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C. C. JOHNSON ET AL

2,172,511

PRINTING RECORDER FOR ELECTRIC IMPULSE SIGNAL SYSTEMS

Filed Jan. 10, 1931

4 Sheets-Sheet 1

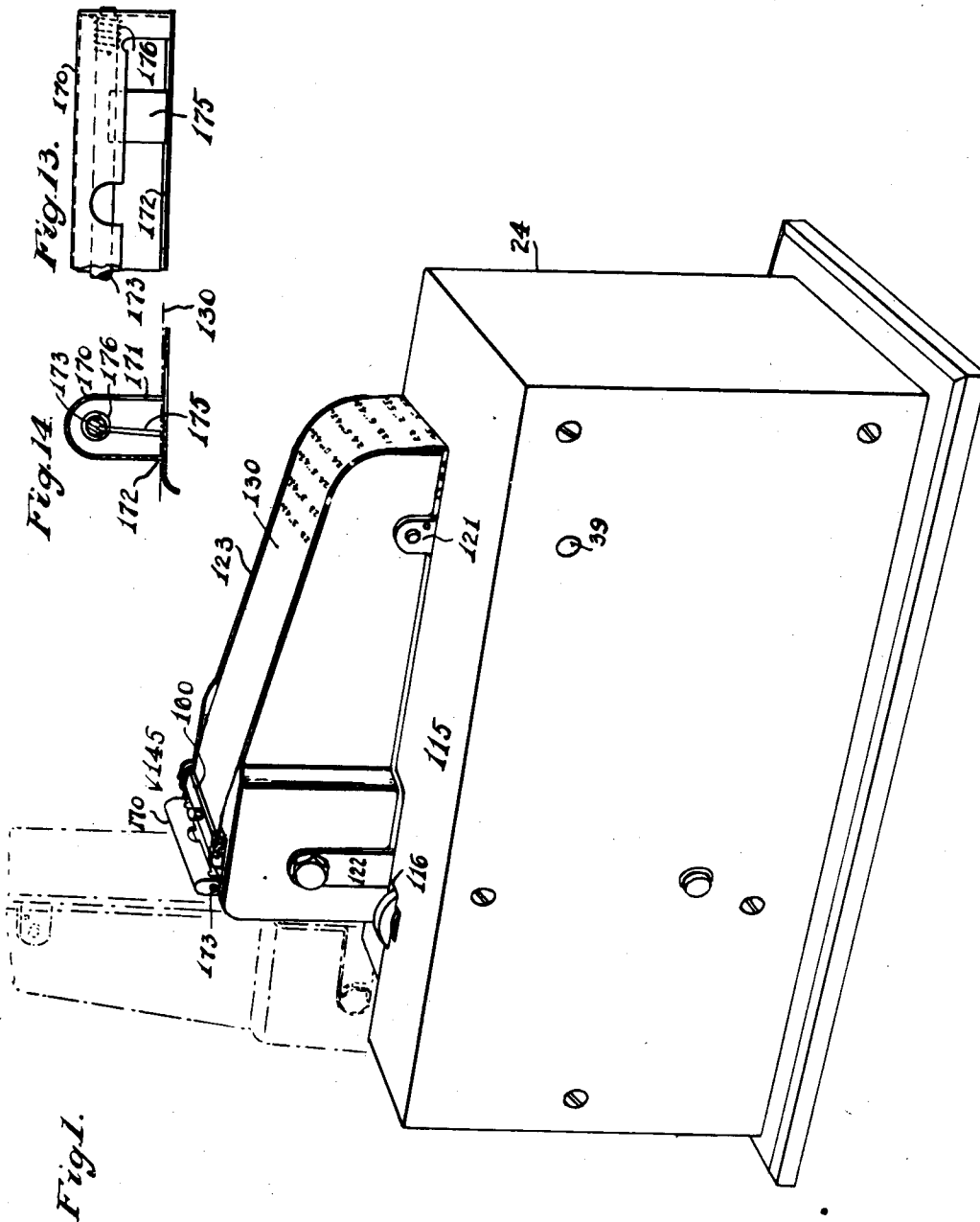


Fig. 1.

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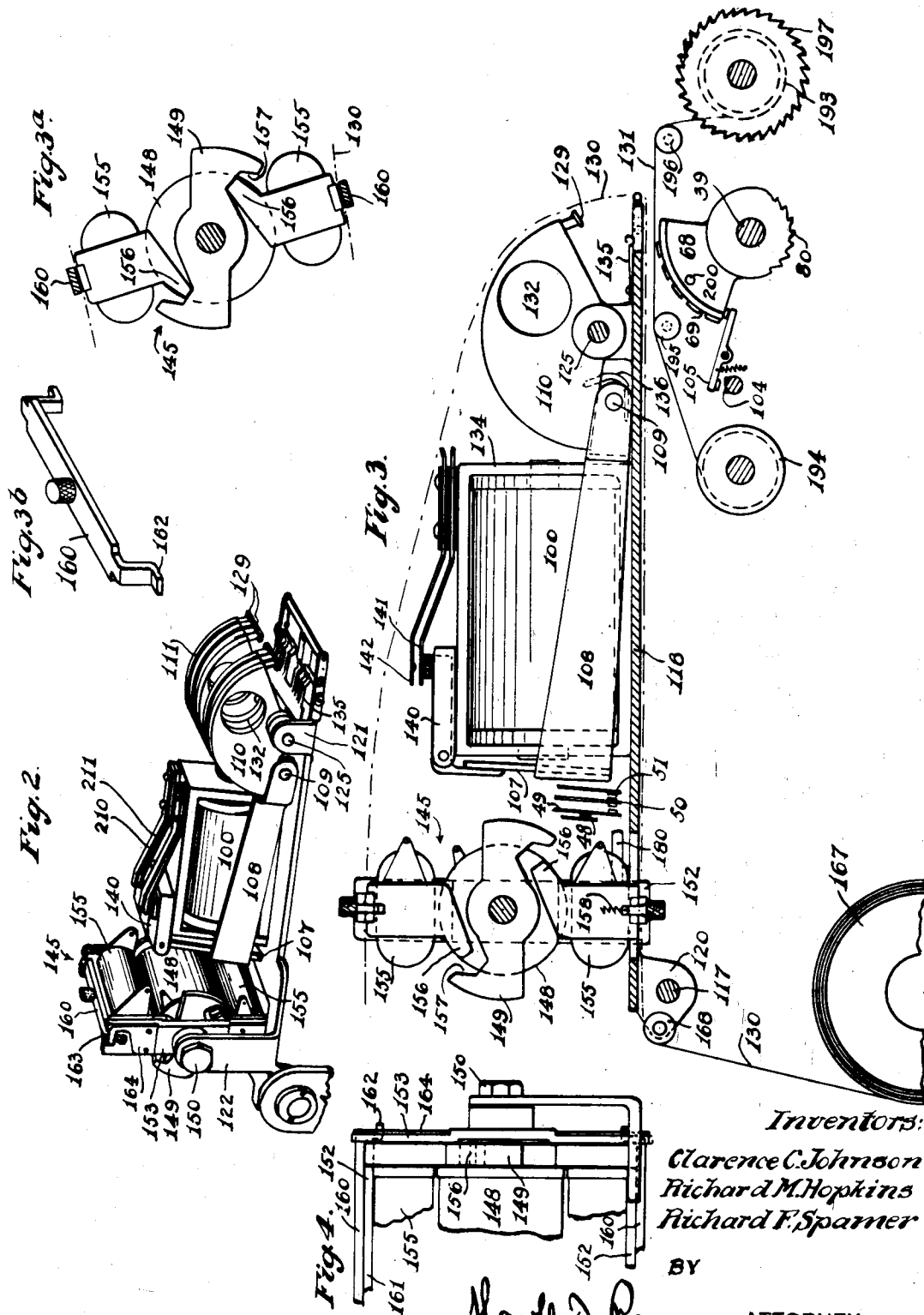
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4 Sheets-Sheet 2



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4 Sheets-Sheet 4

Fig. 15.

