

Oct. 13, 1936.

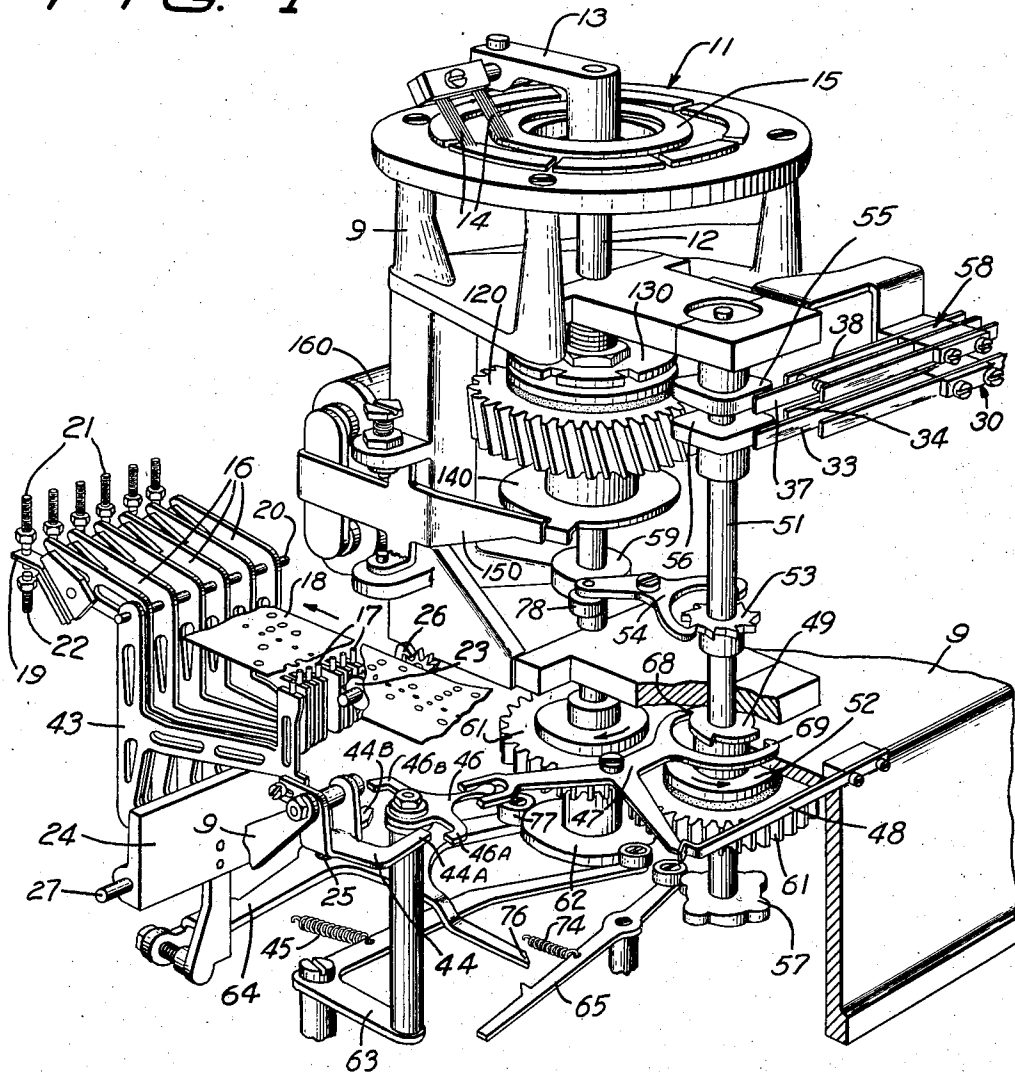
L. M. POTTS

2,057,111

TELEGRAPH TRANSMITTER

Original Filed Dec. 20, 1933 3 Sheets-Sheet 1

FIG. 1



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TELEGRAPH TRANSMITTER

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FIG. 2

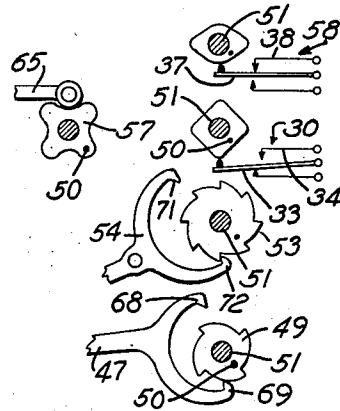
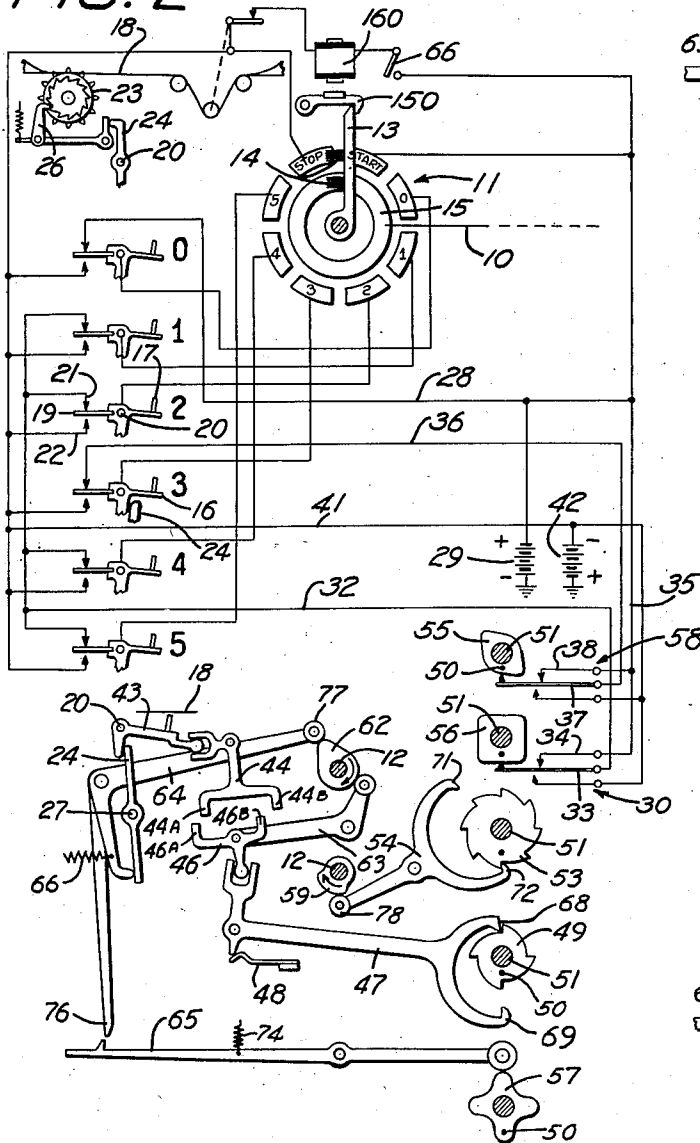


FIG. 5

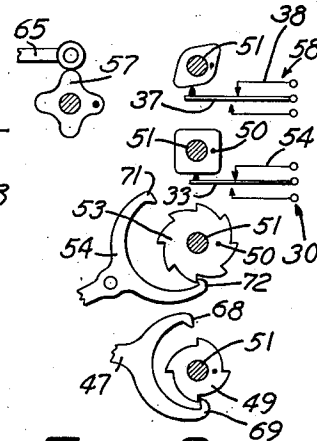


FIG. 6

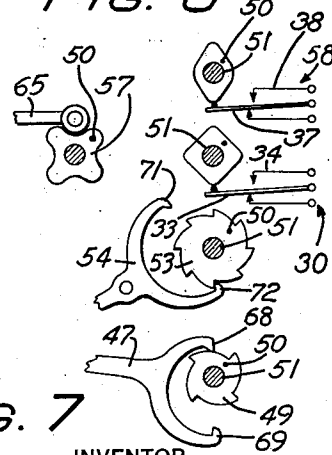


FIG. 7

FIG. 3

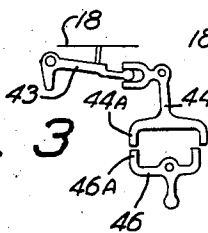
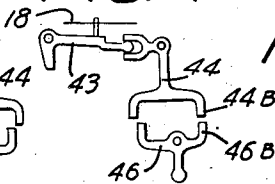


