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MULTISPEED VARIABLE SIGNAL TRANSMITTER

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3 Sheets-Sheet 2

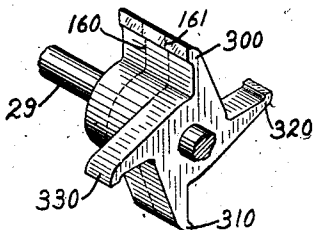
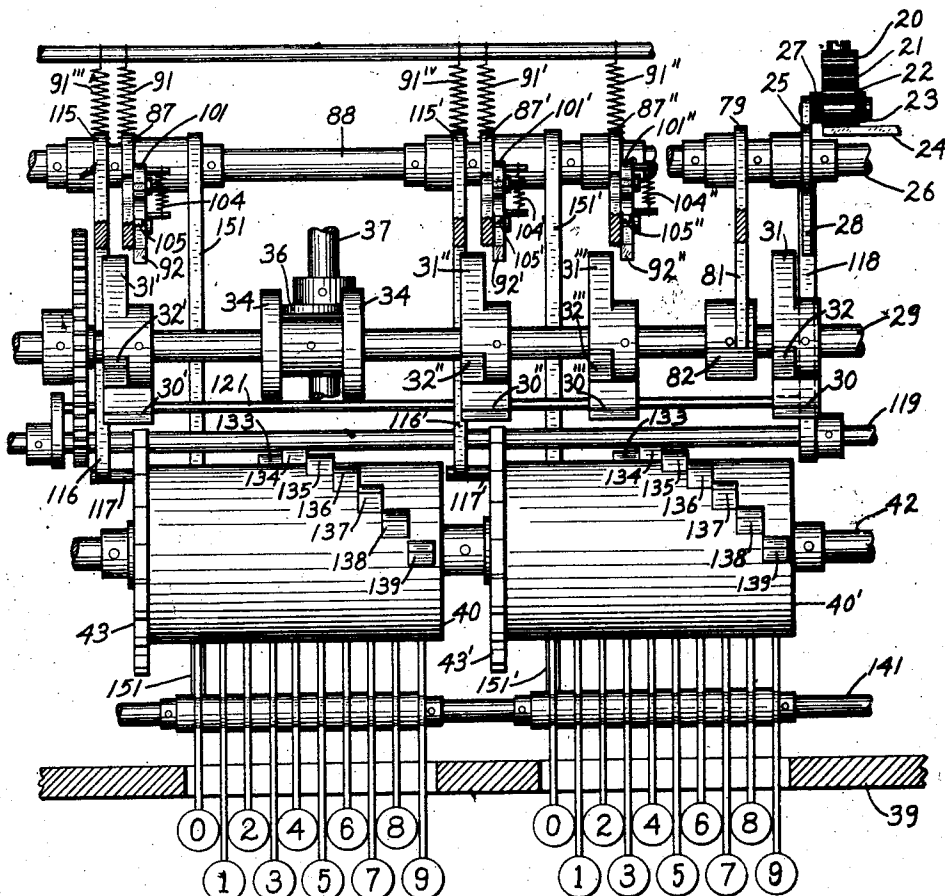


Fig. 7

Fig. 3

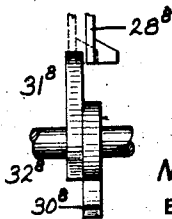


Fig. 8

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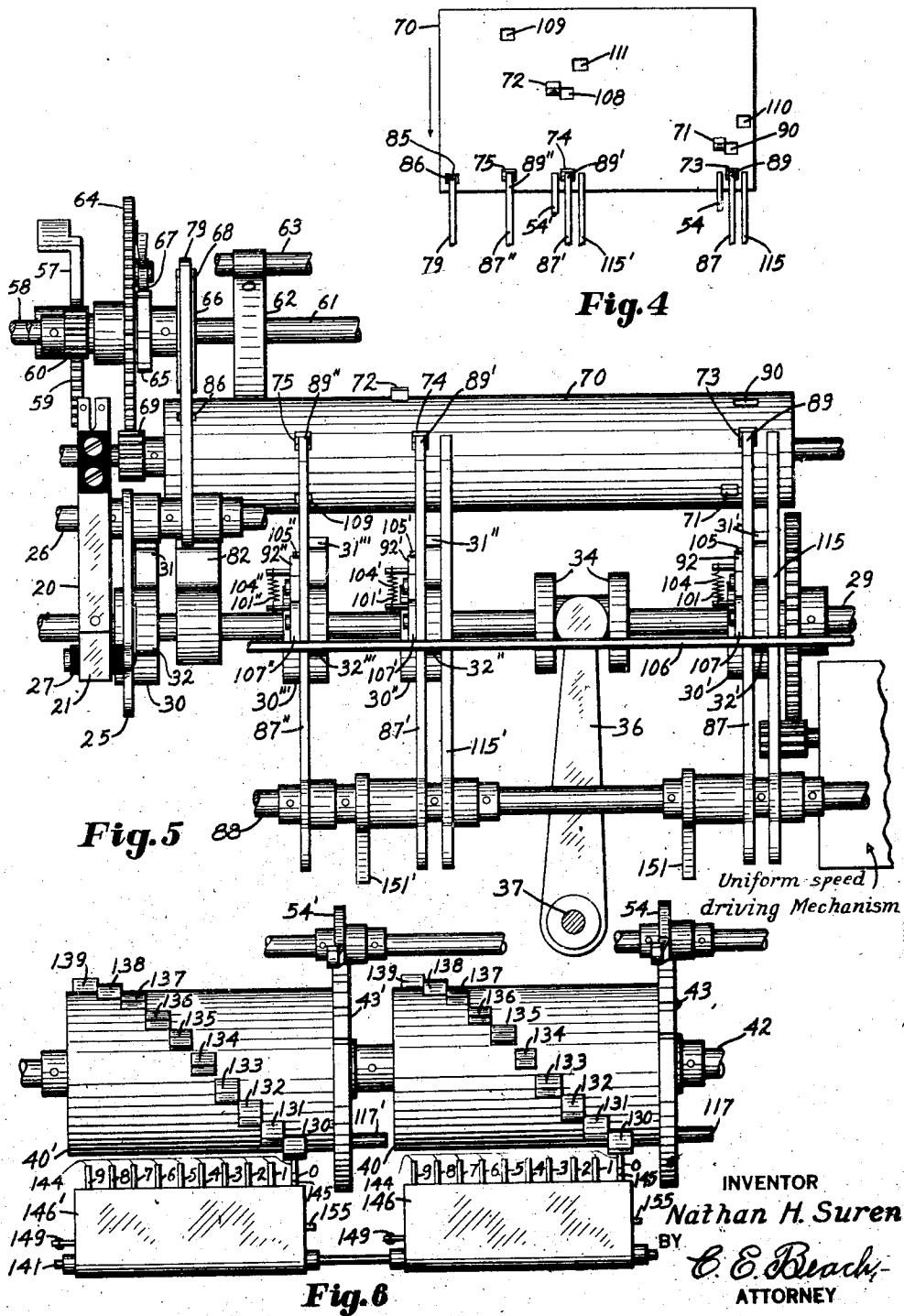
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MULTISPEED VARIABLE SIGNAL TRANSMITTER

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE.

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MULTISPEED VARIABLE-SIGNAL TRANSMITTER.

Application filed August 4, 1924. Serial No. 729,918.

This invention relates to multi-speed variable-signal transmitters, and is particularly suited for embodiment in such transmitters as are provided at fire alarm central stations and are there used for the manual retransmission to the fire companies of alarms received from street boxes, or otherwise.

In order to facilitate references to such transmitters, in the course of the description of this invention, and for want of better terms, the word "signal" is herein employed to signify a message characterized by the number and arrangement of its component parts, which parts may be arranged in one or more groups each consisting of one or more visible or audible manifestations or of impulses of electrical or other energy suited for controlling or causing such manifestations. For like reasons, groups of such manifestations or impulses will be hereinafter referred to as "digits"; such individual manifestations or impulses will be referred to as "strokes"; means for setting the transmitters so as to determine the number of strokes within individual digits will be referred to as "digit-determining" mechanism; the digit-determining mechanism of any given transmitter will be referred to as "number-determining" mechanism; and means whereby such transmitters may be adjusted to effect the formulation of the set signal either once or with one or more repetitions—so as to afford one or more so-called "rounds" of the signal—will be referred to as "round-determining" mechanism. Furthermore, mechanism for measuring or establishing the durations of time intervals between digits of signals—which mechanism is, in many types of transmitters, intermittently operable—will be hereinafter referred to as "pausing" mechanism.

For reasons which are well understood by those skilled in this art, it is important that such transmitters shall be arranged so that all of the intervals between strokes within digits of any signal (hereinafter referred to as "stroke intervals") shall be substantially equal duration; that, when signals comprise two or more digits, the intervals between such digits (hereinafter referred to as "digit pauses") shall be substantially greater and bear a fixed relationship to such stroke intervals; and that, when two or more rounds of a signal are formulated, the intervals between such rounds (hereinafter referred to as

"round pauses") shall likewise be substantially greater and bear a fixed relationship to the digit pauses.

