

Feb. 12, 1952

S. K. FERGUSON

2,584,997

MESSAGE TIMING DEVICE

Filed March 2, 1949

3 Sheets-Sheet 1

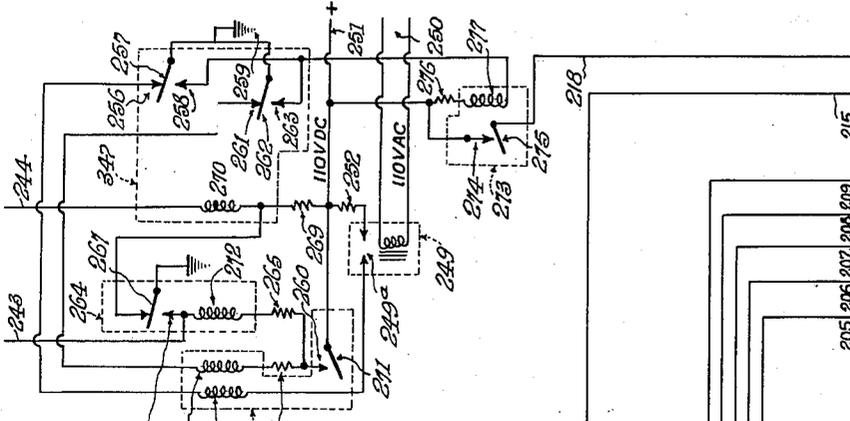


Fig. 3.

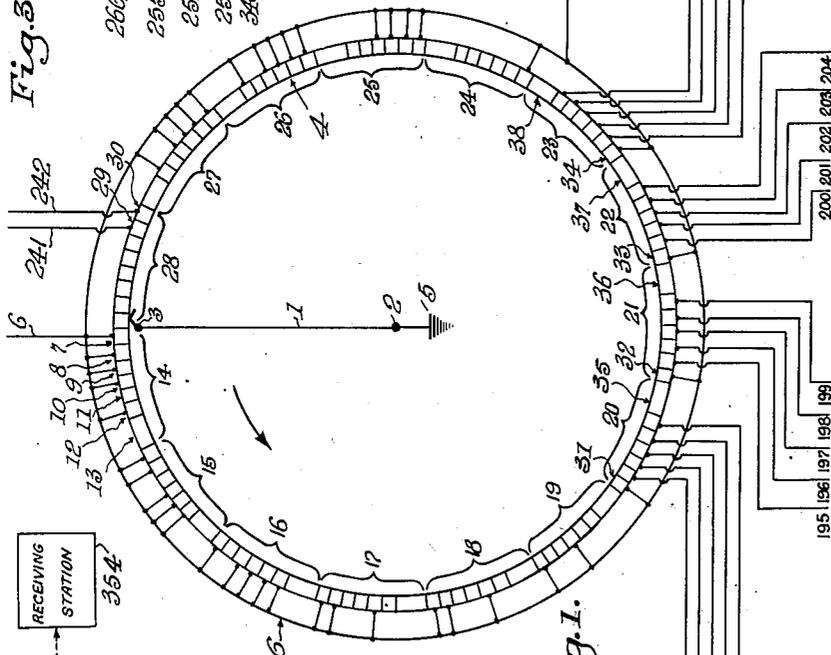


Fig. 1.

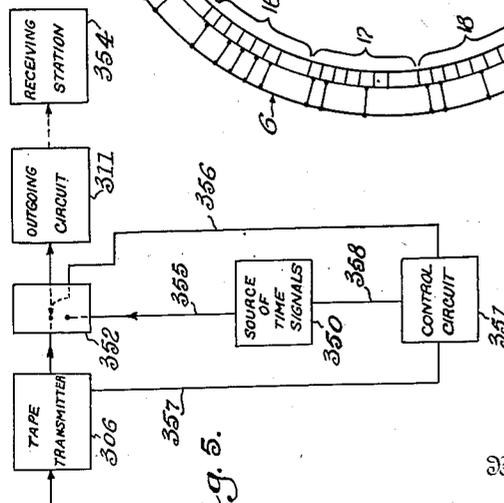


Fig. 5.

