

Nov. 25, 1947.

J. A. SPENCER

2,431,651

TAPE PRINTER

Filed Aug. 28, 1943

4 Sheets-Sheet 1

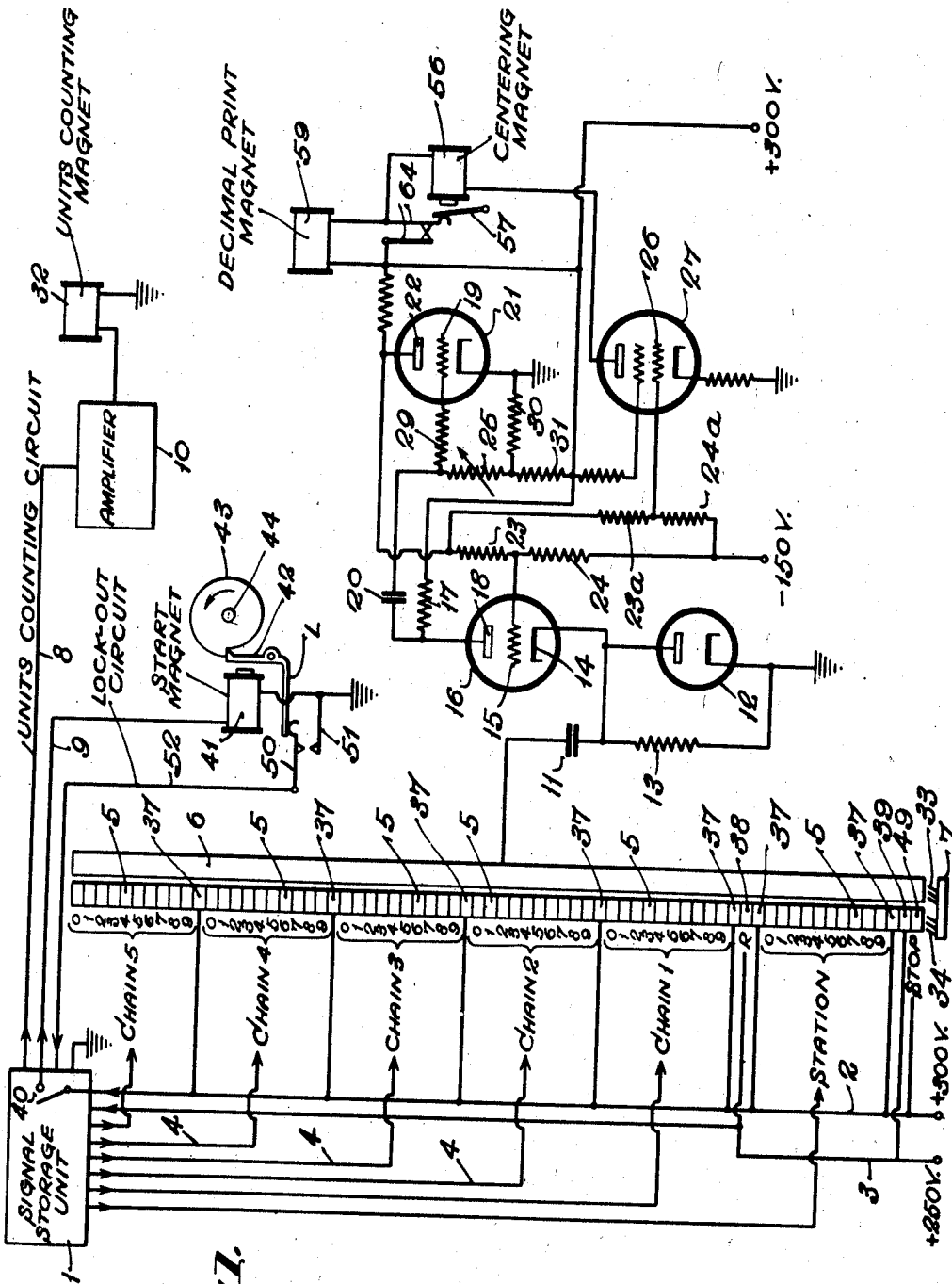


Fig. 1.