From the foregoing it will be apparent that multi-speed transmitters should be so arranged that adjustments affecting the speed of operation thereof shall cause proportional variations in stroke intervals and both the digit and round pauses.

In transmitters of the character just referred to, it has heretofore been customary to equip each transmitter with as many speed governors as there were speeds to be provided for. Thus, for example, in a two speed transmitter, there have been two governors—one of which was always driven by the machine, when running, and served to govern its speed of operation when acting at the faster one of its operating speeds, and being therefore known as the fast speed governor,—while the other has been arranged for detachable connection with the governed mechanism so that, when acting, it would supplement the retarding effect of the fast speed governor and thereby cause the mechanism to operate at a slower speed than when such slow speed governor was detached from the governed mechanism.

For the foregoing reasons, such prior art multi-speed transmitters have not only involved duplication of mechanism which is objectionable from considerations of cost and facility of production, as well as from the consideration of providing such degree of simplicity as will enable users to properly care for and maintain the machine,—but, most important of all, it has been difficult to provide and maintain desired speed adjustments, because such fast speed governors are not only subject to the wear incident to the operation of the machine in formulating fast speed signals, but are also subject to wear incident to transmission of slow speed signals, and all alterations of adjustment of the fast speed governor are likely to necessitate compensating adjustments of the slow speed governor.

In the use of the multi-speed feature of variable-signal transmitters in fire alarm central offices, it is well known that a given signal is, ordinarily, first transmitted at the fast speed and then repeated at the slower speed or speeds, and it is obviously undesirable to shift the speed adjustments of the prior art transmitters while they are operating at fast speed. This has resulted in development of

the practice of stopping the transmitter for the purpose of making such speed shifts between the fast speed and slow speed signals, thereby delaying the transmission of the slow speed signals.

It is, therefore, an important object of this invention to provide a multi-speed transmitter which is so arranged that but one governor will be required for the attainment of all of the various required speeds of signal formulation, and so that the speed of such governor and the parts moving therewith need not be varied in order to vary the speed of signal formulation.

Another object of this invention is to provide, in a signal transmitter having speed governed operating mechanism adapted to cause the formulation of a series of strokes separated by time intervals of diverse relative durations,—means for effecting substantially proportional variations in the durations of said intervals, respectively, without varying the operating speed of said mechanism.

Other objects are to provide a multi-speed transmitter in which the speed controlling mechanism will be effective, reliable, and composed of a small number of parts, severally characterized by strength, durability and facility of assemblage, as well as amenable to low cost of manufacture.

Still other objects together with their inherent advantages will be in part obvious and are in part specifically set forth in the following specification.

In constructing transmitters in accordance with this invention,—the speed governed mechanism provided for causing functional actuation of both the pausing mechanism and the formulating means may be of a type which does not permit of adjustments for varying the rate of movement thereof; or, if adjustable as to speed, should be so arranged that, when desired adjustment is attained, the adjusting mechanism may be secured against revision, as no adjustments of speed are needed in the ordinary course of the utilization of such transmitters when constructed in accordance with this invention. The pausing mechanism and formulating means employed should be such as are arranged for intermittent actuation, and mechanism should be provided whereby adjustments may be readily attained such as will cause the speed governed mechanism to actuate the pausing mechanism and formulating means at any one or another of the desired frequencies without altering the speed of the movement of such governed mechanism. More specifically,—elements are provided which are movable at a substantially uniform speed, as by rotation thereof, together with means for establishing cooperative adjustments between said elements and the formulating means and the pausing mechanism whereby functional actuations of said means and mechanism will be caused by great-

er or lesser numbers of said elements to the end that the speed of such signal formulations may be suitably varied without altering the rate of movement of said elements. It will also be evident that inasmuch as the pausing mechanism is concurrently subjected to changes in frequency of actuation corresponding to those to which the formulating mechanism is subjected,—variations in the durations of digit pauses and round pauses will always be proportional to those in the stroke intervals.

For the purpose of facilitating comprehension of this invention, and for the further purpose of setting forth in greater detail certain of its features,—an embodiment thereof is shown in the accompanying drawings and is hereinafter more fully described, which embodiment is intended as illustrative rather than as limiting the scope of this invention. For convenience, the selected illustrative embodiment includes, by either direct or simplified diagrammatic representations, certain of the features disclosed in my co-pending application filed November 15th, 1919, Serial No. 338,287, Patent No. 1,570,596, dated January 19th, 1926, as well as features which constitute improvements of certain of the features of said application but which, nevertheless, form no part of the invention herein claimed.

Like reference characters denote similar parts throughout the accompanying drawings, in which:—

Figure 1 is a fragmentary side elevation, partly in section, of mechanism of a signal transmitter embodying this invention;

Fig. 2 is a perspective view of one of the parts of the mechanism of the transmitter of Fig. 1;

Fig. 3 is a plan view of certain parts of the transmitter of Fig. 1;

Fig. 4 is a diagrammatic development, at reduced scale, of the controlling drum and associated levers of the transmitter of Fig. 1;

Fig. 5 is a rear elevation of portions of the mechanism of the transmitter of Fig. 1, with certain parts broken away;

Fig. 6 is a rear elevation of other portions of the mechanism of the transmitter of Fig. 1, showing details of the arrangement of the digit-setting members, keys and associated parts; and

Figs. 7 and 8 are fragmentary views illustrating other embodiments of certain features of this invention.

Signal formulating means.

In the transmitter of Fig. 1,—signal formulating means are exemplified by the contacts 20, 21, 22 and 23, which contacts are carried by but separately insulated from the bracket 24; together with the lever 25, which is pivoted at 26, carries an insulated pin 27 arranged for actuation of said contacts, and

comprises an arm 28 so formed as to be adapted for engagement by suitable mechanism for causing actuation of said contacts.

5 *Actuating and interval varying means.*

The shaft 29 is arranged for rotation by any suitable uniform speed driving mechanism, such, for example, as a clockwork or a suitably governed electric motor (diagrammatically indicated in Fig. 5). Said shaft 10 29 is so supported and driven that suitable movement lengthwise thereof may be imparted thereto without impairing the relationship thereof with said driving mechanism; 15 and said shaft carries the flanges 34, 34, which are positioned for cooperation with the arm 36; which arm is connected by means of the shaft 37, with the lever 38 (see Fig. 1), situated in front of the frame plate 39, so as 20 to facilitate adjustment of said shaft 29 between one and the other of two lengthwise positions thereof; thus affording means for establishing diverse cooperative relationships between said signal formulating means (as 25 well as number-determining mechanism and pausing mechanism to be hereinafter more fully described) and actuators therefor carried by said shaft.

A plurality of actuators are carried by said 30 shaft 29, each of which comprises projections, such as the projections 30, 31 and 32 best shown by Fig. 2.

It will be observed that the projection 30 35 is substantially double the width of either the projection 31 or the projection 32, measured along the length of the shaft 29, that the arrangement is such that said projections 31 and 32 revolve in the same circumferential path, and that part of the projection 30 also re- 40 volves in said path and the remainder of said projection 30 revolves in a corresponding path adjacent to said first named path.

When positioned as shown in Figs. 3 and 5, 45 the actuator comprising the projections 30, 31 and 32 is so situated that the arm 28 is in the path of the movement of part of the projection 30 but is not in the path of the projections 31 and 32; it will, however, be ap- 50 parent that lengthwise movement of said shaft to a position somewhat to the right of that shown in Fig. 3 will so position the projections 31 and 32 and part of the projection 30 that the path of movement thereof will in- 55 clude said arm 28; to the end that said signal formulating means may be functionally actuated but once during each revolution of said shaft, while it is in the first of said positions and may be functionally actuated three times 60 when said shaft is in the other of said positions.

From the foregoing it will be apparent that 65 the speed of signal formulation may be varied, without varying the speed of the shaft 29, by moving said shaft relative to the arm 28 so as to cause said lever to be engaged by greater

or lesser numbers of projections such as 30, 31 and 32; and that arrangements may be made for similarly varying the frequency of actuation of the lever 25 throughout wide variations by the provision of suitable numbers of 70 such projections.

Number-determining mechanism.

The digit-setting members 40 and 40' are 75 carried by the fixed shaft 42, for rotation independently thereof, and the discs 43 and 43' are associated with said members 40 and 40' for rotation therewith, respectively. Each of said discs carries a projection 45 (see Fig. 80 1) for a purpose which will be hereinafter more fully explained, and has teeth 46 formed therein, said teeth being arranged for engagement thereof either by retaining pawls for preventing the rotation of said discs in clock- 85 wise direction or by revolving members for rotating said discs in counter-clockwise direction, as viewed in Fig. 1. The actuators comprising the projections 30', 31' and 32', 30'' 31'' and 32'', and 30'''', 31''' and 32'''', are 90 fixed upon the shaft 29, the formation and arrangement of the projections of each of said actuators being similar to that of the actuator having the projections 30, 31 and 32 95 hereinbefore described and best illustrated by Fig. 2. The projections 30', 31' and 32' are so situated with reference to the teeth 46 of the disc 43 that said disc may be actuated by greater or lesser numbers of such pro- 100 jections in a manner analogous to that in which the arm 28 may be actuated by greater or lesser numbers of the projections 30, 31 and 32; the projections 30'', 31'' and 32'' being correspondingly arranged with relation 105 to the teeth 46 of the disc 43'. Each of the projections 30', 31', 32', 30'', 31'' and 32'' are so proportioned and arranged with relation to the teeth of the disc with which it is associated that rotation of the shaft 29 in the 110 intended direction will cause counter-clockwise rotation (as viewed in Fig. 1) of its associated disc, an angular distance somewhat greater than that between the teeth thereof.