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3 Sheets-Sheet 2

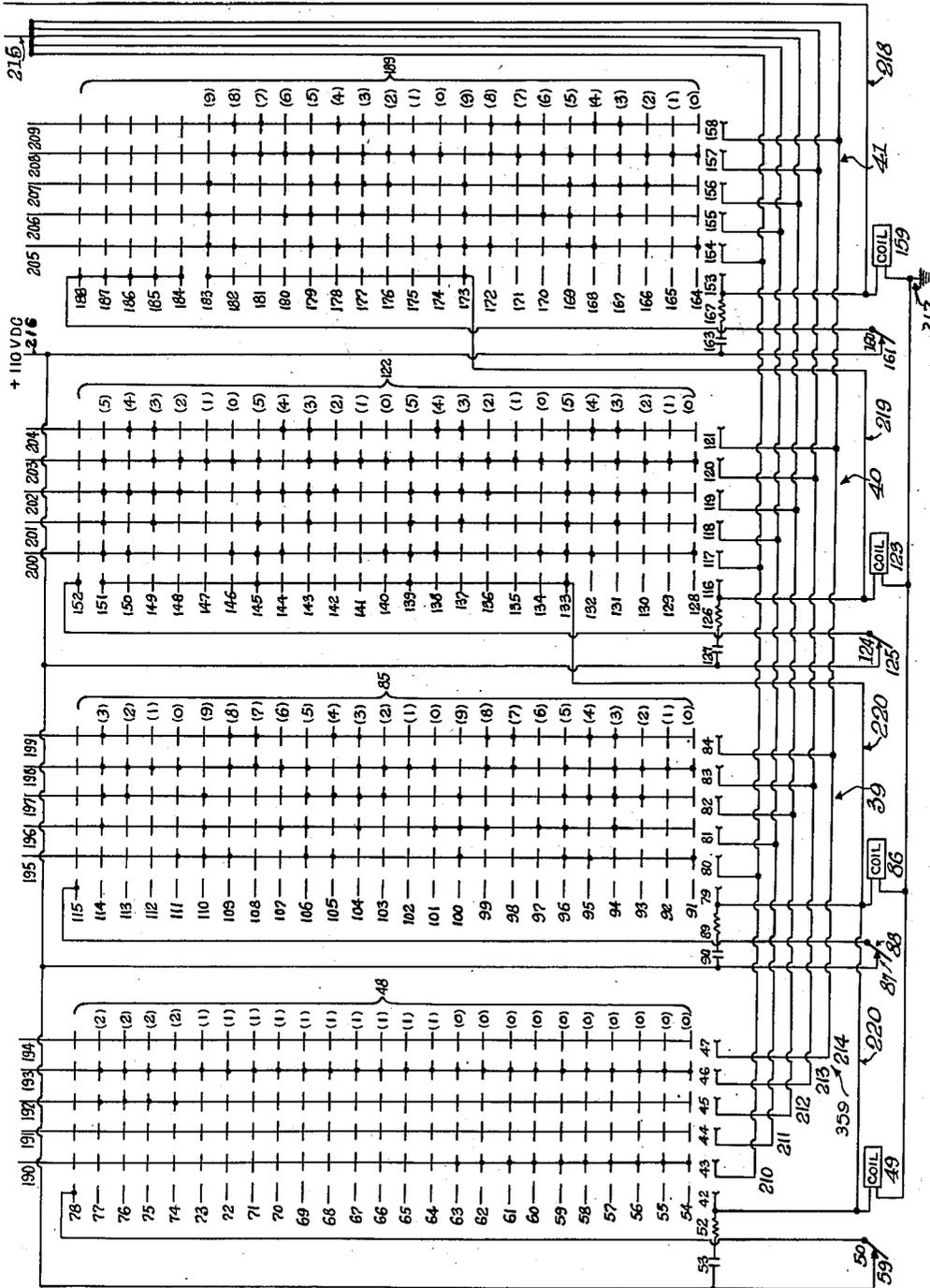


Fig. 2.

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3 Sheets-Sheet 3

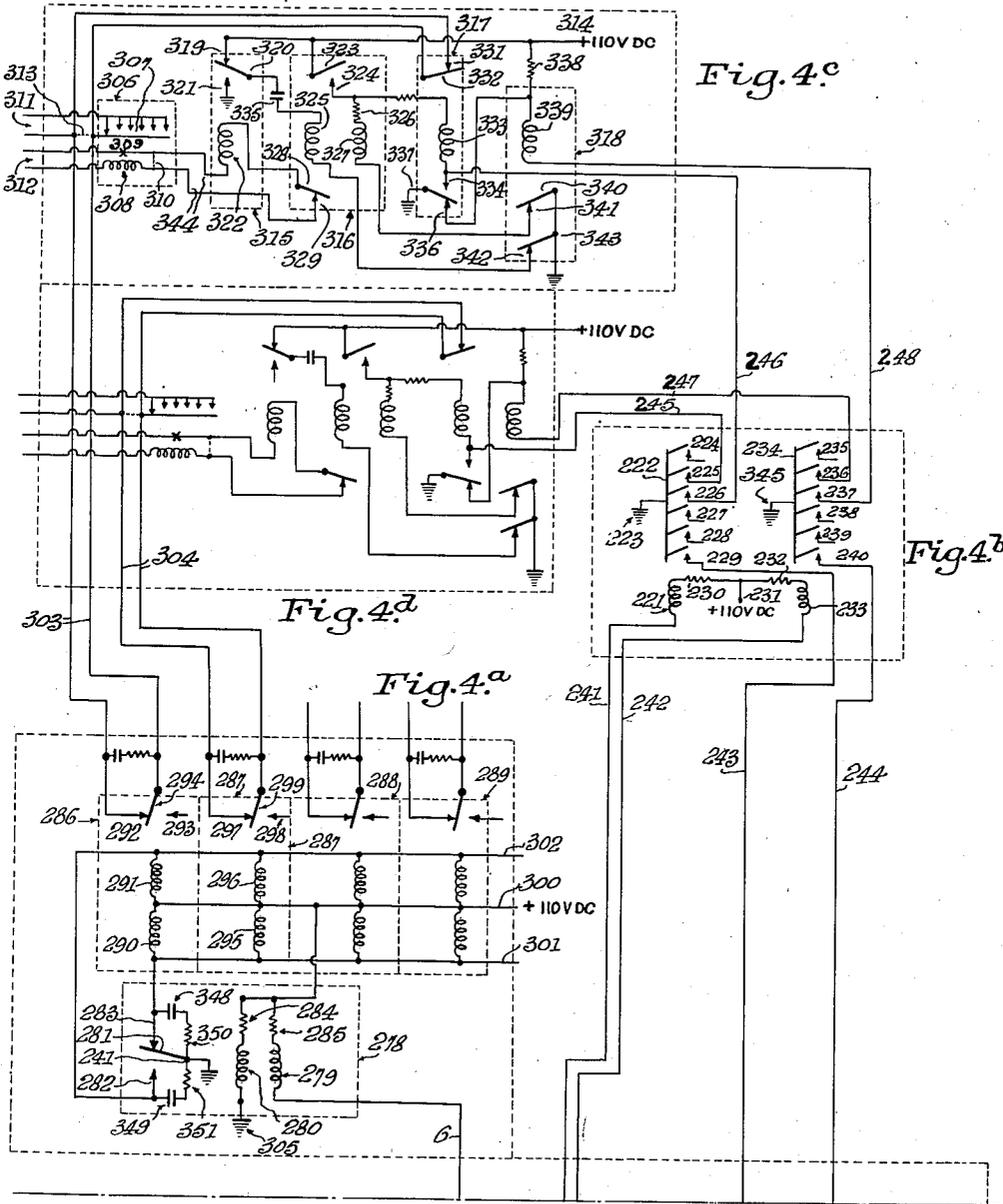


Fig. 4.