FIG. 4



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TELEGRAPH TRANSMITTER

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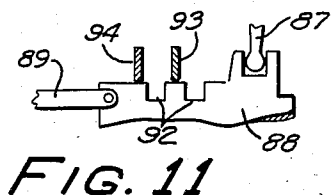


FIG. 8

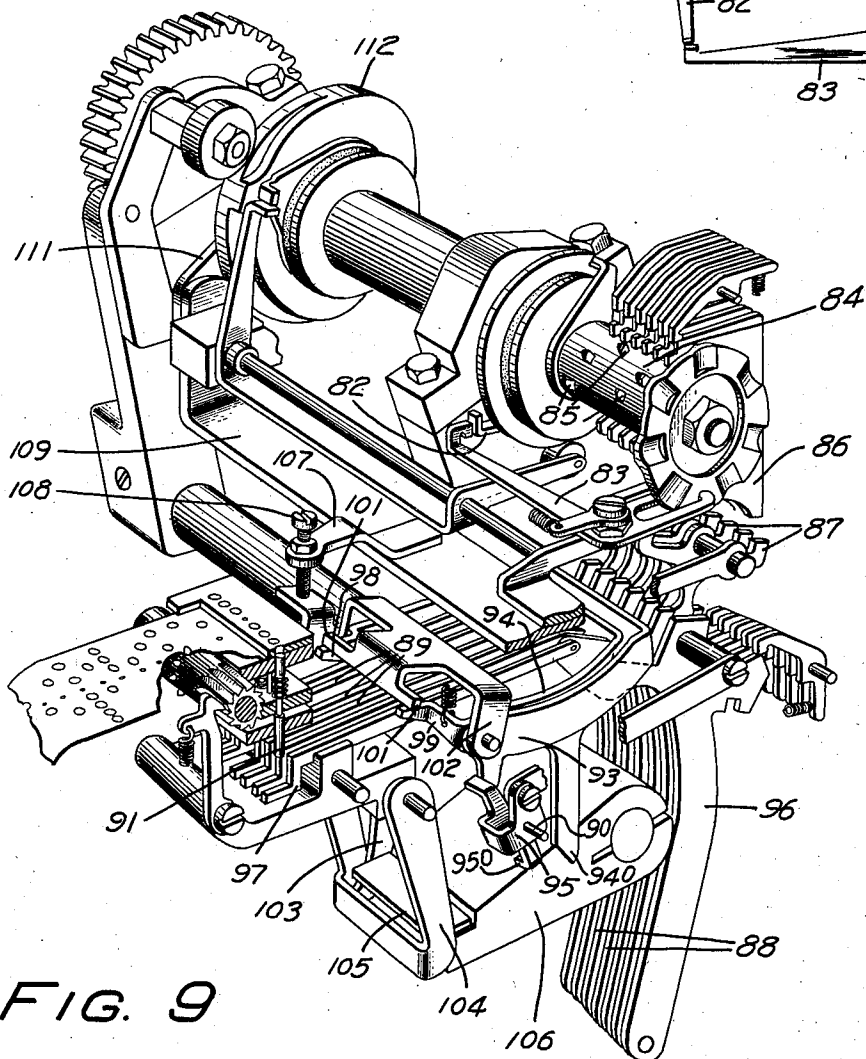
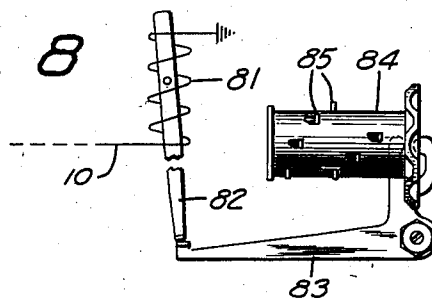


FIG. 9

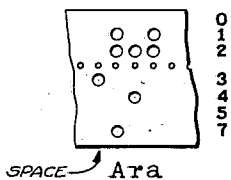


FIG. 10

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2,057,111

TELEGRAPH TRANSMITTER

Louis M. Potts, Evanston, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Application December 20, 1933, Serial No. 703,219
Renewed August 17, 1935

57 Claims. (Cl. 178—17)

This invention relates in general to telegraph systems and apparatus and more particularly to tape controlled transmitting devices and tape-forming receiving devices and methods for operating such devices.

Systems comprising telegraph codes having uniform numbers of unit impulses are widely employed for the control and operation of various telegraph apparatus such as printers, keyboard mechanisms, and the like. Two such code systems are generally employed and are known as the five- and the six-unit codes, each of which is specifically used where its basic permutation possibilities more nearly approximate in number the number of frequently used selective requirements of a particular apparatus. The five-unit code affords thirty-two basic permutative possibilities, while the six-unit code affords sixty-four, each unit number constituting the exponent of a power of two in calculating its total number of permutative possibilities, two being the number of electrical conditions permitted for each impulse.

Where a larger number of selective requirements are needed in the use of either code, a shift operation may be introduced which conditions receiving apparatus to be responsive to two code signals jointly and therefore variously responsive to similar basic code signals as determined by a first or shift signal. An example of this practice is the standard five-unit telegraph printer where the selective requirements exceed the thirty-two basic selective possibilities afforded by the five-unit code and where shift and unshift code signals are employed for increasing the selective possibilities by preconditioning the receiving mechanism to be responsive in one manner to a given code signal which follows a shift signal and in another manner to the same code signal when following an unshift signal. In this way the available basic signaling possibilities are reduced from thirty-two to thirty in number, but by employing two codes for shift and unshift purposes, the thirty remaining active or character codes may be made to effect response in sixty different results.

Another method of increasing the functional possibilities of the five-unit code in excess of the basic number has been employed, which comprises the use of an additional impulse receivable concurrently with each code for modifying it by its marking or spacing nature to indicate shift or unshift, thus converting the five-unit system into a six-unit system.

The use of either of these two methods or practices for effecting a shift operation is equally fea-

ible with any other code unit as well as the five- or six-unit codes which, as mentioned above, have come to be generally recognized. The shift operation, whether accomplished in one manner or another, constitutes a method of transmission for increasing the functional possibilities of a code system beyond that which is afforded by the basic permutation of the smaller code.

Another important aspect of this invention is its utility in connection with a keyboard perforator such as is shown in United States Patent No. 1,884,807, issued to Sterling Morton, wherein the arrangement of the key levers corresponds to that of the standard typewriter keyboard. This device is adapted to prepare a six-hole tape as is illustrated in Fig. 6 of that patent, and which is suitable for use with a tape transmitter embodying the present invention and differing from the species illustrated in the accompanying drawings only by its being adapted for a six-unit tape control instead of the seven-unit tape herein disclosed. By means of such a combination, it is possible for an operator who is accustomed to the standard typewriter keyboard to prepare a six-unit control tape that may be used in transmitting five-unit line signals, thereby utilizing the training and skill of a standard typewriter operator in the preparation of the tape, while at the same time employing a telegraph line more efficiently. Economy in the use of a telegraph line in connection with a five-unit system as distinguished from a six-unit system is dependent to a great extent upon the subject matter of the communication, being greatest where, from the character of the subject matter, the fewest number of shift and unshift signals are used. Either five-unit or six-unit adaptation may have particular enhancement in certain private offices employing standard typewriters and employing also telegraph communication apparatus, by permitting the same operator to use both types of devices by becoming accustomed to but one established type of keyboard.