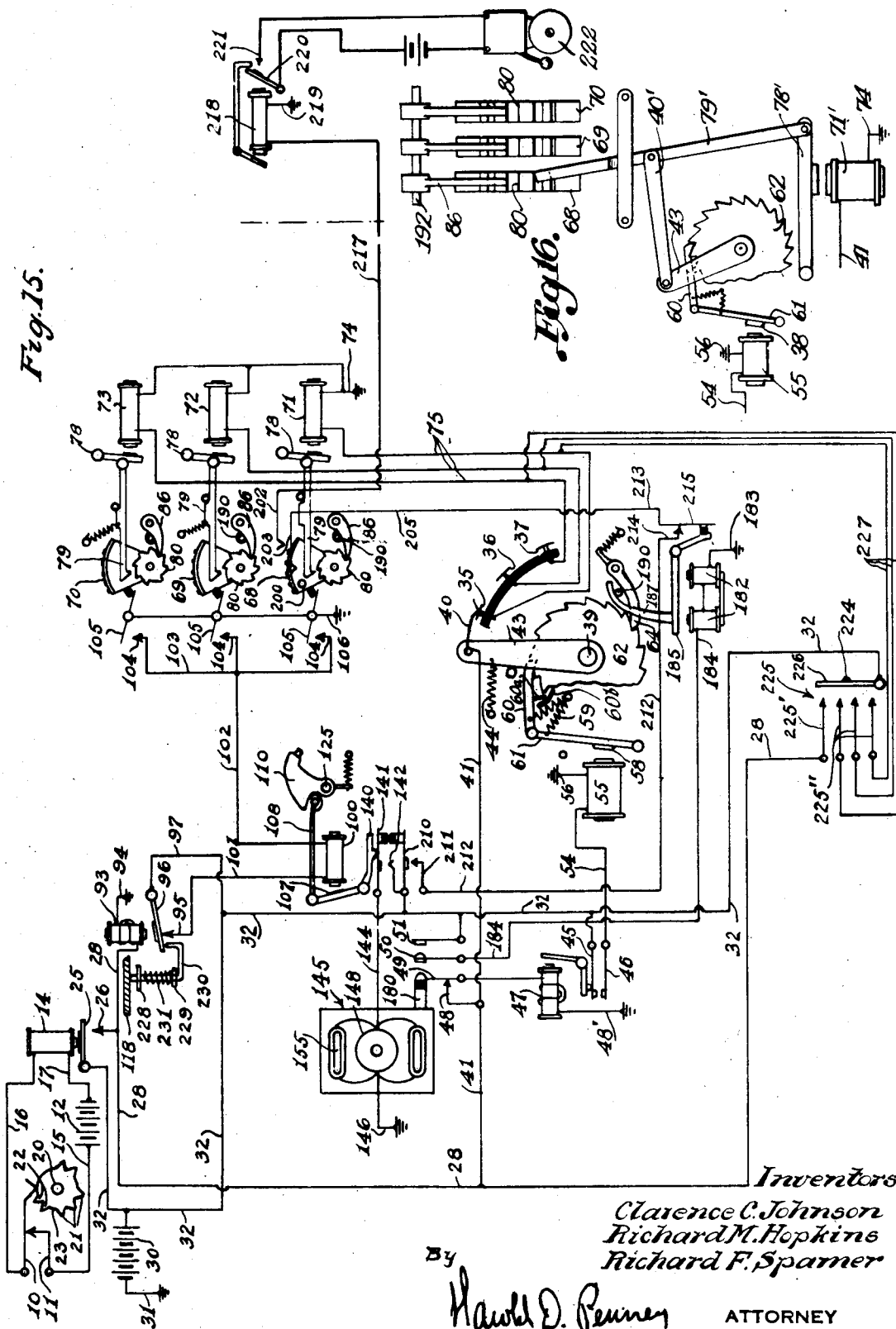
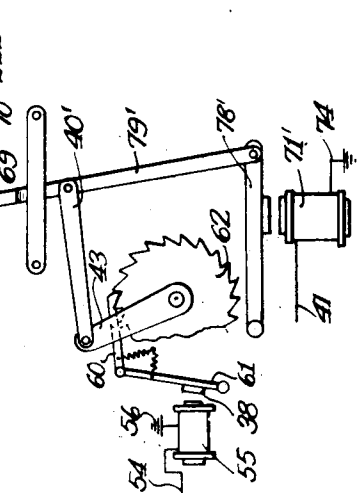


Fig. 16.



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UNITED STATES PATENT OFFICE

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PRINTING RECORDER FOR ELECTRIC IMPULSE SIGNAL SYSTEMS

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41 Claims. (Cl. 234—27.5)

This invention relates to recorders or receivers for electric-impulse code-signal systems and more particularly to printing recorders or receivers for call systems, though it is noted that the invention is not limited in some claims to printing, nor in some claims to electrical devices.

One object of the invention is to provide an apparatus of this kind for receiving the code-signal electric impulses and translating them to Arabic numerals or other indicia.

Another object of the invention is to provide means for printing these indicia.

Another object of the invention is to provide suitable paper feed mechanism for an apparatus of this kind.

Other objects of the invention are to improve generally the simplicity and efficiency of such apparatus and to provide an apparatus of this kind which is economical, durable and reliable in operation, and economical to manufacture.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described and claimed, the invention is not limited to these, since many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

The inventive features for the accomplishment of these and other objects are shown herein in connection with an improved recorder which, very briefly stated, includes type wheels or carriers with numerals thereon for several digits, and stepping means to set the carriers actuated by electric impulses of call signal systems which supply spaced groups of normally spaced impulses.

A slow release selector means held against operation by the normally spaced impulses, is set in operation by the absence of impulses during the intervals between groups, and when thus set in operation, shifts the operation of the setting means from the first digit or hundred type carrier to the next lower digit carrier.

A delayed or slow release printing means held against operation by said impulses during the intervals between impulses and also between the intervals between groups is (after a delay greater than the intervals between groups) released for operation by the absence of said impulses, and prints the numbers on paper and then sets in operation a paper feeding mechanism which in turn sets in operation a reset means for restoring the selector means and carriers to their original positions.

In the accompanying drawings showing, by way

of example, one of many possible embodiments of the invention.

Fig. 1 is a perspective view showing the exterior of the receiver;

Fig. 2 is a fragmental perspective view showing and printing means and paper feed mechanism;

Fig. 3 is a fragmental side elevation, partly in section, showing the structure of Fig. 2;

Fig. 3a is an end elevation, partly in section, showing the end of the rocking frame of the paper feed;

Fig. 3b is a perspective view showing the clamping armature of the paper feed;

Fig. 4 is a fragmental side elevation of an end of the rocking frame;

Fig. 5 is a fragmental plan of parts of the selecting and stepping mechanisms;

Fig. 6 is a fragmental side elevation showing parts of the stepping, selector, and reset-means and magnets and a type carrier;

Fig. 7 is a fragmental side elevation showing a type carrier and associated parts;

Fig. 8 is a plan showing part of the stepping means;

Fig. 9 is a fragmental side elevation showing contacts of the selector switch;

Figs. 10 and 11 are fragmental side and edge elevations showing actuating means for the selector switch;

Fig. 12 is a plan showing a fragment of paper with signals printed thereon;

Fig. 13 is a fragmental side elevation of the detent for preventing retrograde movement of the paper;

Fig. 14 is a transverse sectional view of the detent;

Fig. 15 is a wiring diagram showing the electrical connections and their associated mechanisms very diagrammatically and in modified form for ease of presentation; and

Fig. 16 shows a modified form of selector means.