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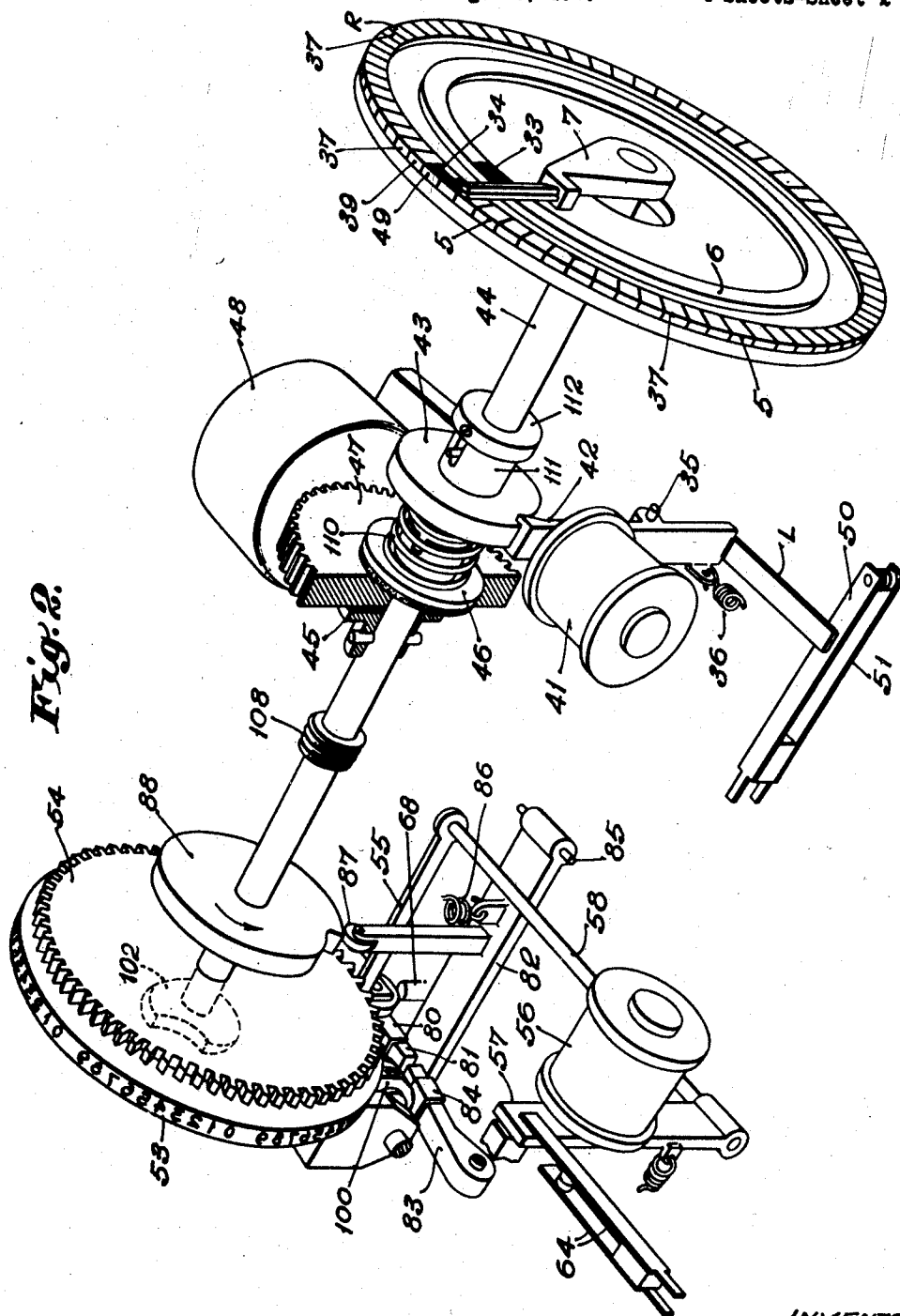
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TAPE PRINTER

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4 Sheets-Sheet 2



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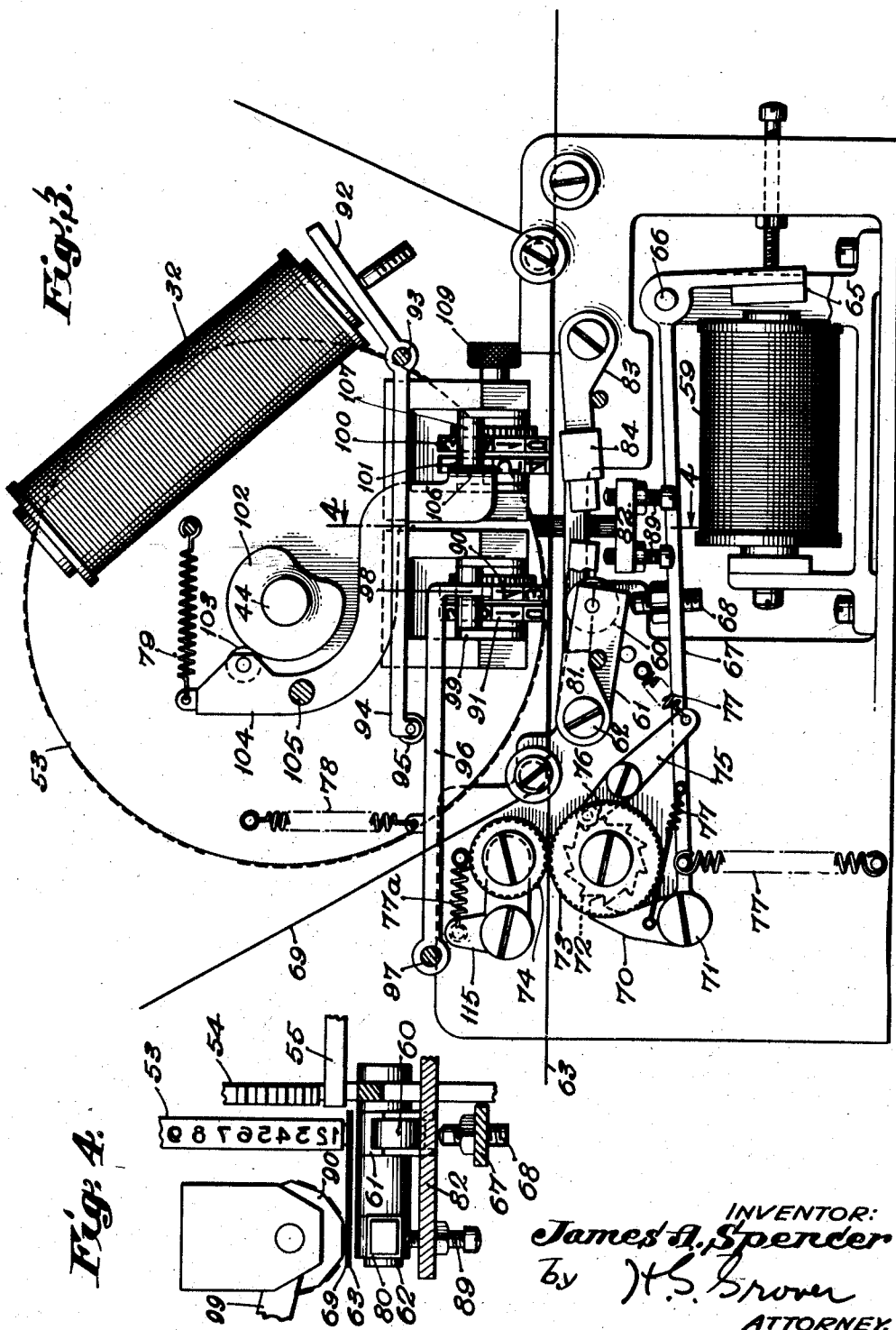
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TAPE PRINTER