Where two classes or systems of codes are employed, the present invention contemplates the provision of apparatus for converting a series of codes from one class to the other, so as to reconcile the use of a control adapted to one class of shift practice to mechanism that is inherently adapted to the other class. Accordingly, one object of the present invention is to provide means for receiving signals of a code-shift system of communication and preparing an impulse-shift perforated tape under control thereof, as well as for employing standard impulse-shift perforat-

ed tape for transmission of a code-shift system of line signals.

In the case of certain keyboard mechanisms whose functional requirements exceed that of even a six-unit code and where a seventh position shift condition is necessary to afford adequate total selective possibilities, such as, for example, a line composing machine control keyboard, it has been observed that it is practical to use a seven-unit code system for operating a control unit therefor, but that such a code system decreases the line signaling time considerably. This being true, it is desirable to be able to use seven-unit codes for local operating and transmitting control purposes while utilizing a six-unit code system for line signaling. To accomplish this purpose, the present invention proposes a system for converting a seven-unit impulse-shift system recorded in a transmitting tape to six-unit line signaling with shift and unshift codes, and far subsequently reconvert-
ing at a receiving station the aforesaid line signaling to a seven-unit code condition.

The present invention will be described particularly with regard to a method and apparatus for accomplishing the last-mentioned purpose, reference being had to a companion application Serial No. 703,220, filed Dec. 20, 1933, wherein are disclosed and claimed features relating to the reperforator apparatus disclosed herein.

In describing the method and mechanism of the present invention, a six-unit transmitting device has been arbitrarily chosen as an example, having incorporated therein certain features for practicing the present invention. The basic permutation possibilities afforded by the six-unit system are sixty-four, but with the use of shift and unshift preconditioning codes, this may be made to serve one hundred twenty-four functions.

At a transmitting station, a tape controlled mechanism is employed having six aligned tape sensing pins and an additional pin for sensing shift indicating perforations preferably disposed to sense a shift condition in the tape one step in advance of the alignment of the six principal or basic code sensing pins. A shift-code of six impulses controls a preconditioning mechanism for a seventh lever or pin at a receiving station, and subsequent character codes of six impulses may be associated with the said preconditioning mechanism of the preceding shift code in the manner herein described, permitting six receiving apparatus levers or pins to be set in alignment with the preconditioned seventh lever or pin, thus modifying the subsequent character code. It would be equally feasible to have the transmitting apparatus six feeler levers set in alignment with their seventh lever, but in keeping with such a system, the receiving or reperforating apparatus would have to be arranged with its seventh impulse perforating element operative upon the tape at a transverse line one step in advance of the character code which it modifies. For this reason it will be understood that the relative arrangement of the preconditioning signal with respect to any character signal is largely a matter of choice and is merely incidental in the present disclosure.

When transmitting six-unit signals under control of a seven-unit tape, the advance pin or feeler anticipates the shift condition of the succeeding signal, and in accordance with the presence or absence of a hole in its particular path,

accordingly establishes one of two alternative succeeding conditions. If a perforation, being present or absent in its path, differs thereby from the previously established shift condition, the advance pin sets into motion an auxiliary shaft, referred to hereinafter as the shift-code-shaft, which may be arrested in either of two positions. When stopped in one of its positions, a shift-code combination of signal impulses is established for communication to corresponding segments of a transmitting distributor, while when arrested in an alternative position, an unshift-code signal combination is similarly established.

Following any change from a previous condition sensed by the advanced pin, the normal operation of the transmitting mechanism is suspended for one code interval, during which time one or the other of the aforementioned prepared conditions is rendered communicative with the transmitting distributor. The suspension of the normal transmitting operation consists briefly in the locking of the sensing pins in their non-sensing condition until the particular shift or unshift signal is inserted in its proper place in the transmission of the message.

For a more comprehensive understanding of the present invention, reference is had to the accompanying drawings and to the following specification in which similar reference characters designate corresponding parts throughout.

Fig. 1 is a perspective view of a transmitting device embodying the features of the present invention and having certain portions broken away or eliminated for the sake of clearness;

Fig. 2 is a diagrammatic view of essential parts of apparatus illustrated in Fig. 1, showing their electrical relationship and illustrating certain minor operating levers slightly modified or graphically distorted in proportion or arrangement so as to be more comprehensive in a dis-
membered diagrammatic view;

Figs. 3 and 4 show alternative operating relations of certain of the parts shown in normal relation in Fig. 2;

Figs. 5 to 7 are diagrammatic views of parts of the shift-code-shaft apparatus illustrated in Fig. 2, showing several conditions of operation which occur successively during one shift-cycle;

Fig. 8 is a symbolic detail view of the reperforator flutter cam, flutter lever and armature associated with a signaling line such as might communicate with the transmitter of Fig. 2;

Fig. 9 is a perspective view of a reperforator mechanism for receiving the signals transmitted by the distributor of the apparatus illustrated in Fig. 1, and reperforating them upon a tape in an arrangement similar to the one from which they originated;

Fig. 10 is a fragmentary detail view of a piece of perforated tape illustrating the relative location of the six character perforations and the added seventh perforation, and

Fig. 11 is a detail view of certain of the selective members in the reperforator mechanism shown in Fig. 8.

Referring to Fig. 1, a segmented distributor head, indicated by the general reference character 11 in Figs. 1 and 2, is provided with eight segments, six of which are character-signal segments severally identified by numerals 0 to 5, while the remaining two are the conventional stop and start segments and are arranged similar to the standard six-unit start-stop sequence. A distributor shaft 12 carries a brush arm 13 which supports a pair of brushes 14 that connect the

segmented ring aforedescribed with a solid ring 15 concentric therewith. The ring 15 is indicated inside of the segmented ring and is connected to a transmission line 10 so that when any potential is induced upon any of the segments, it is conducted over brushes 14, through ring 15, and over the outgoing line 10.

A frame structure 9 is shown in fragmentary form to support distributor 11, shaft 12 and other operating parts. Shaft 12 is driven by power wheel 120 through a friction clutch 130, Fig. 1, and is restrained in start-stop manner by a stop cam 140 and a stop arm 150 controlled by a magnet 160, the arm 150 operating to release shaft 12 when magnet 160 is energized. Shaft 12 carries cam 59 and cam 62 and is geared by wheels 51 and friction clutch 52 to a shift-code-shaft 51 which tends, at all times, to turn in the direction of the arrow shown on clutch 52, but which is restrained by one or the other of two escapements 53—54, and 49—47. Shaft 51 carries a cam 57 for operating a mechanical arm 65 and two cams 55, 56 for operating electrical switches 58 and 30. Cam 62 on shaft 12 controls a tape sensing mechanism comprising six feeler arms 16 and an additional feeler arm 43, all cyclically withdrawn by feeler ball 24 which in turn is operated by lever 64 controlled by cam 62 when the lever 64 is not locked by arm 65 which is controlled by cam 57. Feeler 43 controls transfer member 44, and cam 62 through an arm 63 controls transfer member 46. The two transfer members 44 and 46 cooperate to actuate a pallet 47 of escapement 49—47, and cam 59 actuates pallet 54 of escapement 53—54, the two pallets jointly controlling shaft 51.