The system as a whole

The system as a whole will first be very briefly described to give a general idea of its principal parts, after which enough of the construction and operation of the usual transmitter will be discussed to show what the receiver is to accomplish, and then the receiver will be described in detail.

The operation of the subscriber's transmitter or pull-box code signal wheel 20 (Fig. 15) causes regular momentary closures of the relay switch 25, 26 at the receiving station, thus supplying, to an impulse line 28, groups of normally spaced im-

pulses, with longer spacing intervals between groups, whereby current impulses pass conductors 28, 41 to a digit-selector brush 40 initially engaging the contact 35, and subsequently engageable with the selector contacts 36 and 37.

Stepping magnets 71, 72, 73, electrically connected to the corresponding selector contacts 35, 36, 37 actuate means 78, 79, 80 to move associated numeral type carriers 68, 69, 70 one number on each impulse, thereby initially when the brush 40 is on the contact 35 to set the type for the first digit of the transmitter number.

After the first digit is set up it is necessary to connect the impulse line to the stepping magnet 15 of the second digit. To this end there is provided a slow release relay magnet 47 normally connected to the impulse line and adapted to remain energized between normal impulses but not from one group of impulses to the next group. Thus 20 this magnet becomes deenergized after the first group, and thereby sets in operation means 55, 60, 62 to move said brush 40 from one contact 35 to the next 36, to operate the next stepping magnet 72 and wheel or carrier 69. After the second-digit-group, said means 55, 60, 62 shift the brush 25 40 to the contact 37 and the last digit stepping magnet and type wheel are operated in like manner.

Then the printing operation is initiated by the 30 deenergization of a slow release master magnet 93 connected to the impulse line and energized by the impulses and adapted to hold its magnetism between impulses and groups and until the last group has passed.

As master switch 95, 96 adapted to be opened 35 and held open by this master magnet when energized and closed when the master magnet is deenergized, and switch means 104, 105 closed by any actuated type carrier are connected in 40 series circuit with a printing magnet 100 adapted when energized to effect the operation of printing hammers 110, to print upon the paper 130 (Fig. 3) and to set in operation a paper feeding mechanism 145 (Fig. 15) which in turn sets in 45 operation a reset means 184, 190 and 49, 47, 55, 60 for restoring said brush and carriers.

Other features are an alarm system comprising an alarm switch 203, 204 closed by a projection 200 on one of said type carriers when in 50 a predetermined alarm position to set off an alarm device when means 210, 211 actuated by the printing magnet operates to connect said alarm device in circuit with the current source 30 and the alarm switch 203, 204.

55 There are provided means 214, 215 for breaking said last named circuit during normal resetting to prevent the undesired actuation of the switch 203, 204, by the projection 200.

Also there is a testing means 225 for energizing the master magnet 93 and stepping magnets 60 71, 72, 73 for causing normal operation; and there is provided means 230 to hold open the master switch, from closing and effecting printing when the printing casing 123 (Fig. 1) is 65 raised.

The transmitter

This receiver is used in connection with a closed line circuit in which are interposed in series 70 plurality of subscribers' call boxes or transmitters, such as are indicated at the upper left of Fig. 15. As is well known, these transmitters transmit the number of the station, and each signal transmitter circuit usually comprises a normally closed 75 circuit 10, 11, 12, 14, 15, 16, 17 including a number

of normally closed switches such as the switch 10, 11. This circuit includes also a source of current 12 and a relay magnet 14 connected in series in said circuit by conductors 15, 16, 17 of which conductors 15, 16 represent the line wires, the switch 5 10, 11 being in the subscriber's call box.

A toothed signal wheel 20 of the transmitter clockwork engages with the pan 10 of the switch to open the switch and has substantially uniform motion, the teeth 21, 22 of the wheel being uniformly spaced in groups 21, 22 to represent digits, a single tooth between groups being omitted, to form a space 23 to represent the space between digits. Thus the space 23 constitutes a space greater than the space between adjacent teeth. 15 Therefore, when the toothed wheel is uniformly rotated, the relay magnet 14 will be deenergized at equal small intervals to represent digits, and will be momentarily deenergized for slightly larger spacing intervals to represent the space 20 between digits of numbers.

The receiver

The receiver housing 24 (Fig. 1) encloses the receiver controlled by the magnet 14 and a line 25 relay switch 25, 26 including the armature 25, which switch automatically closes whenever the magnet is deenergized and thus sends impulses into the impulse line 28, from a local source of current 30 having one terminal 31 grounded, and 30 its ungrounded terminal connected by the charged line 32 to one element 25 of the line relay switch.

Thus, whenever the relay magnet 14 is deenergized, an electric impulse is sent to the impulse 35 line 28.

The digit selector

The digit selector comprises an arcuate series of digit contacts 35, 36, 37 (Figs. 6, 9 and 15) 40 embedded in a block of insulating material 38 fast on a fixed shaft 39. The contacts are successively engaged by a brush 40 connected by the conductor 41 to the impulse line 28 and adapted to be successively engaged with said contacts and normally engageable with the first, or highest, 45 digit contact 35. The brush 40 is carried on an arm 43 rotatably received on the shaft 39 and yieldably retracted by the spring 44 (Fig. 11).

Means for moving said arm and brush to a next lower digit contact each time a spacing interval 50 occurs between groups of said impulses will now be described.

A selector relay comprising a normally open relay switch 45, 46 includes a slow release magnet 47 having one end of its coil grounded at 48, 55 and the other connected to the movable element of a double throw switch 48, 49, 50 of a switch 48, 49, 50, 51, having one of fixed element 48 connected through the conductor 41 to the impulse line 28, and normally engaged by the movable element 49 whereby the selector relay magnet 47 is normally connected to said impulse line. 60

One element 45 of the selector relay switch is connected to the permanently charged line 32, the other switch element 46 being connected by 65 the conductor 54 to one end of the coil of an actuating selector magnet 55 having the other end of said coil grounded as at 56. Said selector magnet 47 is constructed to retain its impulse slightly longer than the interval between normal impulses, but not long enough to remain energized entirely throughout the spacing interval between impulse groups so that the pivoted selector armature 58 (Figs. 6 and 15) is attracted by 70 the selector magnet during the intervals between 75

normal impulses and released during the spacing intervals between groups, under the influence of a spring 59 drawing the armature from the magnet.

5 A pawl 60 carried by an arm 61 movable with said armature engages a ratchet 62 fast with said selector arm, and actuated by said pawl on the outstroke only, to push said brush 40 from one selector contact 35 or 36 to the next 36 or 37
10 each time the selector magnet 55 becomes deenergized.

15 When the pawl 60 is retracted by the magnet 55 the projection 60a thereon engages the fixed member 60b and disengages the pawl entirely from the ratchet 62.

20 The spring 44 (Fig. 10) retracts the selector arm to normal position during resetting (to be explained later); and a detent pawl 64 mounted on the frame 65 engages the ratchet for holding the selector arm against retraction except during resetting.

The type setting mechanism

25 The shaft 39 (Figs. 5 to 7) carries also a series of digit printing type carriers such as the segments or wheels 68, 69, 70 corresponding to the selector contacts 35, 36 and 37 respectively. Stepping magnets 71, 72, 73 associated with the respective type carriers have each one end of
30 its coil grounded as at 74, and the other end connected by a conductor 75 to the corresponding selector contact 35, 36 or 37.