Means are associated with each of the setting members 40 and 40' for imparting there- 115 to a tendency to rotate in clockwise direction, as viewed in Fig. 1; such means being herein illustratively indicated as a coil spring 53, one end of which is secured to the shaft 42 and the other end of which is se- 120 cured to the associated setting member.

The retaining pawls 54 and 54' (see Figs. 1 and 6) are associated with the discs 43 and 43', respectively; each of said pawls being so positioned with relation to the teeth 46 of its associated disc that it may be moved 125 into engagement with such teeth to hold same against clockwise rotation and may be moved out of the path of such teeth to permit clockwise rotation thereof while remaining in the path of the projection 45 so 130

as to suitably limit the rotation of such associated disc when disengaged from the teeth 46 thereof. Furthermore, said pawls are so positioned with relation to the projections carried by the shaft 29 that, upon rotation of said disc in response to the engagement of any one of such projections with the one of the teeth 46 thereof which is situated at the end of the series of such teeth farthest from the projection 45, said pawl may engage one of said teeth 46 to prevent clockwise rotation of said disc upon disengagement of such projection therefrom, and so that there will be a suitable number of teeth intervening between the projection 45 and the tooth so engaged by said pawl, for a purpose to be hereinafter more fully explained. The springs 56, 56, are associated with the pawls 54 and 54', respectively, so as to move said pawls toward engagement thereof with the teeth of the discs cooperating therewith.

Rounds-determining mechanism.

The starting and rounds-determining member 57 is pivoted at 58, and one end thereof projects through the frame plate 39 to facilitate manual actuation thereof. The segment 59 moves with the member 57 and engages the pinion 60 which is fixed upon the shaft 61. The driving spring 62 has one end thereof secured to the shaft 61, and the other end thereof secured to the post 63; said spring being so applied as to tend to rotate said shaft in such direction as will raise the end of the member 57 which projects through the frame plate 39; a stop 52 being provided in the path of said member 57 for limiting said movement thereof. A similar stop limits the downward movement of the member 57.

The gear 64 is journaled upon the shaft 61 for rotation independently thereof, and the ratchet wheel 65 and disc 66 rotate with the shaft 61, a ratchet dog 67, carried by said gear 64, engages with the teeth of the ratchet wheel 65, so that counter-clockwise rotation imparted to said ratchet wheel through the shaft 61 by the spring 62 will also be imparted to the gear 64. A notch 68 is formed in the periphery of the disc 66 for a purpose which will be hereinafter more fully explained.

The pinion 69 engages the gear 64 and drives the controlling drum 70, the relationship between said pinion and gear being such that angular movement of said gear corresponding to the angular displacement of the teeth of the ratchet wheel 65 will impart one revolution to said pinion.

The controlling drum 70 turns with the pinion 69, and carries projections 71 and 72, the path of movement of which is such that, as best shown by Fig. 4, during the rotation of said drum these projections will successively engage the retaining pawls 54 and 54', respectively, and thereby disengage same

from the teeth 46 of the discs 43 and 43' associated therewith, for a purpose which will be hereinafter more fully explained; but such actuation of said pawls will not cause them to be withdrawn from the paths of the projections 45, 45 co-operating respectively therewith.

The stop lever 79 is pivoted at 26 and comprises an arm 81 which is so formed that it may be moved into or out of the path of the projection 82 carried by the shaft 29 (see Fig. 3) for the purpose of controlling the operation of said shaft. The form and angular position of said projection 82 corresponds with that of the projection 31 as viewed in Fig. 1, and said projection 82 is so positioned lengthwise of the shaft 29 that, as best shown in Fig. 3, the path of said projection will include the arm 81 irrespective of intended lengthwise movement of shaft 29. The projection 83, carried by said lever 79, is formed and positioned for so engaging the periphery of the disc 66, that, when said disc is in the position which it occupies when the member 57 is resting against the stop 52, in its normal elevated position, said projection 83 may enter the notch 68 formed in said disc, and so that when said projection is in said notch the arm 81 will be disposed in the path of the projection 82 and thereby prevent rotation of the shaft 29, and so that when said projection 83 is supported by the periphery of said disc 66 the arm 81 will be withdrawn from the path of the projection 82 and thereby permit rotation of the shaft 29. A lug 85 carried by the lever 79 rides upon the periphery of the drum 70, said lug being so positioned with relation to the arm 81 that, when said lug is riding upon the periphery of said drum, said arm will be withdrawn from the path of the projection 82; a depression 86 being provided in the periphery of said drum, which depression is so situated and of such depth that, when said drum is in the position to which it is moved when the starting member 57 is in its normal elevated position, said depression will be in the path of the lug 85. From the foregoing it will be apparent that the arm 81 may be disposed in the path of the projection 82 only when both the notch 68 and the depression 86 are in the paths of the projection 83 and lug 85, respectively.

Pausing mechanism.

A lever 87 is pivoted at 88 in such position that the end 89 thereof may ride upon the periphery of the drum 70 in the path of a depression 90 formed therein; said parts being so formed that when said end 89 is situated in said depression 90, said drum 70 will be held against rotation in intended direction. The spring 91 is so applied to said lever 87 as to urge the end 89 thereof toward said drum. For reasons which will be here-

inafter more fully explained, said lever 87 will be hereinafter referred to as the "second round-pause lever."

The bifurcated member 92 is pivotally connected to the lever 87 at 93; in such relationship to the projections 30', 31' and 32' that the faces 97 and 98 of the respective branches of said bifurcated member may be alternatively swung into the path of the movement of said projections 30', 31' and 32'. A stop pin 100 is mounted in the path of the member 92 for limiting movement thereof around its pivot 93, such as may be imparted thereto by engagement of the face 97 thereof by its associated actuator; and a latch 101 is pivotally connected to said lever 87 at 102, which latch is so formed and arranged that it may be moved into or out of the path of the shoulder 103 formed on said member 92; for the purpose of retaining said member in the position to which it may be moved by engagement of the face 98 by the projections 30', 31' or 32', as hereinafter more fully explained. A spring 104 is so connected to the member 92 and the latch 101 as to tend to swing said member away from the stop pin 100 and to swing said latch 101 into the path of the shoulder 103. A stop pin 105 carried by the lever 87 is mounted in the path of the member 92 for limiting the movement thereof in response to said spring 104.

A stop 106 is disposed in the path of the tail 107 moving with the latch 101, and correspondingly extends in the paths of similar tails of other corresponding latches, to be presently referred to. Said stop is so positioned that, when the lever 87 is in the position to which it is moved when the end 89 thereof has been engaged by the projection 73, the tail 107 will be in such engagement with said stop 106 as to hold the latch 101 out of the path of the shoulder 103 of the member 92. If the formation of the face 97 of the member 92 is such with relation to the projections 30', 31' and 32' that, when any one of such projections is engaging said face and thereby moving the lever 87 away from the drum 70, the friction therebetween will be sufficient to overcome the tendency of the spring 104 to withdraw said face from the path of such projection,—the stop 106 may be so positioned as to cause the latch 101 to be withdrawn from the path of the shoulder 103 during such movement of the lever 87 as will withdraw the end 89 thereof from the depression 90; just before such end is moved far enough to permit the periphery of the drum 70 to pass thereunder. If so arranged, the latch 101 will be withdrawn from the path of the shoulder 103 at all times except when the lever 87 is in the position which it occupies when the end 89 thereof is situated in the depression 90; to the end that, while said lever is normally positioned, the rotation of the shaft 29 may

merely cause momentary displacement of the member 92, but will not cause movement of the lever 87 other than when the end 89 of said lever has entered the depression 90, and the member 92 has been thereafter moved to the position where the latch 101 has engaged the shoulder 103 thereof.