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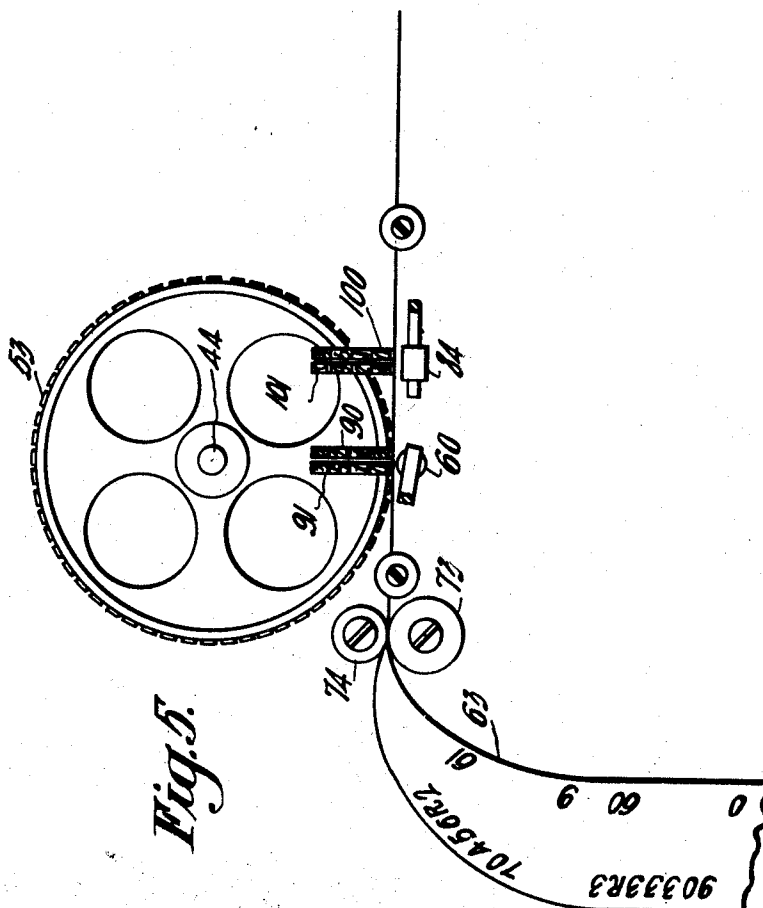
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TAPE PRINTER

Filed Aug. 28, 1943

4 Sheets-Sheet 4



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TAPE PRINTER

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Application August 28, 1943, Serial No. 500,358

8 Claims. (Cl. 234—1.5)

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This invention relates to electromechanically operated tape printers. It is particularly designed to meet certain specific requirements for high speed tape recording.

Considering the many uses for my invention, it will be found that it meets a paramount need for printing numbers on a recording tape. Such numbers may represent information stored in an electronic counter, for example. Electronic counters are used in a great many ways in industry and in making tests. It is desirable, therefore, to provide a high speed printer which will record any preset condition of the elements in an electronic counter.

There are many types of electronic counters and also many types of signal storage devices from which a suitable unit may be selected for controlling the operation of my tape printer. The invention is best illustrated, however, with reference to a signal storage unit of the electronic counter type which is provided with five chains of storage elements. Each storage element represents one of the cardinal numbers, 1, 2, 3, etc., decimally placed. The different chains of storage elements represent figures of different ordinals, such as, tenths, hundredths, thousandths, etc. It is well known that an electronic counter may be used for accurate timing of an elapsed time interval. In such cases, it is often the practice to provide an oscillation generator, the frequency of which is accurately set to, say, 100,000 cycles per second. The electronic counter herein shown can be so actuated as to count the individual cycles fed to it by a generator between a starting moment and a stopping moment of a time interval to be measured. The result stored in the signal storage unit may then be read as a number of seconds followed by the decimal to the 100,000th part of a second. If five counting chains are used, as when measuring a time interval to the 100,000th part of a second, and if the time interval to be measured is greater than one second, then it is desirable to provide an electromagnetically operated counter merely to count the full seconds of the time interval without resorting to the elaborate circuit arrangements which are used in each of the counting chains of an electronic counter.