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# UNITED STATES PATENT OFFICE

2,584,997

## MESSAGE TIMING DEVICE

Syri K. Ferguson, Springfield, Va.

Application March 2, 1949, Serial No. 79,262

6 Claims. (Cl. 178-2)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to printing telegraph apparatus, and particularly to apparatus for automatically recording the time of transmission of messages over printing telegraph circuits and the like. Since, in printing telegraphy, the sending and receiving may normally be assumed to be simultaneous, this same time record is automatically transmitted to the receiving station where it also provides a printed record of the time of receipt of the message at that point.

In the days of manual telegraphy the time transmission and reception was recorded on the message form by the operator who observed a clock, and manually recorded such observed time by whatever method in use.

Today, the manual telegraph has been almost entirely replaced by the printing telegraph. Further, the printing telegraph has developed to a point of semi-automatic, and in some instances, automatic operation. A means of recording on the message the time of transmission or reception of messages has not kept pace with the rest of the art. It is difficult even to hazard a guess as to the time of transmission or reception to the nearest hour, much less to the nearest minute as was the accepted accuracy in the days of manual telegraphy when messages moved in less volume and at a slower rate.

Accordingly, it is an object of this invention to provide a timing device for use with printing telegraph systems for automatically recording upon a printed message the time of transmission and reception of messages over such systems.

It is a further object of this invention to provide a message time-recording device which will record the time of transmission and reception of messages on the message form to an accuracy of plus or minus one minute.

It is also an object of this invention to provide a device which is capable of recording the time of transmission of all messages on all circuits at a center at which it is employed.

These and other objects are achieved in accordance with the invention by providing a continuously available source of instant time signals, arranged to provide a time-significant code which is introduced in the message circuit upon the completion of the transmission of a message.

In one embodiment of the present invention the source of time signals includes: a transmitting commutator having a plurality of circum-

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ferentially arranged conducting segments with a centrally-pivoted brush contactor operating at a constant speed; four rotary line switches each comprising a bank of a plurality of contacts, and electromagnetically actuated stepping contactors in sliding arrangement with the contacts; and a source of electrical pulses which provides electrical pulses to the switches at a rate of one per minute. The switch contacts are connected to the commutator segments to provide for the four elements of a 24-hour time signal. That is, one bank is connected to provide for the units-of-minutes digit of the time in accordance with the teletype code used, the second bank is connected to provide for the tens-of-units digit of the time, the third to provide for the units-of-hours digit of the time, and the fourth for the tens-of-hours digit of the time. In accordance with this invention in the stepping action of the switches due to the received one-per-minute electrical pulses is such as to cause the first switch contactor to be advanced or "stepped" with each received pulse; the second operates once every ten "steps" of the first switch contactor; the third operates once for every 6 steps of the second contactor, and the fourth operates every 10 steps of the third contactor. Thus at any instant the position of the contactors, after initially preset, will be significant of the time of day.

The time-significant connections from the switches to the segments together with the grounded continuously-rotating brush arm result in the completion of an electrical circuit in accordance with the sequence of connections. Selected segments of the commutator are connected to provide the start-stop pulses required by standard printing telegraph codes, and a pulse for reestablishing normal operation.

The continuously - available time - significant code signals are inserted into the message circuit through the action of an interlocking arrangement. During the transmission of a message over a tape transmitter, normal conditions prevail. Upon the completion of a message the interlock circuit through the action of relays, disables the tape transmitter and connects the source of time-significant signals into the outgoing circuit. During approximately one revolution of the commutator contactor there is transmitted, by means of a standard teletype code the required start and stop signals, and the instant time. The contactor then completes a circuit which operates the interlock to reestablish tape transmitter for message tape transmission.

The invention may be better understood from

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a consideration of the following description of an embodiment thereof when read in conjunction with the accompanying drawings, in which

Figure 1 is a diagram of a transmitting commutator used for transmitting the start, stop and time record impulses in accordance with this invention.

Figure 2 is a schematic diagram of that part of the invention which is used for receiving a pulse each unit of time and to convert the time of day into the printing telegraph code used, and at the same time store this code until the following pulse has been received.

Figure 3 is a schematic diagram of a constant speed device for providing electrical pulses at the rate of one per minute.

Figure 4 is a schematic diagram of a control circuit which synchronizes the functions of time transmission with that of message transmission.

Figure 4a is a schematic diagram of a relay circuit used for converting neutral signals into polar signals in accordance with this invention.

Figure 4b is a schematic diagram of a relay switching device which operates to complete one element of the control circuit once each revolution of the transmitting commutator brush arm.

Figure 4c is a schematic diagram of a conventional transmitter as used in printing telegraph systems to sense permutations in a prepared perforated tape and to pass these on in the form of start, stop and code pulses of the desired kind; this diagram also illustrates an embodiment of an interlocking circuit which functions to render the transmitter inoperative at the completion of a message transmission thus permitting the time-significant code to be introduced immediately following the message.

