C. E. BEACH & H. W. DOUGHTY.

VARIABLE SIGNAL TRANSMITTER.

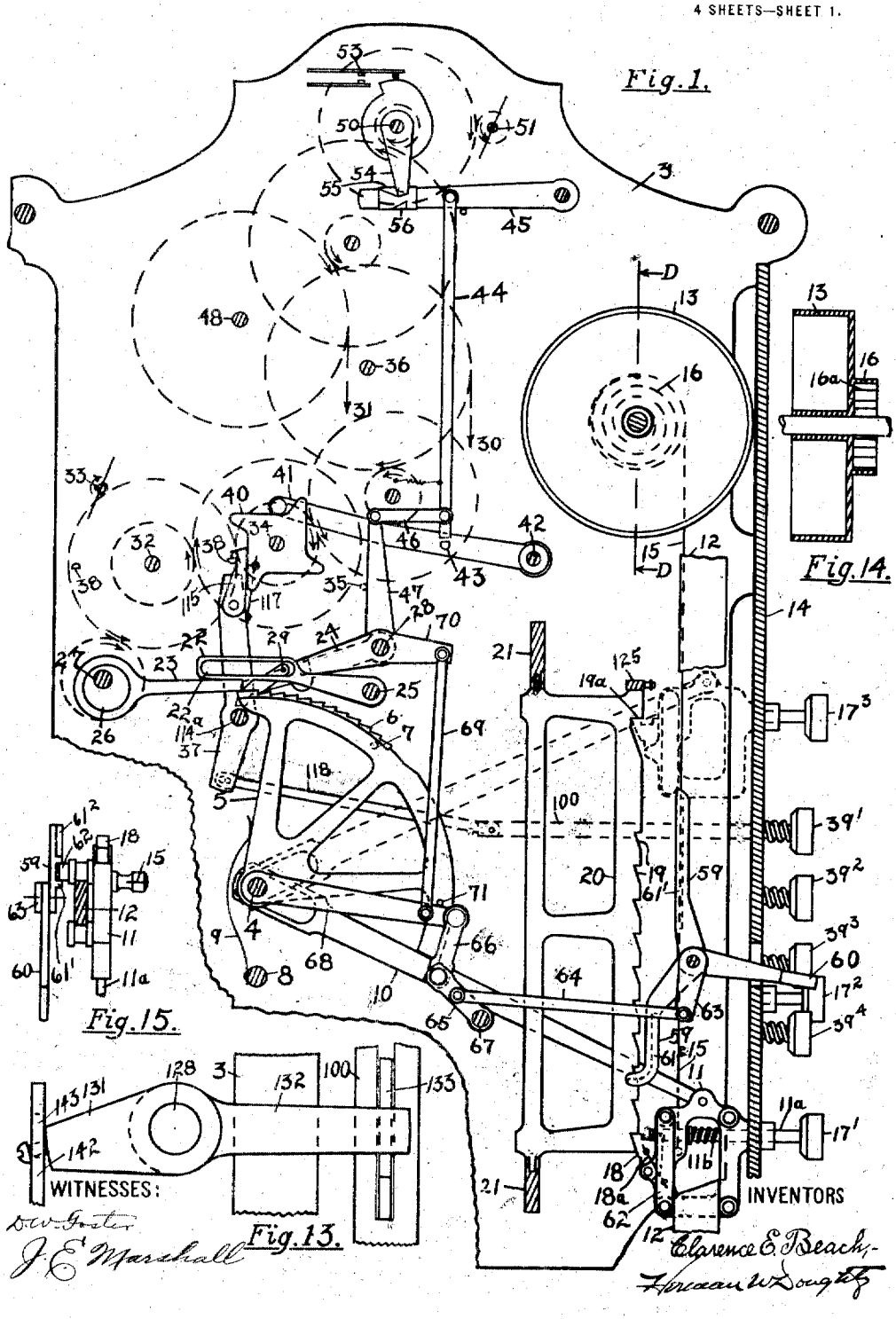
APPLICATION FILED AUG. 7, 1914.

1,237,234.

Patented Aug. 14, 1917.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

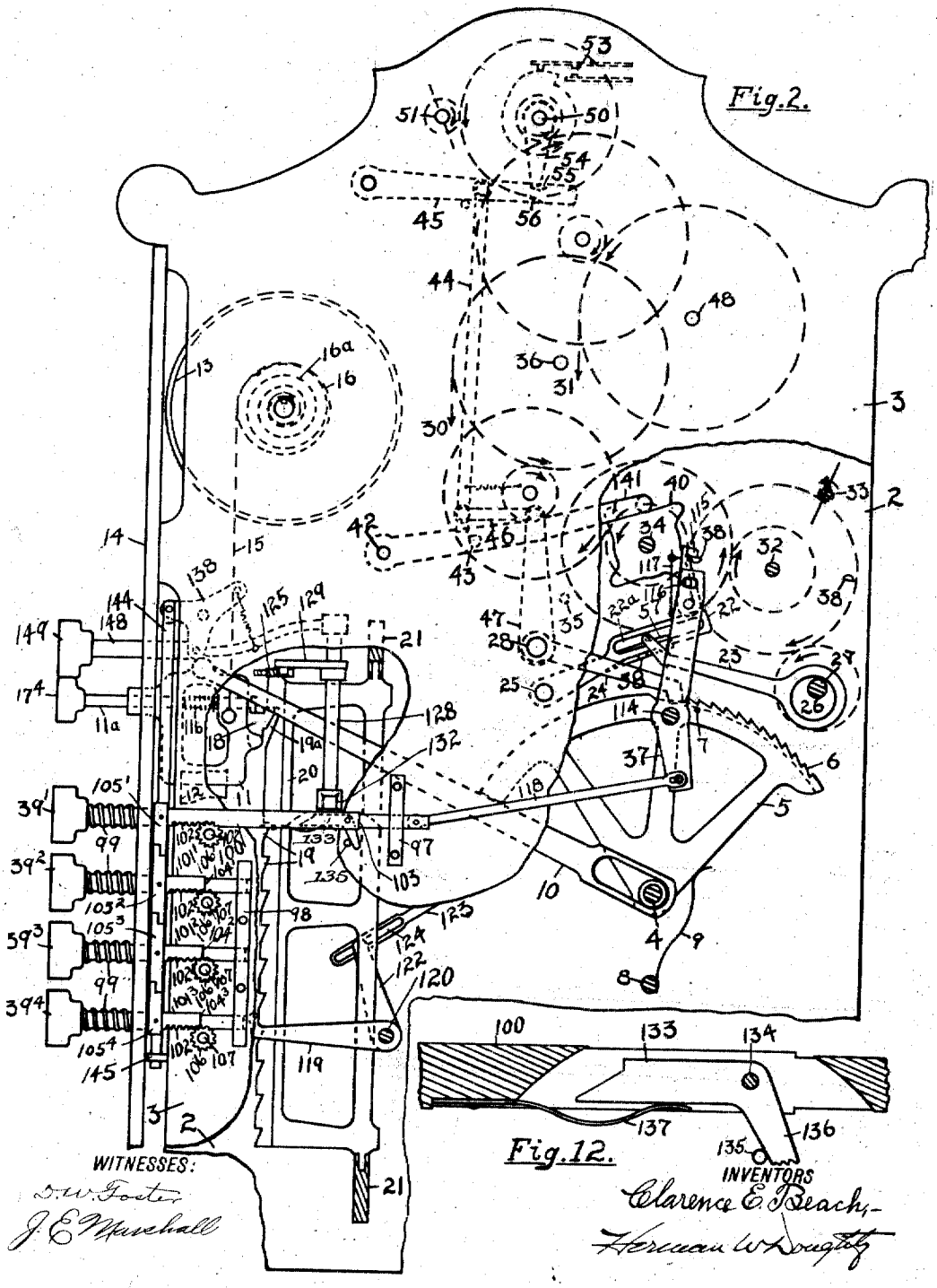

Fig. 12.

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4 SHEETS—SHEET 3.

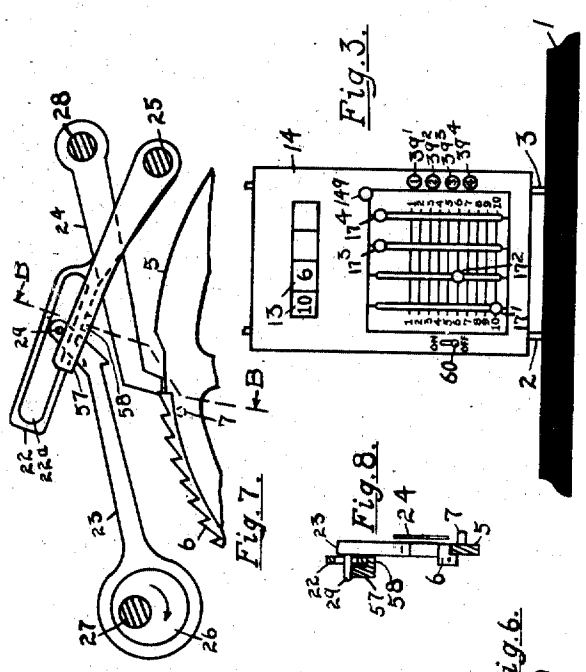

Fig. 3.

Fig. 7.

Fig. 8.

Fig. 6.

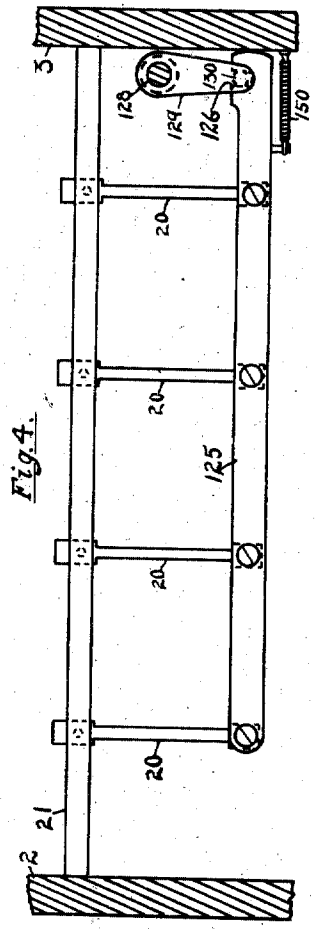

Fig. 4.

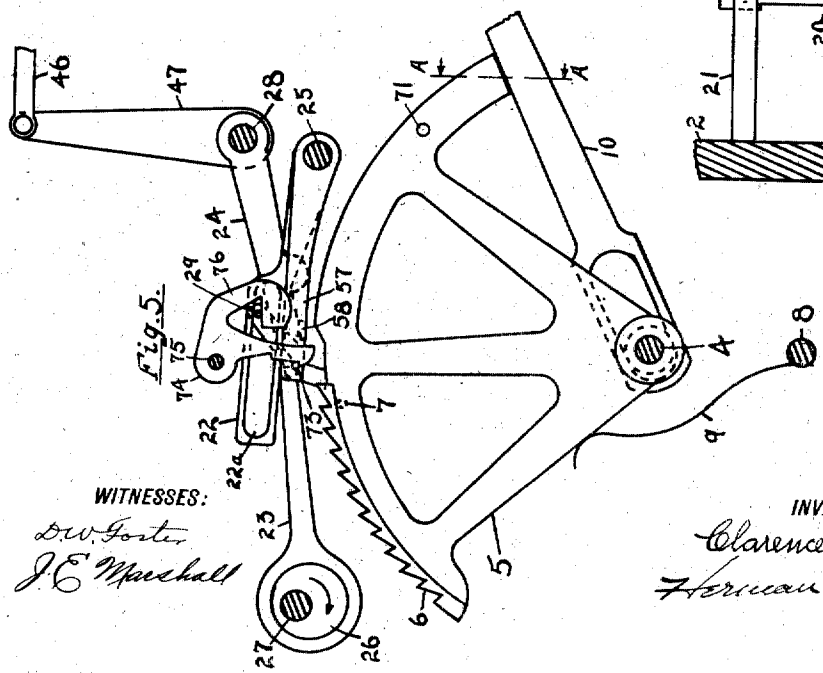

Fig. 5.

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4 SHEETS—SHEET 4.