Accordingly, it is a principal object of my invention to provide a high speed printer for special purpose recording.

It is another object of my invention to provide a combination of recording units suitably coordinated for printing a plurality of sets of numbers on a tape.

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Still another object of my invention is to provide an electromechanical typewheel control device in combination with suitable circuits from a signal storage unit whereby the recording of quantitative measurements on a tape may be obtained. Other objects and advantages will be made apparent hereinafter.

My invention will now be described in further detail, reference being made to the accompanying drawing, in which:

Fig. 1 shows a circuit arrangement suitable for operatively associating the printing mechanism of my invention with a signal storage unit;

Fig. 2 shows in perspective the general arrangement of apparatus elements which are comprehended within the tape printer mechanism;

Fig. 3 shows a front end elevational view of the printer mechanism;

Fig. 4 shows a cross-section of the printer platen arrangement taken on the line 4—4 of Fig. 3; and

Fig. 5 shows a portion of the record tape in its relation to the several typewheels and printing platens.

Referring to Fig. 1, I show therein a signal storage unit 1 which may be of the general type known as an electronic counter. Conductors 2 and 3 feed two different potentials from a suitable direct current source into the signal storage unit whereby the counter chains are actuated. There are numerous output circuits from the storage unit 1. These output circuits may be grouped in accordance with the chains of signal storage elements, such as chain 1, chain 2, chain 3, etc. Each chain includes ten conductors representing the digits from 0 to 9 inclusive. In order to simplify the drawing, a single line 4 represents ten conductors, each individually connected with one of the segments 5 of a rotary distributor. The segments of this distributor are shown in developed form in Fig. 1. The distributor has two rings, one of which contains the individual segments 5, and the other ring 6 is continuous. The brush arm 7 carries two brushes 33 and 34 which are electrically interconnected so as to feed different potentials to a scanning amplifier circuit arrangement (presently to be described) in accordance with the set-up of signals in the storage unit 1.

My invention provides for printing an identifying number following the number which gives a quantity or time interval, and this identifying number in practice represents a particular station from which the intelligence stored in the signal storage unit 1 is derived. In this connection it will be apparent without illustration that

the signal storage unit 1 may be remotely actuated by any one of a plurality of different measuring stations for setting up a number representing a given measurement. Preferably these stations are numbered from "0" to "9," it being useful to record on the tape the identity of such a station. Ten of the segments of the distributor are, therefore, used for station identification. In printing this identifying number on the tape, it is convenient to use a prefix letter, such as the letter "R." The stations could, of course, be identified by letters as well as by figures.

In measuring the time interval which may be greater than one second and where the accuracy of measurement is required to 0.00001 second, it is preferable to provide a signal storage unit in which the decimal part of the quantity is set up on electronic counters and the units of seconds are recorded by means of an impulse-driven electromechanical counter. This counter receives one impulse each time the electronic counter repeats or carries over from "9" to "0" in the tenths ordinal. In order to print the units and tens figures of the quantity measurement, a circuit 8 is provided outgoing from the signal storage unit. A start circuit 9 is also provided in order to set the printer in operation for printing each individual record of time measurement.

A further feature of my invention resides in the provision of means for recording a serial number along with the record of time measurement, so as to identify each individual record in the successive recordings. A serial numbering machine, hereinafter to be described, is, therefore, comprehended in the invention.

In the particular application for which my printer was designed, the available potentials at the signal storage unit happened to be 300 volts for circuits that are not actuated, and 250 volts for those that are actuated to represent an active signal. These voltages are referred to as zero ground potential. It was also a requirement which had to be met in designing my apparatus that it should be controlled by negligibly small currents in the output circuits from the signal storage units. This explains why a 50-volt differential was chosen to distinguish between operating and non-operating conditions. Furthermore, to meet this requirement, an electronic circuit has been designed for control of the printer mechanism in response to the voltage conditions set up in the different elements of the storage unit 1. This electronic circuit arrangement is shown in Fig. 1 and is best considered as:

The scanner amplifier

This amplifier comprises a diode tube 12, two triodes 16 and 21, and a tetrode 27. Positive impulses applied to the input of the scanner amplifier are short-circuited to ground by diode 12, but tends to drive the cathode 14 positive in tube 16. Negative impulses having selective significance are applied through coupling condenser 11 across cathode resistor 13 so as to drive cathode 14 negative. This action is similar to driving grid 15 positive above the cut-off potential thus permitting current to flow through tube 16. The direction of the current is such that practically all of it flows through diode 12, tube 16, and anode load resistor 17. Diode 12 effectively short-circuits resistor 13, which may be made high in value. This resulting anode current flow causes anode 18 to go negative in direction. The grid 19 in tube 21 is coupled to the anode 18 across capacitor 20 and resistor 23. Grid 19 is, there-

fore, driven negative beyond cut-off, causing tube 21 to cease drawing current. Anode 22 then rises to the supply voltage (+300 v.). This raises the voltage on grid 15 to substantially ground potential, as determined by the components 23 and 24 in a voltage divider, thus holding down the voltage on anode 18. Since tube 21 is now cut-off, the circuit will remain in this condition until the charge on condenser 20 leaks off through resistor 25 and permits tube 21 to again become conductive.