Each of the six numbered segments in commutator 11, Fig. 2, is electrically connected to a corresponding one of a set of electrical contacts 19 on feeler levers 16 (so called because they are provided with feeler pins 17), the several of which are arranged in a transverse alignment across the path traveled by a strip of record bearing material 18. The resilient spring contacts 19, move between a pair of oppositely presented contact points 21 and 22.

The perforated strip of record bearing material 18 is fed leftwardly, as indicated in Figs. 1 and 2, by a pawl and ratchet actuated feed wheel 23 in a step-by-step manner. The several feeler levers 16 are periodically reciprocated by a ball 24 in cooperation with individual springs (not shown), alternately presenting and withdrawing their pins 17 from engagement with strip 18. Ball 24 rotates about the pivot 27 and describes a periodic reciprocal movement, and in so doing also actuates a feed pawl 26 which advances the tape 18.

Perforations in the tape 18 occur in regular transverse rows, having various numbers of perforations which are variously distributed in each row. When a transverse row of perforations is presented opposite the alignment of pins 17, the absence of a perforation prevents its associated lever 16 from rotating beyond that point at which it engages the tape, but when a perforation is presented opposite any pin 17, the pin is permitted to enter such perforation and the associated lever 16 continues to rotate to a limited degree beyond the aforementioned point or until its spring contact 19 encounters its associated point 22. The presence of a perforation is generally referred to as a marking condition and the absence of a perforation as a spacing condition. In this sense then, those feeler levers 16 which encounter a marking condition continue to ro-

tate until their spring contacts 19 touch the lowermost contact points 22, while those which encounter a spacing condition fail to travel this distance and remain with their contact springs 19 in engagement with the upper contact points 21. Under normal condition of operation, all upper contact points 21 are connected over various circuits to positive or spacing potential as follows: Contact 21 of 0 position feeler lever communicates over wire 28 to positive terminal of battery 29, while the corresponding contacts of positions 1, 2, 4, and 5, communicate over wire 32 and a contact tongue 33, which forms part of a double contact switch 30 and which, during normal condition of this switch, is in communication with its upper associated contact 34, with positive pole of battery 29 over line 35. The 3 position upper contact point 21 communicates over an individual line 36 with the tongue 37 of another switch 58, which during normal condition, is in communication with its upper associated contact 38, and thus contact 21 of 3 position is in communication with the battery 29 at its positive pole. The lower contact points 22, each communicate over a common wire 41, receiving negative or marking potential from the corresponding terminal of a battery 42.

The foregoing aspect prevails during normal operating conditions as distinguished from the two special conditions, to be presently described, during which the signals of the shift and unshift codes are transmitted and also during which the tape sensing operation is momentarily suspended.

Since then, positive potential exists at the upper contacts 21 and negative at the lower ones 22, the fluctuation of the feeler levers 16 in accordance with the presence or absence of perforations in any particular transverse alignment or code transmits similar electrical conditions to associated segments of the transmitting distributor 11, for sending out upon the line grouped current impulses similar in permutative arrangement to the perforations in the tape 18.

A seventh feeler lever 43, having its pin disposed one step distance in advance of the feeler pins 17 of the levers 16, operates concurrently with such other levers, but through its advanced position senses the condition of a transverse perforation ahead of the ones which are aligned over the pins 17 of the several levers 16. So long as successive code combinations are similar as to the seventh position, the mechanism which is controlled by the advance lever 43 remains dormant, but upon the occurrence of a code signal differing from its preceding signal with respect to this seventh position, a "change" condition is established which results in the interjection of a special line code.

Feeler lever 43 has three positions, and in accordance therewith, its transfer lever 44 also has three positions. First or normal position is shown in Fig. 2, with feeler arm 43 withdrawn to its maximum extent by ball 24, and the pin below and away from tape 18, transfer lever 44 rotated into counterclockwise position, and abutments 44A, 46A, 44B, 46B, all out of alignment, so that operation of arm 63 by cam 62 would move transfer lever 46 but there would be no engagement between transfer lever 46 and transfer lever 44. This first or normal position is shown in Fig. 1 also.

Second or middle position is shown in Fig. 3, with feeler arm 43 released by ball 24 and rotated to its middle position by its spring (not shown), 75

and having its pin in engagement with but not protruding through tape 18. In the absence of any shift hole, transfer lever 44 is rotated into second or middle position by control of lever 43, and abutments 44A and 46A are brought into alignment, so that, thereafter, operation of arm 63 by cam 62 would cause abutments 46A and 44A to engage and move transfer lever 46 (which has but two angular positions) into its counter-clockwise position, and rotate pallet 47 into its position shown in Fig. 2.

Third or farthest position is shown in Fig. 4, with the feeler pin of lever 43 protruding through a shift hole in tape 18, transfer lever 44 rotated into clockwise position by control of lever 43, and abutments 44B and 46B in alignment, so that operation of arm 63 by cam 62 would move transfer lever 46 to cause abutments 44B and 46B to engage, thereby rotating transfer lever 46 into its clockwise position, and rotating pallet 47 into its position shown in Figs. 5 and 6.

Supposing that there occurs a succession of "unshift" code combinations of perforations having no seventh hole, the feeler lever 43 continues to sense the absence of this perforation, and during successive cycles of operation, maintains its yoke-shaped transfer lever 44 in the position indicated in Fig. 3. The pallet 47 is held against accidental displacement by detent spring 48. In its preferred embodiment as shown in Fig. 1, transfer lever 44 and lever 43 are separate members, lever 44 being supported upon a fixed pivot transverse to the pivot upon which the transfer lever 46 is pivoted. As a result of this construction the transfer projections of lever 44, which are preferably of sheet metal or otherwise of thin cross section, are selectively presentable into the plane in which they may engage the associated lugs of lever 46, or are moved but slightly to be drawn out of the plane of lever 46 and be adequately clear therefrom. This permits of a positive shift operation on the part of lever 44 through but a small angular movement thereof.

The movement of pallet 47 from either of its positions to the other releases a scape wheel 49 carried by shaft 51 and under certain circumstances permits the shaft to be rotated a short distance by its friction drive clutch 52, Fig. 1. Shaft 51, when freed by pallet 47 and scape 49, will not be totally unrestrained, however, for another scape 53, having a cam-controlled pallet 54, also determines the freedom of rotation thereof.

Shaft 51 referred to as the shift-code-shaft above, carries three operating cams 55, 56, and 57. In an effort to make the operation of the mechanism more readily comprehensible in the accompanying drawings, the various cams and wheels carried by shaft 51 have been marked by angularly aligned dots 50. By means of these markings, it is thought, the progress of each member with respect to its associated members may be more easily followed. Cam 55 is provided with two apices diametrically opposed and operatively engaging the center tongue 37 of switch 58. Cam 56 has four apices, two of which correspond in angular operating positions with the apices of cam 55, while the other two are located intermediate the first mentioned apices so as to constitute a generally quadrilateral contour. Cam 57 may be similar in shape to cam 56, but has its operating positions disposed at angles thereto, so that its apices operate angularly intermediate the apices of cam 56. The teeth of scape 49 are four in number, while the teeth of scape 53 are

eight in number, four of which correspond to the stop positions of scape 49. Cam 59 on shaft 12 controls pallet 54, which governs the scape 53. Another cam 62, also carried by shaft 12, actuates two levers, one of which, indicated by the reference numeral 63, controls the transfer lever 46 and in cooperation with spring 45 reciprocates the latter for communicating the signaling condition of the advance feeler lever 43 through 44 and 46 to the pallet 47, and the other lever, indicated by the reference numeral 64, reciprocates the feeler lever bail 24 for periodically permitting the feeler levers 16 to sense the condition of a transverse row of perforations in the tape 18.