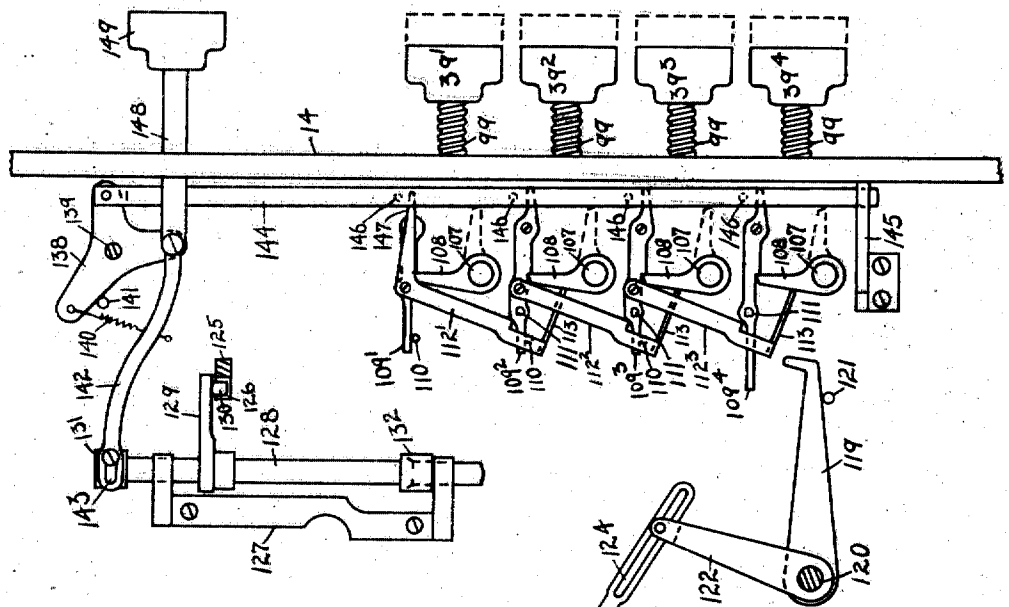

Fig. 9.

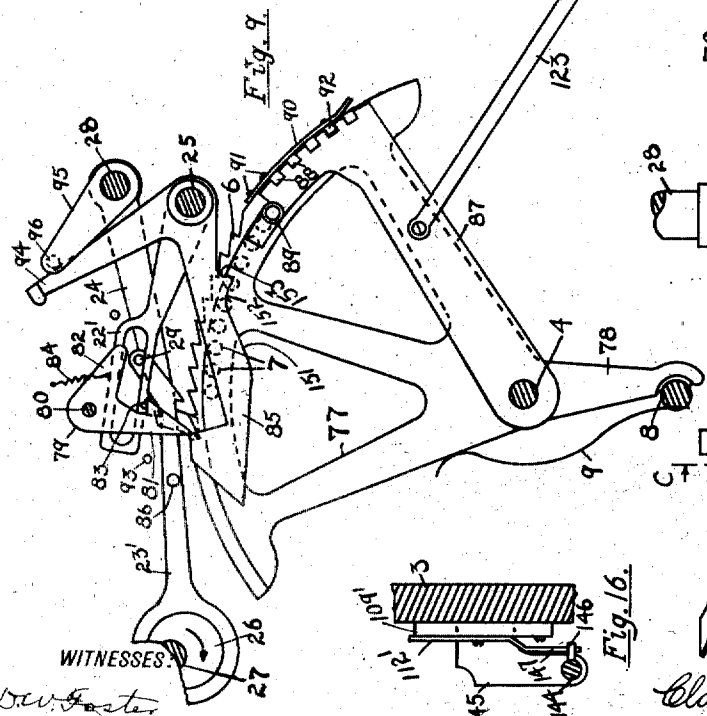

Fig. 10.

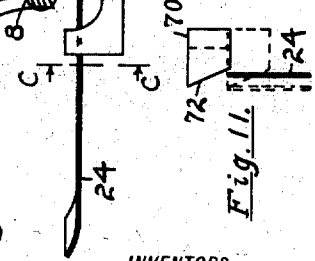

Fig. 11.

Fig. 16.

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UNITED STATES PATENT OFFICE.

CLARENCE E. BEACH AND HERMAN W. DOUGHTY, OF BINGHAMTON, NEW YORK, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

VARIABLE-SIGNAL TRANSMITTER.

1,237,234. Specification of Letters Patent. Patented Aug. 14, 1917.

Application filed August 7, 1914. Serial No. 855,632.

To all whom it may concern:

Be it known that we, CLARENCE E. BEACH and HERMAN W. DOUGHTY, citizens of the United States, residing at Binghamton, in the county of Broome and State of New York, have invented certain new and useful Improvements in Variable-Signal Transmitters, of which the following is a specification.

This invention relates to transmitters such as are suitable for control station fire alarm telegraph systems or other service where it is desirable to provide facilities for the rapid manual formulation of various signals.

This invention is particularly adapted to the type of such transmitters which is provided with operating handles or knobs for use in the formulation of different signals, by adjusting the various handles to the particular digit desired and then initiating the operation of the transmitter by any suitable mechanism.

When such a transmitter acts to formulate a signal comprising two or more digits, it is customary to have the pause or interval between the last stroke of one digit and the first stroke of the following digit substantially greater than the interval between the strokes within any digit, and it is also customary to arrange such transmitters so that if caused to repeat the digits, the pause from the last stroke of the last digit to the first stroke of the first digit in the next succeeding repetition of such digits will be substantially greater than the pause between the last stroke of any other than the last digit and the first stroke of the digit transmitted next thereafter.

One type of such transmitters is ordinarily provided with sectors and their associated parts mounted in suitable relation with a front plate having slots of such length that any one sector may be so adjusted as to permit the transmission of from one to ten consecutive strokes in the formulation of the portion of the signal represented by such sector.

On the front plate of such a transmitter, suitable indicating marks are provided along the slots to aid the operator, and when the setting handle has been moved for the purpose of formulating a signal and is then released, it is automatically returned to the mark last passed. Ten of these marks may be evenly spaced at comparatively widely separated points in a straight line within an area conveniently reached by the operator, thus increasing the accuracy and rapidity of the formulation of a signal by rendering it unnecessary to slowly and deliberately adjust the setting handles in order to stop them within extremely narrow limits.

When the indicating marks are comparatively widely separated an experienced operator is greatly assisted by his sense of position, which enables him to adjust the setting handles for the desired number of strokes without careful visual observation, as he unconsciously associates a certain digit with a certain position of the handles.

The indicating marks for as many as ten strokes may be thus widely separated and the variation in the unit of angular motion of the sectors may readily be compensated for in the design of the apparatus, since this variation for ten divisions would not be as great as the minimum unit of angular motion.

It is sometimes desirable to be able to formulate a signal having more than ten consecutive strokes, and while a sector may be so constructed that it may be adjusted to permit the transmission of more than ten consecutive strokes, yet in the use of a sector so constructed, the facility of adjustment and symmetrical appearance of the transmitter would be seriously impaired.

For example, when the number of strokes is greatly increased, the variation in the units of angular motion would become so great that the indicating marks could no longer readily be evenly spaced, thus confusing the sense of position of the operator and delaying his work in formulating a signal and increasing the chance of error.

The area necessarily occupied by these marks would further be more than proportionately increased, thus not only covering an excessive area but greatly detracting from the symmetrical appearance of the apparatus.

The starting mechanism provided upon transmitters heretofore used, whether of the type to which the other features of this invention particularly apply, or of other types, has been so constructed that although a certain movement of such starting mechanism

would set the transmitter in motion, a further movement of such mechanism was required to assure the complete transmission of the digits to which the transmitter was set, and the movement of said starting mechanism to various points would result in securing the transmission of the digits varying numbers of times, so that there is constant danger that when the operator is acting under stress of haste or excitement, he would either fail to move the starting mechanism far enough to secure the transmission of the digits the desired number of times or that he would move such mechanism so far as to cause such digits to be repeated a larger number of times than intended.

In the use of variable signal transmitters, occasions arise that after the transmitter has been set for certain digits and has been started to transmit said digits for a plurality of repetitions, said transmitter is urgently needed for the transmission of a more important signal, especially when such a transmitter has been set in motion for purposes of test or demonstration, but transmitters heretofore provided have embodied no means for abruptly clearing them of the signal to which they are set, and restoring the parts to normal condition, so that they may be set for the more urgent signal without awaiting the completion of the number of cycles of the operation of the transmitter to which it was set.

One of the objects of this invention is to provide means for formulating a signal having more than ten consecutive strokes without changing the construction of the sectors and without injuriously affecting the accuracy and rapidity of the work of an operator by varying the location of the indicating marks and also without destroying the symmetrical appearance of the transmitter.

Another object of this invention is to provide a transmitter of the character described having starting mechanism consisting of separately operable members so connected with the transmitting mechanism that when one of these members is operated, such transmitter will consecutively transmit the respective digits to which the setting handles for the sectors have been set, while if other of said members are operated it will set the transmitter in motion to repeat said series, so that, for instance, when released by the use of one of said members the series of digits will be transmitted once; when released by another member, twice; when released by another member, three times, etc., these members being so constructed and arranged that any movement of said members which is sufficient to set the transmitter in motion will assuredly set it in motion for the number of repetitions represented by said member.

A further object of this invention is to provide means which may be applied to any form of variable signal transmitter whereby when said transmitter has been set in motion for the repetition of certain digits a given number of times, such setting can be quickly cleared and the transmitter promptly brought to rest in condition to be set for and started to transmit a different signal by a simple movement of a single part.

Other objects of this invention are to provide a form of variable signal transmitter which will be positive and effective in action and which is adapted to be more economically manufactured and will require less skilled supervision than other like transmitters heretofore devised, and other objects are described in the following specification and more particularly pointed out in the claims.

In constructing this invention, a coupling means is provided, which, when manually set in one position, relatively so adjusts two of the sectors associated with the setting handles that when the transmitter is set in motion, the mechanism coöperating with such sectors will cause the pauses between all of the strokes transmitted thereby to be of the duration which the transmitter is intended to provide between the consecutive strokes of any digit to which it may be set, and the number of consecutive strokes transmitted will be represented by the sum of the digits to which said handles are set.

Starting mechanism is provided, consisting of a plurality of manually operable members so connected to the transmitter structure that the manual movement of any one of said members will release the transmitter mechanism from its detent.

In connection with these manually operable members, latching means is provided for holding them in the position to which they may be manually moved, and means operated by the transmitter in running is so applied to such latching means that the detent will only be rendered effective to stop the mechanism of the transmitter at the conclusion of the number of cycles represented by the particular manually operable member which has been manually operated.

The latching means is so applied to the manually operable members that none of said members may be moved to the position which will cause the detent to be disengaged from the transmitter mechanism without such member being caught by its latch.

In the preferred form of this invention shown in the accompanying drawings and hereinafter described, the manually operable members are so interlocked that when one of said members is manually operated it carries with it all of the members (if any) representing a lesser number of cycles

of operation of the transmitter than that represented by the member so operated, all of said members being provided with latching means so applied that they will be held after such manual operation as will result in the withdrawal of the transmitter detent and the disengaging means operated by the transmitter in running is so applied to said latching means that at the end of each cycle of the operation of said transmitter the one of said latches will be disengaged which holds the manually operable member then standing in operated position which represents the greatest number of cycles.

For quickly clearing the transmitter of any signal to which it has been set and restoring the manually operable members to their normal position, an unlatching means is provided which is connected to the latching means of all the manually operable members except the member which will be last released by the disengaging means operated by the running of the transmitter at the conclusion of each cycle thereof, so that at the conclusion of the current cycle of said transmitter mechanism, said latching means will be withdrawn from the last of the manually operable members and the detent rendered effective, and each of the setting handles provided for adjusting the transmitter to the particular digits desired are connected by restoring mechanism tending to move said setting handles and the parts associated therewith (which will be hereinafter referred to as "setting mechanism") to the position representing an absence of strokes for the digit represented by such setting mechanism (which position will be hereinafter referred to as the "unset position").

A locating mechanism and a latch are provided for each setting mechanism arranged to permit movement of the setting mechanism away from said unset position and to hold said setting mechanism at certain points against the tendency of the restoring mechanism to move said setting mechanism toward its unset position.

The unlatching means provided for manual unlatching of all but one of the manually operable members of the starting mechanism is also arranged to simultaneously disengage the locating mechanism and locating latches of all the setting mechanisms and thereby permit said mechanisms to be moved to their unset position by the restoring mechanism.

The locating mechanism and locating latches are so relatively constructed that when once so disengaged they cannot again be brought into such relation as to hold any of the setting mechanisms against the tendency of the restoring mechanisms until all of said setting mechanisms have been moved to unset position, means being provided for bringing said locating mechanism and locating latches into effective correlation when all of the setting mechanisms are in their unset position.

A separate tripping means is provided for causing the disengagement of the locating mechanism and the locating latches whenever the detent for the transmitter mechanism is moved to its effective position.

Suitable sectors are associated in suitable relation with the various manual setting mechanisms, together with such gearing and other mechanism as will suitably control and operate said sectors and cause the operation of suitable circuit changing means.

In order that this invention may be better understood, the drawings annexed to and forming part of this specification show a form of transmitter embodying the various features of this invention, but we do not limit ourselves to the construction shown, as it is evident that the features of this invention may be applied, either separately or in combination with each other, to various other forms of transmitters, and we do not limit ourselves to the construction or design of parts shown in the drawings hereinafter described, as the same are given merely for the clearer illustration of this invention, and many changes in construction and arrangement and insertion or omission of parts may be made without departing from the spirit of this invention.