Figure 4d is a schematic diagram of an arrangement similar to that shown in Figure 4c for use with a plurality of circuits.

Figure 5 is a simplified block diagram of the invention.

Referring now to the drawings and particularly to Figure 1, the reference numeral 1 indicates a brush arm rotatably mounted about a pivot 2 in such manner as to permit rotation in the direction indicated. A brush 3 is mounted on the end of the brush arm 1 and makes contact with segments of commutator 4. The segments of commutator 4 are circumferentially and sequentially arranged into groups 14 through 28. A common lead 6 connects to selected segments in each of these groups. As brush 3 contacts these selected segments, they are connected to ground through brush arm 1 and ground connection 5. As indicated on the diagram, as brush 3 moves from the position shown in the direction indicated the brush 3 will contact segments 7, 8, 9, 10, 11, 12 and 13 in this order and connect them to ground. Segments 29 and 30 are connected to relays 221 and 223, Figure 4, through conductors 241 and 242.

Segments 31, 32, 33 and 34 are utilized in connection with the start pulses; segments 35, 36, 37 and 38 are respectively utilized in connection with the corresponding stop pulses, as employed in start, stop printing telegraph systems.

The time required for one revolution of the transmission commutator will be governed by the number of functions other than time that it is desired to transmit. These will include station identification characters in addition to pulses for clearly interlocking circuits. In one practical situation, the brush is arranged to rotate at a speed of 22.7 revolutions per minute.

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Figure 2 illustrates four rotary line switches of a well-known type (one type of which is manufactured by Automatic Electric Company of Chicago, designated as Catalog No. 73G), and are indicated by reference numerals 359, 39, 40 and 41. These switches are arranged to receive a pulse each minute and to transform the actual time of day into the telegraph code and at the same time store this code until the following pulse has been received. These rotary line switches have banks of contacts 48, 85, 122 and 189 arranged in 6 rows of 25 contacts, semi-circular in mounting so that double-arm wiping contacts 42 to 47, inclusive, 79 to 84, inclusive, 116 to 121, inclusive, and 153 to 158, inclusive, pass successively over the different rows of contacts 54 to 78, inclusive, 91 to 115, inclusive, 128 to 152, inclusive, and 164 to 188, inclusive, by means of a ratchet wheel driven by a dog which in turn is driven by a spring (not shown) that has been extended from normal length by an electric current in the coils 49, 86, 123 and 159. When one end of the wiping contacts 42 to 47, inclusive, 79 to 84, inclusive, 116 to 121, inclusive, and 153 to 158, inclusive, moves off of the rows of contacts 78, 115, 152 and 188, the other ends of the wiping contacts 42 to 47, inclusive, 79 to 84, inclusive, 116 to 121, inclusive, and 153 to 158, inclusive, then move onto the rows of contacts 54, 91, 128 and 164, thus a continuously complete rotary switch is obtained equivalent to 360 degrees of rotation.

The connection made at 215 in Fig. 2 provides for flexibility in the event that a different type of transmitting commutator or more than one transmitter commutator is required.

Since in the recording of the transmission and reception time of messages a 24-hour clock system is universally used, the invention incorporates features which will provide the four elements of the time, that is, tens of hours, units of hours, tens of minutes and units of minutes. Thus the time will vary from 0001 which is one minute after midnight to 2400 which is midnight; 2400 is also synonymous with 0000 the beginning of the next day. It will be noted that the device of the present invention must be capable of providing for the first element of the time a 0, a 1 or a 2; for the second element, 0 through 9; for the third element, 0 through 5; and for the fourth element, 0 through 9.

On the rotary line switches 38, 39, 40 and 41 of Figure 2, the wires 190 to 194, inclusive, 195 to 199, inclusive, 200 to 204, inclusive, and 205 to 209, inclusive, are connected to the contacts successively wiped by the wiping contacts 43 to 47, inclusive, 80 to 84, inclusive, 117 to 121, inclusive, and 154 to 158, inclusive, in accordance with the predetermined pulses it is desired to transmit. Switch 38 is used for the first digit or tens of hours, 39 is used for the second digit or units of hours, 40 is for the third digit or tens of minutes and 41 is used for the fourth digit or units of minutes.

That portion of the commutator 4 of Fig. 1 that is set aside for the selection as set up by switches 38, 39, 40 and 41 is shown at 20, 21, 22 and 23 being in the order mentioned; tens of hours, units of hours, tens of minutes and units of minutes. The wiping contacts 43 to 47, inclusive, 80 to 84, inclusive, 117 to 121, inclusive, and 154 to 158, inclusive, are connected to wire leads 210, 211, 212, 213 and 214 are combined into wire lead 215 and then go to the common lead 6 of Fig. 1. Therefore, as the wiping contacts 43 to 47, inclu-

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sive, 80 to 84, inclusive, 117 to 121, inclusive, and 154 to 158, inclusive, successively rest at various positions in Fig. 2, the predetermined code is transferred to the transmitting commutator 4 of Fig. 1 by wire leads 190 to 194, inclusive, 195 to 199, inclusive, 200 to 204, inclusive, and 205 to 209, inclusive, also common lead 6 of Fig. 1 is connected to the desired segments 20, 21, 22 and 23 of Fig. 1 by wire lead 215, wire leads 210, 211, 212, 213 and 214 and the wiping contacts 43 to 47, inclusive, 89 to 84, inclusive, 117 to 121, inclusive, and 154 to 158, inclusive.

Reference numeral 48 indicates a bank of contacts 54 to 78, which are used to provide the first element of a 24-hour time system. For clarity, the value of the first element of the time is shown within parentheses to the right of the contact used to provide this element. As previously explained, and indicated by the values within the parentheses, this first element may vary in value from 0 to 2. The contacts of bank 48 are connected to leads 190 to 194 in accordance with the code used.