The third cam 57, carried upon shaft 51, actuates a locking lever 65 and in accordance with the latter's position, permits or prevents the reciprocation of lever 64 and consequently of feeler bail 24, it being noted that lever 64 is advanced by the positive action of cam 62 but is withdrawn by the resilient action of an associated spring 66.

Figs. 2 to 7 illustrate various conditions of the transmitting mechanism while transmitting the signals which are illustrated by the perforations in the fragment of tape shown in Fig. 10. The six standard code impulses are designated 0, 1, 2, 3, 4, and 5 arbitrarily, while the seventh or shift impulse position is designated by the numeral 7. As illustrated on the fragment of tape, there are four transverse rows of holes indicating, respectively, Space, A, r, and a. Now, as set forth hereinbefore, the object of the present invention, as applied to this example, will comprise the transmission not only of the four character codes in the form of six units each, but also of the shift code of six units for effecting the capitalization of the A and the unshift code of six units for restoring the unshift or lower case condition of the r for the foregoing recited purposes or in order that a receiving mechanism adapted to the code-shift method of preconditioning may be properly responsive.

In the course of the following description, a condition of the apparatus following an unshift code of signals during which the standard codes of character signals are transmitted shall be referred to as the normal condition, while the condition following a shift code of signals shall be referred to as a shift or shifted condition. The sensing of change between normal and shift conditions causes the transmitting mechanism to effect a momentary suspension of tape sensing operations during the transition from one condition to the other only, but when either condition is once established, communication thereunder proceeds quite normally in accordance with the standard perforations in the transmitting tape. Thus, in Fig. 2 the mechanism is illustrated in normal condition, the advance feeler lever 43, having last encountered no perforation in the seventh position, and shaft 51 remaining quiescent, since the cooperating transfer lever 46 has not been operated again. The mechanism is shown stopped by an open switch 66. While the presence of a perforation in the extra (in this case the seventh) position is, in accordance with the present showing, taken to represent the shift condition, and its absence therefrom, the unshift condition, this should be understood to constitute mere option since either condition may, with equal convenience, be represented by one or the other of the two signals.

During the normal or idle condition of resting it will be noticed that negative potential from battery 42 over line 41 communicates with each of 75

the lower contacts 22, while positive potential from battery 29 communicates over lines 28, 32, 35, and 36 with the upper contacts 21, thus maintaining a condition whereby the standard feeler levers 16, in accordance with their respective positions, are capable of introducing positive or negative potential to the several segments 0, 1, 2, 3, 4, 5, and that in accordance with the permutations of these electrical conditions, corresponding signals may be sent forth upon line 10 as distributor arm 13 and brushes 14 sweep over the several segments during clockwise rotation of shaft 12.

The operation of transmission is as follows: The tape shown in Fig. 10 having been presented over the feelers 17 in position for transmission of space, the transmitter shown normally in resting position in Fig. 2 now is started by closing a manual switch 66 which energizes magnet 160 and releases brush arm 13, permitting shaft 12 to start, carrying brushes 14 and cams 59 and 62.

When arm 13 and shaft 12 are at normal or rest position, as shown, or are in operation and are passing that position between successive cycles of rotation, which position will be designated the zero position of shaft 12, and when a character code of "unshift" nature is to be transmitted, then shift-code-shaft 51 also will be in its zero position, as shown in Fig. 2 and as identified by the vertical alignment of dots 50. In this condition, with shaft 12 at zero and shaft 51 at zero, shaft 51 is held against the urge of its friction driving clutch 52 by engagement of a tooth of scape 49 with blocking pawl 68 of pallet 47. A succeeding tooth of scape wheel 53 is near hook pawl 71 of pallet 54 but cannot at this time engage it by a few degrees, so that when blocking pawl 71 of pallet 54 is moved into the path of the teeth of scape 53 as presently will occur, it will not affect scape wheel 53, but will merely take a position in front of a tooth thereof so that a small angular movement of scape 53 will be permitted before engagement. Shaft 51 therefore is instantly freed from control of pallet 54, and is placed under control of pallet 47 which is operable only through transfer levers 46 and 44, under control of seventh feeler or shift feeler 43 and by power and timing control from cam 62 on shaft 12.

When shaft 12 has rotated about 45 degrees, distributor arm 13 approaches segment, 0; cams 62 and 59 have released arm 64 and pallet 54 for spring operation, arm 64 has released bail 24 for spring operation, which in turn has released all feelers 16 for spring operation, of which the feeler in 3 position is responsive to the instant code perforation for space and has permitted its contact arm 19 to engage its electrical contact 22. Feeler 43, sensing the shift perforation of the following code for A, has permitted its transfer lever 44 to assume a position such as the one indicated in Fig. 4 so that the right-hand abutment 44B of transfer lever 44 is in alignment with the right-hand abutment 46B of the associated transfer lever 46. All segments 0 to 5 of distributor 11 now are potentially prepared for the transmission of a space code signal to line 10, and such transmission proceeds as shaft 12 rotates farther. Meanwhile pallet 54 has withdrawn hook pawl 72 and now presents blocking pawl 71 to scape wheel 53.

When, thereafter, shaft 12 has rotated about 150 degrees, cam 62 operates arm 63 to move transfer lever 46 into engagement with transfer lever 44 at their right-hand abutments, 44B, 46B, thus rocking transfer lever 46 and operating pallet 47 into its alternative position as shown in Fig. 5. Blocking pawl 68 has released the en-

gaged tooth of scape 49 and shaft 51 has rotated through a small distance and now is held by engagement of a tooth of scape 53 with blocking pawl 71 of pallet 54. Cams 55 and 56 have also moved slightly but not enough to change either switch 58 or 30. Hook pawl 69 of pallet 47 rests upon the top of the first or spot tooth of scape 49 and is pressed against the scape 49 by tension of decentering detent spring 48. Cam 62 now releases arm 63. The next cam action occurs when cam 59 engages roller 78.

When shaft 12 has rotated through about 315 degrees, the signal transmission for the code signal of space will be near conclusion after which the electrical potentials set upon segments 0 to 5 may be withdrawn or changed. At this time, cam 59 has engaged roller 78 and has operated pallet 54 until blocking pawl 71 releases scape 53 and shaft 51 starts, turning now through about 45 degrees at the speed of shaft 12 so that shaft 51 travels about 45 degrees while shaft 12 reaches 360 degrees or zero position. Shaft 51 will be stopped by engagement of scape 53 with hook pawl 72, cam 57 will have released follower arm 65 which will have moved its tooth into the path of locking arm 76, and all parts shown in Fig. 5, including switches 58 and 30, will be now in their positions as shown in Fig. 5 with shaft 51 at 45 degrees as indicated by dots 50. The final effect of cam 62 through arm 64 and bail 24 is to move arm 76 within the tooth of arm 65 and to operate pawl 26 to step tape 18, thus positioning the perforated record for signal A, Fig. 10, over the feelers 17, Fig. 2.

When shaft 12 has completed its cycle for space and is passing its zero position to begin its cycle for transmitting the shift code, the conditions are as follows: Cam 12 when passing zero holds arm 64 at normal which holds bail 24 at normal which holds all feeler arms 16 at normal with all feeler pins down and all contact springs 19 in engagement with contacts 21, of which, contact of segment 0 is connected to spacing battery 29 over wire 28, contact of segment 3 is connected to spacing battery 29 over wire 36 and unoperated switch 58, and contacts of segments 1, 2, 4, 5 are connected over wire 32 and operated switch 30 to marking battery 42, thus setting up electrical potentials upon segments 0 to 5 for the code for "shift". Arm 64 and feeler bail 24 also hold feeler arm 43 at normal which in turn holds transfer lever 44 in counterclockwise or first position as shown in Fig. 2. Cam 57 permits arm 65 to engage arm 76, thus locking the arm 64 and preventing movement of feelers 17, or of transfer lever 44 until after arm 76 has been unlocked.