With tube 21 cut off, the voltage on grid 26 in tube 27 is driven from cut-off to zero volts in the same way that grid 15 was so conditioned. This action permits tube 27 to draw current through the coil of the centering magnet 56.

As soon as the charge on condenser 20 leaks off sufficiently to raise grid 19 above cut-off, tube 21 starts to conduct, which makes anode 22 go negative in direction. This drives grid 15 negative; anode 18 becomes positive and grid 19 more positive until its bias becomes zero. Grids 15 and 26 are then driven negative beyond cut-off. The scanner circuit retains this condition until another negative impulse is applied to its input.

The length of time during which tube 27 remains conductive is dependent upon the values of condenser 20 and resistor 25. Resistor 25 is made variable in order to provide a means for regulating the length of the impulse delivered to magnet 56.

Resistors 29, 25, 30, and 31 apply a positive threshold bias to grid 19 to prevent tube 21 from tripping tube 27 in response to stray negative impulses that might be picked up. Signal potentials operating through tubes 12, 16, and 21 are, therefore, effective for rendering tube 27 conductive for the limited time interval necessary to energize the centering magnet 56. The conductive condition in tube 27 is brought about through a change in the potential drop in a positive direction through the voltage divider 23a, 24a when tube 21 is biased to cut-off.

It will be noted that the scanner amplifier as above described delivers a short sharp pulse to the centering magnet 56, and that the electronic circuit is immediately restored to normal conditions substantially prior to the passage of the brush 7 onto a succeeding segment 5 on which the normal 300-volt potential is impressed. In order to increase the time interval between successive energizations of the printer magnet 56, where otherwise adjacent segments would happen to carry the 250-volt actuating potential, additional segments 37 intervening between the chain groups are all of them connected to the 300-volt bias. Accordingly, if segment "9" in chain 5 and segment "0" in chain 4 are both to carry signals of 250-volt potentials, then the centering magnet 56 will surely be de-energized while brush 34 sweeps over the intervening segment 37 which carries a constant 300-volt potential. In other words, the discharging of capacitor 20 need not be depend upon entirely for restoring the scanner amplifier to a normal condition.

The electronic circuit represented by the box 10 is used for amplification of the electromechanical counter impulses and this circuit may, if desired, be an exact duplicate of the above described scanner amplifier circuit. It is used to deliver counting impulses to a magnet 32 for driving the typewheel in the units position of the seconds recorder. This seconds recorder will be hereinafter described in more detail.

The starting mechanism and motor drive

The starting of the printer is accomplished by means of a push button or other switch 40 on the panel of the signal storage unit 1. This push button closes a circuit through a magnet 41 and retracts the pawl on the end of armature 42 (Fig. 2) from engagement with a single abutment on the periphery of a stop-start cam 43. This cam is mounted on the main shaft 44 which also carries the brush arm 7 of the distributor, as well as other rotatable elements of the printer mechanism hereinafter to be described. Shaft 44 is driven through a friction clutch consisting of disks 45 and 46, and through a gear train which includes the gear 47. The latter may be meshed with a spur gear, or else a worm forming part of a speed-reducing gear train driven by a motor 48. The motor runs continuously while operating the printer.

The disks 45 and 46 are faced with felt or friction cloth. Gear 47 is preferably interposed between the felt layers of the two disks. Disk 45 is pinned to the main shaft 44 and disk 46 is fastened to a yieldably mounted sleeve 111 which is urged by a spiral spring 110 to exert pressure against the gear 47 and thus to apply torque to the shaft 44. The spring pressure is adjustable by means of a collar 112 mounted on the shaft 44 and held in position by a set-screw. The friction clutch will, therefore, be understood to be more or less conventional in design.

From the two preceding paragraphs, it will be clear that upon each momentary energization of the start magnet 41 the shaft 44 carrying the brush arm 7 and typewheel 53 will be permitted to make one complete cycle and will finally come to rest at the homing position determined by the abutment on the cam 43. During each complete cycle, as will be shown presently, the typewheel 53 is brought to a number of selected stops for printing the decimal part of the number set up by the storage unit 1, and for also printing the station identifying number.

Associated with the armature 42 is a lever arm L which presses down upon a contact member 50 when the magnet 41 is energized. Contacts 50 and 51 close for the purpose of sending back a signal through lock-out circuit 52 to the storage unit, which signal locks the set-up of the information stored therein and prevents a premature attempt to set up a new record before the current record is printed. The interference preventor thus provided is not part of my invention and will not, therefore, be described in greater detail.