In any event, the relations of the branches of the bifurcated member 92 to one another, to the shoulder 103 of said member, and to the parts arranged for co-engagement or co-operation therewith, are such that when said member is being held by the spring 104 in engagement with the pin 105, and the end 89 of the lever 87 is in the depression 90,—the face 98 of said member 92 will be positioned for engagement thereof by the actuator comprising the projections 30', 31' and 32', to the end that the rotation of the shaft 29 may so move said member 92 as to withdraw the shoulder 103 from the path of the latch 101, so that said latch may act to retain the face 97 in the path of its associated actuator so long as the end 89 of the lever 87 remains in the depression 90, and that said actuator may thereupon engage said face to thereby so swing said lever as to carry the end 89 thereof out of said depression 90. It will also be observed that the formation and arrangement of the member 92 with relation to the projections 30', 31' and 32' is such that, irrespective of the relationship which may exist between said member and any one of said projections at a time when the depression 90 is presented to the end 89 of the lever 87, said member 92 will not so engage or be engaged by any such projection as to prevent said lever from moving to carry the end 89 thereof into said depression; for a reason the importance of which will be more particularly pointed out in the description of the operation of this mechanism hereinafter contained. This result is attained because the face 97 of the member 92 is the only part thereof which can be so engaged by any of said projections as to cause the lever 87 to be so moved as to carry the end 89 thereof out of said depression 90, or to prevent such movement of said lever as will carry said end into such depression; and because said face 97 will be brought into the path of such projections only when the end 89 of said lever has entered the depression 90 and the member 92 has been thereafter moved to the position where the latch 101 has engaged the shoulder 103 thereof;—which characteristics are, in turn the result of such relative construction of the various parts that the latch 101 is withdrawn from the path of the shoulder 103 at all times except when the end 89 of said lever is within the depression 90; thus permitting the spring 104 to rotate said member 92 around its pivot 93 so as to carry the face 97 of said member out of the path of said projections.

The levers 87' and 87'' (see Fig. 5)—which

are hereinafter referred to as the "digit-pause lever" and the "first round-pause lever", respectively, are similar in formation, arrangement and functioning to the lever 87 hereinbefore just described in detail, and are respectively provided with springs 91' and 91'', members 92' and 92'', latches 101' and 101'', coengaging with the stop 106, stop pins 100', 100'', 105' and 105'' corresponding to those associated with lever 87, and ends 89' and 89'' arranged to cooperate with the projections 74 and 75 and the depressions 108 and 109, in a manner which will be hereinafter more fully described and which corresponds generally with that of the end 89 of the lever 87 with the projection 73 and the depression 90.

The levers 115 and 115', which are hereinafter referred to as the "first digit lever" and the "second digit lever", respectively; are pivoted at 88 for independent movement; respectively comprise the arms 116 and 116'; and have the springs 91''' and 91'', respectively, applied thereto.

As most clearly shown in Fig. 4, the depression 90 and the projection 71 are so situated in the periphery of the drum 70 as to be brought into the paths of the end 89 of lever 87 and the pawl 54, respectively, by intended rotation of said drum immediately following the withdrawal of the depression 86 from the path of the lug 85; the depression 110 is so situated as to be brought into the path of the end of the lever 115 by intended rotation of said drum immediately following the withdrawal of said depression 90 from the path of said end 89; the depression 108 and the projection 72 are so situated as to be brought into the paths of the end 89' and the pawl 54', respectively, by intended rotation of said drum immediately following the withdrawal of said depression 110 from the path of said lever 115; the depression 111 is so situated as to be brought into the path of the end of lever 115' by intended rotation of said drum immediately following the withdrawal of said depression 108 from the path of said end 89'; the depression 109 is so situated as to be brought into the path of the end 89'' by intended rotation of said drum immediately following the withdrawal of said depression 111 from the path of the end of said lever 115'; and the depression 86, and projections 73, 74 and 75 are so situated as to be brought into the path of the lug 85, and the ends 89, 89' and 89'', respectively, by intended rotation of said drum immediately following the withdrawal of said depression 109 from the path of said end 89''.

The pins 117 and 117' are carried by the discs 43 and 43', respectively, for cooperation with said arms 116 and 116', respectively. The relative arrangement of said arms 116, 116' and their cooperating pins 117, 117' is such that, for example, when the disc 43 is at

the limit of the intended counterclockwise rotation thereof, as viewed in Fig. 1,—the pin 117 carried by such disc will engage its cooperating arm 116 and so move same as to swing the lever 115 out of the path of the periphery of the drum 70; and so that, when such disc is otherwise positioned, the pin 117 carried thereby will be withdrawn from the path of the arm 116, so that the end of the lever 115 may enter the depression 110 in the drum 70.

The arm 118 is pivoted at 119 and is so formed and arranged that the free end thereof may be swung into the path of the lever 25 when said lever is in the position to which it may be moved by the engagement of the arm 28 thereof by one of the projections of its associated actuator carried by the shaft 29; a spring 120 being so applied to said arm 118 as to tend to move same into the path of said lever 25. A rod 121 is suitably mounted for movement with said arm 118, and said rod extends across the paths of the arms 116 and 116', so that when either of said arms is in the position which it assumes when the end of the lever associated therewith is in the depression provided in the drum 70 for cooperation therewith, the arm so associated with such lever will engage said rod 121 and thereby move said arm 118 out of the path of the lever 25, and so that when both the arms 116 and 116' are in the position in which they may be held by the periphery of the drum 70 or that to which they may be lifted by the pins 117 cooperating respectively therewith, they will permit said rod 121 to assume a position in which the free end of the arm 118 will be disposed in the path of the free end of the lever 25.

The mechanism thus far described provides for the formulation of a code signal number consisting of the digits 99; it will be well understood by those skilled in this art that, if a signal number comprising a larger number of digits is desired, additional groups of mechanism each comprising a disc 43 with its associated parts—including a digit-pause lever similar to the lever 87—should be provided for each desired additional digit, and such additional discs and their associated parts should be arranged for sequential actuation in a manner corresponding to that of the discs 43 and 43', as hereinbefore described in greater detail; and, correspondingly, if a signal consisting of but one digit is desired, the disc 43 and its associated parts could be omitted.

It will also be readily understood by those skilled in this art that, if desired, digits other than 99 may be formulated by mechanism such as already described, if the number of teeth such as the teeth 46 are increased or decreased in accordance as the desired digits individually exceed or are less than the number 9.

Variable speed operation.

The operation of the mechanism thus far

described, in the absence of the other mechanism shown and to be hereinafter more fully described, is as follows.

When the machine is at rest, the parts occupy the relative positions shown in Figs. 1, 3, 4 and 5: in which the member 57 is held in engagement with the stop 52 by the spring 62 acting through the pinion 60 and segment 59, and therefore the disc 66 is so positioned that the notch 68 therein is presented to the projection 83 carried by the lever 79 and the drum 70 is so positioned that the depression 86 is presented to the lug 85 carried by said lever 79. The lever 79, having thus been permitted to move in response to the spring 80, is so positioned that the free end of the arm 81 thereof is situated in the path of the projection 82, and thus holds the shaft 29 against rotation.

While the drum 70 is normally positioned, as just described, the projections 73, 74 and 75 are situated beneath the lever ends 89, 89' and 89'', respectively, for a purpose which will be hereinafter more fully explained, and the levers 87, 87' and 87'' are therefore so positioned that the latches 101, 101' and 101'' carried respectively thereby will be swung out of the paths of the shoulders 103 of the members 92, 92' and 92'' cooperating respectively therewith, by the engagement of the tails 107 of said latches with the stop 106. Furthermore, during the normal positioning of said drum 70, projections 71 and 72 are so situated as to permit the springs 56, 56' to move the pawls 54 and 54' into engagement with the teeth 46 of the discs 43, and 43'; and said discs are therefore retained against the force of their actuating springs 53 in the positions where their projections 45 are spaced, from their said respective pawls, the extreme distance to which such discs may be moved through the engagement of the teeth 46 thereof by the actuators associated therewith, respectively.

When the discs 43 and 43' are normally positioned, as just described, the pins 117 and 117' carried respectively thereby support the arms 116 and 116' in the position thereof where the free ends of the digit levers 115 and 115' are lifted out of engagement with the periphery of the drum 70 and said arms are withdrawn from the path in which the rod 121 is moved when the arm 118 moves to the position where it is disposed in the path of the lever 25. Said lever is in its actuated position, and therefore has permitted said arm 118 to move into locking engagement therewith, and has moved contact 22 away from contact 23 and contact 21 into engagement with contact 20.

Suitable signaling circuits may be connected to the contacts 20, 21, 22 and 23; the contacts 20 and 21 being suited for controlling a normally closed signaling circuit, and the contacts 22 and 23 being suited for controlling a normally open signaling circuit. As will be well understood by those skilled in

this art, either the contacts 20 and 21 or the contacts 22 and 23 may be duplicated, so as to provide for as many normally closed or normally open circuits as it is desired to control by the transmitter; and contacts such as the contacts 20 and 21 may be omitted when there are no normally closed signaling circuits to control, and contacts such as the contacts 22 and 23 may be correspondingly omitted when there are no normally open signaling circuits to control.

As hereinbefore pointed out, the transmitter thus far described is arranged for operation at one or the other of two predetermined speeds. If it is desired to condition the transmitter for operation at the slower of such speeds, the lever 38 should be so actuated as to move the shaft 29 lengthwise to the left, as viewed in Fig. 3; and if it is desired to transmit a signal at the faster of such speeds said lever 38 should be so actuated as to move the shaft 29 to the right, as viewed in Fig. 3; and the member 57 should thereupon be moved downwardly for a greater or lesser distance depending upon whether it is desired to transmit the code signal 99 but once (that is for one round thereof) or to transmit two, three or four rounds of said signal. If transmission of but one round is desired, the member 57 should be moved downwardly far enough to carry one tooth of the ratchet wheel 65 past the dog 67, and if a greater number of rounds is desired, a correspondingly greater number of such teeth should be moved past said dog.