In the accompanying drawings, in which like characters of reference denote the same parts throughout—

Figure 1 is a left side elevation, partly in section and with one frame plate removed, of a sector transmitter showing this invention applied thereto;

Fig. 2 is a right side elevation, partly in section;

Fig. 3 is a front view of such a transmitter;

Fig. 4 is a plan view showing the means for shifting the racks;

Fig. 5 is an enlarged view of the first sector and associated parts;

Fig. 6 is a section on the line A A of Fig. 5;

Fig. 7 is an enlarged view of a portion of the fourth digit sector and associated parts;

Fig. 8 is a section on the line B B of Fig. 7;

Fig. 9 is an enlarged view of the round pause sector and associated parts;

Fig. 10 is a further enlarged view of the flexible pause arm associated with the coupler mechanism;

Fig. 11 is a section on the line C C of Fig. 10;

Fig. 12 is an enlarged vertical sectional view of the tripping means;

Fig. 13 is a plan view thereof;

Fig. 14 is a sectional view on the line D D

of Fig. 1 showing the restoring mechanism;

Fig. 15 is a plan view of a detail of the coupling means; and

Fig. 16 is a plan view of a detail of the unlatching means.

In Fig. 3, 1 is the base which supports the frame plates 2 and 3, which in turn, carry the mechanism of the transmitter.

In Fig. 1, 4 is the sector shaft which extends across the transmitter, 5 is the first digit sector which is loosely mounted upon said shaft and is adjustable by means of the left-hand setting handle 17^1 shown in Fig. 3, and other similar digit sectors are similarly mounted upon the same shaft and provided with corresponding associated parts adapting them to be adjusted by means of the setting handles 17^2, 17^3 and 17^4; but as the construction and arrangement of the other digit sectors and their associated mechanism may be understood from the illustration and description of the first digit sector and its associated mechanism, in the interests of brevity and clearness, the other sectors and their associated parts are not indicated in Fig. 1, and will only be hereinafter briefly referred to.

The rim of each sector is provided with a flange which has a series of ratchet teeth 6 cut therein. At the end of the series of teeth, upon each of the digit sectors, the flange is cut away. 24 is a flexible pause arm rigidly secured to the pause shaft 28. The free end of this pause arm extends toward and to one side of the sector 5, and other corresponding pause arms are attached to the same shaft in like manner and similarly located with relation to the other sectors. 7 is a pause pin extending from one side of the sector 5 and adapted to engage with and operate its associated pause arm 24 when the sector is in a certain position. The pause arm 24 is shown as being rendered laterally flexible by constructing it from thin material, as indicated in Figs. 10 and 11.

The shaft 8 shown in Fig. 1 extends across the transmitter below the sector shaft 4, and in suitable relation to each sector there is mounted upon this shaft a sector spring 9 which is so constructed and applied that the force tending to move the sectors in clockwise direction is practically constant at all times, whether this force is mainly due to the weight of the sector when its center of gravity is to the right of its point of support, as shown in Fig. 1, or to the increased pressure of the spring when the sector is in a position where its center of gravity has been moved to the left, due to the movement of the sector in counter-clockwise direction.

For adjusting each of the digit sectors, a setting arm 10 is so mounted upon the shaft 4 that a portion of said arm will lie in the path of an offset end of the sector, as shown in Fig. 6, in which the setting arm 10 is shown in the path of sector 5.

One end of each setting arm is mounted upon the shaft 4 and is provided with a slot permitting suitable motion of the arm in the line of its longitudinal axis, and the other end of each setting arm is connected by a suitable pivot stud with a carriage provided therefor.

The carriage 11 shown in Fig. 1 is provided for controlling the position of the setting arm 10 coöperating with sector 5 and is operable by handle 17^1, similar carriages being controlled by setting handles 17^2, 17^3, and 17^4.

Each of the carriages is adapted to move upon a suitable vertical guide, the vertical guide 12 shown in Fig. 1 being provided for the carriage 11.

Each of the carriages is connected with a revoluble drum 16 by means of a flexible ribbon 15, and each drum is equipped with a restoring spring 16^a, tending to rotate such drum in a direction which will raise the carriage. In Figs. 1 and 14, the dial 13 is shown, said dial moving with said drum 16.

The shaft upon which the drums are mounted is secured against rotation and the drums are loosely mounted thereon, and suitable indicating numbers are provided around the periphery of each dial 13. In suitable relation to these numbers openings are provided in the front plate 14 (see Fig. 3), so that when any setting handle is adjusted for a certain figure, the same figure upon its dial will be presented to view through the opening in the front plate.

The restoring spring 16^a is suitably connected between the drum 16 and its shaft and is of such strength that it will raise the carriage 11 and connected parts against the force of gravity.

In suitable relation with each carriage is provided a rack plate 20 having ratchet teeth 19, and a locating latch 18 is mounted in each carriage for engaging the teeth of said rack plate, the construction and arrangement of these parts being shown in Fig. 1, in which the rack plate 20 is shown as being mounted in suitable relation to the carriage 11 and is adapted to be engaged by the locating latch 18 carried by said carriage 11.

The ratchet teeth 19 in the rack plate 20 are of such form as to arrest the movement of the carriage in one directoin but to permit it to be freely moved in the other direction. The spring 18^a tends to hold the locating latch 18 in the path of the teeth 19, but this latch may be withdrawn from the path of said teeth by means of the rod 11^a, which is loosely mounted in the carriage 11, and may be operated by the setting handle 17^1. The engagement between latch 18 and the rod 11^a is such that the latch 18 may vibrate

in passing over the teeth 19 without moving said rod 11^a, but the rod 11^a may be pulled forward by means of the handle 17^1, to a point where it will withdraw the latch 18 from the path of the teeth 19, the spring 11^b being provided for normally holding the rod 11^a out of engagement with the latch 18.

The travel of the free end of the latch 18 permitted by the rod 11^a is greater than the depth of the teeth 19, so that when the rack plate 20 is swung out of the path of said latch 18, said latch will be moved by the spring 18^a past the bottom of the notches of the teeth 19 and thereby prevent said rack plate 20 swinging to a position which will bring the teeth 19 into the path of the latch 18 until the carriage 11 moves to a point which brings said latch 18 opposite the notch 19^a, when, owing to the extra depth of notch 19^a, said latch 18 will no longer obstruct the movement of the rack plate 20.

Suitable supports 21 extend across the transmitter above and below the rack plates 20, said rack plates being pivotally mounted between said supports 21 near the edge of said rack plates farthest from the ratchet teeth 19, so as to permit said rack plates to swing into and out of the path of locating latches 18 coöperating therewith, and to thereby form disengageable locating mechanism.

A link 125 forms a connecting means for the free edges of the rack plates 20, and an extension of said link is provided with a notch 126 (see Fig. 4). A spring 150 is connected with the link 125 and tends to move said link in the direction which will bring the rack plates 20 in the path of their coöperating locating latches 18, thereby forming means tending to adjust the locating mechanism to engaged position.

A bracket 127 is mounted on the frame plate 3 in suitable relation to the notch 126 (see Fig. 9), a shaft 128 being journaled in said bracket and carrying the arm 129.

Near the free end of the arm 129 is mounted a pin 130 adapted to engage the notch 126 (see also Fig. 4).

The arm 131 (see Fig. 13) is mounted upon the shaft 128 and moves with the arm 129. An arm 132 carried by the shaft 128 and moving with the arm 129 extends at one side of and past the rod 100. A dog 133 (see Figs. 2 and 12) is pivoted at 134 in the rod 100 in suitable relation to the arm 132, so that the free end of said dog may engage said arm at certain times, thereby forming tripping means for the disengageable locating mechanism, and a stop-pin 135 is mounted in the path of the tail 136 of the dog 133, thereby forming disengaging means for said tripping means, said tail being so shaped that when the rod 100 is in the position shown in Fig. 2, the free end of the dog 133 will be held out of the path of the arm 132. A spring 137 carried by the rod 100 is so applied to the dog 133 as to tend to swing the free end of said dog into the path of the arm 132.

A three-arm bell crank 138 (see also Fig. 9) is pivoted at 139, a spring 140 being so applied to one arm of said bell crank as to tend to swing said arm against the stop-pin 141. A link 142 connects another arm of said bell crank with the arm 131 carried by the shaft 128, the slot 143 in the end of said link being of such length as to permit the arm 131 to move far enough to swing the rock plates 20 out of engagement with their coöperating latches 18, without moving the bell crank 138.

A rod 144 is mounted at one end in the bracket 145 to slide freely therethrough and the other end of said rod is pivoted to an arm of the bell crank 138. Pins 146 are mounted in the rod 144 in suitable relation to the latch dogs 109^1, ^{2}, ^{3}, ^{4} so that when the rod 144 is moved downwardly, suitable portions of the latch dogs 109^2, ^{3}, ^{4} will be engaged by their associated pins 146, and said latch dogs will be thereby disengaged from their coöperating latch arms 108.

The pin 146 mounted on the rod 144 near the latch dog 109^1 is so short that said pin may pass said latch dog without engaging therewith (see Fig. 16).

An arm 147 moving with the detachable bar 112^1 extends in the path of the pin 146 nearest to latch dog 109^1, and said arm 147 bears such relation to the latch dog 109^1, that when the rod 144 is being depressed for the purpose of disengaging the latch dogs 109^2, ^{3}, ^{4} from their associated latch arms 108, the bar 112^1 will be moved out of the path of its coöperating lug 111 before the latch dog 109^2 commences to rise in response to such movement of the rod 144.

The rod 148 is mounted in the plate 14 to pass freely therethrough and one end of said rod is pivoted to the arm of the bell crank 138 to which the link 142 is pivoted, and the other end of said rod 148 is provided with the unlatching button 149.

The teeth 19 (see Fig. 1) are so spaced as to be adapted to hold the carriage 11 opposite any one of the indicating marks provided on the front plate 14 (see Fig. 3), an extended blank space being provided above the tooth corresponding with the upper indicating mark, and a corresponding extension of the slot in the front plate above this mark being provided to permit the carriage 11 to move upward far enough to bring the pause pin 7 to the left of the free end of the pause arm 24 (as shown in Fig. 1) when the carriage 11 has not been moved down far enough to permit the latch 18 to engage with any of the teeth 19, and

the deep notch 19^a is located in such position that it will be engaged by the locating latch 18 when the carriage is in such highest or unset position, the other carriages, rack plates, slots and coöperating parts being similarly arranged.

The carriage 11 and setting arm 10 are shown in solid lines in Fig. 1 in the position they would occupy when adjusted for the transmission of ten strokes, and these parts are shown in dotted lines, in the same figure, in their normal or unset position.

The mechanism for actuating and holding the various sectors being substantially alike, and as a showing of all these parts in one figure would unduly complicate the drawing, Fig. 1 only shows necessary parts for cooperation with the first digit sector 5, and it will be understood that the following description of parts coöperating with sector 5 correspondingly applies to equivalent parts provided for coöperation with the other digit sectors.

The shaft 25 extends across the transmitter and has loosely mounted thereon a retaining pawl 22, having a projection adapted to engage with the teeth 6 carried by the sector 5.

An eccentric shaft 27 extends across the transmitter and bears suitable eccentrics 26, one of which is mounted in suitable relation to each of the sectors. The eccentric arm 23 is mounted upon eccentric 26 and said arm is provided with a lifting pin 29, of such length as to reach past the retaining pawl 22 and be adapted to be engaged by an arm mounted beyond said retaining pawl 22 (see Fig. 8). An opening 22^a is provided in the retaining pawl 22 in such position and of such shape as to permit the lifting pin 29 to reciprocate freely therein.

A projection is provided near the free end of the eccentric arm 23 which is adapted to so engage the teeth 6 on sector 5 that upon the rotation of eccentric 26, the sector 5 will be rotated in counter-clockwise direction against gravity and the pressure of spring 9. The construction of the retaining pawl 22 and the opening 22^a therein is such that when the sector 5 has been moved by the eccentric arm 23, the action of this retaining pawl will prevent the sector from moving in the opposite direction during the return stroke of the eccentric arm.

The throw of the eccentric 26 is such that the arm 23 reciprocates through a distance greater than the distance between any two of the teeth 6, but not so great as twice that distance.

For the purpose of successively rendering effective the retaining pawls and eccentric arms for the various sectors, an actuating arm 57 (see Fig. 5) is mounted by the side of each retaining pawl, all of said actuating arms being so connected as to move together, and said arms being set with a progressive angular displacement so that when the free end of the one of these arms which coöperates with the retaining pawl associated with the sector which may be adjusted by the setting handle 17^1 is held on a plane with the top of said sector, the free ends of the actuating arms associated with the other sectors will be a suitable distance above the tops of said sectors, and if the free end of the actuating arm 57 associated with the retaining pawl which coöperates with the sector which may be adjusted by the setting handle 17^2 is held on a plane with the top of said sector, the free ends of the actuating arms associated with the sectors which may be adjusted by the setting handles 17^3 and 17^4 will be a suitable distance above the tops of said sectors, and the same will be true of the relation between the actuating arms associated with the sectors which may be adjusted by the setting handles 17^3 and 17^4.