Reference numeral 85 indicates a second bank of contacts 91 to 115 which are arranged to provide the second element of the time in accordance with the 24-hour system. For purposes of clarity the value of the second element of the time is shown, in parentheses on Figure 2 to the right of the contact involved. As indicated by the values within parentheses, the contacts are arranged to provide units of hours values from 0 to 4. The contacts of bank 85 are connected to leads 195 to 199 in accordance with the code used.

Reference numeral 122 indicates a bank of contacts 128 to 152 which are arranged to provide the third element, or tens of minutes, of a 24-hour clock system. As in the previous case, the value of this third element is shown in parentheses to the right of its corresponding contact. As indicated by the values within parentheses the contacts provide for a range of values for the third element of the time of 0 to 5. Contacts of bank 122 are connected to leads 200 to 204 shown at the top of the bank.

Reference numeral 189 indicates a fourth bank of contacts, 164 to 188 which are arranged to provide the fourth element, units of minutes, of a 24-hour clock system. Since this value will vary from 0 to 9, the contacts are arranged to provide this range. For clarity, these values are shown to the right of the contact involved. The contacts of bank 122 are connected to leads 205 to 209 which are shown at the top of bank 189, in Figure 2.

Contact rows 78, 115, 152, 184 to 188 are not used in the embodiment shown, since the twenty-five rows of contacts of banks 48, 85, 122 and 189 are not divisible by the number of items it is desired to transmit. It is necessary, therefore, to provide some means whereby the wiping contacts 42 to 47, inclusive, 79 to 84, inclusive, 116 to 121, inclusive, and 152 to 158, inclusive, after coming to rest on the unused contacts 78, 115, 152, 184 to 188, are advanced to the next respective used rows of contacts 54, 91, 128 and 164.

When wiping contact 153 comes to rest on contact row 184 an electrical current flows from the 110 volt direct current source at 216 through the normal contact 161 and moving contact 160 of the stepping coil 159 thence the left-hand contact in row 184 through the wiping contact 153, through the stepping coil 159 to the ground connection 217 thus completing the circuit. The stepping coil then attracts its armature with the

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stepping spring, stepping dog and moving contact 160 attached (for purposes of clarity, the spring and dog are not shown). At some point near the end of the armature travel, the circuit through the stepping coil 159 is broken due to moving contact 160 being pulled away from the back, or normal contact 161. The stepping spring, having been extended from normal length, contracts and in so doing drives the stepping dog (not shown), the ratchet wheel (not shown) and wiping contact 153 to the next succeeding point of rest. The armature of stepping coil 159 is no longer attracted by the stepping coil 159 and falls back. When the armature returns enough to effect a contact between 160 and 161, the circuit is again restored but this time through the left-hand contact of 185. This action continues until the wiping contact 153 comes to rest on the next contact which does not have a source of electrical potential connected to it. In this instance wiping contact would come to rest at contact row 164. Condenser 163 and resistor 162 are included as normal spark protection for contacts 160 to 161.

The clearing of wiping contacts 42, 79 and 116 over their respective unused contacts 78, 115 and 152 is accomplished in a like manner.

Pulses of electric current at one minute intervals and of short duration are present in wire lead 218, Figure 2. Each time a pulse of electrical current is received by wire 218 it passes through stepping coil 159 and results in an advance of the wiping contacts, 153 to 158, one step forward. After nine such pulses are received, the wiping contacts 153 to 158 will be at rest on contact row 173.

When the tenth pulse is received, it is necessary to advance the wiping contacts 116 to 121, inclusive, of switch 40 to the contact row 129 of contact bank 122, thus indicating that an interval of ten minutes has elapsed. Upon the receipt of the tenth pulse over wire 218 the wiping contacts 152 to 158, inclusive, will be at rest on contact row 173 or 183, considering that the starting point may have been contact row 164 or 174. With wiping contacts 153 on its respective contact in row 173 or 183 the flow of current received during a pulse over wire lead 218 will, in addition to stepping wiping contacts 153 to 158, step the wiping contacts of the tens-of-minutes switch 40 one step as a result of the establishment of a circuit through wire lead 218, wiping contact 153, left-hand contact of contact row 173, wire lead 219, stepping coil 123, to ground at 217.

When the wiping contact of switch 40 rests on contact rows 133, 139, 145 or 151, at a time when wiping contact 153 of switch 41 rests on contact row 173 or 183, it is necessary that upon the receipt of the next following pulse of current over lead 218, all of the wiping contacts 42 to 47, inclusive, 79 to 84, inclusive, 116 to 121, inclusive, and 153 to 158, inclusive, be advanced one step. Under the condition assumed above, the next impulse of electrical current over wire lead 218 will energize stepping coil 159 directly and will energize stepping coil 123 by means of a circuit established through wire lead 218, wiping contact 153, the left-hand contact of contact row 173 or 183, wire lead 219, stepping coil 123 to ground connection 217. The stepping coils 49 and 86 will be energized and their respective wiping contacts will be moved to the next position by means of the same pulse in the circuit; wire lead 219, wiping contact 116, left-hand contact in contact row 133, 139, 145 or 151, wire lead 220,

and stepping coils 49 and 86 in parallel to ground 217.

As brush 3 of Fig. 1 is driven over segment 29 by brush arm 1 pivoted at 2 and grounded at 5, an electrical circuit is established between the positive terminal of electrical source 231 of Fig. 4b and ground. This circuit comprises a current limiting resistor 230, relay coil 221, wire lead 241, segment 29, brush 3, brush arm 1 and ground connection 5. The establishment of this circuit results in the movement of a relay contact 222 into contact with relay contacts 224 to 229, thus grounding contacts 224 to 229 through ground connection 223.