When shaft 12 has rotated 45 degrees in the "shift" signal transmission cycle, cam 62 has moved away from roller 77 but arm 64 has not operated, being locked at 76. Cam 59 has operated pallet 54, withdrawing hook pawl 72 and introducing blocking pawl 71 into the teeth of scape 53, permitting shaft 51 to move through a small angular distance without changing switch 30. Commutator 11 is transmitting the starting impulse, and continues with the signals of the "shift" code.

When shaft 12 is passing 150 degrees, cam 62 will operate arm 63 but transfer lever 46 will not be rotated since transfer lever 44 is in its first or normal position as shown in Fig. 2 and all abutments are out of alignment.

When shaft 12 has rotated about 315 degrees of the shift-code cycle, signal transmission for the code of "shift" will be at or near an end and the

electrical potentials set upon segments 0 to 5 may be withdrawn or changed. At this time, cam 59 has engaged roller 78 and has operated pallet 54 until blocking pawl 71 releases scape 53 and shaft 51 starts, turning now at the speed of shaft 12 so that shaft 51 reaches 90 degrees at the same time that shaft 12 reaches 360 degrees or zero position. Shaft 51 will be stopped at 90 degrees by engagement of scape 49 with hook pawl 69, and all parts shown in Fig. 6 including switches 58 and 30 will be now in their positions as shown in Fig. 6 with shaft 51 at 90 degrees as indicated by dots 50. The final action of cam 62 in the shift-code cycle is to pass under roller 77 to support arm 64 against operation by its spring 66 at the moment that it is unlocked by arm 65 when arm 65 is operated back to normal by cam 57. Arm 64 has not been operated in the shift-code cycle, tape 18 has not been stepped in that cycle, and the record for A in the tape 18 remains aligned with feelers 17.

Shaft 12 and arm 13 continue in rotation and start upon the cycle of transmission for the character A, with the conditions shown in Fig. 2 modified in positions as indicated in Fig. 6. When shaft 12 has rotated 45 degrees, cams 62 and 59 have released arm 64 and pallet 54 for spring operation, arm 64 has released bail 24 for spring operation, which in turn has released all feelers 17 for spring operation, feelers 17 in 1 and 2 positions have operated their contacts 19 responsively to the instant code perforation for A, and feeler 43 sensing now the shift or unshift record of the forthcoming code record for the character r, Fig. 10, has engaged tape 18 because of the absence of a record-hole in that position, and has rotated to its middle position and has stopped there with feeler 43 stopped by tape 18 as shown in Fig. 3. Transfer lever 44 has been rotated by lever 43 into its middle position so that left-hand abutment 44A is in alignment with left-hand abutment 46A of transfer lever 46. Transmission of signals for A upon line 10 proceeds as shaft 12 rotates farther.

When shaft 12 completes about 150 degrees, cam 62 operates arm 63 to cause transfer lever 46 to engage transfer lever 44 at left-hand abutments 46A, 44A, thus rocking transfer lever 46 counterclockwise and operating pallet 47 into its initial position as shown in Figs. 2 and 7. Hook pawl 69 releases scape 49 and shaft 51 rotates a few degrees and causes scape 53 to engage pawl 71, thus stopping shaft 51 at about 90 degrees.

When shaft 12 passes 315 degrees, cam 59 operates pallet 54 to release scape 53 and shaft 51 starts, turning now for 43 degrees and reaching 135 degrees when shaft 12 reaches zero position. Shaft 51 will be stopped by engagement of scape 53 with hook pawl 72, cam 57 will have operated arm 65 into locking position, and all parts shown in Fig. 7, including switches 58 and 30, will be now in their positions as shown in Fig. 7, with shaft 51 at about 135 degrees as indicated by dots 50. The final effect of cam 62 is to cause arm 76 to pass to locked position with relation to the tooth of arm 65 and to stop tape 18, thus positioning the perforated record for r, Fig. 10, over feelers 17, Fig. 2.

Because the last code transmitted was A and the next code to be transmitted is r, it is required to transmit "unshift" code to line 10. The conditions have been set up for an unshift-code cycle. Cam 12 when passing zero position holds all contact springs 19 in engagement with contacts 21, of which contact of segment 0 is con-

nected to spacing battery 29 over wire 28, contact of segment 3 is connected over wire 36 and through operated switch 58 to marking battery 42, and contacts of segments 1, 2, 4, 5 are connected over wire 32 and operated switch 30 to marking battery 42, thus setting up electrical potentials upon segments 0 to 5 for the code for "unshift." Feeler arm 43 is held at normal by locking arm 65 through arm 76 and bail 24, which in turn holds transfer lever 44 in first or normal position as shown in Fig. 2 with no abutments in alignment.

Transmission of "unshift" follows in manner similar to transmission of "shift" as described above, with the exceptions that the signal from segment 3 is marking and that code-shift shaft 51 advances from 135 degrees to 180 degrees, which is a normal position, and all parts shown in Fig. 2 are in the positions shown in Fig. 2.

In the next cycle of shaft 12, transmission follows for r in manner as for A with the exception that feeler 43 finds no record hole in tape 18 and accordingly transfer lever 44 is rotated to middle position, but no action results by transfer lever 46 and pallet 47 so long as an "unshift" or "no hole" record condition is sensed by feeler 43 in tape 18.

Particular attention is again directed to the simplified operation of the described apparatus in that so long as either normal or shifted condition prevails, the transmitting mechanism may continue to function as an ordinary transmitter may be expected to do, no time being lost for determining the succeeding transmission processes, but accomplishing these objects during the same time and in collaboration with the incidental transmission functions. Also, that when the standard signal transmission is suspended for the interjection of a shift or unshift signal, only so much time is occupied thereby as is inherently required by such interjected signals. Thus the time occupied in accomplishing the conversion from one system of transmission to the other does not exceed that by which the incidents of the latter system inherently differ from that of the former.

Certain optional practices have been illustrated and explained in connection with the foregoing description such as the degrees of rotation of shaft 51 for effecting each shift condition, and the shapes of cams 55, 56, and 57, as well as the connection of the upper contacts with switches 58 and 30 so as to transmit a certain predetermined signal. It is considered obvious that any other signal may be similarly arranged for transmission if desired, thus the essentials of the present invention are more far reaching than might be understood from the mere contemplation of the shift and unshift signal accommodations and may include the transmission of other or additional signals under similar or related conditions.

Reperforator

As pointed out in a foregoing paragraph, one of the advantages that is to be obtained from converting an impulse-shift system of signaling to a shift-code system and vice-versa resides in the saving of signaling time. Towards this end it is proposed to employ a transmitting mechanism such as the one described above for converting an impulse-shift system record from a perforated tape into a shift-code system upon a telegraphic signaling line. Since the outgoing signals are of the shift-code class, it then devolves upon the remote station whose apparatus may be respon-

sive solely to an added perforation tape to re-convert the signals accordingly. For this purpose the mechanism illustrated in Fig. 9 and disclosed in the copending application referred to above may be employed.