35 Each type carrier is provided with peripheral type 76', 76², 76³, 76⁴, 76⁵ (Fig. 7), respectively having type to print corresponding numbers up to 5, except that the highest digit carrier 68 has no "3" type but has type 76³ formed to print the letter "F", as will be explained in connection with the fire signal. A greater number of type can
40 be provided if necessary.

45 A yieldably retracted armature 78 is associated with, and attracted and released by, each stepping magnet on each normal impulse when the stepping magnet is selectively connected to the impulse line through the associated contact 35, 36 or 37, and causes a pawl 79 to engage a ratchet 80 fast with the type carrier. The pawl 79 is carried by a sliding piece 79' (Fig. 8) slidable in a guide 81 mounted on bracket 82 (Fig. 6). The
50 pawl is pivoted to an arm 84 fast on the armature 78.

The piece 79' rests on the stop 81', when the stepping magnet is deenergized, thereby disengaging the pawl 79 from the ratchet 80.

55 The pawl is normally disengaged from the ratchet, and moves into engagement with the ratchet on each impulse to move the type carrier one higher number on each impulse. A spring pressed detent pawl 86 fulcrumed on a bracket 87 on the frame 65 engages the ratchet 80 and holds the type carrier in set position
60 against the action of the coil spring 90 (Fig. 7).

Operation of the digit selector and the type setting

65 When the impulses passing through the highest digit contact 35, (Fig. 15) have caused the first or higher digit carrier 68 to be stepped up one number for each impulse of the impulse line, the
70 space or interval 23 in the code signal wheel will cause a pause after the last impulse long enough to deenergize the slow release magnet 47 and consequently the magnet 55 and cause the release of the armature 58 aided by the action of the spring
75 59, to cause the brush 40 to engage the next con-

tact 36 and supply the impulses of the next lower digit to the magnet 72, to step up the next lower digit carrier 69.

In like manner, at the next interval between digit-impulse groups, the brush 40 will be shifted 5 to contact 37 and the lowest digit carrier 70 will be set; and the apparatus will be ready for the printing operation to be initiated by the master magnet 93 (Fig. 15).

The master relay

10 The slow release master relay comprises the slow release magnet 93 having an end of its coil connected with the impulse line 28 and the other end grounded as at 94, and a normally closed
15 master switch 95, 96 adapted to be opened by the attraction of the armature 96 when the impulse line receives an impulse, and held open (because of the inherently delayed release of the magnet) during the intervals between impulses and dur-
20 ing skip of impulses between digit groups and until a short time after the code signal is completed. One element 96 of the master relay switch is connected through conductors 97, 92 to
25 said ungrounded terminal of the source 30.

The printing mechanism control

The printing magnet 100 has one end of its coil connected by a conductor 101 to the other
30 element 95 of the master switch, and the other end of its coil connected by conductors 102, 103 to one element 104 of normally open switches 104, 105 insulated from, and held open by, said type carriers when in unactuated position. Each
35 switch has the other element 105 grounded as at 106, whereby when any type carrier has been actuated and the master switch 95, 96 has been closed, current may pass through the printing magnet 100.

40 A pivoted printing armature 107 (Figs. 2 and 15) attracted by the printing magnet 100 carries arms 108 carrying a universal rod 109 engaging under the rear edge of the hammers 110, where-
45 by printing is effected when the printing magnet is energized.

The printer housing

50 The receiver housing 24 has thereon a top plate 115 (Fig. 1) having a large opening 116 extending to its rear end beneath the rear of which is disposed a transverse shaft 117 (Fig. 3) in
55 brackets carried by the receiver frame. A pivoted elongated printer carrying plate 118 normally horizontally disposed longitudinally of the housing is provided at its rear corners with
60 downturned perforated ears 120 received on said shaft. A casing or printer housing secured over said pivoted plate between the forward and rear uprights 121, 122, has an open rear part and a rearwardly upwardly inclined record exposing
65 face 123.

The printer

A printing shaft 125 passed through the forward upright 121 and the side walls of the casing carries the segmental hammers 110, 111 loosely
65 pivoted on the printing shaft, the hammers 110 being respectively disposed over type carriers 68, 69, 70, while the hammers 111 are disposed over type of a printing time clock indicated by dotted lines 127 of Fig. 5, to print the time and date as
70 shown at 128 (Fig. 12), on the paper 130. The forward part of each hammer is provided with a downwardly faced striking head 129 adapted to strike the paper 130 (Fig. 3) against the ink ribbon 131. The front end portion has a cut-out
75

132 for lightening the front end, so that the heavier rear end normally raises the striking head, to the position of Fig. 3.

The printing magnet 100 is carried in a frame 134 mounted longitudinally on said plate 118 to the rear of the hammers, to which frame the armature 107 is pivoted at its upper end to be attracted by the rear end of the magnet, whereby when armature 107 is attracted the rod 109 rises and striking heads 129 are thrown against the ribbon and the rebound springs 135. The weight of the arms 108 and rod 109 acting on the curved wires 136 stuck in the lower part of the rear ends of the hammers helps to restore the hammers.

Paper feed switch

A switch actuating arm 140 carried by the armature 107 above the magnet engages under the spring paper feed switch 141, 142 when said printing armature is attracted, said switch having one element 142 electrically connected to said charged line 32, and the other element connected by a conductor 144 to a paper feed mechanism 145 (Fig. 15).

The paper feed mechanism

The paper feed mechanism serves for feeding the paper 130 and includes paper feed actuating magnets 155 having one end of their coils grounded as at 146, whereby when the printing has been effected, paper is fed for the next printing. This mechanism will now be described in detail.

A transverse stationary electromagnet 148 is disposed between said rear uprights or (Fig. 2) brackets 122 and provided at its ends with elongated horizontal pole pieces 149 transverse to the magnet. Bearing pins 150 passed through said brackets are secured fast to the brackets and the magnet core, whereby the electromagnet is held stationary.

A normally vertical rocking frame 152 of non-magnetic material has end members 153 carried by said pins 150 between the brackets and electromagnet, and carries movable magnets 155 secured fast to and within the frame on both sides of, and parallel to the stationary magnet 148. Each magnet 155 is provided with a pole piece 156 (Fig. 3), each turned in the same circumferential direction relative to the axes of said pins and adapted to be received in an adjacent recess 157 in the pole piece 149.

Said magnets 148, 155 are interposed in circuit with the feed switch 141, 142 and so wound that when the current flows, unlike poles are adjacent and the upper side of the frame is oscillated backwardly (leftwardly in Fig. 3) away from the hammers against the action of the spring 158.

Clamping armatures 160 (Figs. 3b and 4), adapted to be attracted by pole pieces 156 to clamp the paper 130, are loosely disposed longitudinally of the outer faces of the respective horizontal members 161 of said frame, and each provided at each end with an inwardly and outwardly turned end 162 received in slots 163 (Fig. 2) in the ends of the end members 153.

Retaining pieces 164 secured on the end frame members 153 and hooked over the ends 162, loosely hold the armatures in place.

The paper 130 passes from a supply roll 167 70 within the rear of the housing 24. Thence it is passed, over a guide roller 168 at the rear of the pivoted plate, between the lower clamping armature 160 and the frame 152, under the plate 118, over the type of the type carriers, around 75 front end of the plate over the inclined face of

the housing and thence between the upper clamping armature 160 and the frame 152.

