagement with the pin *h*. The contact arm 219 thereupon performs one revolution, as before. In the figure the rod 215 is fitted with a hollow wheel 223 with teeth into which may slip a lever 224 which is worked by an armature 225 of an electro-magnet 225′. In a well known manner this coupling can be so arranged, that the lever 224 will slip automatically out of the wheel 223, when the latter has made one revolution. To each of the seven metal pieces of the ring 218 are connected conductors which leads to seven metal pieces 226, 227, 228, 229, 230, 231, 232. From these pieces conductors leads to some metal springs 233, which are insulated from each other and are arranged in groups, corresponding to the Morse signs which they represent. Over each group of springs is placed a key 234 of which there are as many as letters and signs in use at the apparatus. Each key is on the upper side marked with the corresponding letter or sign and is provided with a metal piece 235 to make contact with the springs 233. Moreover they are provided with a rod 236 which can push against a lever 237 which will press a contact 238 against a spring 239 so that the current from a battery 240 may flow through the windings of the magnet 225′. For the sake of simplicity there is shown only three keys—the A, B and C key. The metal ring 217 is through a conductor 241 connected with the battery 240 and an electro-magnet 242 acting on a Morse key 243 in the wave or current transmitting system, which electro-magnet is on the other side connected to the metal pieces 235 on the keys by means of a conductor 244.

The apparatus will work in the following way: When at the transmitting station a telegram is to be sent, the motor is first started and moves the screw 16 with a constant velocity. The operator then has only to press down the keys, which are marked with the letters and signs to be transmitted. If he presses down the key A, the metal piece 235 will make contact with the corresponding metal spring groups and thereby with the corresponding metal pieces of the ring 218 by A it will be the 1st, 2nd, 5th, 6th, and 7th. Moreover the key will push against the lever 237 and establish contact between 238 and 239, and thereby the current will flow through the electro-magnet 225′ and cause the lever 224 to connect the arm 219 to the shaft 215. The arm 219 will therefore slide over the rings 217 and 218 and lead the current from the metal pieces corresponding to the letter A and over the ring 218, the conductor 241 through the electro-magnet 242, which acts upon the Morse key 243, and the key 243 will cause the spark etc. to start. During one round of the arm 219 there will therefore pass so many impulses through the electro-magnet 242 as there are contact springs in the corresponding group A.

The construction of the different apparatus can be varied in many ways without departing from the spirit of the present invention.

When the apparatuses are to be used for wireless telegraphy, they should be provided with devices to prevent the atmospheric discharges from setting the mechanism going. This may be done in several known manners.

I claim:

1. In a signal receiving system, a series of

incomplete electric circuits, each of which has an arrangement of openings therein differing from the others, an electro-magnet, a set of contact pieces, means controlled by said magnet for selectively actuating said contact pieces, and means to produce relative movement and contact between said contact pieces and circuits whereby the selected pieces will close the corresponding incomplete circuit and apparatus actuated by the closing of said circuit.

2. In a signal receiving system, a circuit to be acted upon by electro-magnetic waves, a relay in said circuit, a local electric circuit controlled by the said relay, an electro-magnet in said local electric circuit, metal pieces, means actuated by said magnet to selectively position said pieces, rows of insulated contacts each of which rows forms part of a second local circuit, means for moving the selected metal pieces relatively to and in contact with the rows of contacts, and an electrically operated device inserted in the electric circuit comprising a row of contacts.

3. In a signal receiving system, an electro-magnet, a series of metal pieces, means actuated by said magnet to selectively position said pieces, and rows of insulated metal pieces, each of which rows forms part of an electric circuit, means to effect the electrical connection of the row of metal pieces corresponding to the selection of the metal pieces in the series, and an electrically operated device in each circuit.

4. In a signal system, rows of insulated contacts, each row comprising a different arrangement of contacts, said rows forming parts of electric circuits, a plurality of electric circuits including different electrically controlled apparatus, a circuit breaker in each of the several circuits the members of which are to be acted upon by the closing of one of the rows of insulated contacts.

5. In a system of reproducing signals, the combination with a number of metal pieces arranged in a row, means to selectively position said pieces in operative position, said positioning means operated by current impulses, a normally open local circuit containing as many parallel branches as there are selective combinations to be produced by said metal pieces and each branch having different combinations of gaps in order to control the branches, and means to move the branches over the metal pieces until all the gaps of that branch are closed which correspond to the metal pieces selected, thereby closing the local circuit, and means in said circuit for producing a signal.

6. In a signal system, a drum having rows of contacts thereon, each row having a different arrangement of contacts, and means to rotate the drum; in combination with a row of independently movable contacts, means traversable along said row of movable contacts to selectively position them in correspondence with a signal to close that row of contacts on the drum corresponding to the signal set up on the movable contacts.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

ABRAHAM NILSEN HOVLAND.

Witnesses:
J. BORRESEN,
C. BUTENSCHIN.