The incoming signals being received over line 10 are impressed upon the windings of a polar magnet 81 which controls the setting of a mechanical distributor and storage device. The armature 82 of magnet 81, reciprocating in accordance with the electrical conditions impressed upon the windings, alternatively blocks and clears the path of a flutter lever 83, which correspondingly shifts a selector cam barrel 84 longitudinally. A series of cam projections 85, arranged in a spiral progression upon cam barrel 84, set selectively a series of storage elements 86 in accordance with received signal impulses. The condition of the several storage elements 86 is then simultaneously transferred through the medium of a set of transfer levers 87 to a similar set of reciprocating levers 88 to which are connected a set of interposition bars 89. Those elements 86 which are set in accordance with a marking impulse cause the presentment of their associated bars 89 in their advanced position so as to underlie associated punches 91, while those of the elements 86 which are impressed with a spacing signal withdraw their bars 89 so as to clear the punches 91.

When a shift or unshift code of signals is received, levers 88 are positioned so as to afford an alignment of notches 92 to receive either of the two responsive bails 93 and 94. The bail 93 responds to the shift code, and upon its operation rocks lever 95 counterclockwise and moves lever 96 forward so as to present interposition bar 97 in its effective position, while the bail 94 upon its operation, causes its arm 940 to engage the arm 950 to rock lever 95 counterclockwise upon its pivot 90 so as to return lever 96, thus withdrawing bar 97 from its effective position.

In this manner the levers 88 are made to afford a selection of the bails 93 or 94 previous to the actuation of the punch operating mechanism, and to suspend the punch operation in the following way if either a shift or unshift code of signals is received.

Bail 93 is provided with an offset extension arm 98, while bail 94 is provided with a similar but symmetrically opposite arm extension 99. Upon the selection of either of these bails, the extension arm 98 or 99 engages a projection 101 of an overslung bail 102, rocking the bail clockwise and causing its depending arm 103 to move an underslung bail 104 out of engagement with a shoulder 105 of the punch operating arm 106. This disconnection is effectuated upon the operation of either bail 93 or 94, but is immediately restored for the subsequent operating cycle when a succeeding code is transferred. The restoration is effected by an arm 107 which carries a striker 108 for returning bail 102, and which arm 107 is carried by the transverse bail 109. A follower roller for actuating bail 109 is carried by arm 111 of bail 109 and travels in a box cam channel located on the rear side of cam 112, as viewed in Fig. 9. As a result of the suspension of operation of punch bail 104, no row of perforations is installed upon the reception of either a shift or unshift code of signals, but instead, the result of either of these codes is stored by a conditioning of the seventh punch intervention bar 97 and is made to modify each succeeding

character signal by its presence or absence therewith.

In this manner the received shift-code is converted to an impulse-shift record for the purpose set forth.

It will be understood, of course, that where the receiving mechanism is responsive directly to shift and unshift codes, the aforescribed re-conversion will be unnecessary.

It will be obvious that numerous modifications and adaptations of the principles herein disclosed may be made without departing from the spirit or scope of the invention. It is therefore intended not to be limited to the details illustrated in the accompanying drawings nor to the specific language in the foregoing description, but to be permitted a latitude of interpretation in accordance with the hereinafter appended claims.

What is claimed is:

1. In a tape-controlled telegraphic communication system, a tape reader responsive to signal perforations in a tape, said tape having perforations arranged in codes and each code having a predetermined number of unit elements, a signal distributor adapted to transmit signal codes of a lesser number of unit elements than that of said tape, means for transmitting signal codes over said distributor under control of the readings of said tape reader, and means for transmitting additional signal codes over said distributor under control of single perforations in said tape.

2. The combination set forth in claim 1, including means for storing said additional codes, and means responsive to both said stored codes and said first mentioned transmitted codes for re-perforating a tape.

3. In a telegraph transmitting apparatus, the method of communication which comprises the steps of sensing telegraph signals of a definite unit code in a physical recording means in which each code is comprised of a definite number of elements each element of which may have alternative signalling characteristics, and immediately transmitting corresponding electrical signals of a lesser unit code.

4. The method set forth in claim 3, including the step of reconverting said transmitted electrical signals into a set of stored signals corresponding to the original stored signals.

5. In a tape-controlled telegraphic communication system, a tape reader responsive to signal perforations in a tape, said tape having perforations arranged in codes and each code having a predetermined number of unit elements, a signal distributor adapted to transmit signal codes of a lesser number of unit elements than that of said tape, means for transmitting signals over said distributor under control of some of the concurrent readings of said tape reader, and means for transmitting further signals under control of the remaining readings, the total number of signals transmitted being greater than the number of concurrent readings.

6. In a tape-controlled telegraphic communication system, a tape reader responsive to signal perforations in a tape, said tape having perforations arranged in codes and each code having a predetermined number of unit elements, a signal distributor adapted to transmit signal codes of a lesser number of unit elements than that of said tape, means for transmitting codes of signals over said distributor under control of the readings of codes of perforations in said tape, and means including a set of code setting ele-

ments responsive to the elements of said tape codes in excess of corresponding distributor codes for creating further codes to be transmitted over said distributor.

7. In a tape-controlled automatic telegraphic transmitter, a distributor head having a set of signal impulse segments, a set of sensing members individually responsive to alternative conditions in a tape for impressing corresponding electrical conditions upon said segments, a further sensing member, and circuit changers responsive to alternative conditions of said further sensing member for impressing a set of electrical conditions upon said set of segments.

8. In a tape-controlled telegraphic transmitter, a rotary distributor having a set of impulse elements, a tape reader responsive to perforations in one part of a tape for associating corresponding electrical potentials with said impulse elements, and means for suspending the operation of said tape reader under control of other perforations of said tape and for supplying other electrical potentials to said impulse elements.

9. In a tape-controlled transmission system, a distributor, a tape sensing apparatus adapted to receive perforated tape bearing character signal perforations and conditioning signal perforations, a set of circuit closers in said apparatus responsive to said character signal perforations and operative with said distributor for impressing corresponding electrical signals upon a line, a further set of circuit closers, and means responsive to said conditioning signal perforations and operative to arrest said tape sensing apparatus to operate said further set of circuit closers to close predetermined circuit combinations for impressing further electrical signals upon the line, and thereafter to release said tape sensing apparatus.

10. In a transmission system, the method of controlling a code-shift receiving mechanism at a remote station by use of an impulse-shift tape which includes the steps of, converting the shift-impulse record of each complete code of the tape into a shift-code of signals, and arresting transmission of character signals to transmit the said shift-code of signals between character codes of signals.

11. A method of reducing signaling time in the transmission of signals having equal numbers of impulse intervals which includes the steps of considering the signals as belonging to two classes, diminishing by one the number of intervals of each signal, sending a conditioning signal to introduce the signals of each class, and following it with all of the consecutive signals which relate to that class.

12. The method of communication which comprises the steps of storing telegraph signals of a definite unit code, transmitting corresponding electrical signals in terms of a lesser unit code, and distinguishing between similar signals in the two codes by independent modifying signals accompanying the latter code.

13. In a telegraph signal transmitting apparatus, a set of levers responsive to records of codes in a plurality of groups, and means responsive to said levers upon a change of group to insert an appropriate group signal.

14. In a telegraph transmitter, a case determining lever operable to each of a plurality of positions in accordance with case groups, and cam means controlled by said case determining lever having electrical switches for effecting signals corresponding to case signals.

15. In a telegraph transmitter, a mechanism

adapted to control the transmission of shift codes of signals solely, a set of signal elements, means to adjust said signal elements in accordance with signals to be transmitted, and means to initiate the operation of said mechanism under control of one of said set of signal elements.

16. In a record reader mechanism, a plurality of elements responsive to the perforated conditions of a tape, a subjective mechanism cyclically operated to receive a setting from said feelers, means for advancing the tape in said record reader in accordance with the operation of said elements, and means under the control of one of said elements to suspend the operation of said advancing means while permitting the continued operation of said subjective mechanism.