As brush 3 of Fig. 1 is driven over segment 30 an electrical circuit is established between the positive terminal of electrical source 231 and ground. This circuit comprises a current limiting resistor 232, a relay coil 233, wire lead 242, segment 30, brush 3, brush arm 1 and ground connection 5. The completion of this circuit moves relay contacts 234 into contact with relay contacts 235 to 240 thus grounding these through ground connections 345. It will be evident from the foregoing that relay contacts 224 to 229 and 235 to 240 are grounded once during each revolution of brush arm 1. This ground is established for a time interval equal to the time of contact of brush 3 with segments 29 and 30.

Figure 3 includes a constant speed device 249 connected to an electrical source 250. This constant speed device drives an eccentric cam which rotates at one revolution per minute. Contacts 249a are closed once each minute through the action of the eccentric cam (not shown). The closure time of contacts 249a is approximately of one second duration.

When contacts 249a close, they complete an electrical circuit comprising the positive terminal of electrical source 251, current limiting resistor 252, contacts 249a, relay coil 254, relay contacts 256 and ground 259. The completion of this circuit results in the closing of electrical contacts 271 and 260 thus completing another circuit which comprises the positive terminal of electrical source 251, contacts 271 and 260, current limiting resistor 346, relay coil 255, relay contacts 261 and 262 of relay 347, and ground connection 259. The establishment of this latter circuit locks relay 253 in an operated condition.

With relay 253 in an operated condition the positive side of electrical source 251 is extended through contacts 271 and 260, current limiting resistor 265, relay coil 272, wire lead 243 to relay contact 229 of Fig. 4b. Since relay contacts 224 to 229, inclusive, will be closed to ground as brush 3 of Fig. 1 moves over segment 29, it will be apparent that relay 264 will be operated each time brush 3 contacts segment 29, provided that relay 253 is in an operated condition. Once relay 264 is operated, it will lock in an operated condition by its own contacts 266 and 267.

With relays 253 and 264 locked in their operating positions the electrical circuit is further extended from electrical source 251, through current limiting resistor 269, relay coil 270, wire lead 244 and relay contact 240 of Fig. 4. Since each time brush 3 of Fig. 1 moves over segment 30 the contacts 235 to 240 of Fig. 4 will be grounded, it follows that if relays 253 and 264 are in their operated condition, relay 347 will operate as brush 3 moves over segment 29. This being the case, the operation of relay 347 breaks the holding circuit coil 255 of relay 253 at contacts 261 to 262 and breaks the pick-up circuit of relay coil 254

of relay 253, by means of contacts 256 to 257. This results in relays 253, 264 and 347 reverting to their unoperated condition as shown in Fig. 3.

The operation of relay 347 of Fig. 3 completes an electrical circuit from the positive terminal of electrical source 251, through current limiting resistor 276, relay coil 277, contacts 262 to 263 and 257 to 258 to ground 259. The completion of this circuit operates relay 273 closing contacts 274 to 275. This connects the positive terminal of electrical source 251 through wire lead 218, to the stepping coils 159, 123, 86 and 49 of Figure 2. These coils are then selectively connected to the source of potential through the action of wiping contacts 42, 79, 116 and 153.

In Figure 4a are shown five polar relays of a variety commonly used in printing telegraph equipment. One type is manufactured by the Western Electric Company under the type number 255-A. These relays have two windings, and may be used in various ways. One way is to apply a certain value of current through one of the windings so that the moving contact is pulled toward the fixed contact which is to be used for the spacing condition during the transmission of the code used. A higher value of current is then used in the other winding during a marking condition. Thus when a mark signal is impressed, the current in the second winding in effect, overcomes the effects of the spacing or bias current in the first winding resulting in a movement of the movable contact against the contact used for the marking condition. This condition can be reversed so that the relay is biased to a mark condition by means of a fixed current in one winding and when a space condition is desired, a higher current is made to flow through the other winding.

Relay 278 of Fig. 4a is used to convert the neutral signals on common lead 6 of Fig. 1 with polar signals for the operation of relays 286, 287, 288 and 289. Other polar relays may be added as required. It is necessary only to add additional wire pairs such as 303 and 304 from these relays, to provide outputs for multiple circuits from the transmitting commutator of Fig. 1.

The moving contact 281 of relay 278 of Fig. 5 is held in contact with fixed marking contact 283 of relay 278 by means of an electrical current from a source of direct current potential through wire lead 300, current limiting resistor 284, relay coil 280 to ground at 305. The relay contacts 281 and 283 remain closed when brush 3 in Fig. 1 makes contact with a segment or segments of commutator 4 which are not connected to common lead 6.

As brush 3 of Fig. 1 moves onto a segment of commutator 4 that is connected to common lead 6, such as segment 7, for example, a larger electrical current, than flows in relay coil 28, will flow from the electrical source through wire lead 300, through current limiting resistor 285, relay coil 279, common lead 6, brush arm 1 to ground connection 5. This larger current through relay coil 279 is poled in such a manner that it causes relay armature 281 to make connection with fixed spacing contact 282.

It will be seen by referring to Fig. 4a that when contacts 281 and 283 are connected together for the marking condition, the marking coils 290 and 295 are energized by an electrical current from wire lead 300 through coils 290 and 295 in parallel, wire lead 301, contact 283 to ground through 75 contact 281. With this current flows through

coils 290 and 295 their respective moving contacts 294 and 299 are pulled to their respective marking contacts 292 and 297. When contacts 281 and 282 are connected together current is made to flow through the spacing coils 291 and 296 in such direction that the moving contacts 294 and 299 are pulled to their respective spacing contacts 293 and 298.