The typewheel and associated mechanism

The typewheel 53 is fixedly mounted on the shaft 44 and its several type faces are, therefore, maintained in fixed angular relation to the brush arm 7. Centering disk 54 is provided having teeth and notches arranged for engagement by a holding pawl 55 under control of mechanism which is operated by the arresting magnet 56. Magnet 56 has been referred to in the description of the scanner amplifier and will be understood to be energized whenever the brush of the distributor contacts a segment on which a 250-volt signal is impressed. Magnet 56, upon energization, draws up its armature 57 and rocks the shaft 58 sufficiently to raise the stop arm 55 and cause it to engage in one of the notches of the centering disk 54. By this means, the typewheel 53 is arrested in position to print each figure of the record.

The energization of magnet 56 is only momentary, and upon release of its armature 57, the

single cycle excursion of the brush arm and typewheel is continued until the next selected printing point is reached according to the 250-volt signal conditions on different distributor segments 5.

Since there are seventy segments, 5 and the like, in the distributor ring, and seventy corresponding positions in the periphery of the typewheel, it is apparent that a plural digit number representing the value of a given time interval may be printed by successive operations of arresting the typewheel while the distributor brush 34 makes a single excursion over its segments. There is, therefore, very little lost time in making a record, and, in fact, in a practical embodiment of the invention which has been built, a complete record of the time interval measurement may be printed on the tape within a period of about five seconds or less. The printer is thereafter brought to a stop with the brush 34 resting upon segment 49, and is in readiness to make a new record.

The printer platens and associated mechanism

Three printer platens are provided, one for printing from the typewheel 53 on an upper line of the tape 63, and the other two platens for printing on a lower line from the respective mechanical counters which comprise typewheels 90, 91, 100, and 101. The platen and typewheel arrangements are shown in Figs. 3 and 4. The platen first mentioned is in the form of a roller 60, mounted on an operating lever 61, the latter being pivoted by means of a shouldered screw stud 62. Print magnet 59 has an armature 65 pivoted at 66. This armature lifts a lever arm 67, thereby driving the end of a stud 68 against lever 61 for producing a printing stroke of the platen 60.

Print magnet 59 is shunted by normally closed contacts 64 (Figs. 1 and 2) which are adjusted to open slightly before the centering magnet armature 57 completes its travel toward its pole piece. This arrangement delays the operation of the print magnet 59 until after the stop lever 55 has been seated in a selected notch of the centering disk 54. The opening of contacts 64 puts the windings of the two magnets 56 and 59 in series, thus causing the printing stroke of platen 60 to follow immediately upon the arresting of the typewheel 53.

A conventional typewriter ribbon 69 overlies the recording tape 63 and travels beneath all of the type faces carried by the several typewheels.

The energization of the centering magnet 56 is timed in accordance with the operation of the scanner amplifier circuit. After each printing stroke both magnets 56 and 59 are automatically released, thereby dropping the platen 60 back into normal position and allowing the rotation of typewheel 53 to be resumed.

The operating lever 67 carries a pawl 70 pivoted on a stud screw 71 and arranged to cooperate with a ratchet wheel 72 which is used for tape advancement. The ratchet wheel 72 rotates through an angular space of one tooth upon the downward stroke of pawl 70. Fixedly mounted on the hub of the ratchet wheel 72 is a roller 73 which forms a base for the tape 63. The tape is compressed between the knurled peripheries of two rollers 73 and 74 by the action of a spring 77a working through a bell crank 115 on which the roller 74 is mounted. The two rollers 73 and 74 grip the record tape 63 sufficiently to produce advancement with each downward stroke of the pawl 70. The ratchet wheel 72 is prevented from turning clockwise when the pawl 70 is lifted, a retrograde

movement preventer being provided in the form of a lever arm 75 carrying a roller 76 which engages with the teeth of the ratchet wheel 72. In connection with the tape feed mechanism, two coil springs 77 are used to maintain proper bias upon the moving parts to which they are attached.

For the purpose of printing the full number representing that part of a measurement which is to the left of the decimal point and which number is preferably printed on a line below the record of a decimal, a second printing platen 80 is provided. This platen is shown in Figs. 2 and 4. It is carried on a lever arm 81 and is mechanically actuated by means of a print hammer 82 which also simultaneously actuates the lever arm 83 carrying the third printing platen 84. Print hammer 82 is pivoted at 85 and is held up by a spring 86. Its upward movement is limited by a stop (not shown) in order that its striker studs 89 may properly function to apply printing swings to the platen carrier arms 81 and 83. A similar stop is provided for lever arm 67. The momentum applied to all three platen carriers 61, 81, and 83 is relied upon for imprinting the characters without blurring and without unduly delaying the operation of the tape feed mechanism.

The initial position of hammer 82 is assumed by pressure of the cam follower roller 87 against the periphery of cam 88 where the greatest radius opposes. As the shaft 44 starts to rotate, cam follower 87 rides over the radial face of cam 88 and an upward movement of the hammer 82 is produced.