A lug 58 extends over the portion of the teeth 6 which are cut upon the flange of the sector 5 (as best shown in Fig. 8), and the purpose of this lug is to support the arm 57 of which it forms a part, so long as the flange of its coöperating sector lies within its path.

Similar lugs are provided upon each of the actuating arms, so that while any given sector is being moved in counter-clockwise direction (Fig. 1), its flange will cause its coöperating actuating arm to hold the actuating arms associated with the sectors located to the right of such actuated sector (looking at the front of the transmitter) in such position that the retaining pawls and eccentric arms associated with the other sectors will be held out of engagement with the teeth thereof; but as soon as the movement of the actuated sector has brought its flange out of the path of the lug of its coöperating actuating arm, such arm will be permitted to drop and thereby bring the actuating and holding mechanism for the sector located next to the right into operative condition.

It is evident that after any actuating arm 57 drops below the plane of the rim of its associated sector, the retaining pawl 22 associated with its sector will remain in effective position until such actuating arm 57 is raised to a plane above its associated flange and therefore said flange will be held out of the path of the lug or its actuating arm until said arm has been so raised.

For the purpose of measuring the silent interval immediately preceding each repetition, one of the sectors may be provided with additional pause pins and as herein shown a sector is provided which is not subject to the control of any of the setting handles or carriages, but having a plurality of pause pins and adjustable means for rendering a greater or smaller number of said

pause pins effective so that the duration of this silent period may be suitably adjusted.

This additional sector is shown in Fig. 9 and comprises the sector 77 pivoted on the shaft 4 and provided with a spring 9 acting in like manner to the springs 9 applied to the digit sectors.

A downwardly extending arm 78 is carried by the sector 77 and the free end of this arm is adapted to engage with the shaft 8 and thereby limit the rotation of the sector 77 in one direction.

A plurality of pause pins 7 are carried by the sector in suitable relation to its pause arm 24 so as to influence this arm in a manner similar to that described in connection with sector 5, these pins being so located with reference to each other that when the sector 77 is moved counter-clockwise, one of these pins will raise and support its cooperating pause arm 24, and thereafter the continued movement of the sector 77 counter-clockwise will cause other pause pins to successively support said pause arm; a sufficient number of these pins being provided to produce the longest silent period for which it may be desired to adjust the transmitter.

An arm 87 is mounted in suitable relation to the sector 77 and is provided at its free end with a series of notches 88 spaced at the same angular distance as the teeth of the sector 77.

A roller 89 is suitably mounted near the free end of the arm 87, for a purpose hereinafter described.

A spring 90 is secured to the sector 77 by means of the screws or rivets 91, and a block 92 is secured to the spring 90 near the free end thereof, said block being adapted to engage with any one of the notches 88, and the free end of said spring is so formed as to facilitate manual disengagement of this block from said notches.

The eccentric arm 23^1 is similar in construction and operation to the eccentric arm 23 already described.

The retaining pawl 22^1 is similar in construction to the retaining pawl 22 already described, and is pivoted on the shaft 25.

A latch 79 is pivoted on the frame at 80 and comprises the bell crank arms 81 and 82, the arm 81 being provided near its free end with a ledge from the end of which a slanting face extends to the end of said arm.

A pin 83 is mounted upon the retaining pawl 22^1 in such relation to the ledge carried by the arm 81 that said ledge may engage with this pin and thereby support the retaining pawl 22^1 out of engagement with the teeth of the sector 77 and carry the eccentric arm 23^1 by means of its lifting pin 29 out of engagement with said teeth.

A spring 84 is so applied to the latch 79 as to tend to move the arm 81 of said latch toward the pin 83, thus bringing the ledge under said pin whenever the pin is above said ledge and tending to hold the retaining pawl 22^1 in engagement with the teeth of the sector 77 by means of the slanting face when the pin is below the ledge.

The arm 82 of the latch 79 extends toward the shaft 25 and is of such form as to adapt it to be engaged by an arm carried by said shaft 25 so as to move the arm 81 away from the pin 83.

Pin 93 is mounted in the path of the arm 81 and is adapted to restrict the movement of said arm away from the pin 83.

A resetting lever 85 is secured to the shaft 25 to move therewith and the free end of said lever has a slanting face adapted to be moved in the path of a pin 86 carried by the eccentric arm 23^1 and so formed that when said face is in the path of said pin and the eccentric 26 is in one position the eccentric arm 23^1 may engage the teeth of the sector 77 but when said eccentric 26 is in another position the slanting face of the lever 85 will hold the eccentric arm 23^1 high enough to cause the lifting pin 29 to raise the retaining pawl 22^1 high enough to bring the pin 83 above the ledge carried by the arm 81 and thereby bring both the retaining pawl and eccentric arm out of engagement with the teeth of the sector 77.

The lower face of the lever 85 has formed therein a cam face 151 and a shoulder 153 adapted to be engaged by the roller 89 to be moved thereby so that when the roller 89 is brought against the shoulder 153 it will raise the resetting lever 85 to a point where the pin 86 will not be operatively affected by the slanting end of said resetting lever 85; and the lower face of said lever 85 between the shoulder 153 and the cam face 151 has a radial surface 152 adapted to maintain said resetting arm 85 in the position to which it is raised by engagement of the roller 89 with the shoulder 153 during the movement of the sector 77 represented by one of the teeth of said sector, whereupon said roller 89 will be brought into engagement with the cam face 151 and the movement of the sector 77 represented by the next tooth thereof will so raise the lever 85 as to bring the slanting face of the free end thereof into the path of the pin 86.

The upper surface of the lever 85 is shown cut away so that when this lever has been raised by the roller 89, said lever will not engage with the pins 29 or 83.

The arm 94 is carried by the lever 85 and the free end of said arm is adapted to engage with the arm 82 of the latch 79, to so move said latch as to bring the ledge carried by the arm 81 thereof out of the path of the pin 83.

Referring now to Fig. 5, a latch 74 is pivoted on the frame at 75 and is provided wit

an extension having two ledges adapted to coöperate with the pin 73 carried by the actuating arm 57 which coöperates with sector 5 associated with setting handle 17¹. These ledges are so positioned with relation to the pin 73 that when said pin is supported by either of these ledges, the arm 57 and associated arms will be held in such position that the retaining pawls and eccentric arms associated with the sectors will be held out of engagement with the teeth thereof, and said ledges are located one above the other so that when the upper ledge is withdrawn from supporting the pin 73, the movement of the actuating arm 57 may be arrested by the engagement of said pin 73 with the lower ledge before said arm 57 has dropped far enough to bring any of the retaining pawls or eccentric arms into engagement with their coöperating sectors.

An arm 76 of the latch 74 extends in the path of the lifting pin 29 carried by the eccentric arm 23 coöperating with sector 5, the arm 76 being so formed that when the pin 73 is supported by the upper ledge of the latch 74, the throw of the eccentric 26 will cause the eccentric arm 23 to move the pin 29 against the arm 76 and swing the latch 74 around its pivot 75 far enough to disengage the upper ledge from the pin 73, but the end of the arm 76 is provided with a ledge which will support the pin 29 and thereby prevent the eccentric arm 23 from dropping with the actuating arm 57 when the pin 73 is thus disengaged, and the portion of the arm 76 above said ledge is of such form that the throw of the eccentric arm 23 will not move the latch 74 far enough to withdraw the lower ledge from the path of the pin 73 while the pin 29 is supported by the ledge carried by the arm 76.

The face of the ledge carried by the arm 76 is of such length that when the eccentric 26 has drawn the arm 23 to the position which carries the pin 29 farthest from the arm 76, said pin 29 will be carried beyond the end of said ledge and will permit the eccentric arm 23 to drop down far enough to bring the pin 29 in the path of a projection carried by the free end of the arm 76.

The projection carried by the free end of the arm 76 is of such form that when the pin 29 is moved by the rotation of the eccentric 26 against the end of this projection, the lower ledge carried by the latch 74 will be withdrawn from the path of the pin 73 and the actuating arm 57 will be permitted to drop, carrying the pin 73 out of control of the latch 74. The portion of the latch 74 carrying the ledges engaging with the pin 73 must be so proportioned with relation to the pin 29 that said portion of the latch 74 will not interfere with the free movement of the pin 29.

The lever 85 (see Fig. 9) is secured to the shaft 25 in such position with relation to the actuating arm 57 coöperating with the sector 5 that when the lever 85 has been raised to its upper position said actuating arm 57 will be so raised as to carry its pin 73 above the upper ledge of the latch 74.

The arm 94 is so located upon the shaft 25, with reference to the actuating arms 57 carried by said shaft that said arm 94 will not engage with the arm 82 while any of the arms 57 are supported by their coöperating sectors.

A suitable governor (see Figs. 1 and 2), indicated by a characteristic representation of a fan, is mounted upon the shaft 33, and said shaft is connected by gearing with the shaft 32, which is, in turn, geared to the eccentric shaft 27. The cam shaft 34 is geared to the shaft 36 and to the shaft 32.

Only the pitch lines of the various gears are shown, the arrows indicating the direction of motion of the various shafts.

The releasing cam 40 is mounted upon the cam shaft 34, and is shown as having four lobes, and the ratio of the gearing between cam shaft 34 and eccentric shaft 27 is shown as 1 to 4. The ratio of this gearing to the form of this cam should, in all events, be such that one lobe of this cam will pass a given point upon each revolution of the eccentric shaft 27.

The releasing arm 41 is pivoted on the frame at 42 and is provided with a roller adapted to bear upon releasing cam 40.

The angular relation of the releasing cam 40 to the eccentrics 26 should be such that the releasing arm 41 is raised and allowed to drop while the eccentric arms are passing through their idle stroke.

The detent lever 45 is pivoted to the frame above the releasing arm 41 and normally rests against a suitable stop, as shown. The releasing bar 44 is suspended from a pivot stud upon the detent lever 45 and the free end of said bar extends in the direction and to one side of the releasing arm 41 when the transmitter is at rest, as shown by dotted lines in Fig. 2.

The releasing pin 43 is mounted on the releasing arm 41 in a position adapting it to engage the free end of releasing bar 44.

The releasing bar actuating arm 47 is mounted upon the pause shaft 28, and moves with the pause arms 24 which are also mounted upon said shaft, this arm 47 being of such length as to be adapted to move the free end of releasing bar 44 into or out of the path of releasing pin 43.

The link 46 is loosely connected to the free ends of the releasing bar 44 and the releasing bar actuating arm 47, said link 46 being of such length that when any pause pin 7 on any sector has been moved under and has thereby raised its pause arm 24, the free end of the releasing bar 44 will be

moved out of the path of the releasing pin 43.

A stop pin 35 is mounted on the frame and projects in the path of the releasing bar actuating arm 47, in such position that when the pause pins on the various sectors are withdrawn from the support of their operating pause arms, the rotation of the shaft 28, resulting from the weight of the pause arms, will be arrested when the free end of the releasing bar 44 has been brought into the path of releasing pin 43.

The arm 95 (see Fig. 9) is fixed upon the shaft 28 in such position that a pin 96 mounted in the free end of said arm may be engaged by the arm 94 so as to rotate the shaft 28 to the point which will carry the releasing bar actuating arm 47 clockwise (Fig. 1) far enough to move the releasing bar 44 out of the path of the pin 43 whenever the roller 89 has raised the lever 85 to its upper position.

The rotation imparted to the shaft 25 when the resetting lever 85 is raised by the roller 89 passing under the shoulder 153 is such as will raise all of the actuating arms 57 far enough above the rims of their coengaging sectors to carry the projections of the eccentric arms 23 and retaining pawls 22 associated with said actuating arms above the path of the ratchet teeth 6 of their associated sectors, and when the resetting lever 85 is raised by the roller 89 passing under the cam face 151, the rotation of such shaft is such as to bring the pin 73 (see Fig. 5) above the upper ledge of latch 74 and thereafter said latch 74 will prevent the pin 73 from dropping far enough to allow the shaft 25 to turn far enough to sufficiently withdraw the support of the arm 94 from the arm 95 to permit the shaft 28 to turn far enough to bring the free end of the releasing bar 44 into the path of the releasing pin 43 so long as said pin 73 is above either of the ledges formed in the latch 74.

The train thus far described constitutes means for causing vibration of the detent lever 45 and further provides means for determining the duration of the period which shall elapse between different vibrations, and for brevity and convenience, will hereafter be referred to as a determining train.

In addition to the determining train, a transmitting train is provided, said transmitting train being controlled by the detent lever 45 and arranged to suitably operate contacts 53, constituting circuit changing means.

Any suitable driving means may be employed for operating both the determining train and the transmitting train. In Figs. 1 and 2 such driving means is indicated digrammatically by the dash lines 30 and 31 and the arrows on the ends of these lines indicate the direction of the pull of the driving means thereon.