Upon the commencement of such movement of the member 57, the notch 68 in the disc 66 will be withdrawn from the path of the projection 83, and said disc will therefore so swing the lever 79 as to carry the free end of the arm 81 out of the path of the projection 82, thus permitting the shaft 29 to rotate in response to the driving mechanism provided therefor. Such movement of the lever 79 will also withdraw the lug 85 from the depression 86, in the periphery of the drum 70, in which said lug had been resting, so that, when the member 57 is manually released and thereby permitted to move in response to the spring 62, the resultant rotation of the ratchet wheel 65 will act through the dog 67 to cause such rotation of the drum 70 as will carry the depression 86 out of the path of said lug 85 and will carry the depression 90 into the path of the lever end 89, which will thereupon enter said depression and thereby arrest the rotation of said drum. When the end 89 thereof enters the depression 90, as just described, the lever 87 will carry the latch 101 away from the stop 106 far enough to permit said latch to move into the path of the shoulder 103 of the member 92.

Assuming now that the lever 38 is positioned for causing slow speed signal formulation,—the shaft 29 will be positioned for es-

establishing cooperative relationships between the actuator projections 30, 30', 30'' and 30''' and the arm 28, the disc 43 and the member 92, the disc 43' and the member 92', and the member 92'', respectively. It will therefore be evident that, upon rotation of the shaft 29, said projections will engage the parts with which they are operatively associated once during each revolution of said shaft, to slightly displace said parts without causing functional actuation thereof.

When the member 57 is manually released, the drum 70 will carry the projections 73, 74 and 75 out of the paths of the lever ends 89, 89' and 89'', respectively, and the levers 87, 87' and 87'' will thereupon move in the direction of the periphery of said drum 70. Such movement of these levers has no significance as to the parts already described, but has to do with the variable-signal setting mechanism to be hereinafter more fully described. If such variable-signal setting mechanism is not provided, the projections 73, 74 and 75 may be omitted.

Such initial rotation of the drum 70 will also carry the projection 71 into engagement with the pawl 54 and thereby move said pawl out of the path of the teeth 46 of the disc 43, whereupon the spring 53 will rotate said disc in clockwise direction, as viewed in Fig. 1, until the projection 45 is brought into engagement with said pawl 54.

When the parts have assumed positions such as just described, each revolution of the shaft 29 will cause the projection 30' to engage one of the teeth 46 of the disc 43 and thereby rotate said disc in counter-clockwise direction, as viewed in Fig. 1, an angular distance somewhat in excess of that between adjacent ones of said teeth; but, so long as the pawl 54 is held out of the path of said teeth, said disc will return to the position where the projection 45 rests against said pawl upon disengagement of the projection 30' following each actuation of said disc, as just described. Furthermore, during the revolution of the shaft 29 immediately following movement of the latch 101 away from the stop 106, said projection 30' will engage the face 98 of the member 92 and thereby swing said member to a position which will bring the face 97 into the path of said projection upon the next succeeding revolution thereof, and the latch 101 will thereupon move into the path of the shoulder 103 of said member, thus retaining said member in such position.

Upon the next succeeding revolution of the shaft 29, said projection 30' will engage said face 97 and thereby cause said lever 87 to carry the end 89 thereof out of the depression 90; whereupon the drum 70 will so rotate, in response to the spring 62, as to carry the depression 90 and the projection 71 out of the paths of the end 89 and the pawl 54, respectively, and carry the depression 110 into the

path of the end of the lever 115. Whereupon, the spring 56 will move the pawl 54 into the path of the teeth 46 of the disc 43, and the spring 91''' will so move the lever 115 as to carry the end thereof into said depression 110 and thereby arrest the rotation of the drum 70; at the same time so swinging the arm 116 as to engage the rod 121 and thereby swing the arm 118 out of the path of the lever 25. It will be noted that, prior to the engagement of the arm 116 with the rod 121, the projection 30 will so engage the arm 28 as to swing the lever 25 slightly away from the arm 118 during that portion of each revolution of the shaft 29 when the projection 30' is in position to so move the lever 87 as to carry the end 89 thereof out of the depression 90; so that, when the depression 110 is presented to the end of the lever 115, the movement thereof in response to the spring 91''' will not be impeded by friction between the end of the arm 118 and the lever 25; and so that the movement of said lever 25 which permits abnormal positioning of the contacts 21 and 22 will be timed by the disengagement of the projection 30 from the arm 28.

After the arm 118 has been moved out of the path of the lever 25 and the projection 30 has moved out of the path of the arm 28, as just described, said lever will be moved, by the tension of the contacts 21 and 22, so as to permit said contact 21 to move away from the contact 20 and to permit said contact 22 to move into engagement with the contact 23, to thereby cause the formulation of a signaling impulse in the circuit or circuits controlled by said contacts.

After the parts have assumed positions such as just described, each revolution of the shaft 29 will cause the projection 30' to engage one of the teeth 46 and thereby rotate the disc 43 an angular distance somewhat in excess of that between adjacent teeth of said disc, carrying one of said teeth past the co-operating end of the pawl 54. The spring 56 moves said pawl 54 into the path of each of such teeth, so as to hold said disc against reverse movement during the times when said projection is not in engagement therewith; and, while the arm 118 remains out of the path of lever 25, each such revolution of the shaft 29 will also cause the projection 30 to engage and then disengage the arm 28, thereby causing the lever 25 to act through the insulated pin 27 to impart an operative cycle of functional actuation to the contacts 21 and 22.

Assuming the digit 9 is being formulated then, following the eighth of such operative cycles, the projection 30' will restore the disc 43 to its normal position, where it will be retained by the pawl 54, and the pin 117 will so raise the arm 116 as to permit the arm 118 to move into the path of the lever 25, and so as to withdraw the lever 115 from the de-

pression 110 in the drum 70. Whereupon the drum 70 will be so rotated as to bring the depression 108 into the path of the end 89' and the projection 72 into the path of the pawl 54'; whereupon the lever 87' will move in response to its associated spring 91' so as to carry said end 89' thereof into said depression and thereby arrest the rotation of said drum and so as to carry the latch 101' away from the stop 106 far enough to permit said latch to move into the path of the shoulder 103 of the member 92', and said pawl 54' will move out of the path of the teeth 46 of the disc 43' and said disc will thereupon rotate in response to its associated spring 53 until its projection 45 is brought into engagement with said pawl.

The projection 30 will now act through the arm 28 to so swing the lever 25 as to restore the contacts 21 and 22 to their normal position; thereby permitting the arm 118 to move into the path of said lever 25 and hold same against reverse movement when the projection 30 is withdrawn from the path of said arm 28. Concurrently with the action just described, the projection 30'' will engage the face 98' of the member 92' and thereby swing said member to a position which will bring the face 97' into the path of said projection, for engagement thereby upon the next succeeding revolution thereof, and the latch 101' will thereupon move into the path of the shoulder 103 of said member, thus retaining said member in such position.

Upon the next succeeding revolution of the shaft 29, said projection 30'' will engage said face 97' and thereby cause said lever 87' to carry the end 89' thereof out of the depression 108; whereupon the drum 70 will so rotate, in response to the spring 62, as to carry the depression 108 and the projection 72 out of the paths of the end 89' and the pawl 54', respectively, and carry the depression 111 into the path of the end of the lever 115'. Whereupon, the spring 56 will move the pawl 54', into the path of the teeth 46 of the disc 43' and the spring 91'' will so move said lever 115' as to carry the end thereof into said depression 111 and thereby arrest the rotation of the drum 70; at the same time so swinging the arm 116' as to engage the rod 121 and thereby swing the arm 118 out of the path of the lever 25. The lever 25 will thereupon be moved, by the tension of the contacts 21 and 22, so as to permit functional actuation of said contacts; and, during succeeding revolutions of the shaft 29, the disc 43' will be restored by a step by step action, and eight operative cycles will be imparted to the contacts 21 and 22, in a manner corresponding to that hereinbefore described in greater detail in connection with the operation of the disc 43 and the functional actuations of said contacts incidental thereto.

At the conclusion of the operative cycle of

the disc 43', the movement imparted to the arm 116' by the pin 117' will cause the withdrawal of the end of the lever 115' from the depression 111 in the drum 70, and said drum will thereupon so rotate as to bring the depression 109 into the path of the end 89''; whereupon the lever 87'' will move said end into such depression and thereby arrest the rotation of said drum and so condition its member 92 that said end 89'' will be withdrawn from such depression 109 after two operative cycles of the projection 30'', in a manner corresponding to that hereinbefore more fully explained in connection with lever 89.