The paper detent

When said clamping armatures clamp the paper 5 to the frame and the magnets 148, 155 are energized, the frame is rotated backwardly, thereby to feed the paper a line space, thereby to expose the printed matter, and to push the paper rearwardly under the detent means shown in Figs. 1, 10 13 and 14.

This means is contained in a transverse detent cover 170 mounted on the rear end of the casing and provided with lower front and rear openings 171, 172 through which the paper passes.

A shaft 173 rotatably mounted in the cover carries detent plates 175 radially mounted fast on the shaft and slightly rearwardly inclined into engagement with the paper.

A similar plate (not shown) is mounted near 20 the other end of said shaft.

A spiral spring 176 around the shaft and secured to the shaft and cover, tends to move the bottom edge of the detent plates backwardly into clamping engagement with the paper, thereby to 25 hold the paper against retrograde movement when the magnets are deenergized, the clamping armatures released and the frame restored under the action of the spring 158.

The reset switch

The switch 48, 49, 50, 51 (Figs. 3 and 15) is actuated by the engagement, with the element 49, of an insulating projection 180 carried by said feed mechanism frame when rocked. Said switch comprises a relatively stationary impulse element 48 (Fig. 15) connected to the impulse line, a relatively stationary charged element 51 connected through the charged line 32 to the ungrounded terminal, a movable element 49 40 normally engaging the impulse element and connected to the selector relay magnet 47, and movable to normally disengaged reset element 50.

Said movable elements 49 and 50 are movable by the action of the projection 180 to cause movable elements 49 and 50 to engage with each other and to both be electrically connected with said charged element 51 and the charged line 32.

The reset means

The reset magnet 182 (Figs. 6 and 15) is carried by the frame 82 and has one end of its coil grounded as at 183 and its other end connected by a conductor 184 to the normally disengaged element 50 of said switch.

An armature 185 pivoted to the frame 82 and attracted by the reset magnet whenever the rocking frame 152 is rocked, carries an arm 187 which engages a universal bar 190 carried by a pair of arms 191 fast on a shaft 192 partially rotatable in the brackets 87 on the frame 65. When this bar is depressed it releases all of the detent pawls 64 and 86, the selector magnets 47, 55 being at the same time energized to withdraw the relay pawl 60 from the selector ratchet, whereby the selector arm 43 and type carriers 68, 69, 70 are restored to normal position under the action respectively of the springs 44 and 90.

The action of the magnet 182 and shaft 192 also brings about the ribbon feed as will now be explained.

The ribbon feed

Take-up and supply ribbon spools 193, 194 (Fig. 3) and guide rollers 195, 196 (Fig. 3) guide the inking ribbon 131 between the type and strik- 75

ing heads 129. A ratchet 197 on the take-up spool is engaged by a pawl 198 (Fig. 6) carried on a rocking arm 199 forming a continuation of one of the arms 191 carrying the universal bar 190. Said pawl engages and drives the ribbon feed ratchet 197 for feeding the ribbon once for each resetting.

The fire alarm

A fire alarm actuating projection or pin 200 (Figs. 7 and 15) is so positioned on the type carrier 68, that it will engage a projection 201 on a normally open fire switch 202, 203 positioned to be closed by said projection only when the highest digit carrier is set to print the type 76³ which is at the "3" position between "2" and "4". This type prints "F" as shown at 206 (Fig. 12). The pin 200 is insulated from the carrier.

The switch 202, 203 is connected in series with a switch 210, 211 closed by the printing armature when attracted and having one element 210 connected by conductor 32 to said ungrounded terminal and the other element 211 connected by conductors 212, 213 and switch 214, 215, to one element of the fire switch. The other element 204 of the fire switch is connected by conductor 217 to one end of the magnet coil 218 of a drop annunciator having its other end grounded as at 219.

The drop 220 of the annunciator constitutes a part of a fire alarm switch 220, 221, whereby, when the "F" is set up on the carrier 68 and the printing takes place, the current passes through the magnet 218, the drop falls and a fire alarm 222 connected in circuit with the switch 220, 221 is sounded.

A cut out switch 214, 215 is interposed in the conductor 212, 213 between the fire switch and the normally open switch 210, 211 and opened by said reset magnet, to prevent the sounding of the fire alarm by the closure of the switch 203, 204 during any resetting of the carrier 68, as is necessary to prevent the alarm in normal operation.

The annunciator may be situated any suitable distance from the receiver, as indicated by the dot-and-dash line of Fig. 15.

Testing switch

Some time during repairs, cleaning or ribbon replacement, the type carriers might be left in other than the unactuated position and cause an incorrect printing. To avoid this, and for general testing, a testing switch is provided. Testing switch 225 comprises a movable element 226 connected by the conductor 32 to said ungrounded terminal, and has separate stationary elements 225', 225'', the element 225' being connected by conductor 28 to the master magnet 93, the other fixed elements being respectively connected by conductors 227, 75 to the stepping magnets 71, 72, 73 whereby a momentary closure of the testing switch by pressure on the button 224 moves the type carriers one space, and causes subsequent printing, paper feed and resetting to correct normal position so that a subsequent signal will be correctly printed.

Signal retaining means

Parts 228, 229 (Fig. 15) of the frame in the housing 24 carry an upwardly spring raised means such as the U-member 230 (Fig. 15) adapted to be depressed by the bottom plate 118 of the casing 123 when in normal position, and to rise under the influence of a spring 231 and engage and hold raised the master armature 96, when the casing is raised from printing position (as in the

dotted lines of Fig. 1), thereby to delay the printing until the casing has been restored to normal position. This prevents the resetting the carriers and loss of a set-up signal, before the signal is printed as when the casing 123 is raised when 5 threading paper from a new roll to the position of the dotted line 130 of Fig. 3.

Normal operation

The operation of the receiver will be understood and need now be only briefly summarized as follows:

The code signal wheel 20 is shown, by way of example, as having three groups of teeth having respectively 2, 3 and 2 teeth to send the number 232. The operation of sending this number will be described by way of example.

The watchman or other person at the subscriber's or other transmitting station sends the signal in the ordinary way, causing uniform rotation of the code-signal wheel 20 (Fig. 15) causing intermittent closing of the switch 25, 26, causing two normal code signal impulses in the impulse line 28, conductor 41, highest digit contact 35 and the stepping magnet 71, the circuit being completed through the ground 74, the ground 31, battery 30 and conductor 32 to the switch 25, 26.

The magnet 71 receives two impulses equal to the numeral value of the first digit, and the pawl 79 moves the type carrier the same number of spaces and places, under the hammer striking-head 129, the corresponding type, in this case 76² to print "2" as shown on the code-signal wheel 20.

On the first of these two impulses, the master magnet 93 is energized, opening the switch 95, 96; and also the slow release magnet 47 is energized, closing switch 45, 46, energizing the magnet 55, which attracts the armature 58 and remains energized between said two impulses, but releases the armature at the interval of space 23, whereupon the spring 59 acts to cause the arm 61 and pawl 60 to shift the brush 40 to the contact 36. This shift takes place before the first impulse of the second digit group is received, so that this first impulse passes through the contact 36 and conductor 75 to the second digit setting magnet 72. The three impulses of the second digit group then set the carrier 69 to print "3".

In like manner, the third and last digit "2" is set up on the carrier 70; and as each digit type is set up, a switch 104, 105 is thereby closed.

During the intervals between digit groups, the master magnet 93 remained energized, and the switch 95, 96 remained open; but after the whole number "232" has been sent, the impulses cease, and the master magnet becomes deenergized, permitting the master switch 95, 96 to close, thus allowing current to flow from the source 30, through conductor 32, switch 95, 96, conductor 101, printing magnet 100, switches 104, 105 (which were closed by the type-setting) to the ground 106.