The transmitting train main shaft 48 is geared to the contact shaft 50. The shaft 51 is geared to the shaft 50 and carries a suitable governor, indicated by a characteristic representation of a fan. Suitable contact operating mechanism is carried by shaft 50 and is arranged to close and open the contacts 53 once during each revolution of the shaft 50.

The detent arm 54 is attached to the shaft 50 and has a laterally extending end. Detent ledges 55 and 56 are suitably mounted upon the free end of the detent lever 45 in such position that the ledge 55 will lie in the path of the laterally extending end of the detent arm 54 when the detent lever 45 is in its normal position, and the detent ledge 56 will lie in the path of the laterally extending end of the detent arm 54 when the detent lever 45 has been raised through the action of the cam 40.

The starting button 39^1 (see Fig. 2) is mounted upon the rod 100 which passes through front plate 14 and bracket 97 to slide freely therethrough, and the buttons 39^2, ^{3}, ^{4} are similarly carried by the rods 101^1, ^{2}, ^{3} respectively which pass through front plate 14 and the bracket 98. Restoring springs 99 are provided for moving the various buttons away from the front plate 14.

Upon the rod 100 and each of the rods 101^1, ^{2}, ^{3} a suitable rack 102 is cut, and shoulders 103 and 104^1, ^{2}, ^{3} are provided upon the respective rods to limit the motion of the buttons 39^1, ^{2}, ^{3}, ^{4} toward the plate 14. Blocks 105^1, ^{2}, ^{3}, ^{4} are provided upon the rods 100 and 101^1, ^{2}, ^{3} respectively, and form interlocking means between said rods, these blocks being so formed that when the button 39^1 is pressed, none of the other rods are affected, but if the button 39^2 is pressed it carries the rod 100 with it but does not affect rods 101^2, ^{3}. The block associated with button 39^3 similarly controls rods 100 and 101^1, but does not control rod 101^3, but the block 105^4 is adapted to carry all of the other rods with it when button 39^4 is moved toward front plate 14.

In suitable relation to each of the racks 102 a pinion 106 is mounted, said pinions being carried by the shafts 107 pivoted in the plate 3.

A latch arm 108 (see Fig. 9) is carried by each of the shafts 107 in such position that said arms will stand at approximately right angles to the axis of the rods 100 and 101^1, ^{2}, ^{3} when the buttons 39^1, ^{2}, ^{3}, ^{4} have been pressed toward the front plate 14 until the shoulders 103 and 104^1, ^{2}, ^{3} have abutted against the brackets 97 and 98.

The latch dogs 109^1, ^{2}, ^{3}, ^{4} are pivoted on

the plate 3, one of said latches being mounted adjacent to each of the latch arms 108, and a notch is provided on the lower side of each of these latch dogs, adapted to engage the free end of its associated latch arm 108 when said arm is in the position it occupies when the button associated therewith has been pressed toward the plate 14 as far as it will go, said latch arms and latch dogs thus forming a latching means for the starting mechanism.

Stop pins 110 are mounted in the path of the free ends of the latch dogs $109^{1, 2, 3}$ in such position as to support said latch dogs when they are not engaged by their corresponding latch arms 108.

Lugs 111 are suitably formed upon or applied to the latch dogs near the free ends thereof and detachable bars $112^{1, 2, 3}$ are pivotally mounted upon the latch dogs $109^{1, 2, 3}$ respectively, each of said bars being of such length that the free ends of said bars respectively extend somewhat below the latch dogs $109^{2, 3, 4}$.

Near the free end of each bar a shoulder is formed in such position that it may be brought into the path of the lug 111 carried by the latch dog next below the latch dog supporting said bar, so that when said shoulders lie within the path of their co-acting lugs 111, the lifting of any lug 111, by the movement of its latch dog to a distance sufficient to disengage its coöperating latch arm 10[illegible] will, by means of these detachable bar[illegible] raise all of the latch dogs 109^{1}, etc., situated above the latch dog so raised out of the path of their coöperating latch arms.

An ex[illegible]ension 113 from the free end of each det[illegible]chable bar lies in the path of the latch arm 108 which is directly below the arm 108 associated with the latch dog carrying said bar, said extensions being of such length that when any arm 108 is in its latched position, bar 112 carried by the latch dog associated with the next higher arm 108 will be moved out of the path of its co-operating lug 111. Said lugs, bars, and their extensions therefor form successive disengaging means for the latching means.

The latching means for the starting mechanism and the successive disengaging means for the latching means form accumulation mechanism which is responsive to the operation of the starting buttons or members $39^{1, 2, 3, 4}$ and, while the accumulation mechanism hereinbefore shown and described has numerous points of novelty and utility, it should be understood that the term "accumulation mechanism," as hereinafter used, is not limited to the particular construction shown and described but is intended to embrace other forms of mechanism which are adapted to have various accumulations imparted thereto and withdrawn or deducted therefrom.

The lever 37 (see Fig. 2) is pivoted at 114 on the frame, and near one end of said lever a detent 115 is pivoted.

A stop pin 116 is carried by this detent and extends through an opening in the end of the lever 37 for limiting the movement of said detent around its pivot. The hooked end of the detent 115 is so formed that when the lever 37 is in a certain position, said hooked end will act as a detent for the pins 38 which are mounted in a gear mounted upon the shaft 32, and the co-acting faces of said detent and pins are so formed as to provide considerable friction to disengagement thereof.

The pins 38 are each so located in relation to the releasing cam 40 and the eccentrics 26 that the engagement of either of these pins with the detent 115 will cause the determining train to stop with the releasing arm and the eccentric arms in the same relative position.

A spring 117 is so applied to the detent 115 that when the lever 37 has been moved far enough to positively disengage the detent 115 from one of the pins 38, said spring 117 will move the detent 115 still farther away from the path of the pins 38 until the motion of said detent is arrested by the engagement of the pin 116 with the lever 37.

The lost motion of the pin 116 in the opening provided therefor in the lever 37 must be sufficient to permit such movement of the lever 37 toward the path of the pins 38 as might result from the lost motion in the mechanism, without bringing the detent 115 into the path of the pins 38.

The lever 37 is connected to the rod 100 by the link 118, so that when the button 39^{1} is moved toward the front plate 14 until its associated latch arm 108 is caught by the latch dog 109^{1}, the detent 115 will be moved out of the path of the pins 38, thereby forming a releasing means, and when the button 39^{1} has been moved away from the plate 14 by its spring 99, upon the disengagement of the latch dog 109^{1} from its latch arm 108, the detent 115 will be carried into the path of the pins 38.

An arm 110 (see Figs. 2 and 9) mounted on the shaft 120 is so mounted that its free end may engage with the free end of the latch dog 109^{4} to move said latch dog out of the path of its coöperating latch arm 108. A stop pin 121 is mounted in the path of the arm 119 at such point as to permit said arm to move out of engagement with the latch dog 109^{4} when said latch dog is holding its latch arm 108.

An arm 122 is mounted upon the shaft 120 to move with the arm 119, and the free end of said arm 122 is connected to the arm 87

by means of the link 123, thereby providing operating means for the successive disengaging means. The link 123 is provided with a slot 124 of such length as to permit the arm 87 to be moved to the limit of its adjustment, and so that when said arm 87 is moved to the position where the roller 89 has raised the lever 85 to its highest position, the arm 119 will raise the latch dog 109^4 out of the path of its latch arm 108.

A coupling means is provided whereby the portion of the signal represented by setting handles 17^1 and 17^2 may be transmitted as a single digit, said coupling means being adapted to be adjusted by means of the coupler handle 60 which is pivoted to the frame and carries with it the arm 63 (see Fig. 1).

A toggle joint comprising the arm 65 and 66 is supported by means of a pivot 67 carried by the frame and connected to the lower end of arm 65.

The link 64 is connected at one end with the lower toggle arm 65 and at the other end with arm 63 moving with coupler handle 60 so that the movement of said handle will be suitably communicated to the toggle joint.

An arm 68 is pivoted upon the sector shaft 4 and the free end of said arm is so pivotally connected with the free end of the upper toggle arm 66 that the arm 68 will be raised when the handle 60 is elevated and will be dropped when the handle 60 is lowered, the angular movement thus imparted to the arm 68 being substantially equivalent to the angular distance between consecutive teeth 6 on the sector 5.

The pin 71 is carried by the first digit sector 5 and lies in the path of the arm 68, and the position of this pin is such that when the arm 68 is in its elevated position the sector 5 will be prevented from moving in a clockwise direction farther than the position it would occupy when in engagement with the setting arm 10 when the setting handle 17^1 is opposite the numeral 9 on the front plate of the transmitter.

The shifter arm 70 (see also Figs. 10 and 11) is loosely mounted upon the shaft 28 and is provided at one end with a slanting face 72 adapted to engage with the pause arm 24 and bend said arm sidewise out of the path of its coöperating pause pin 7.

The width of pause arm 24 where it is engaged by the upper edge of the slanting face 72 of the shifter arm 70 must be such that when said shifter arm has been moved to a position where it holds the pause arm 24 out of the path of its pause pin 7, the movement of said pause arm incident to the engagement of other pause arms with their coöperating pause pins must not disengage the pause arm 24 from the shifter arm 70. The link 69 so connects the shifter arm 70 with the arm 68 that when said arm 68 is in its elevated position, the slanting face 72 will force the pause arm 24 out of the path of its coengaging pin 7, and so that when the arm 68 is in its lower position, the slanting face 72 will be moved far enough away from the pause arm 24 so that said pause arm will not be affected thereby.

The coupler controlling arm 59 is suitably mounted to move with the coupler handle 60. The guides $61^{1,2}$ are secured to the controlling arm 59 (see also Fig. 15). The bar 62 is mounted upon the carriage 11 and the form and relative position of such bar and the guides $61^{1,2}$ are such that when the coupler handle 60 is in the position shown in Figs. 1 and 3, the bar 62 may freely pass between said guides, and so that when the carriage is in any position other than at digit 10 (as shown in these views) one or the other of said guides will abut against the bar 62 and thus prevent raising the coupler handle to its upper or "on" position. The form and arrangement of the guide 61^2 and bar 62 are also such that when the carriage 11 is in the "10" position, the coupler handle 60 is free to be raised to its "on" position, and if this is done, the lower end of the guide 61^2 will extend in the path of movement of the bar 62.

The lower end of the guide 61^2 is rounded off, as shown, so that if the carriage 11 is moved away from its "10" position while the coupler handle 60 is in its "on" position, the upper end of the bar 62 will engage this rounded lower end of the guide 61^2 and restore the coupler handle 60 to its "off" position.

The operation of the transmitter shown in the accompanying drawings is as follows:—

Assuming the various parts to stand in the normal or unset position, as shown in all figures except Figs. 1, 3, 9, and 14, and that suitable motive power is applied to the main shafts 36 and 48:

When it is desired to transmit a signal, each handle $17^{1,2,3,4}$, or so many of them as may be needed for the signal, is successively grasped and moved downward, starting with the handle 17^1 for the first digit of the signal, and released when it has been moved to a position where it is on a line with, or slightly below, the desired numeral, and in so moving the setting handle, its associated dial 13 is rotated by means of the ribbon 15 bringing into view through the opening in plate 14 the numeral corresponding to the one to which the setting handle has been adjusted.

When the carriage 11 is thus moved downward to a point carrying the locating latch 18 below anyone of the teeth 19 and is there-

upon released, the restoring spring 16^a will act through the ribbon 15 to raise the carriage until said locating latch 18 engages with the tooth last passed, thus accurately locating the sector associated with that carriage, with a minimum chance of error on the part of the operator.

If, in setting the transmitter, the operator accidentally moves one of the setting handles, as for example, handle 17^1 to a point where the latch 18 has passed too many of the teeth 19, such error may be corrected by pulling the handle 17^1 away from the front plate and thereby moving the latch 18 out of the path of the teeth 19 by means of the rod 11^a, whereupon the carriage may be raised the desired distance and the latch 18 again rendered effective by permitting the handle 17^1 to move toward the front plate 14.

If the signal is to be made up of one or more digits, none of which comprise more than ten consecutive strokes, such signal may be set upon the transmitter by the adjustment of the various handles as just described, and having thus adjusted the transmitter for the proper formulation of its intended signal, the transmission of such signal may be initiated by pressing one of the starting buttons, as for instance the top button 39^1 and thereby swinging the detent 115 out of the path of the pin 38.

Assuming that the setting handle 17^1 has been moved slightly below the indicating mark numbered 3 and the setting handle 17^2 has been moved slightly below the indicating mark numbered 2, and the setting handle 17^3 has been moved slightly below the indicating mark numbered 1, the dial 13 associated with the setting handle 17^1 would be held by the ribbon 15 in such position as to bring the numeral 3 thereon within the opening provided therefor in the front plate 14, and the dials 13 associated with setting handles 17^2 and 17^3 would be likewise held so as to similarly expose their numerals 2 and 1, respectively.