If, now, the member 57 was initially conditioned for the formulation of but one round of the signal 99, the notch 68 will be presented to the projection 83 and the depression 86 will be presented to the lug 85, so that when said member 57 is brought to rest against the stop 52, the lever 79 will move in response to the spring 80 so as to carry the arm 81 into the path of the projection 82, and thereby arrest rotation of the shaft 29. If, however, the member 57 was initially conditioned for the formulation of two or more rounds of the signal, the notch 68 will not be presented to the projection 83, at the time when the depression 86 is presented to the lug 85 during the rotation of the drum 70 following the withdrawal of the end 89'' from the depression 109, and the rotation of said drum will therefore continue until arrested by the entry of the end 89 into depression 90; whereupon the sequence of operative cycles hereinbefore described in greater detail will be repeated.

It will thus be seen that there will be an interval following each round, during which there will be no signal strokes and which will therefore constitute a round pause; each of which intervals will have, under the conditions just described, a duration measured by the rotation of the shaft 29 for four revolutions. Inasmuch as such round pause interval extends from the last stroke of one round to the first stroke of the next round, it is evident that the commencement of said interval is substantially coincident with the conclusion of the operative cycle of the disc 43', at which time the movement imparted to the arm 116' by the pin 117' causes the withdrawal of the lever 115' from the depression 111 in the drum 70; whereupon said drum will so rotate as to bring the depression 109 into the path of the end 89'' of the lever 87'', which end will thereupon enter the depression 109 and stop the rotation of the drum 70. When the rotation of the drum 70 has been thus arrested, two supplemental revolutions of the shaft 29 will be required to cause the withdrawal of the end 89'', whereupon said drum will resume its rotation. As a result of such further rotation of

said drum, the depression 90 therein will be brought into the path of the end 89 of the lever 87, and said end will enter this depression and thereby again stop the rotation of said drum until said shaft 29 has made two more revolutions and thereby effected the withdrawal of said end 89 from said depression 90, whereupon said drum will turn until its movement is arrested when the lever 115 enters the depression 110 therein. Said drum will now be positioned for again rendering the actuating mechanism operative for the formulation of another round of the signal.

From the foregoing it will be apparent that, during the described operation of the mechanism, the duration of the "stroke intervals" will be co-extensive with the time required for one revolution of the shaft 29; the duration of the "digit-pauses" will be that required for two revolutions of said shaft; and the duration of "round-pauses" will be that required for four revolutions of said shaft. Thus, so long as said shaft is rotated at a substantially uniform speed, there will be substantial uniformity of all "stroke intervals", of all "digit-pauses", and of all "round-pauses", during ineffectiveness of the projections 31, 31', 31'' and 31''', and the projections 32, 32', 32'' and 32'''.

Assuming now that the lever 38 is positioned for causing fast speed signal formulation, the shaft 29 will be so positioned that operative relationship will be established between the projections 30, 31 and 32 and the arm 28, the projections 30', 31' and 32' with the disc 43 and the member 92, the projections 30'', 31'' and 32'' with the disc 43' and the member 92, and the projections 30''', 31''' and 32''' with the member 92''. It will therefore be evident that each revolution of the shaft 29 will render all three of the projections of each of the actuators effective for consecutively acting upon the part or parts with which they are operatively associated, to the end that there may be three operative cycles of actuation during each revolution of the shaft 29, instead of but one cycle as is the case when said shaft is positioned for slow speed signal formulation.

The detailed operation of the transmitter shown, when adjusted for fast speed operation, is identical with that during slow speed operation thereof, as hereinbefore described in detail, except as to the number of operative cycles of actuation for each revolution of the shaft 29; for this reason, such description will not be here repeated. It will, however, be apparent that, during fast speed operation, all "stroke intervals", "digit pause", and "round pauses" will be so shortened that the duration thereof will be but one-third of that during slow speed operation; so that adjustment of the lever 88 will cause substantially proportionate variations

in respective time intervals without varying the operating speed of the actuator shaft 29.

If it is desired to cause the formulation of a signal partly at one speed and partly at another speed, the lever 38 should be set for the speed at which it is desired to first transmit the signal, and, after the desired number of rounds have been transmitted at such speed, said lever should be moved to effect the desired change in speed of formulation. For example, if it is desired to cause the formulation of two rounds at fast speed followed by two rounds at slow speed, the lever 38 should be so positioned that the shaft 29 will be situated at the right hand one of the positions to which it may be moved, as viewed in Fig. 3, and the member 57 should thereupon be moved downward as far as it will go and then released, thus moving four of the teeth of the ratchet wheel 65 past the dog 67. Then, after the formulation of two rounds of the signal, the lever 38 should be so positioned that the shaft 29 will be situated in the left hand one of the positions to which it may be moved, as viewed in Fig. 3. This will result in the formulation of two rounds of the signal at fast speed followed by two rounds of the signal at slow speed in a manner corresponding to that hereinbefore described in greater detail.

Shifting the adjustment of the transmitter from that for fast to that for slow speed signal formulation, as just stated, will not incur any clashing of parts or any attempt to establish meshing relationship between gears or clutch members, moving at diverse speeds—as has been the case in prior transmitters—but will be accomplished by so positioning the shaft 29 that the paths of movement of the actuator projections 31, 32, 31', 32', 31'', 32'', 31''' and 32''' will not include the members which were operable thereby during fast speed formulation.

Digit-determining mechanism.

Reference has hereinbefore been made to number-determining mechanism for setting the transmitter so as to determine the number of strokes within individual digits, and the detailed construction and operation of such mechanism will now be more fully described. Two digit-determining mechanisms are shown which comprise the digit-setting members 40 and 40' hereinbefore referred to, each of which members carry the teeth 130 to 139, inclusive; one such tooth being provided for each digit for which the respective determining mechanism should be set. It will be understood by those skilled in this art that, although ten such teeth are shown for each of said members, a greater or lesser number may be provided, as circumstances may require. Inasmuch as said teeth and the mechanism cooperating therewith are identical for said members 40 and 40', they will

be described in detail only with reference to said member 40. Said teeth are spaced circumferentially around the member 40 in order of succession, and are also spaced lengthwise said member so that the path of movement of each of said teeth is independent of the paths of movement of all the others of said teeth, and the angular displacement between successive ones of said teeth is substantially the same as that between successive teeth 46 of the disc 43.

The manually operable keys, 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are associated with the teeth 130 to 139 inclusive, respectively; such keys being hereinafter referred to as "digit keys". Said digit keys are independently journaled on the shaft 141 and have the springs 143 so applied thereto as to urge movement thereof toward the fixed stop 142. The end 144 of each of such keys is so formed and positioned that movement of such key away from the stop 142 will carry said end 144 into the path of its associated tooth. A shoulder 145 is formed on each of said digit keys near the end 144 thereof, and the locking bars 146 (see Fig. 6) and 146' are pivoted on the shaft 147 for independent movement; said locking bar 146 having a projection 148 arranged for engagement with the shoulders 145 of the digit keys associated with the setting member 40, and the locking bar 146' being correspondingly arranged with reference to the keys associated with the setting member 40'. The springs 149, 149 are so applied to said bars 146 and 146', respectively, as to urge movement of such bars toward the position where their projection 148 will be disposed in the paths of the shoulders 145 of the digit keys associated respectively therewith.

Now again confining this description to the locking bar 146 and the digit keys associated with the member 40,—the projection 148 of said bar and the shoulders 145 of each of said keys are so relatively formed and arranged that when such shoulder of any one of said keys is situated below said projection, movement of such key in opposition to the pull of the spring 143 will cause said locking bar to carry said projection to a position which will permit its shoulder 145 as well as the corresponding shoulders of the other keys associated therewith to pass said projection, and so that when the shoulder 145 of any one of the keys associated with that particular locking bar is situated above the projection 148 thereof, such key will be so positioned that the end 144 thereof will be situated in the path of its associated one of the teeth 130 to 139, inclusive; and such key will be held against movement such as would withdraw its end 144 from the path of such associated tooth until said locking bar is moved out of the path of such shoulder 145, as by the elevation of the shoulder 145 of some other key incident to the manual actuation thereof.

It will thus be seen that any one of said keys may be moved from its normal position (where its shoulder 145 is below the projection 148 of the locking bar 146) to its set position (where said shoulder is above said projection) at any time when the locking bar 146 is not held against movement out of the path of the shoulders 145 of said key as hereinafter more fully described; and that when any key is so moved, it so displaces the locking bar 146 as to permit any key which had previously been so moved to be restored to its normal position by its associated spring 143, and the last key which has been moved to its abnormal position is there held until some other key is correspondingly actuated.

The arm 151 moves with the lever 87 and extends from said lever in a line substantially parallel with but somewhat below the unit key 0 to a point in approximate vertical alignment with the shaft 141 upon which said key is journaled, and the arm 152 depends from and moves with said key 0, and carries, at the free end thereof, a hook 153, which hook is so formed and positioned that when said key 0 is so positioned that the shoulder 145 thereof is above the projection 148 of the locking bar 146, said hook 153 will be disposed in the path of the free end of the arm 151 for the purpose of preventing such movement of said arm as would permit the end 89 of the lever 87 to enter the depression 90 in the drum 70.