This causes the armature 107 to throw the hammer striking heads 129 (Fig. 3) against the paper to cause printing; and at the same time the movement of the armature closes the switch 141, 142 to cause current to pass through the charged conductor 32, the switch 141, 142 conductor 144, magnets 148, 155, to the ground 146.

This causes the rearward rocking of the frame 152 and the feeding of the paper a line space.

This rocking of the frame 152 causes the opening of the switch 48, 49 and the simultaneous closing of the switch elements 49, 50, 51 thereby to connect, with the charged line 32, the relay 75

magnet 47 and the reset magnets 182, thereby to energize the reset magnet and release pawls 64 and 86, and retract the armature 58 and pawl 60, to permit the restoration to initial position of the selector arm 43 and the type carriers, under the action of the respective springs 44 and 90.

This restoration opens the switches 104, 105, deenergizes the printing magnet, opens switches 141, 142, deenergizes and restores the paper feed magnets, separates switch elements 49, 50, 51, and closes the switch 48, 49, preparing the apparatus for the next signal.

Operation of the fire alarm

This printing receiver is designed for use in well known systems in which fire calls are sent in by transmitters repeating the station number five times followed each time (after a pause long enough to accomplish printing, paper feed and resetting) by a fire-signal group consisting of a normal dot, a normal space, a normal dash, a normal space and a normal dot. This is the Morse letter "F" and is now customarily used to signal a fire. This code signal will be received after the above mentioned printing and paper feed and will cause the energization of the master magnet, three impulses of the stepping magnet 71 (Fig. 15), three steps of the carrier 70 to position to print "F", and the closure of the fire switch 203, 204. The impulses will then cease, the master magnet will release and permit the switch 95, 96 to close, causing operation of the printing mechanism and printing on the line below the printing of the station number, at the same time causing the closure of the switch 210, 211. Current will then flow through conductor 32, switch 210, 211, conductor 212, switch 214, 215, conductor 213, switch 203, 204, conductor 217, magnet coil 218 and ground 219. This will cause the drop 220 to drop, closing the switch 220, 221 and the alarm circuit (not shown) ringing a suitably located fire alarm.

After the printing and the alarm signal, paper feed and subsequent energization of the resetting magnet 182 take place as previously explained. This energization opens the switch 214, 215, preventing any current in the conductor 217 during normal operation and resetting, when no alarm is desired.

Assuming a transmitter box numbered 41 is operated only one round, the F signal would not appear after the round, and the carrier wheel 68 would make four steps and in passing close the switch 203, 204, but no current would flow through the annunciator, as its battery circuit is open at the switch 210, 211.

Since the number of transmitters which can operate on a single line-circuit is limited to a number much smaller than the type wheels can accommodate, it is convenient to omit the use of "3" as the first numeral in box numbers, thus reserving the "F" position on the type carrier 68 for the fire alarm. However if a transmitter giving the signal number 343 is operated for fire, the transmitter number would be printed F 43 and the time as at 206 of Fig. 12.

If box 321 is pulled for fire, the signal would come in F 21 Time, after which the printer would go through its regular cycle, feed the paper ahead one line space, so that when the later dot-dash-dot fire signal "F" came in, it would be as a separate signal and would appear as "F" and the time, on the line below the box number. In this manner the system avoids confusion, since a "fire" signal will always be on a separate line.

Operation of the testing switch

The function of the testing switch 225 is to enable the operator to check his time on the clock 127, and to check the operation of the type wheels. By pushing the button 224 once the three type wheels will be advanced one step and when the button is released the master relay switch 95, 96 will close and the printer will then function throughout its entire cycle, and if the type segments have been correctly set 111 and the time will appear on the tape. By pressing the button twice in rapid succession 222 and the time will appear.

Also the selector brush 40 and the type wheels may get out of step through carelessness of the operator in setting the time-stamp wheels or other parts of the mechanism. This condition can be corrected by pushing the test button or by manually operating the relay switch 25, 26. Either operation will cause battery current to flow through the selector contact on which the brush rests and the associated stepping magnet will thereby close its switch 104, 105. Of course, the master relay will also have been operated and when it is released, battery current will then flow through the print magnet and switch 104, 105 to ground; and the machine will then function throughout its cycle.

If the operator does not notice that the selector brush 40 is off the normal position, the first signal that comes in will be misprinted but the mechanisms will all be restored to normal, following the operation and release of the master relay.

As indicated in Fig. 15, the shift of the impulse effect from one type carrier to the next is accomplished by shifting the path of electric impulses, by means of the brush 40, rather than by employing the arm 43 to shift a pawl 79 from one ratchet 80 to the next; but it is clear that the invention is not thus limited. Thus the selector may be as shown in Fig. 16, in which figure is shown a link 40' moved an increment, by the arm 43, each time the magnet 55 is deenergized, to move from one ratchet wheel 80 to the next the single hook-pawl 79 pivoted to the free end of the single armature 71' attracted by the single stepping magnet 71' connected between the conductor 41 and ground 74. When the magnet 71' receives its impulses the hook-pawl 79' moves the associated type wheel in an obvious manner.

Also in practice, it is found that during ribbon changing it is easy to read the type when held from printing by the raised casing 123 and pin 230. Thus the type carriers are really visual indicators and could be made useful as such without the use of a printing means with or without reversing the type; so the invention is not limited to a printing device. If a signal, especially a fire signal, should come in during ribbon-changing, the operator could easily read the signal directly from the type without waiting to finish threading the ribbon.

We claim as our invention:

1. In combination, means for supplying one or more signal impulses; type carriers; setting means actuated by the impulses to set one or more of the carriers; a printing means held against operation by said impulses during and for a while after their occurrence, and released for operation irrespective of the number of digits to be printed by a predetermined length of period of absence of said impulses, as soon as and whenever said predetermined length of period is completed.

2. In combination, means for supplying spaced groups of normally spaced impulses; type carriers; setting means actuated by the impulses to set the carriers; a selector means held against operation by the normally spaced impulses, and released for operation on the absence of impulses during the intervals between groups, to shift the operation of the setting means from one carrier to the next; and an impression means held against operation by said groups during the intervals between impulses and groups and released for operation only by continued absence of said impulses longer than said intervals.

3. In combination, an impulse line; means for supplying to said line, groups of impulses, with longer spacing intervals between groups than within the groups; a digit selector comprising at least three contacts and a single brush successively engageable with the contacts and electrically connected to the impulse line; numeral type carriers corresponding to said contacts; a stepping electromagnet for each carrier, electrically connected to the corresponding selector contact; means actuated by each stepping magnet to move the associated type carrier one number higher on each impulse; a slow release relay electromagnet connected to the impulse line and adapted to remain energized between impulses but not from one group to the next; means controlled by said magnet to move said brush one contact when the magnet becomes deenergized; and impression means associated with the carriers.

4. In combination, means for supplying one or more signal impulses; type carriers; a plurality of setting means actuated by the impulses to set the carriers respectively; impression means held against operation by said signal impulses and released for operation whenever and as soon as a predetermined length period of absence of impulses is completed, irrespective of the number of digits to be printed.

5. In combination, means for supplying spaced groups of normally spaced impulses; type carriers; stepping means actuated by the impulses to set the carriers; a slow release selector means held against operation by the normally spaced impulses, and released for operation during the intervals between groups, to shift the operation of the setting means from one carrier to the next; impression means held against operation by said groups during the intervals between impulses and groups and released for operation only by a continued absence of said impulses longer than said intervals, irrespective of the number of digits to be printed.