The setting arm 10 associated with setting handle 17^1 would stand in such position as would permit its associated sector 5 to move far enough to the right (see Fig. 1) so that five of the ratchet teeth 6 would lie to the right of the projections on the eccentric arm 23 and retaining pawl 22, and the setting arms 10 associated with the setting handles 17^2 and 17^3 would be so positioned as to permit four teeth and three teeth, respectively, to lie to the right of their corresponding eccentric arm and retaining pawl projections.

The retaining pawls and eccentric arms would all be normally held out of engagement with their associated sectors, the arms and pawls of the sectors associated with the setting handles being held out of engagement with their sectors by their corresponding actuating arms 57, because the actuating arm of the sector associated with the setting handle 17^1 is supported by the engagement of the lower ledge of the latch 74 with the pin 73 (see Fig. 5), and the retaining pawl 22^1 (see Fig. 9) would be supported by the engagement of its pin 83 with the ledge of the latch 79, thereby carrying the projection on eccentric arm 23^1 and the projection on said retaining pawl 22^1 out of the path of the teeth 6 of their associated sector.

The movement of the starting button 39^1 toward the front plate 14 would first so swing the lever 37 (see Fig. 2) as to bring the right-hand wall of the opening around the pin 116 against said pin, and thereafter, the continued movement of the button 39^1 would force the detent 115 out of engagement with the pin 38 by means of which said detent had held the shaft 32 at rest.

The movement of rod 100, in transmitting the movement of the starting button 39^1 to the lever 37, would also be transmitted to the upper latch arm 108 (see Fig. 9) through its associated pinion and rack, and said latch arm would be brought to a position where it would be latched by the latch dog 109^1 just before the rod 100 had been moved far enough to disengage the detent 115 from the pin 38, but a slight additional travel of the rod 100 would disengage said detent 115 from its pin 38 and thereupon the spring 117 would swing said detent still farther out of the path of the pins 38, so that when the button 39^1 is released and moved away from the front plate 14 in response to its restoring spring 99 until such movement is arrested by the shoulder of latch dog 109^1, stopping the rotation of latch arm 108, such movement will not swing the detent 115 into the path of the pins 38.

Upon the movement of the detent 115 out of the path of the pins 38, the gearing of the determining train will commence to revolve in response to the power of the driving means applied to the main shaft 36 and the eccentrics 26 will first draw the eccentric arms 23 back and a lobe of the cam 40 will raise the releasing arm 41 during the succeeding forward throw of the eccentrics 26, but this movement of the arm 41 will not be transmitted to the detent lever 45, because the free end of the releasing bar 44 is held out of line with the releasing pin 43 (as shown by dotted lines in Fig. 2) through the pin 73 (see Fig. 5) being supported on the lower ledge of latch 74 and thereby holding the shaft 25 in such position as to cause the arm 94 (see Fig. 9) to support the arm 95 in such position as will cause the shaft 28 to hold the arm 47 in the position shown in Fig. 2.

After the releasing arm 41 has been raised high enough to bring the pin 43 above the

free end of the releasing bar 44, the latch 74 (see Fig. 5) will be swung by the lifting pin 29 engaging with the projection on the arm 76 of said latch, and the pin 73 will thus be released from the lower ledge of said latch 74, and the eccentric arm 23 and retaining pawl 22 co-acting with the sector 5 associated with the setting handle 17^1 will be permitted to drop into the path of the teeth 6 of said sector and the arm 94 (see Fig. 9) will cease to hold the arm 95 in such position as to keep the free end of the releasing bar 44 out of the path of the pin 43, and said bar 44 will be moved against the side of the pin 43 by the weight of the pause arms 24.

At the end of the forward stroke of the eccentric arms 23, the releasing arm 41 will have dropped off from the lobe which lifted said arm during said forward stroke, thus permitting the free end of the releasing bar 44 to move into the path of the pin 43.

The continued movement of the eccentric 26 associated with the setting handle 17^1 will now draw back its eccentric arm 23 and with it its associated sector 5, which sector will be moved far enough to bring one of its teeth 6 behind the projection carried by its associated retaining pawl 22, which projection will prevent the return movement of said sector during the following forward movement of its associated eccentric arm 23.

During the subsequent rotation of said eccentric 26, the eccentric arm 23 will be carried forward in position to engage with another tooth of its associated sector 5, and during said forward movement of the eccentric arm the releasing arm 41 will be lifted by another lobe of the cam 40 and thereby lift the detent lever 45 through the engagement of the free end of the releasing bar 44 by the pin 43 and thus swing ledge 55 out of the path of the offset end of the detent arm 54 and permit the transmitting train to rotate the contact shaft 50 for one revolution, thereby suitably operating the signaling contacts 53 so as to produce suitable circuit changes in the signaling circuit connected thereto.

If the speed of the determining train, as fixed by the governor on shaft 33, is such that the detent lever 45 is held in elevated position by the cam 40 for a period longer than that required for one revolution of the shaft 50, as fixed by the governor on shaft 51, the rotation of said shaft 50 will be arrested by the engagement of the detent arm 54 with the ledge 56, but in any event, when the releasing arm 41 drops to its lower position, the detent lever 45 will be permitted to fall to the position where the detent arm 54 will be held by engagement with the ledge 55.

The continued rotation of the eccentric 26 will now cause the eccentric arm 23 to draw the sector 5 back another tooth, in which position said sector will be held as before, and during the subsequent forward stroke of the eccentric arm, the cam 40 will again raise the releasing arm 41 and cause the transmitting train to be again released.

After the transmitting train has been thus released three times, the sector 5 will be moved by its associated eccentric arm 23 to the position which will bring the pause pin 7 under the end of the pause arm 24, and thus turn the shaft 28 far enough to cause arm 47 to swing the free end of the releasing bar 44 out of the path of the pin 43 so that when the releasing arm 41 is next raised by the cam 40, the transmitting train will not be released.

It will thus be seen that after the transmitting train has been released three times during the forward strokes of the eccentric arms 23, said transmitting train will not be released during the next stroke, thereby producing a pause or interruption in the succession of changes in the signaling circuit controlled by the signaling contacts 53.

During the back stroke of the eccentric arm 23, which brought the pause pin 7 into operative engagement with the pause arm 24, the flanged portion of the sector 5 was withdrawn from the path of the lug 58 of the actuating arm 57, and said arm thereupon dropped until the corresponding arm associated with the setting handle 17^2 engaged with the flange of its coöperating sector.

During the back stroke of the eccentric arm 23 following the forward stroke during which the transmitting train was not released, the sectors 5 associated with setting arms 17^1 and 17^2 were each moved back one tooth and thus brought the pin 7 carried by the sector associated with setting arm 17^1 out of the path of its pause arm 24 and thereby permitted the free end of releasing bar 44 to swing into the path of the releasing pin 43, and said sectors will be held in this position by their retaining pawls 22.

During the next two revolutions of the eccentric 26 the transmitting train will be released by the lobes of cam 40 in the manner already explained and thereafter the pause pin 7 associated with the setting handle 17^2 will swing the free end of releasing bar 44 out of the path of the releasing pin 43 and thereby produce the pause indicating the termination of the second digit of the signal.

The parts associated with the setting handle 17^3 act in a similar manner and thereby cause the transmitting train to be released once, and when the actuating arm 57 is freed from the support of the flange of the sector 5 associated with said setting handle 17^3, the actuating arm 57 associated with the sector of the setting handle 17^4 will not be ar-

rested by said sector because said sector will be held in the unset position, as shown in Fig. 7, and the continued falling of the actuating arms 57 will turn the shaft 25 to the point which will bring the arm 94 (see Fig. 9) against the arm 82 and thereby swing the latch 79 out of the path of the pin 83 and permit the eccentric arm 23^1 and retaining pawl 22^1 to drop into engagement with the pause sector 77.

During the stroke of the eccentric arms 23, which carries the pause pin 7 of the sector associated with the setting arm 17^3 out of the path of its pause arm 24, the eccentric arm 23^1 will move the sector 77 to a position which will bring the first of its pause pins 7 in the path of its pause arm 24 and will therefore hold the shaft 28 in such position as will keep the free end of the releasing bar 44 out of the path of the pin 43.

The determining train will now continue to act without releasing the transmitting train until the sector 77 has completed its cycle of operation.

As the sector 77 is swung back, the roller 89 will be brought into the path of the shoulder 153 of the lever 85 and will raise said lever and thereby disengage the arm 94 from the latch 79 and successively swing the actuating arms 57 associated with the setting handles 17^4, 17^3, 17^2 and 17^1 above the flanges of their associated sectors and thereby lift their associated eccentric arms and retaining pawls out of the path of the teeth of said sectors, and after the movement of said sector 77 has so moved the actuating arms 57 the eccentrics 26 will make another revolution during which the roller 89 will be moved under the radial surface 152 without raising the resetting lever 85, so as to permit the sectors released by the lifting of the actuating arms 57 to fall until their movement is arrested by their respective setting arms 10 and they have settled down from any rebound incident thereto, whereupon the next back stroke of the eccentric arm 23^1 will bring the roller 89 against the cam face 151 of the resetting lever 85 and such back stroke of the eccentric arm 23^1 will carry said sector 77 to a position which, through the engagement of the block 92 with one of the notches 88 in said sector 77, will have carried the arm 87 to a point which has pulled the link 123 far enough to cause the arm 119 to swing against the latch dog 109^4 and thereby lift said latch dog.

Inasmuch as the starting buttons 39^2, 39^3 and 39^4 were not depressed at the commencement of the signal, the latch arms 108 associated with these buttons will be in the position shown by dotted lines in Fig. 9 and the detachable bars 112^1, 112^2, and 112^3 will be in engagement with their coöperating lugs 111, so that the movement thus imparted to latch dog 109^4 will be transmitted through the detachable bars to the latch dog 109^1 which will be moved out of engagement with its latch arm 108, thereby permitting its associated rod 100 to move out under the tension of the spring 99 and thereby swing the detent 115 into the path of the pins 38 just after one of said pins has passed above the path of said detent so that the shaft 32 will be permitted to turn nearly one-half of a revolution and the eccentrics 26 will turn nearly an entire revolution before the next pin 38 will be brought against said detent and thereby arrest the running of the determining train.

During such additional run of the determining train the eccentric arm 23^1 will complete its back stroke and thereby raise the resetting arm 85 high enough to turn the shaft 25 to a point which will carry the pin 73 above the upper ledge of the latch 74 (see Figs. 9 and 5) and soon after the commencement of the succeeding forward stroke of the eccentric arm 23^1 the pin 86 will ride up the inclined face of the end of the resetting lever 85 and thereby disengage said eccentric arm 23^1 and the retaining pawl 22^1 from the teeth of the sector 77 and raise said arm and pawl high enough to bring the pin 83 above the ledge carried by the latch 79; thereby permitting the sector 77 to swing forward until its motion is arrested by the engagement of its arm 78 with the shaft 8 and latching its eccentric arm and retaining pawl out of engagement therewith so that it will not be affected by the further operation of the determining train until the actuating arms 57 have all been again dropped below the flanges of their respective sectors.

During the forward stroke of the eccentric arm 23^1 in which the pin 86 carried said arm high enough to cause the pin 83 to be carried above the ledge of the latch 79, the pin 29 (see Fig. 5) was being carried by the eccentric arm 23 toward the arm 76 of the latch 74, and just after the pin 83 was carried above the ledge of the latch 79, as just described, the pin 29 was brought against said arm 76 and thereby swung the latch 74 far enough to disengage the upper ledge of said latch from the pin 73 but not far enough to carry the lower ledge of said latch out of the path of said pin, and thereupon said pin and the actuating arm 57 upon which it is carried dropped to the position shown in Fig. 5.

The movement of the rod 100 in swinging detent 115 into the path of the pins 38 also caused the dog 133 (see Fig. 2) to engage with and swing the arm 132 and the shaft 128 and arm 129 associated therewith so as to swing the rack plates 20 (see Fig. 4) out of the path of their coöperating locating latches 18 (see Fig. 1), which latches thereupon snapped back far enough to prevent said rack plates swinging into the path of

said locating latches and the continued movement of the rod 100 brought the tail 136 (see Fig. 12) of the dog 133 against the pin 135 and thereby disengaged the dog 133 from the arm 132.

When the rack plates 20 were thus swung out of the path of their coöperating locating latches 18, the springs 16^a acted through the ribbons 15 and raised the carriages 11 associated with the setting handles 17^1, 17^2, and 17^3 to their unset position, thereby bringing their associated locating latches 18 opposite the deep teeth 19^a of their associated rack plates and permitting said rack plates to swing into the path of said locating latches in response to the tendency of the spring 150, and thus all parts of the transmitter were restored to their normal or unset position.