The resistors 350 and 351 and condensers 248 and 249 are included as normal spark protection for these contacts.

It will be seen that the signals as transmitted by the transmitting commutator of Fig. 1 are reproduced at wire pairs 303 and 304. Additional reproductions may be had simply by adding relays such as 288 and 289.

Figure 4c shows a conventional type of transmitter 306 such as used in printing telegraph systems to sense permutations in a prepared tape. Transmitter 306 passes this "sense" on in the form of start, stop and code pulses of the code used.

During operation, when a perforated tape is fed into the transmitter, a signal is transmitted to line pair 311 through the action of contacts 307. Under normal operating conditions, the line pair 311 will be complete. It will not be broken as indicated by broken line at 313; nor will wire pair 303 be connected at 313. The dotted lines are shown to indicate the points at which the time signal is introduced into the message transmitting circuit. When used for message transmission without the present invention the lines 313 and 310 are complete.

As long as a message tape remains in the transmitter 306, the transmitter will continue to operate because of a control current furnished over wire pair 312 to the clutch magnet 308. This clutch magnet has a pair of contacts, in one of the wires of wire pair 312, which open upon the completion of the run of the message tape through the transmitter. For the purposes of the present invention, control pair 312 is broken at 310 and extended by means of wire pair 344. Wire pair 344 is connected to a control circuit which comprises relays 315, 316, 317 and 318. These relays are of a well-known kind. Relay 315 may be of the type manufactured by the C. P. Clare Co., Chicago, Illinois, under Catalog No. C-2294; relays 316, 317 and 318 may be of the type manufactured by the Western Electric Company under Catalog No. E-6470.

Assume that transmitter 306 is in operation transmitting a tape message. Under this condition the control circuit holds the transmitter in running condition and the contacts 309 are closed.

Upon the completion of the message tape, contacts 309 open, de-energizing coil 308. With contacts 309 separated, coil 322 is de-energized opening contacts 320 to 321 and closing contacts 319 to 320 of relay 315. The short circuit across condenser 335 which consisted of ground connection 320 to 321, relay coil 325, and contacts 342 to 343 is now removed.

With the closing of contacts 319 to 320, condenser 335 receives a surge of charging current from electrical source 314. This charging current passes through relay coil 325, contacts 342 to 343 to ground, thus energizing relay 316. Contacts 323 to 324 of relay 316 close establishing a circuit from the positive terminal of electrical source 314, through contacts 323 to 324, current limiter resistor 326, relay coil 327, non-operated

contacts 340 to 341 to ground. Relay 316 is caused to lock up in an operated condition opening the transmitter control circuit 312 at contacts 328 to 329 of relay 316. Transmitter 306 is now disabled and cannot run.

With relay 316 in an operated condition, the positive terminal of electrical source 314a is extended through relay contacts 323 to 324, current limiting resistor 330, relay coil 333, wire lead 246 to contact 226 of Fig. 4. Since contacts 224 to 229 are grounded each time brush 3 of Fig. 1 passes over segment 29, relay 317 will also operate provided relay 316 is in an operated condition.

When relay 317 operates it locks into an operated condition upon itself by means of contacts 334 and 337. The operation of relay 317 opens contacts 331 to 332 thereby removing the short circuit from wire pair 303. Since signals are transmitted by the transmitting commutator of Fig. 1 and are present on wire pair 303, it follows then that the signal as transmitted by the transmitting commutator will enter the message circuit 311 at point 313. This amounts to breaking the message circuit 311 and inserting a wire pair 303 therein.

The operation of relay 317 opens the shunt to ground of relay coil 339 by opening contacts 336 to 337. After approximately 360 degrees of rotation of brush arm 1 of Fig. 1, or at the end of the time transmission, the brush 3 passes over segment 29 and in so doing operates relay 318 completing the circuit from the positive terminal 314 through current limiting resistor 338, relay coil 339, wire lead 248, contact 237 to ground at 234.

The operation of relay 318 opens the holding coil circuit of relay 316 at contacts 340 to 341. It also opens the pick-up coil circuit of relay 316 at contacts 342 to 343. The relays 316, 317 and 318 are, therefore, returned to their unoperated condition as shown on the diagram. Transmitter 306 is again operative as the control circuit is remade at contacts 328 to 329.

Figure 4d shows an arrangement which is equivalent to that of Figure 4c and illustrates the manner in which this invention may be used in connection with several circuits simultaneously. The operation of the circuit of Figure 4d is the same as that of Figure 4c.

Figure 5 illustrates by means of a block diagram the operational relation of the several elements comprising this invention. Reference numeral 306 represents a conventional permutation-code tape transmitter which may be employed in a communication system incorporating my timing device. Reference numeral 350 represents a source of time signals and includes the previously-described commutator, line switches and source of periodic electrical pulses as shown by Figures 1, 2 and 3. Block 351 represents the control circuit of this invention and includes previously described elements of Figures 4, 5 and 6. 355, 356, 357 and 358 represent the electrical interconnection of elements of blocks 305, 350, 351 and 352. Block 352 represents the change-over means of my invention and includes the contacts of relay 317 for opening and closing circuit 311 at 313, and those contacts of relay 316 which open the code transmitter control circuit. The outgoing circuit 311 corresponds to line pair 311 of Figure 6. 354 represents the receiving station to which the message is being transmitted.