The latch 154 cooperates with a pin 155 carried by the locking bar 146, so that said latch may, at times, prevent such movement of said bar as would permit the shoulders 145 of any of the digit keys from passing the projection 148 of said bar. A flexible arm 156 moves with the latch 154, the free end of said arm being so arranged with relation to the arm 151 that, when said arm 151 is in the position which it occupies when the projection 73 of the drum 70 has so engaged the end 89 of the lever 87 as to move said lever away from said drum, said latch 154 will be so positioned as to permit movement of the bar 146 such as will carry the projection 148 out of the path of the shoulders 145 of the digit keys, and so that said latch may lock the bar 146 when said lever 87 is in any of the positions to which it may be moved by means of the spring 91 when the projection 73 is not in the path of the end 89 of said lever.

The arm 151' (see Fig. 3) moves with the lever 87' and correspondingly cooperates with the arm 152 and hook 153 provided on the key 0 associated with the member 40', and with the latch 154 associated with the locking bar 146'.

Variable-signal operation.

The operation of the digit-determining mechanism which has just been described, is as follows.

The digit keys 0 of both groups may be normally depressed, thus positioning the hooks 153 in the paths of the arms 151, as indicated by Fig. 1.

To set the machine for the transmission of any desired signal number, the digit key of each group should be depressed which represents the digit which should occur in the formulated signal in a position relative to the other digit or digits corresponding to that group. For example, if it is desired to transmit the signal number 32, the digit key 3 in the left hand group as shown by Fig. 3 and the digit key 2 of the right hand group should be depressed. The movement thus imparted to said keys will cause their associated locking bars to withdraw the projections 148 carried thereby from the shoulders 145 of the keys 0 associated respectively therewith, and the springs 143 of such keys will thereupon move them so as to carry the ends 144 and shoulders 145 thereof out of the path of the teeth 130 and below the projections 148, associated respectively therewith. Such movement of said keys 0 will also cause the hooks 153 of the arms 152 associated respectively therewith to be withdrawn from the paths of the ends of the arms 151 and 151', respectively.

If, now, the transmitter is set in motion as hereinbefore described, the operation thereof will be the same as that already set forth in detail, except as to the following particulars.

Upon the initial rotation of the drum 70, when the projections 73 and 74 are withdrawn from the paths of the arms 87 and 87', respectively, the resultant movement of the arms 151 and 151' will permit the latches 154 to so engage the pins 155 as to retain the locking bars 146 and 146' against such movement as would permit the shoulders 145 of any of the digit keys to pass the projections 148 of said bars.

When the pawl 54 has been withdrawn from the path of the teeth 46 of the disc 43, the resultant rotation of said disc will be arrested by the engagement of the tooth 133 carried by the member 40 with the end 144 of unit key 3, when 3 of said teeth 46 have passed the end of said pawl 54; and, under like circumstances, the rotation of disc 43' will be arrested when two of the teeth 46' have passed the pawl 54', because the tooth 132 carried by the member 40' will then engage the end 144 of the unit key 2 associated therewith.

From the foregoing it will be evident that the signal number 32 will be formulated in a manner corresponding to that in which the signal number 99 was formulated under the circumstances hereinbefore described in greater detail.

When the transmitter is brought to rest at the conclusion of the transmission of a signal, such as that just described, the projec-

tions 73 and 74 carried by the drum 70 will cause such movement of the arms 151 and 151' as will disengage the latches 154 from their associated pins 155, and thus permit manual actuation of any of the digit keys. If, now, the key 0 of each group is moved against the tension of its associated spring 143, the parts will be returned to the position first described; or, if it is desired to set the transmitter for some other signal, the actuation of the digit keys representative thereof will cause restoration of the keys 3 and 2 previously used, and thus condition the machine for the formulation of such other signal.

If it is desired to cause the formulation of a signal consisting of but one digit, this can be effected by pressing the key representative of such digit in one group, and pressing the key 0 of the other group, (if same is not already in depressed position). Thereupon, if the transmitter is set in motion as hereinbefore more fully described, the operation thereof will differ from that hereinbefore stated in detail, in particulars as follows.

Assuming, for example, that the digit key 6 associated with the member 40 and the digit key 0 associated with the member 40' have been manually actuated (being those of the left hand and right hand groups, respectively, as shown in Fig. 3) and that the transmitter is thereupon started in operation, as hereinbefore more fully explained,—after the contacts 21 and 22 have been subjected to six operative cycles, and the disc 43 has been moved to a position where the pin 117 has engaged the arm 116 in a manner corresponding to that hereinbefore described in greater detail, upon withdrawal of the end of the lever 115 from the depression 110 in the drum 70, said drum will rotate until the depression 109 is presented to the end 89' of the lever 87', whereupon the rotation of said drum will be thereby arrested. In this connection, it will be observed that the end 89' of the lever 87' did not enter the depression 108 when same was presented thereto immediately after the withdrawal of the end of the lever 115 from the depression 110, because the arm 151 associated with said lever 87' was held by the hook 153 associated with the digit key 0 of the group which controls the member 40', so as to prevent such movement of said arm as would permit the lever 87', to carry the end 89' thereof into said depression 108; and, similarly, the end of the lever 115' did not enter the depression 111 during the rotation of said drum immediately after the depression 108 was presented to the end 89', as just described, for the reason that when the pawl 54' was withdrawn by the projection 72 from the teeth 46 of the disc 43', the end 144 of the digit key 0 associated with the tooth 130 of the member 40' was disposed in the path of said tooth and therefore prevented such movement of the

disc 43' as would have so carried its pin 117' away from the arm 116' as to permit the lever 115' to carry the end thereof into said depression 111.

It will be further observed that, because said arm 116' was so held against movement at the time when the depression 111 was presented thereto, said arm did not move to carry the arm 118 out of the path of the lever 25, and the contacts 21 and 22 were therefore not subjected to any operative cycles other than the six actuations which occurred while the end of the lever 115 was in the depression 110 of the drum 70.

If the digit key 0 of the group associated with the member 40 and, say, the digit key 4 of the group associated with the member 40' have been depressed at a time when the transmitter is set in motion, the levers 87 and 115 and the disc 43 will be correspondingly rendered inoperative, and the contacts 21 and 22 will be subjected to four cycles of functional actuation during the activity of the disc 43'; but otherwise, the operation of the various parts will correspond to that hereinbefore described.

More than two formulating speeds.

As already set forth in greater detail, the illustrative embodiment of this invention shown by Figs. 1, 2, 3 and 5 is arranged for operation at one or the other of two predetermined speeds; and, to this end, actuators comprising two groups of projections are therein provided for the actuation or control of each of the instrumentalities whose operation should be timed. Thus, the functional actuation of the signal formulating means is accomplished either by the one of such groups which consists of the projections 30, 31 and 32 or by the one which consists of the projection 30, as determined by the adjustment of the lever 38; the group consisting of the projections 30', 31' and 32' and the group consisting of the projection 30' being correspondingly associated with the digit-determining mechanism comprising the disc 43 and the pausing mechanism comprising the member 92, the group consisting of the projections 30'', 31'' and 32'' and the group consisting of the projection 30'' being correspondingly associated with the digit-determining mechanism comprising the disc 43' and the pausing mechanism comprising the member 92', and the group consisting of the projections 30''', 31''' and 32''' together with the group consisting of the projection 30''' are correspondingly associated with the pausing mechanism comprising the member 92''. It should, however, be understood that if greater disparity between fast and slow time operation of the transmitter is desired, it can be attained by providing a correspondingly greater disparity between the number of projections in one and the other of the groups

provided for the respective actuators; and if provision should be made for more than two speeds of signal formulation, this can be accomplished by providing as many groups of projections for each of such actuators as there should be speeds of signal formulation. Thus, for example, substitution of actuators each comprising three groups of projections as illustratively indicated by Fig. 7 for actuators each comprising but two groups of projections as illustratively indicated by Fig. 2 and hereinbefore described in detail, would enable the transmitter hereinbefore described to be adjusted for operation at any of three speeds.

Referring now more specifically to Fig. 7,—attention is directed to the dotted lines 160 and 161 by which the projections there shown are divided into three groups, one of which groups comprises the portion of the projection 300 situated between the dotted line 160 and the end of said projection adjacent thereto, another of which groups comprises the portion of the projections 300 and 310 which are disposed between the dotted lines 160 and 161, and the third of which groups includes the portion of the projection 300 situated at the side of the dotted line 161 farthest from the line 160 and the corresponding portions of projections 310, 320 and 330.

In this connection it should be noted that the word "group" is herein used to designate the projection or projections, such as those carried by the shaft 29, all or some portion of which move in any given path irrespective of whether other portions of one or more of such projections move in other such paths. Thus, in the case of Fig. 7, the portion of the projection 300 which extends from dotted line 160 away from dotted line 161 is herein referred to as a group, notwithstanding the fact that such "group" contains what might be termed but a part of one projection, being physically integral with the portions of said projection which form parts of other groups. Furthermore, the dotted lines 160 and 161 may be considered either as representing the division lines between three separate physical pieces or as representing boundary lines between portions of the respective parts which are alternatively available for the actuation of the instrumentalities cooperating therewith, depending upon the lengthwise positioning of the shaft 29. In any event, elements such as said projections should be angularly spaced and, in effect, move in diverse paths—as when disposed in diverse circumferential planes; which elements and the operating mechanism therefor constitute speed governed operating mechanism adapted to cause functional actuations of signal formulating means and pausing mechanism.