If the signal had been initiated by pressing button 39^4 instead of button 39^1, the operation of the transmitter would be as already described except in the following respects:—

When button 39^4 was pressed toward the front plate 14, carrying rod 101^3 with it, the engagement of the interlocking block 105^4 mounted on said rod 101^3 with the block 105^3 mounted on rod 101^2 would have caused said rod 101^2 to move with the rod 101^3 and the rods 101^1 and 100 would likewise have been moved by their interlocking blocks 105^2 and 105^1 mounted thereon so that the rod 100 would have been caused to swing the lever 37 and withdraw the detent 115 from one of the pins 38 just as already described.

The movement of the rods 100, 101^1, 101^2, and 101^3 would have been communicated to the pinions 106 associated with the racks 102 formed in said rods to rotate the shafts 107 associated with said pinions (see Fig. 2) and thereby swing the latch arms 108 to the position shown by solid lines in Fig. 9, said latch arms being turned to the point where the shoulders of their associated latch dogs dropped in front of them just prior to the lever 37 reaching the point in its movement where it caused the disengagement of the detent 115 from its associated pin 38.

The movement of the latch arms 108 just described would cause said arms to engage the extensions 113 of the detachable bars 112^1, 112^2, and 112^3, and thereby swing said bars out of the path of their co-engaging lugs 111.

After the disengagement of the detent 115 from its associated pin 38, the determining train would operate as already described to cause the release of the transmitting train to formulate the digits 3—2—1 and after a suitable interval after the last stroke during which the transmitting train remained at rest, the movement of the sector 77 would be communicated to the arm 119 so that said arm would be brought in engagement with the latch dog 109^4 and would first lift and then drop said dog, thereby completing one cycle of the operation of the transmitter.

The operation of the various parts from the disengagement of the detent 115 to the lifting of the latch dog 109^4, would be identical with that described for the operation of the transmitter when the transmission of its signal was initiated by pressing the button 39^1, but as the button 39 would have now been pressed and the detachable bar 112^3 would have been moved out of the path of the lug 111 carried by said latch dog 109^4, the latch dogs 109^1, 109^2 and 109^3 would not be affected by this lifting of the latch dog 109^4 but the lifting of said latch dog 109^4 would disengage it from its associated latch arm 108 and permit the starting button 39^4 to be moved away from the front plate 14 by its restoring spring 99 and thereby turn its associated pinion 106, shaft 107 and latch arm 108 to the position shown in Fig. 2 by solid lines and in Fig. 9 by dotted lines, thereby carrying said latch arm 108 out of the path of the extension 113 of the detachable bar 112^3, and permitting said bar to swing against its associated lug 111, and upon the dropping of the arm 119 and latch dog 109^4 at the end of the cycle of operation of the transmitter, the detachable bar 112^3 would be swung by the force of gravity into the path of its associated lug 111.

Inasmuch as the movement of the rod 101^3 just described would not affect the rod 100, the detent 115 would not be brought in the path of the pins 38 and the running of the determining train would continue and the digits 3—2—1 would be again formulated by the transmitting train and after a run of the determining train thereafter without releasing the transmitting train represented by the travel of sector 77, the movement of said sector 77 would be again communicated to the arm 119 which would in turn, first raise and then drop the latch dog 109^4, thereby completing the second cycle of the operation of said transmitter.

This lifting of the latch dog 109^4 would be communicated through its lug 111 and the detachable bar 112^3 to the latch dog 109^3, and would thereby permit the starting button 39^3 to be moved away from front plate 14 by its spring 99.

The latch arm 108 associated with button 39^3 would thus swing out of the path of extension 113 of detachable bar 112^2 and said bar would be permitted to swing into the path of the lug 111 carried by latch dog 109^3.

At the end of the third cycle of the operation of the transmitter the movement imparted to latch dog 109^4 by arm 119 would be likewise imparted to latch dog 109^2 through

the engagement of detachable bars 112^2 and 112^3 with their associated lugs, and starting button 39^2 would thereupon be released and moved away from front plate 14 by its spring 99, permitting detachable bar 112^1 to swing into the path of its associated lug 111.

At the end of the fourth cycle of the operation of the transmitter, the four intended repetitions of the various digits having been formulated, thereby completing the signal for which the transmitter was set, the movement imparted to latch dog 109^4 by arm 119 would be transmitted to latch dog 109^1 through the detachable bars 112^1, 112^2 and 112^3 and their co-engaging lugs 111, and the parts would be restored to their normal or unset position in the manner already described.

If it is desired to formulate a signal of more than ten consecutive strokes, as, for example, sixteen (16) strokes, the setting handle 17^1 should be moved slightly below the indicating mark numbered 10 and the setting handle 17^2 should be moved slightly below the indicating mark numbered 6, whereupon the dials associated with said handles will indicate 10—6, as shown in Fig. 3, and the sector 5 associated with the setting handle 17^1 would be swung forward twelve teeth and the sector associated with the setting handle 17^2 would be swung forward eight teeth.

The coupling handle 60 should now be lifted from its "off" position to its "on" position, thereby straightening the toggle joint consisting of the arms 65 and 66 (see Fig. 1) and thereby raising the arm 68 and swinging the arm 70 by means of the links 69 around its shaft 28.

Such lifting of arm 68 would swing the sector 5 associated with the setting handle 17^1 back one tooth by means of the pin 71, and the swinging of the arm 70 would, by the action of its slanting face 72 upon the pause arm 24, swing said pause arm out of the path of its associated pause pin 7 (see also Figs. 10 and 11).

The transmission of the signal may now be initiated by pressing the desired one of the starting buttons, and during each cycle of the operation of the transmitter incident to the formulation of the signal so initiated, the operation of the various parts would be the same as already described except that the pause pin 7 carried by the sector 5 associated with setting handle 17^1 would not engage its associated pause arm 24, and therefore the series of circuit changes formulated by the transmitting train would be continuous during the movement of the sectors associated with said setting handles 17^1 and 17^2.

Through the use of the coupler mechanism the pause pin 7 associated with setting handle 17^1 would be thus rendered ineffective, but if this alone were done it would not only cause an uninterrupted series of circuit changes to be formulated by the transmitting train, but such series would comprise one more stroke than would have been formulated had this pause pin been effective. For this reason, the sector 5 associated with setting handle 17^1 was raised one tooth by the arm 68 acting against the pin 71 when the coupler handle 60 was raised so that the number of teeth of the sector 5 associated with said setting handle 17^1 in front of the projections of their co-acting eccentric arm 23 and retaining pawl 22 was reduced from twelve to eleven.

When the coupler handle 60 was raised as just described, the guide 61^2 was swung in the path of the bar 62 so that when the rack plate 20 was swung out of the path of the locating latch 18 associated with the setting handle 17^1 and its carriage 11 was thereupon lifted by the restoring spring 16^a acting through the ribbon 15, said bar 62 acted upon the guide 61^2 and restored the coupler handle down to its "off" position.

As the coupler mechanism is never needed for single digits of less than eleven strokes and inasmuch as digits of eleven strokes or over can be most conveniently formed by setting one handle for ten strokes and the other handle for the number of strokes in excess of ten strokes, the guides 61^1 and 61^2 act to hold the coupler handle locked in its "off" position except when the setting handle 17^1 has been moved to its "10" position.

It is therefore necessary to move said handle to its "10" position before the coupler handle can be moved to its "on" position.

If the setting handles 17^1, 17^2, 17^3 and 17^4 or any of them have been adjusted for the formulation of some signal (either for testing or demonstrating the transmitter), and it becomes desirable to quickly clear the transmitter from such setting and adapt it to be set for some other signal, although this result can be accomplished by withdrawing each of the locating latches 18, one after another, from its associated rack plate 20, by pulling its associated setting handle away from the front plate 14 and holding said handle out while it is moved to its unset position, or to the position to which it was desired to set such handle for the urgent signal, it is evident that if one of the setting handles which had been adjusted for the demonstration or test was not needed for the urgent signal, such handle might be overlooked, and through remaining as originally set, might cause an unintended digit to be included with the urgent signal. It is therefore preferable, under these circumstances, to press the unlatching button 149, thereby so moving the rod 148 and link 142 (see Fig. 9) as to swing the arm 131 and the arm 129 associated therewith to a point

which will carry the rack plates 20 out of the path of their co-engaging locating latches 18, whereupon the setting handles will all be restored to unset position by the restoring springs 16^a acting through ribbons 15 in the manner already described, and all parts of the transmitter will be brought to their normal or unset position.

If the transmitter was operating either for demonstration or test or for a comparatively unimportant signal, and it was desired to quickly render the transmitter available for some other signal without awaiting the completion of the cycles of operation for which its operation had been initiated, the unlatching button 149 should be pressed toward the front plate 14 whereupon the setting handles 17^1, 17^2, etc., will be permitted to return to their unset position, as just described, and at the same time, the movement of the rod 148 will be transmitted to the rod 144 through the bell crank 138, and thereby swing the latch dogs 109^2, 109^3, and 109^4 out of the path of their associated latch arms 108, thereby permitting the starting buttons 39^2, 39^3, and 39^4 to be instantly moved away from the front plate 14 by their associated springs 99 and thereby swing their associated latch arms 108 out of the path of the extensions 113 of the detachable bars 112^1, 112^2, and 112^3, and upon the release of the unlatching button 149, the said detachable bars will swing into the path of their associated lugs 111.

Such movement of the setting handles 17^1, 17^2, etc., to their unset positions carried the flanges of their associated sectors 5 out of the path of the actuating arms 57 associated therewith so that all of said actuating arms dropped below their associated flanges and thereby turned the shaft 25 to the point which brought the end of the arm 94 against the arm 82 and thereby swung the latch 79 out of the path of the pin 83, permitting the eccentric arm 23^1 and retaining pawl 22^1 to engage with the teeth of the sector 77 and cause said sector to swing the arm 119 against the latch dog 109^4 and thereby quickly bring the transmitter to rest after restoring all of the parts to their normal or unset position in the manner already described.

When the latch dogs 109^2, 109^3 and 109^4 were lifted as just described the short pin 146 adjacent to latch dog 109^1 engaged the arm 147 of detachable bar 112^1 and swung said bar out of the path of its coengaging lug 111, thereby preventing the movement of latch dog 109^2 being imparted to latch dog 109^1 even if the latch arm 108 associated with tarting button 39^2 was in the position shown by dotted lines in Fig. 9, so that the latch dog 109^1 can never be lifted by operating the unlatching button 149 but can only be lifted through the action of the arm 119 and the detent 115 will therefore only be brought into the path of the pins 38 at the completion of the cycle of operation of the sector 77.

If it is desired to vary the duration of the pause represented by the operation of sector 77, this may be accomplished by raising the free end of spring 90 so as to bring the block 92 above the notches 88 in the arm 87 and swinging said arm 87 with relation to the sector 77, it being evident that if the arm 87 is swung toward the teeth 6 of the sector 77, the roller 89 will be more quickly brought into engagement with the lever 85 and if said arm 87 is swung away from the teeth 6 of the sector 77, the roller 89 will be carried farther away from the lever 85, and the pause or period of inactivity of the transmitting train represented by the movement of said sector 77 will thus be correspondingly decreased or increased.

What we claim and desire to secure by Letters Patent of the United States is:—

1. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, locating mechanism for each setting mechanism adapted to hold said mechanism at certain points, restoring mechanism tending to move said setting mechanisms to their unset positions, means for disengaging said locating-mechanism, said means including devices for positively locking said locating-mechanism, whereby the latter will be locked against reëngagement and be unlocked only when all setting mechanisms are in their unset position and means tending to adjust said locating mechanism to engaged position.

2. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, locating latches, one of which is pivoted in a member of each of said setting mechanisms, locating mechanism for said latches, a spring adapted to move each latch into engagement with its locating mechanism, a manually operable rod adapted to move each latch out of engagement with its locating mechanism, a spring operating to move each rod out of engagement with its latch, restoring mechanism tending to move said setting mechanisms to their unset positions, means for disengaging said locating mechanism from said latches, said locating mechanism and latches being so constructed and arranged as to remain in disengaged relation when once disengaged until all setting mechanisms have been moved to unset position, and means tending to adjust said locating mechanism to engaged position.

3. In a variable signal transmitter, a plurality of manual setting mechanisms adapt-

ed to determine the extent of the groups of signals to be formulated by said transmitter, locating latches, one of which is associated with each setting mechanism, a suitable rack plate having ratchet teeth adapted to be engaged by said latch, suitable supports between which said rack plates are pivoted upon an axis parallel to the line of the ratchet teeth, connecting means for said rack plates adapted to rotate said plates around said axis, a manually operable unlatching means adapted to move said connecting means, restoring mechanism tending to move said setting mechanisms to their unset positions, said ratchet teeth and said locating latches being so constructed and arranged as to hold said racks in disengaged position when once disengaged until all setting mechanisms have been moved to their unset position, and means tending to adjust said rack plates to engaged position.

4. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter; locating mechanism for each setting mechanism adapted to hold said mechanism at certain points; a plurality of restoring mechanisms, one of which is associated with each setting mechanism, and each having a revoluble drum mounted in suitable relation to its associated setting mechanism, a restoring spring adapted to rotate said drum, and a flexible ribbon connecting said drum and its associated setting mechanism and adapted to be wound upon said drum upon rotation thereof by said spring and to thereby move said setting mechanism to its unset position; means for disengaging said locating mechanism, the coengaging portions of said locating mechanism and said setting mechanism being so relatively constructed and arranged as to be held in disengaged relation when once disengaged until all setting mechanisms have been moved to their unset position; and means tending to adjust said locating mechanism to engaged position.

5. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter; locating mechanism for each setting mechanism adapted to hold said mechanism at certain points; a plurality of restoring mechanisms, one of which is associated with each setting mechanism, and each having a revoluble drum mounted in suitable relation to its associated setting mechanism, a dial moving with said drum and marked with suitable characters for indicating the extent of the signal group represented by the associated setting mechanism, a restoring spring adapted to rotate said drum, and a flexible ribbon connecting said drum and its associated setting mechanism and adapted to be wound upon said drum upon rotation thereof by said spring and to thereby move said setting mechanism to its unset position; means for disengaging said locating mechanism, the coengaging portions of said locating mechanism and said setting mechanism being so relatively constructed and arranged as to be held in disengaged relation when once disengaged until all setting mechanisms have been moved to their unset position; and means tending to adjust said locating mechanism to engaged position.

6. In a variable signal transmitter, signal formulating mechanism adapted to formulate a constant series of signals, pausing mechanism operable by said formulating mechanism and adapted to act to separate said series into groups, a plurality of setting mechanisms controlling the operation of said pausing mechanism and each adapted to be set to determine the extent of a group of signals, and coupling means whereby, while two of said setting mechanisms are set, their groups of signals may be combined into one group.

7. In a variable signal transmitter, means for causing successive changes in one or more electric circuits, setting mechanisms adapted to adjust said transmitter to arrange said circuit changes into groups separated by time periods, said time periods between groups being of greater duration than the time periods between circuit changes within the groups, and coupling means whereby, while the transmitter is adjusted for a plurality of such groups, the time period between certain of said groups may be shortened so as to have no greater duration than the time period between successive circuit changes within a group.

8. In a variable signal transmitter, means for causing successive changes in one or more electric circuits, setting mechanisms adapted to adjust said transmitter to arrange said circuit changes into groups separated by time periods, said time periods between groups being of greater duration than the time periods between circuit changes within the groups, and coupling means adapted for operation only while the transmitter is so adjusted for the arrangement of certain pluralities of groups of circuit changes whereby the time period between certain of said groups may be shortened so as to have no greater duration than the time period between successive circuit changes within a group.

9. In a variable signal transmitter, means for causing successive changes in one or more electric circuits, setting mechanism adapted to adjust said transmitter to arrange said circuit changes into groups separated by time periods, said time periods between groups being of greater duration than the

time periods between circuit changes within the groups, coupling means whereby the time period between certain groups for which said transmitter is so adjusted may be shortened so as to have no greater duration than the time period between successive circuit changes within a group, and locking means for said coupling means controlled by the setting mechanism for one of said groups.

10. In a variable signal transmitter, signal formulating mechanism adapted to formulate a constant series of signals, pausing mechanism adapted to cause the interruption of said series, thereby forming groups of signals, means for varying the number of signals in said groups, coupling means whereby the signals of two of said groups may be formulated without an interruption between them, and a member moving with said coupling means and mounted in suitable relation to a member of the means for varying the number of signals in one of said two groups for locking said coupling means against movement to a position which will render said coupling means effective while the coöperating member of the varying means is in certain positions.

11. In a variable signal transmitter, a series of manually operable members for adjusting the number of cycles of the operation of said transmitter to be produced when said transmitter is released, each having a rack moving therewith, a restoring spring, a pinion adapted to engage said rack, a latch arm moving with said pinion, and a latch dog adjacent to said latch arm and adapted to engage the latch arm.

12. In a variable signal transmitter, a series of manually operable members for adjusting the number of cycles of the operation of said transmitter to be produced when said transmitter is released, each having a rack moving therewith, a restoring spring, a pinion adapted to engage said rack, a latch arm moving with said pinion, a latch dog adjacent to said latch arm and adapted to engage the latch arm; and suitable means operated by the transmitter in running for disengaging said latch dogs.

13. In a variable signal transmitter, a series of manually operable members for adjusting the number of cycles of the operation of said transmitter to be produced when said transmitter is released, each having a rack moving therewith, a restoring spring, a pinion adapted to engage said rack, a latch arm moving with said pinion, a latch dog adjacent to said latch arm and adapted to engage the latch arm; a series of detachable bars extending between adjacent latch dogs, each of which is arranged to be detached from one of its associated latch dogs by the latch arm coöperating with such dog when said latch arm is in position to be engaged by said dog; and means moved by the transmitter at the conclusion of each cycle of the operation thereof adapted to move one of said latch dogs to disengage it from its coöperating latch arm.

14. In a variable signal transmitter, a series of manually operable members for adjusting the number of cycles of the operation of said transmitter to be produced when said transmitter is released, each having a rack moving therewith, a restoring spring, a pinion adapted to engage said rack, a latch arm moving with said pinion, a latch dog adjacent to said latch arm and adapted to engage the latch arm; a detent for said transmitter controlled by one of said manually operable members; means moved by the transmitter at the conclusion of each cycle of the operation thereof adapted to move one of said latch dogs to disengage it from its coöperating latch arm; a detachable bar extending between two of said latch dogs and so coöperating with the latch arm engageable by one of said two latch dogs as to be adapted to transmit movement from said one latch dog to the other only when said latch arm is not in position to be engaged by its latch dog.

15. In a variable signal transmitter, a series of manually operable members for adjusting the number of cycles of the operation of said transmitter to be produced when said transmitter is released, interlocking means between said members permitting certain of said members to be moved without moving certain other of said members and causing the manual movement of certain of said members to be transmitted to certain other of said members, latching means adapted to hold said members in the positions to which they may be manually moved, a detent for said transmitter, releasing means operated by one of said manually movable members for moving the detent to disengaging position when said member is held by its latching means and for moving the detent to engaging position when said member is not held by its latching means, means tending to restore said manually movable members to the positions from which they may be manually moved, means for successively disengaging the latching means for said members, and means for operating said disengaging means at the conclusion of each cycle of the operation of said transmitter.

16. In a variable signal transmitter, adjusting means which may be set to condition said transmitter for a certain number of cycles of operation when released, latching means adapted to hold said adjusting means in set position, a detent for said transmitter, releasing means operated by said adjusting means for moving the detent to disengaging position when said adjusting means is held by said latching means and

for moving the detent to engaging position when said adjusting means is not held by said latching means, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, disengageable locating mechanism for each setting mechanism adapted to hold said mechanism at certain points, restoring mechanism tending to move said setting mechanisms to their unset positions, tripping means so connected with the releasing means as to be adapted to be operated to simultaneously disengage the locating mechanism from all of the setting mechanisms whenever said releasing means is moved to bring the detent to engaging position, means for unlatching said adjusting means and disengaging the locating means from all of the setting mechanisms, and means for disengaging the tripping means from the releasing means when the adjusting means has been moved to the position which carries the detent to engaging position.

17. In a variable signal transmitter, a series of manually operable members, controlling means whereby said transmitter is held at rest while said members are in normal position and is released while any member is in operated position, and restoring means responsive to the running of said transmitter for successively moving operated members from their operated to their normal positions.

18. In a variable signal transmitter, a series of manually operable members, controlling means whereby said transmitter is held at rest while said members are in normal position and is released while any member is in operated position, and restoring means responsive to the running to the said transmitter at the conclusion of each cycle of the operation thereof for successively moving operated members from their operated to their normal positions.

19. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, locating mechanism for each setting mechanism, a locating latch associated with each setting mechanism adapted to engage said locating mechanism, and admit of disengagement of the locating-mechanism therefrom, and upon disengagement to positively lock said locating-mechanism, whereby the latter will be locked against reengagement and be unlocked only when all setting mechanisms are in their unset position.

20. In a variable signal transmitter, a series of manually operable starting members, each separately operable holding mechanism for retaining said members in operated positions, and disengaging mechanism for said holding mechanism jointly controlled by the running of the transmitter and by said members.

21. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, locating mechanism for each setting mechanism adapted to be engaged by a suitable latch at certain points, a locating latch associated with each setting mechanism and adapted to engage said locating mechanism, and admit of disengagement of the locating-mechanism therefrom, and upon disengagement to positively lock said locating-mechanism, whereby the latter will be locked against reëngagement and be unlocked only when all setting mechanisms are in their unset position.

22. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, locating mechanism for each setting mechanism adapted to be engaged by a suitable latch at certain points, a locating latch associated with each setting mechanism and adapted to engage said locating mechanism, means for manually disengaging said locating latch and the locating mechanism, said locating latch and said locating mechanism being so relatively constructed and arranged that they will be held in disengaged position when once disengaged until all setting mechanisms have been moved to unset position.

23. In a variable signal transmitter, adjusting means which may be set to condition said transmitter for a certain number of cycles of operation when released, latching means adapted to hold said adjusting means in set position, a detent for said transmitter, releasing means operated by said adjusting means for moving the detent to disengaging position when said adjusting means is held by said latching means, and for moving the detent to engaging position when said adjusting means is not held by said latching means, and manually operable means for unlatching said adjusting means so as to prevent the commencement of further cycles of operation of the transmitter, regardless of the number of cycles for which it may have been manually adjusted.

24. In a variable signal transmitter, a detent therefor, releasing means for said detent, a plurality of manual setting mechanisms adapted to determine the number and extent of each group of signals to be formulated by said transmitter, disengageable locating mechanism for said setting mechanisms adapted to hold said mechanisms at certain points, restoring mechanism tending to move said setting mechanisms to their unset positions, tripping means so connected with the releasing means as to be adapted

to be operated to simultaneously disengage the locating mechanism from all of the setting mechanisms whenever said releasing means is moved to bring the detent to engaging position, means for disengaging the tripping means from the releasing means, and manually operable means for disengaging the locating mechanism from the setting mechanisms.

25. In a variable signal transmitter, a plurality of manual setting mechanisms adapted to determine the extent of the groups of signals to be formulated by said transmitter, a locating latch associated with each manual setting mechanism, means for manually operating each of said locating latches, restoring mechanism tending to move said setting mechanisms to their unset positions, locating mechanism adapted to be engaged by said locating latches to hold said setting mechanisms at certain points against the tendency of said restoring mechanism, means for disengaging said locating mechanism, and upon disengagement to positively lock said locating-mechanism, whereby the latter will be locked against reëngagement and be unlocked only when all setting mechanisms are in their unset position.

26. In a variable signal transmitter, a series of manually operable starting members, accumulation mechanism adapted to be operated in varying degrees by different members of said series, and restoring means for said accumulation mechanism operable by said transmitter in running.

27. In a variable signal transmitter, a series of manually operable starting members, accumulation mechanism adapted to be operated in varying degrees by different members of said series, and step by step restoring means for said accumulation mechanism operable by said transmitter in running.

28. In a variable signal transmitter, a series of manually operable starting members, accumulation mechanism adapted to be operated in varying degrees by different members of said series, and step by step restoring means for said accumulation mechanism operable by said transmitter at the conclusion of each cycle of the operation thereof.

29. In a variable signal transmitter, a series of manually operable members, means whereby the movement of one of said members to operated position will release said transmitter, and connecting means whereby the movement of any one of the other of said members to operated position will be communicated to said first named member, said connecting means being arranged to act through any intervening members in said series.

30. In a variable signal transmitter, a series of manually operable members, means whereby the movement of one of said members to operated position will release said transmitter, connecting means whereby the movement of any one of the other of said members to operated position will be communicated to said first named member, said connecting means being arranged to act through any intervening members in said series, and means controlled by the running of said transmitter for successively restoring said manually operable members.

31. In a variable signal transmitter, a series of manually operable members, means whereby the movement of one of said members to operated position will release said transmitter, connecting means whereby the movement of any one of the other of said members to operated position will be communicated to said first named member, said connecting means being arranged to act through any intervening members in said series, and means controlled by the running of said transmitter at the conclusion of each cycle of the operation thereof for successively restoring said manually operable members.

32. In a variable signal transmitter, signal formulating mechanism adapted to be adjusted to formulate groups of signals representing Arabic numerals expressing a number, and coupling means whereby, when said formulating mechanism is adjusted to formulate groups so expressing a number, groups representing adjacent numerals of such number may be combined into a group comprising signals equal in number to the sum of the numerals represented by the groups so combined.

In witness whereof, we have hereunto subscribed our names this 30th day of July, A. D., 1914.

CLARENCE E. BEACH.
HERMAN W. DOUGHTY.

Witnesses:
HARRY F. HOLTON,
D. WINTHROP FOSTER.