The typewheels 90 and 91 for the units and tens figures of the time interval recorder are preset during the timing operation itself. As each second of the time interval elapses, an impulse is transmitted over circuit 8 (Fig. 1) which includes operating magnet 32. This magnet is provided with an armature 92 pivoted at 93 and having an extension arm 94 at the end of which is a presser roller 95. Roller 95 bears against an actuating lever 96 which is pivoted at 97 and which carries at the end thereof an operating yoke 98 for engagement with a counter advancing lever system 99. Counter advancement is obtained in a conventional manner by stepwise rotation of the units typewheel. The tens typewheel is advanced from one figure to the next by means of a carry-over mechanism operable from the units wheel, as is conventional.

It will be understood that prior to the sending of a start impulse into magnet 41, a complete storage of the time interval to be recorded will have been set up in the storage unit 1, and during this period of storing the record, the typewheels 90 and 91 will have been advanced to the proper point for printing the units and tens figures of the measurement. This printing operation takes place at the outset of the cyclic operation of the printer mechanism. Simultaneously, a record is also made by means of typewheels 100 and 101 comprised in a serial number printing unit. The serial number is printed on the lower line of the tape which also records the seconds of the time interval measurement. The stepwise advancement of the typewheels 100 and 101 is, however, dependent upon the number of full revolutions of the shaft 44. Operation of the contour is performed by means of a cam 102 fixedly mounted on shaft 44 and having a periphery suitable for operating the cam follower 103 on an operating lever 104. Lever 104 is pivoted at 105 and has an extension in the form of a yoke 106 for engagement with the typewheel advancing mecha-

nism 107 of the serial number printing machine. This machine operates in the same manner as the numbering machine previously described except that it advances the units typewheel one step for each revolution of the shaft 44. This numbering machine, therefore, makes a record on the tape of the serial number by which successive complete records are identified.

The typewheels 90 and 91 immediately following the printing of a given record are reset by means not shown but operated through a gear train driven by the shaft 44. The resetting mechanism forms no part of the present invention and need not, therefore, be further mentioned. It is apparent, however, that prior to storing the next record of time measurement in the storage unit 1, typewheels 90 and 91 must be set to a zero position. Thereafter the stepwise actuation of the units wheel 90 and the carrying mechanism which suitably actuates the tens wheel 91 will provide for proper recording of the figures to the left of the decimal point but underneath the line on which the decimal itself is recorded by the typewheel 53.

During a given period of tests and record-making, the advancement of the serial numbering machine will not be disturbed, but at the outset of any new period, such as a day, the typewheels 100 and 101 may be reset manually by turning the knob 108. Such resetting mechanism is conventional in counters having rotatable figure drums.

My improved printer is, of course, provided with spools for carrying the typewriter ribbon and a ribbon feed device which preferably includes a reversing mechanism. The details of the ribbon feed and ribbon reverse mechanism are not shown since they are conventional, but it will be understood that they may readily be actuated from the shaft 44 by suitable gearing which, for example, is preferably meshed with the worm 108.

On the distributor is a segment 39 which the brush 34 traverses immediately before reaching the stop segment 49. Segment 39 carries a 250-volt potential at all times and, hence, the typewheel is arrested at this point immediately upon taking the final step to the rest position corresponding to segment 49. The typewheel periphery presents a blank to the printing platen when arrested in position of segment 39, but the tape feeding device is enabled to operate so as to space the tape and to separate successive measurement records.

Operating sequence

The operating sequence which results from the design of my printer in accordance with the foregoing description will now be reviewed. Let it be assumed that in the signal storage unit 1 a time interval measurement has been stored representing 12.31475 seconds. Let it be assumed also that this record was obtained from station 6 and that it is the 89th measurement to have been obtained during the test run. The counter stepping magnet 32 has received 12 impulses during the elapsed time of the interval which was measured. Accordingly, typewheel 90 has been rotated through a complete revolution and has been further advanced to the figure 2. In carrying over from 9 to 0, the units wheel 90 advances the tens wheel 91 so as to record the figure 1. The serial numbering machine had been advanced during the previous cyclic operation of the printer so as to set the wheels 100 and 101 to record the serial number 89. The typewheel 53 stands in its initial

position during the storing of the time measurement figures in the unit 1. Brush 34 also stands on stop segment 49.

The time measurement having been made and stored, the operator presses start button 40 and causes start magnet 41 to be energized. Pawl 42 disengages itself from the cam 43, and the motor 48 drives shaft 44 through the clutches 45 and 46.

Cam follower roller 87 rides into the depression in the cam 88 and allows spring 86 to pull up the lever arm 82 at the end of which are the two platen levers 81 and 83 carrying the printing platens which strike the under side of the paper tape and cause the printing of the figures set up in the two counters including typewheels 90, 91 and 100, 101. These figures are all recorded on the lower of the two printing lines on the tape.

As the brush arm 7 rotates, it causes the brushes 33 and 34 to bridge between the amplifier input circuit and different segments of the distributor. Each of the segments 5 which carries a 250-volt potential representing a selected figure in each counting chain so operates the amplifier as to deliver an impulse to the centering magnet 56.

The centering disk 54 in consequence of the operation of magnet 56 is arrested in suitable position for printing each of the figures in the decimal part of the time record.