A simplified description of the operation of my invention based on Figure 5 is as follows: With a message tape running through tape transmitter

306 in the usual manner, the output of transmitter 306 will feed directly into the outgoing circuit 311 and then to receiving station 354. At the instant that the message tape completes its run through transmitter 306, control circuit 351 through 357 disables transmitter 306 and inserts into the outgoing circuit 311 through 356 and 358, permutation code signals from 350; through 355 and action of means 352, representing the instant time of day. This time is transmitted to the receiving station 354 immediately following the transmission of the message thus providing the receiving station with time of transmission. Since in printing telegraphy and in all forms of automatic communications systems, the time of receipt of a message is substantially the time of transmission, the time that appears on the message will be the time of transmission. Further, since it is the usual practice to have a "home copy" at the transmitting station of all transmissions, a record is thus available of the transmission time of all messages from the station.

In tape relay operation it is a practice to have a monitor printer usually a tape type reperforator "ride" the circuit to give a complete running history of what goes out of the transmitter. Where tape relay operation is not used a page, type monitor would then ride the circuit and provide a record.

From the above, it will be apparent to those skilled in the printing telegraph art that at the receiving station the "time" that is transmitted will appear on the tape or page that is made there. When the message is retransmitted, two "times" will then appear one below the other and as the message is again retransmitted, we will say relayed a half dozen times, the time of transmission will appear on the home copy.

It should be understood that the above embodiment has been shown and described to illustrate the features and operation of this invention. It will be apparent to those skilled in the art that many changes and variations in the specific form of the apparatus herein disclosed may be resorted to without departing from the essentials of the invention.

1. In a printing telegraph system including means for transmitting and means for receiving telegraph messages, said means for transmitting including a tape transmitter utilizing a permutation message code, a device for automatically recording the time of transmission and reception of said messages comprising a continually operative source of signals significant of instant time, and an automatically operating control means; said source of signals including an electromechanical distributor comprising a series of conductor segments insulated from each other, a continuously moving electrical contactor in sliding relation to said segments, a source of periodic electrical pulses, a switching circuit connected to said source of electrical pulses, said switching circuit including a plurality of banks of contacts and brush contactors movable with respect to said contacts and being selectively responsive to said pulses, electrical connections between said contacts and said segments in accordance with said permutation code to provide the elements for the instant time, whereby the position of said brush contactors on the contacts is significant of said time; said control means connected between said tape transmitter and said source of signals and including means for automatically disabling the tape transmitter after the completion of a message and including also means for inserting said time signals into the

outgoing circuit, thereby providing a time record of the transmission of said message, said time also being substantially the time of receipt of said messages.

2. The device according to claim 1 in which said series of conducting segments includes segments for supplying a terminal signal and in which said control circuit includes means responsive to said terminal signal for reconnecting said transmitting means to said transmission circuit at the completion of the transmission of the instant time, thus resetting the system for the next message.

3. In a printing telegraph system, including a transmitting means for transmitting permutation code signals, and an outgoing transmission circuit, a device for automatically inserting into said transmission circuit the time of transmission of a message, said device comprising a continually operating source of signals significant of the instant time, and control means; said source of signals including a commutator comprising a series of conductor segments insulated from each other, a continuously moving electrical contactor in sliding relation to said segments, a source of electrical pulses, said switching circuit connected to the source of electrical pulses, said switching circuit including a plurality of contacts and brush contactors movable with respect to said contacts and being selectively responsive to said pulses, electrical connections between said contacts and said segments in accordance with said permutation code to provide the elements for the instant time, whereby the position of said brush contactors on the contacts so significant of said time, and a time signal output circuit connected to said commutator segments; said control means including magnetically operated means for automatically disconnecting said transmitting means from the transmission circuit upon the completion of a message, and for connecting the time signal circuit to said transmission circuit, whereby the time of transmission of said message is transmitted immediately after the transmission of a message.

4. The device according to claim 3 in which said series of conducting segments includes segments for supplying a terminal signal, and in which said control circuit includes means responsive to said terminal signal for reconnecting said transmitting means to said transmission circuit at the completion of the transmission of the instant time, thus resetting the system for the next message.

5. In a printing telegraph system means for automatically recording the time of transmission of messages over an outgoing circuit, said means comprising: an electromechanical distributor, said distributor comprising a circular series of conducting segments insulated each from the other, a continuously operating electrical contactor in sliding relation to said segments; a source of periodic pulses of electrical energy; switching means responsive to said periodic pulses, said switching means comprising a plurality of banks of contacts and brush contactors movable longitudinally relative to the banks of said contacts; electrical connections between said contacts and said segments, said connections made in accordance with a time-significant code; said switching means being responsive to said received pulses, whereby the position of said brush contactors on the contacts is significant of the time of day; control means; said control means including means connected to the distributor and

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the outgoing circuit for automatically interrupting the outgoing circuit at the completion of a message tape, and for inserting the time-significant code into said outgoing circuit, thereby providing a record of the time of transmission of said message.

6. In a message transmitting system, including a transmitting unit and an outgoing transmission circuit a device for recording the time of transmission of messages comprising: a continuously-operating source of instant time signals including an electromechanical distributor comprising a series of conductor segments insulated from each other, an electrical contactor in sliding relation to said segments said electrical contactor moving at a substantially constant speed, a source of periodic electrical pulses, a magnetically operated switching means connected to said source of electrical pulses, said switching means including a plurality of banks of contacts and brush contactors movable with respect to said contacts and being selectively responsive to said pulses, electrical connections between said contacts and said segments in accordance with predetermined time units, to provide the elements for the instant time, whereby the position

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of said brush contactors on the contacts is significant of said time; said source having an output circuit; an automatic control circuit comprising a plurality of magnetically operated means for disconnecting said transmitting unit from said outgoing circuit, at the completion of a message and also means for connecting said output circuit to said transmission circuit, whereby the time of transmission of said message is transmitted immediately following the transmission of a message.

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