6. In combination, an impulse line; means for supplying thereto groups of normally spaced impulses with spacing intervals between groups; type carriers; stepping means including stepping magnets actuated by the impulses to set the associated type carrier; a slow release magnet connected to said line and adapted to remain energized between impulses and to be deenergized during said intervals; selector means controlled by said magnet to shift the operation of the setting means from one carrier to the next when the magnet becomes deenergized; a slow release master magnet connected to the impulse line and adapted to hold its magnetism during said intervals; impression means; means for operating the impression means actuated by the cooperation of the master magnet when deenergized and a type carrier when actuated.

7. An apparatus as in claim 6 comprising an

alarm device, set in operation by the joint operation of the impression means and one of said carriers when in alarm position.

8. In combination, an impulse line; means for supplying thereto one or more signal impulses; a type carrier; stepping means connected to the impulse line and actuated by the impulses to set the carrier; a slow release master magnet connected to the impulse line and adapted to hold its magnetism during and between impulses and to become deenergized a while after the impulses have ceased; a master switch adapted to be opened and held open by the master magnet; a printing magnet in circuit with the master switch; an alarm switch closed by said carrier when the carrier is in alarm position; an alarm device; and means actuated by the printing magnet to connect said alarm device in circuit with said source and alarm switch.

9. In combination, an impulse line; means for supplying thereto one or more signal impulses; type carriers; stepping means associated with the carriers respectively and each including a stepping magnet adapted to be connected to the impulse line and actuated by the impulses to set the associated carrier; a slow release master magnet connected to the impulse line and adapted to hold its magnetism during and between impulses and to become deenergized a while after the impulses have ceased; impression means held against operation by said master magnet, and set in operation by the deenergization of said master magnet.

10. In combination, an impulse line; means for supplying thereto one or more signal impulses; a type carrier; setting means connected to the impulse line and actuated by the impulses to set the carrier; a slow release master magnet connected to the impulse line and adapted to hold its magnetism during and between impulses and to become deenergized a while after the impulses have ceased; a relay switch held open by said master magnet; impression means in circuit with said switch and movable into and from cooperation with the carrier and operated on the closure of the switch; a reset means for said carrier set in operation by the impression means after the printing; and means for automatically disabling the reset means when the impression means is out of cooperation with the carrier.

11. A mechanism comprising an elongated casing; downwardly pointing hammers in the casing; a type carrier under each hammer; a transverse stationary electromagnet in the casing and provided at its ends with elongated horizontal pole pieces transverse to the magnet; a normally vertical rocking frame of non-magnetic material having end members intermediately pivoted at the respective ends of said electromagnet; movable magnets fast on the frame on opposite sides of the stationary magnet, and each having a pole piece, all the pole pieces being turned in the same circumferential direction relative to the rocking axis; clamping armatures loosely disposed longitudinally of the outer faces of the horizontal frame members and attracted by the movable magnets to clamp against the frame; means to supply and guide paper between the lower clamping armature and the frame, under the casing, between the hammers and type, over the casing, and thence between the upper clamping armature and the frame.

12. A paper feed mechanism comprising an electromagnet having pole pieces; a rocking frame; a movable magnet on the frame and

having poles attracted by said pole pieces in a direction to rock the frame; a clamping armature loosely disposed on the outer face of the frame and attracted by the movable magnet to clamp paper against the frame; and means to supply and guide paper between the clamping armature and the frame.

13. A paper feed mechanism for a printing means comprising a substantially stationary electromagnet having pole pieces transverse to the magnet; a rocking frame having members pivoted at the respective ends of said electromagnet; movable magnets on the frame and each having poles attracted by said pole pieces in a direction to rock the frame; clamping armatures loosely disposed longitudinally of the outer faces of the frame and attracted by the movable magnet to clamp paper against the frame; and means to supply and guide paper between one clamping armature and the frame, to the printing means, and thence between the other clamping armature and the frame.

14. In combination, means for supplying one or more electric signal impulses; a type carrier; stepping means actuated by the impulses to set the carrier; a slow release magnet separate from the stepping means adapted to be connected to the impulse means and inherently adapted to hold its magnetism during and between impulses and of itself to become deenergized a while after the impulses have ceased; and impression means set in operation by the deenergization of said magnet.

15. In combination, means for supplying spaced signals; a plurality of exhibiting means; setting means including quick release magnets actuated by the signals to set the exhibiting means; a selector magnet magnetized by said signals, and maintaining its magnetization at all times during said signals, and demagnetizing by the absence of signaling between signals; and selector means held against operation by said magnet when magnetized and released by said magnet when demagnetized between said signals, to cause the setting means to select the exhibiting means to be operated.

16. In combination, means for supplying spaced signals; a plurality of exhibiting means; setting means actuated by the signals to set the exhibiting means; a selector magnet magnetized by said signals; means associated with said magnet for maintaining the magnetization of said magnet at all times during signaling and allowing the demagnetization of the magnet between said signals; selector means held against operation by said magnet when magnetized during signaling and released by said magnet when demagnetized between said signals, to cause the setting means to select the exhibiting means to be operated.

17. In combination, impulse means for supplying one or more signal impulses; type carriers; a plurality of stepping magnets associated with the carriers respectively and each adapted to be actuated by impulses to set the associated carrier; shifting means for successively connecting said magnets to the impulse means; and testing means for at will energizing the stepping magnets, independently of the shifting means.

18. In combination, impulse means for supplying one or more signal impulses; type carriers; a plurality of stepping means associated with the carriers respectively and each adapted to be actuated by impulses to set the associated carriers; means for successively connecting said

stepping means to the impulse means; impression means; an actuating means connected to the impulse means and adapted to be set in operation by said impulses and to actuate said impression means only after said impulses have ceased; and testing means for at will simultaneously energizing the actuating means and stepping means.

19. In combination, impulse means for supplying one or more signal impulses; type carriers; a plurality of stepping means associated with the carriers respectively and each comprising a magnet adapted to be actuated by impulses to set the associated carrier; shifting means for successively connecting said magnets to the impulse means; impression means; a slow magnet connected to the impulse means and adapted to actuate said impression means only after said impulses have ceased; a reset means actuated by the impression means after printing; and testing means for at will with a single manual movement simultaneously energizing the slow and stepping magnets, with a single impulse, independently of the shifting means, thereby simultaneously effecting the resetting and testing with economy of time and movement.

20. In combination, an impulse means for supplying one or more signal impulses; type carriers; stepping means adapted to be successively connected to the impulse line and actuated by the impulses to set the carriers; impression means adapted to be energized by one more of said impulses to effect printing only after the impulses have ceased; and testing means for at will supplying an impulse simultaneously to the stepping means and impression means.

21. In combination, an impulse supply means for supplying one or more signal impulses; type carriers; stepping means associated with the carriers respectively and each comprising a stepping magnet connected for connecting to the impulse means and actuated by one or more impulses to set the carrier; impression means; a slow magnet connected to the impulse and adapted to actuate said impression means only after said impulses have ceased; and testing means for at will simultaneously energizing the slow and stepping magnets.

22. A testing means for testing a signal receiver comprising a source of current, impulse means connected to said source for supplying one or more signal impulses, type carriers, a plurality of stepping means associated with the carriers respectively and each comprising a magnet adapted to be actuated by impulses to set the associated carrier, means for successively connecting said magnets to the impulse means, impression means, and a slow magnet connected to the impulse means and adapted to actuate said impression means only after said impulses have ceased, said testing means comprising a switch comprising a movable conducting element and a plurality of fixed contacts simultaneously engageable thereby; a conductor connecting the movable element to said source; and conductors connecting said fixed contacts to said magnets respectively.