Each actuation of the centering magnet 56 anticipates slightly the energization of the printing magnet 59 due to the retarding effect of the shorting contacts 64 as applied to magnet 56, as heretofore explained. When magnet 59 pulls up its armature 65, the printing and tape feeding mechanism is actuated through the lever arm 67. Successive imprints by the typewheel 53 are thus produced for completely recording the decimal part of the time record. Each printing operation throughout the cycle is completed by de-energization of the centering magnet 56 when the time constant circuits of the scanning amplifier so permit. The main shaft 44, therefore, advances the typewheel 53 from a selected position in chain 5 to another selected position in chain 4 and so on through the respective chains until segment 38 is reached by the brush 34. At this point typewheel 53 is again arrested to print the letter "R." The selection of this letter is purely arbitrary and merely designates that the subsequently printed figure represents a station number. The selected station number is then printed by impressing a 250-volt potential on one of the segments 5 of the station identifying group.

During each cyclic revolution of the shaft 44, the typewheels 90 and 91 are restored to zero position and the ribbon feeding device operates in a conventional manner. The tape is also fed one space following the moment of arresting brush 34 on segment 39.

As may be seen by reference to Fig. 5, the recording tape 63 as it issues from the printer mechanism, including the feed rollers 73 and 74, bears its record in two lines. On the lower line the time in units of seconds is designated by figures such as 0 and 9. These figures may appear as one or two digits according to the setting of the typewheels 90 and 91.

In between these figures a serial number such as 60 and 61 are printed by the numbering machine, the typewheels of which are designated 100 and 101.

On the upper line of the record tape seven characters are printed in series by the typewheel 53. The first five of these characters rep-

resents the decimal value in seconds of the time interval that has been measured. Following this decimal is the letter R which indicates that the subsequently printed digit is the station number from which the signal originates.

It will be understood by those skilled in the art that modifications of my invention may be made without departing from the spirit and scope of the invention itself. The embodiment herein shown and described is, of course, of a highly specialized nature and yet it may readily be seen that it has numerous useful applications.

I claim:

1. In a tape printer, a typewheel having a plurality of type faces disposed around its periphery, a distributor having stationary segments corresponding to said type faces and a brush mounted for rotation in unison with said typewheel and arranged to sweep said segments, a source of signals having individual connections to said segments, means for arresting said typewheel at a fixed number of different selected positions during each single revolution of the same, means for causing an imprint on tape of typewheel characters selected by said arresting means, and an electronic amplifier operable under control of signals fed through said distributor for actuating said arresting means.

2. A device according to claim 1 in which said type faces are arranged in groups, each group comprising the numerals "0" to "9" inclusive, and the individual connections from said source to said segments constitute means for controlling the repeated arrest of said typewheel, thereby to print a plural-digit number during a single revolution of the typewheel.

3. A system for recording a plural-digit number comprising a typewheel the type faces of which include multiple series of the numerals "0" to "9" inclusive, means including a source of signals and a rotary distributor for selecting different positions at which to arrest said typewheel, means for causing an imprint of a character presented to a tape when said typewheel is so arrested, and means for causing the arrest of said typewheel at a predetermined number of selected positions during a single cyclic scanning operation of said distributor, thereby to record said plural-digit number.

4. A system in accordance with claim 3 in which the numbers recorded by said typewheel are imprinted lengthwise of said tape, and separate means are provided and are subject to control by said source of signals for imprinting other characters on a separate line running lengthwise of said tape.

5. A typewheel recorder for use in association with an electronic counter of the type having a plurality of output circuits individual to the cardinal numbers in each place of digits in the quantity to be counted, said recorder comprising a typewheel mounted for rotation on a shaft, motor-and-clutch means operatively associated with said shaft for intermittently driving the same, stop-start means effective to arrest said typewheel in a predetermined number of different positions to print a series of figures selected during the period of driving said shaft through a single cycle, means for effecting a printing operation at different points of arrest of said typewheel, and means operative under control of signal potentials selectively applied to the output circuits of said counter for determining said different points of arrest.

6. Apparatus for recording information on a

record tape, comprising a typewheel having a plurality of groups of type faces disposed around its periphery, a distributor having stationary segments corresponding to said type faces and a brush mounted for rotation in unison with said typewheel and arranged to sweep said segments, a source of signals having individual connections to said segments, means responsive to said signals for arresting said typewheel at selected positions for causing one character in each group to be imprinted on tape during a single typewheel revolution, and print-hammer means operable immediately upon arresting the typewheel in a selected printing position for making the character imprints on said tape.

7. Apparatus according to claim 6 and including separate means subject to control by other signals originating at the same source for causing the imprint of characters on a separate line of the tape parallel to the line of characters printed from said typewheel.

8. Apparatus for recording a plural-digit number on a tape, comprising a typewheel having a plurality of groups of type faces, each group including the numerals "0" to "9" inclusive, a rotary distributor having stationary segments corresponding to each of the type faces on said typewheel and a brush mounted for rotation in uni-

son with said typewheel and arranged to sweep said segments, means for impressing a stand-by voltage on the segments of said distributor, an amplifier subject to control by different voltages derived from said brush as it sweeps said segments, a source of signals constituting means for shifting the voltage on one selected segment in each group from the stand-by value to an operating value, means controlled by the output from said amplifier for arresting said typewheel at points corresponding to said selected segments, and means including a printing platen for causing said tape to be imprinted with each character which the typewheel presents thereto at the moment of its arrest.

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