From the foregoing, it will be obvious that the substitution of actuators each having

three groups of projections, such as those shown by Fig. 7, for those having two groups of projections, such as those shown by Fig. 2, in a transmitter such as that hereinbefore described in detail, would provide for such adjustment of the shaft 29 as would cause but one functional actuation of the associated instrumentalities when the path of movement of the portion of the projection 300 extending from the dotted line 160 away from line 161 includes the cooperating part of such instrumentality, two functional actuations per revolution of said shaft when the path of movement of the portions of projections 300 and 310 which are situated between dotted lines 160 and 161 includes such cooperating part, and four actuations for each revolution of said shaft when the path of movement of the projections 320 and 330 and the portions of said projections 300 and 310 extending from the line 161 away from the line 160 includes such cooperating part.

Similarly, it should be understood that, for the purposes of this description, a given projection is considered as part of every group with which it has cooperative relationship, although the path of such projection may not at any time coincide with the paths of all other projections which at any time serve therewith as group constituents. For example, referring to Fig. 8, the projections 30^s does not at any time move in a path identical with that of the projections 31^s or 32^s, but, because the arm 28^s shown in association therewith is of such form that the projection 30^s may be brought into operative relationship with said arm either alone or concurrently with the projections 31^s and 32^s,—for the purposes hereof, such projection 30^s will be considered as constituting a group of one when positioned for operative relationship with the arm 28^s at a time when the projections 31^s and 32^s are not so positioned, and as forming one of a group of three projections when the shaft 29 is so positioned as to bring about operative relationship between all of such projections and said arm.

Inasmuch as those skilled in this art will readily understand, from the foregoing, that various other relative arrangements may be provided between projections having characteristics in common with those hereinbefore described and instrumentalities arranged for actuation or control thereby for effecting corresponding changes in speed of signal formulation, it is not deemed necessary to here provide further examples of such alternative arrangements.

As many changes could be made in construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matters contained in the foregoing description or shown in the accompanying drawings shall be in-

terpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween; excepting only those features which are disclosed in my co-pending application filed November 15th, 1919, Serial No. 338,287, Patent No. 1,570,596, dated January 19th, 1926, and features which constitute improvements of certain features of said application but which are not herein separately claimed.

What I claim and desire to secure by Letters Patent of the United States of America is:

1. In a signal transmitter comprising signal formulating means and pausing mechanism,—elements revoluble at a substantially uniform speed and adapted to thereby cause functional actuations of said means and said mechanism to formulate a series of strokes separated by time intervals of diverse relative durations, mechanism for variably determining the number of such strokes to be formulated, and means whereby the actuations of both said pausing mechanism and said number determining mechanism may be controlled by greater or lesser numbers of said elements to thereby effect substantially proportional variations in the durations of said intervals, respectively, while maintaining the speed of revolution of said elements substantially constant.

2. A signal transmitter having actuating mechanism including groups of revoluble projections, the projections of each group so formed and arranged that the number of and angular displacement between those moving past a certain point differ from the number of and displacement between those moving past another point, code signal formulating means involving means adjustable for variously determining the characteristics of such code signals, pausing mechanism for determining the time of occurrence and measuring the duration of pauses between groups of signal strokes within code signals, rounds-determining mechanism for determining the number of repetitions of the code signal and acting to measure the duration of the pauses between said code signals, means operable by projections of said respective groups for independently effecting functional actuation of said formulating means, said pausing mechanism and said rounds-determining mechanism, and selectively operable means for rendering effective those of the projections of said respective groups which move past a relative one or another of said points whereby substantially constant operating speed of said projections may effect a selected one or another of a plurality of speeds of signal formu-

lation and one or another of a corresponding plurality of pause durations within and between code signals.

3. A signal transmitter having actuating mechanism including groups of revoluble projections, the projections of each group so formed and arranged that the number of and angular displacement between those moving past a certain point differ from the number of and displacement between those moving past another point, signal formulating means and rounds-determining mechanism each operable independently of the other by projections of said respective groups for the formulation of code signals and for causing and measuring the duration of pauses between such signals, said formulating means involving means adjustable for variously determining the characteristics of such code signals, and selectively operable means for rendering effective those of the projections of said respective groups which move past a relative one or another of said points whereby substantially constant operating speed of said projections may effect a selected one or another of a plurality of speeds of signal formulation and one or another of a corresponding plurality of pause durations.

4. A signal transmitter having actuating mechanism including groups of revoluble projections, the projections of each group so formed and arranged that the number of and angular displacement between those moving past a certain point differ from the number of and displacement between those moving past another point, signal formulating means and pausing mechanism each operable independently of the other by projections of said respective groups for the formulation of code signals, said formulating means involving means adjustable for variously determining the characteristics of such code signals, and selectively operable means for rendering effective those of the projections of said respective groups which move past a relative one or another of said points whereby substantially constant operating speed of said projections may effect a selected one or another of a plurality of speeds of signal formulation.

5. A signal transmitter having actuating mechanism including a shaft revoluble at a substantially uniform speed and carrying groups of projections angularly spaced and of which those in each group are disposed in diverse circumferential planes, code signal formulating means involving means adjustable for variously determining the characteristics of such code signals, pausing mechanism for determining the time of occurrence and measuring the duration of pauses between groups of signal strokes within code signals, rounds-determining mechanism for determining the number of repetitions of the code signal and acting to measure

the duration of the pauses between such code signals, means operable by projections of said respective groups for independently effecting functional actuation of said formulating means, said pausing mechanism and said rounds-determining mechanism, and selectively operable means for rendering effective those of the projections of said respective groups which are disposed in a relative one or another of said planes whereby functional actuation of said formulating means, of said pausing mechanism and of said rounds-determining mechanism, incident to signal formulation, will be effected at a selected one or another of a plurality of speeds.

6. A signal transmitter having actuating mechanism including a shaft revoluble at a substantially uniform speed and carrying groups of projections angularly spaced and of which those in each group are disposed in diverse circumferential planes, signal formulating means and rounds-determining mechanism each operable independently of the other by respective groups of said projections for the formulation of code signals and for causing and measuring the duration of pauses between such signals, said formulating means involving means adjustable for variously determining the characteristics of such code signals, and selectively operable means for rendering effective those of the projections of said respective groups which are disposed in one or another of said planes whereby functional actuation of said formulating means and of said rounds-determining mechanism, incident to signal formulation, will be effected at a selected one or another of a plurality of speeds.

7. A signal transmitter having actuating mechanism including a shaft revoluble at a substantially uniform speed and carrying groups of projections angularly spaced and of which those in each group are disposed in diverse circumferential planes, signal formulating means and pausing mechanism each operable independently of the other by respective groups of said projections for the formulation of code signals, said formulating means involving means adjustable for variously determining the characteristics of such code signals, and selectively operable means for rendering effective those of the projections of said respective groups which are disposed in one or another of said planes whereby signal formulation will be effected at a selected one or another of a plurality of speeds.

8. A signal transmitter having actuating mechanism including a plurality of elements movable at a relatively constant speed, code signal formulating means involving means adjustable for variously determining the characteristics of such code signals, pausing mechanism for determining the time of occurrence and measuring the duration of

pauses between groups of signal strokes within code signals, rounds-determining mechanism for determining the number of repetitions of the code signal and acting to measure the duration of the pauses between such code signals, and selectively operable means for subjecting said formulating means, said pausing mechanism and said rounds-determining mechanism to independent functional actuation by greater or lesser numbers of said elements whereby substantially constant operating speed of said elements may effect a selected one or another of a plurality of speeds of signal formulation and one or another of a corresponding plurality of pause durations within and between code signals.

9. A signal transmitter having actuating mechanism including a plurality of elements movable at a relatively constant speed, signal formulating means and rounds-determining mechanism independently operable by certain of said elements for the formulation of code signals and for causing and measuring the duration of pauses between such signals, said formulating means involving means adjustable for variously determining the characteristics of such code signals, and selectively operable means for subjecting said formulating means and said

rounds-determining mechanism to independent functional actuation by greater or lesser numbers of said elements whereby substantially constant operating speed of said elements may effect a selected one or another of a plurality of speeds of signal formulation and one or another of a corresponding plurality of pause durations.

10. A signal transmitter having actuating mechanism including a plurality of elements movable at a relatively constant speed, signal formulating means and pausing mechanism independently operable by certain of said elements for the formulation of code signals, said formulating means involving means adjustable for variously determining the characteristics of such code signals, and selectively operable means for subjecting said formulating means and said pausing mechanism to independent functional actuation by greater or lesser numbers of said elements whereby substantially constant operating speed of said elements may effect a selected one or another of a plurality of speeds of signal formulation.

In witness whereof, I hereunto subscribe my name this 30th day of July, 1924.

NATHAN H. SUREN.