23. In combination, a settable type carrier; means for setting said carrier step-by-step; a switch closed by said carrier when the carrier reaches a certain position of setting, the switch being in open position whenever the carrier fails to reach said position or goes beyond said position; impression means set in operation only after said carrier is set; and alarm means co-

operating with said switch when closed and said impression means during printing, for operating an alarm, thereby to prevent alarm except during printing simultaneous with closed position of the switch and to permit operation of the alarm when said carrier is in switch closing position.

24. In combination, a settable type carrier; means for setting said carrier step-by-step; a switch closed by said carrier when the carrier reaches a certain position of setting, the switch being in open position whenever the carrier fails to reach said position or goes beyond said position; impression means set in operation only after said carrier is set; a switch closed by the impression means during printing; an alarm; and circuit means cooperating with both switches only when both are closed, for operating the alarm, thereby to operate the alarm during printing and to prevent operation of the alarm when said carrier passes said position during setting.

25. In combination, a settable type carrier; impression means; a support for holding the impression means in normal position in cooperative relation with the carrier and movable therefrom to abnormal position the type carrier being settable while the carrier is in said abnormal position; and means operated by the support when thus moved to abnormal position for preventing operation of the impression means when in abnormal position.

26. In combination, a settable type carrier; impression means; a support for holding the impression means in normal position in cooperative relation with the carrier and movable therefrom to abnormal position; a reset means for the carrier; and means operated by the support when thus moved to abnormal position for preventing operation of the reset means.

27. In combination, a settable type carrier; impression means; a casing for holding the impression means in normal position in cooperative relation with the carrier and movable therefrom to abnormal position; a reset means for the carrier; and means operated by the casing when thus moved to abnormal position for disabling the impression means, and reset means.

28. In combination, a settable type carrier; impression means; a casing for holding the impression means in normal position in cooperative relation with the carrier and movable therefrom to abnormal position; a reset means for the carrier; and means operated by the casing when thus moved to abnormal position for preventing the impression means, and reset means from operating, and for causing the operation of the impression means when the casing is restored to normal position, thereby preventing the resetting of the carrier and the loss of the record while the casing is in abnormal position.

29. In combination, a settable type carrier; impression means; a casing on which the impression means is mounted for holding the impression means in normal position in cooperative relation with the carrier and movable therefrom to abnormal position; a reset means for the carrier; paper feed and guide means carried by the casing for feeding and guiding paper between the impression means and type carrier when the casing is in normal position, and removing the paper and guide means from above the type to expose the type and to expose the guide means for threading when the casing is moved to abnormal position; and means operated by the casing when thus moved to abnormal position for

disabling the impression means and reset means to prevent loss of the record.

30. In combination, a housing; settable type carriers therein having upwardly disposed type; an elongated casing pivoted on the housing; hammers pivoted in the casing one over each type carrier, and normally raised from the type; a printing circuit including a printing magnet in said casing; an armature attracted by the magnet; means actuated by said armature and engageable with the hammers, whereby when the armature is attracted the hammers are thrown toward the type; pivot means pivotally supporting said casing for permitting raising said casing and said hammers and magnets therewith to expose the carriers; and means to hold said circuit open when the casing hammers and magnet are raised.

31. A recorder comprising a housing; settable carriers therein having upwardly facing type; an elongated casing pivoted at its rear end on the housing; hammers pivoted in the casing one for each type carrier and each having a striking part at the extreme free front end of the casing and over the associated carrier; means for guiding paper under the rear end of the casing, under said striking parts, upwardly over the front end and top face of the casing and past the rear thereof; and a rocking frame having clamping means at the upper and lower parts thereof for simultaneously drawing the paper back at the upper rear part of the casing and feeding it forward at the lower rear part of the casing; whereby when the paper is fed, the matter printed under the hammer is immediately exposed at said front end of the casing and remains exposed on the top face thereof as feeding continues.

32. A paper feed means for use with a recorder having a housing, settable carriers therein having upwardly facing type, an elongated casing pivoted at its rear end on the housing, and hammers pivoted in the casing one for each type carrier and each having a striking part at the extreme free front end of the casing and over the associated carrier said paper feed means comprising means for guiding paper under the rear end of the casing, under said striking parts, then upwardly over the front end and top face of the casing and past the rear thereof; and a rocking frame having clamping means at the upper and lower parts thereof for simultaneously drawing the paper back at the upper rear part of the casing and feeding it forward at the lower rear part of the casing; whereby when the paper is fed, the matter printed under the hammer is immediately exposed at said front end of the casing and remains exposed on the top face thereof as feeding continues.

33. In combination, a settable indicator; settable under abnormal condition; a reset means for the indicator operative after setting; and means operated when said condition takes place to prevent said reset means from resetting.

34. In combination, a record support changeable to inoperative condition; a settable member when the support is in said condition cooperating means cooperating with the member for recording settings of the member on the record; a reset means for the member automatically operative after said recording; and means automatically operated when said condition takes place to prevent said reset means from resetting.

35. In combination, a record support changeable to inoperative condition; a settable member when the support is in said condition cooperat-

ing means cooperating with the member for recording settings of the member on the record and changeable to inoperative condition; a reset means for the member automatically operative after said recording; and means operated when one of said conditions takes place to prevent the cooperating means and said reset means from operating.

36. In combination, a settable member; a record support; cooperating means cooperating with the indicator for recording settings of the member on the record; a casing for said support and cooperating means movable to inoperative position; a reset means for the member automatically operative after said recording; and means operated, when said casing is moved to inoperative position, to prevent the cooperating means and said reset means from operating.

37. In combination, a settable type carrier; means for setting said type carrier to alarm-indicating position and non-alarm indicating positions; impression means cooperating with the carrier and set in operation only after said type carrier is set for recording indications by the type carrier; an alarm; and means cooperating with both said type carrier and impression means only when the type carrier is set to alarm position and the impression means is operated, for operating the alarm.

38. In combination, a settable type carrier; means for setting said type carrier to alarm-indicating position and non-alarm positions; a switch closed by said type carrier only when the type carrier is in alarm position; impression means cooperating with the carrier and set in operation only after said type carrier is set; a switch closed by said recorder when operated; an alarm; and means cooperating with both said switches only when both are closed for operating the alarm.

39. In combination, exhibiting means settable by signals to different positions and subject to accidental displacement; cooperating means adapted to cooperate automatically with the exhibiting means when set to record indications

thereof and then to restore the exhibiting means to normal; and a separate testing means for at will causing the cooperation of said cooperating means making a record indicating whether or not or how much the exhibiting means had been displaced since the previous record, and then normalizing the displaced exhibiting means.

40. In combination, exhibiting means successively settable by signal impulses to different positions; said indicators being subject to accidental displacement; cooperating means adapted to be operated by signal impulses when the exhibiting means are set to record indications thereof and then to restore the exhibiting means to normal; and a separate testing means for at will simultaneously supplying one impulse to each exhibiting means advancing the exhibiting means one step, and operating the recording means to make a test record and then restoring the indicators; the test record indicating whether or not or how much the exhibiting means had been displaced since the previous record, the restoration after the test normalizing the displaced exhibiting means.

41. In combination, impulse means for supplying one or more signal impulses; settable exhibiting means; a plurality of stepping means associated with the exhibiting means respectively and each adapted to be actuated by impulses to set the associated exhibiting means; means for successively connecting said stepping means to the impulse means; cooperating means adapted to cooperate with the exhibiting means to record indications thereof; a reset means operated by the cooperating means after recording; an actuating means connected to the impulse means and adapted to be set in operation by said impulses and to actuate said cooperating means only after said impulses have ceased; and a separate testing means for at will simultaneously supplying one impulse to the cooperating means and the stepping means.

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