17. In an automatic telegraph transmitter, a plurality of tape sensing elements, a tape advancing mechanism, means to transmit a code of signals in accordance with the setting of certain of said elements between operations of said mechanism, and means for transmitting a plurality of codes of signals between operations of said mechanism.

18. In a telegraph transmitter, a set of elements, an additional element, means to present said elements in varying combinations, means to transmit a code of telegraph signals in accordance with the setting of said elements, said signals having a given number of elementary code impulses corresponding to the number of said elements, and means to transmit other codes of signals having a corresponding number of elementary code impulses under the control of said additional element.

19. In a record reader for telegraphic transmitting devices, a record feeding mechanism comprising a cyclically moving member, means for actuating said member subsequent to each reading of the record, and means to defer a reading of the record and actuation of said member for a time period of one cycle in response to some readings of the record.

20. In a tape controlled telegraphic transmitting mechanism, a distributor, tape controlled contacts, a source of current, circuit connections from said source through said contacts to said distributor, and further contacts included in said circuit connections for varying the circuit connections between said source and said distributor independently of said tape controlled contacts.

21. In a telegraphic communication system, a tape reader responsive to signal perforations in a tape, having perforations arranged in codes each of which comprises a predetermined number of unit elements, a signal distributor to transmit a signal code of a lesser number of unit elements than appearing in said tape, means for transmitting a code of signals over said distributor under control of the code perforations in said tape, and means controlled by the difference between a corresponding code of said tape and the code of said distributor for transmitting an additional signal over said distributor.

22. In a perforated record-controlled automatic telegraph transmitter, a distributor, a set of character signal segments in said distributor, a record reader including a set of character perforation feelers, a shift impulse perforation feeler, means individual to each one of said character perforation feelers for impressing a predetermined electrical potential upon one of said segments of said distributor, and means responsive to the control of said shift impulse perforation feeler for impressing a predetermined set of electrical poten-

tials upon several of said segments in said distributor.

23. In a tape controlled telegraphic transmitter, a distributor including a set of impulse elements, a set of contactors each individual to one of said elements for controlling the association of electrical potentials therewith in accordance with character perforations in the tape, and a plurality of contactors for controlling the association of electrical potentials with the several of said elements under the control of an additional perforation associated with said character perforations.

24. In a telegraph system, a tape sensing apparatus to receive perforated tape bearing character signal perforations and conditioning signal perforations, a set of circuit closers in said apparatus responsive to said character signal perforations and operative for impressing corresponding electrical signals upon a line, a further set of circuit closers for impressing electrical signals upon said line, means responsive to said conditioning signal perforations and operative to arrest said tape sensing apparatus from further operating said first mentioned set of circuit closers for impressing electrical signals upon the line, a reperforating apparatus having a receiving distributor responsive to the signals transmitted over said line, a set of punches for installing code perforations in the tape under the control of said character signals, and a conditioning device responsive to said further electrical signals for modifying the installed codes of perforations.

25. In a telegraph system, a tape sensing apparatus to receive perforated tape bearing character signal perforations and conditioning signal perforations, a set of circuit closers in said apparatus responsive to said character signal perforations and operative for impressing corresponding electrical signals upon a line, a further set of circuit closers, means responsive to said conditioning signal perforations and operative to arrest said tape sensing apparatus from further operating said first mentioned set of circuit closers for impressing electrical signals upon the line, a remote station having a character signal responsive apparatus connected to said line, a conditioning signal responsive device, and means under the control of the signal responsive device for modifying the performance of the signal responsive apparatus.

26. In a telegraph signal transmitting apparatus, a set of signal impulse feeler levers responsive to perforations in a control form which are representative of characters relating to a plurality of case groups, means to transmit electrical signals in accordance with the conditions of said levers, and means responsive to said levers upon a change of case for inserting a signal indicative of the succeeding case.

27. In a telegraph transmitter, a case determining lever, signal transmitting means, and means responsive to the operation of said case determining lever to cause said signal transmitting means to transmit first a case determining signal and then a character signal to be modified by said case determining signal.

28. In a telegraph communication system, a start-stop transmitting distributor, a record reader, means to operate the record reader intermittently, means to operate said distributor cyclically to transmit a signal corresponding to each operation of said record reader, and means to operate said distributor through a plurality of cycles for transmitting a corresponding plurality of sig-

nals in response to certain single operations of said record reader.

29. In a telegraph transmitter, a plurality of signal elements, means to adjust said elements in accordance with various signal combinations, means to transmit telegraph signals in accordance with the settings of certain of said elements, and additional means to transmit a special signal in accordance with a changed setting of other of said elements.

30. In a telegraph transmitter, a set of transmitting elements, means to position said elements in varying permutations in accordance with signals to be transmitted, means to transmit a code of telegraph signals in accordance with the positions of certain ones of said elements, and means to transmit a code of signals varying in accordance with the setting of a single one of said elements.

31. In a tape controlled telegraphic transmitting device in which a tape is perforated with code combinations and in which each code combination is arranged transversely of the tape, a set of feelers for sensing periodically a plurality of perforations in the tape, a tape feeding wheel periodically operable after each tape reading, and means for deferring the operation of said sensing feelers and said feed wheel for a time interval corresponding to one cycle of operation, said means being responsive to a combination of two consecutive readings of the tape.

32. In a tape controlled telegraphic transmitting device in which a tape is perforated with combinational perforations each one of which is arranged in a row transverse of the tape, tape reading feelers for sensing periodically a plurality of perforations in a tape, a feed wheel periodically operable for each tape reading, means for comparing two successive readings of a tape, and means for deferring the operation of said feelers and said wheel for a time interval equivalent to one cycle under the control of said comparing means.

33. In a record reader for telegraphic transmitting devices, a record reading mechanism, means for actuating said mechanism cyclically, and means to suspend the actuation of said mechanism for a time interval equivalent to one cycle of operation in response to certain record readings of said mechanism.

34. In a tape controlled telegraphic transmitting device in which the tape is perforated with combinational perforations and individual perforations, a set of feelers for sensing periodically a plurality of said combinational and individual perforations, and means for deferring the performance of said feelers for a cyclic time interval in response to certain readings of said individual perforations.

35. In a tape controlled telegraphic transmitting device in which a control form is provided having combinational perforations, tape reading means for sensing periodically pluralities of perforations in said form, means for comparing two successive readings of a tape, and further means for arresting the operation of said tape reading means for a cyclic time interval, said further means being responsive to said first means.

36. In a tape controlled transmitting mechanism, a distributor, a set of distributor transmitting contacts, a source of current potential, circuit connections from said source through said contacts to said distributor, further contacts included in said circuit connections for modifying the circuit paths between said source and said

distributor independently of said tape controlled contacts, a tape sensing apparatus, and means controlled by said apparatus for variously actuating said further contacts.

37. In a tape controlled telegraphic transmitting apparatus, a distributor, tape controlled contacts, a tape sensing mechanism, a source of current potential, circuit connections from said source through said contacts to said distributor, additional contacts included in said circuit connections for modifying the circuit paths between said source and said distributor independently of said tape controlled contacts, and code storing mechanism for comparing control signals of said tape for actuating said additional contacts.

38. In a tape controlled telegraphic transmitting mechanism, a signal sending means, an auxiliary signal sending means, comparison means comprising first and second members, the first member controlled by a tape and the second member controlled by the first member and in turn controlling said auxiliary sending means, said second member retaining any position into which it may be set by said first member, and said first member operating cyclically and in response to tape control to set said second member in accordance with tape control in any cycle.

39. A tape controlled telegraphic transmitting mechanism as described in claim 38 in which the tape control is exercised by a shift or unshift record in the tape and in which the auxiliary signal sending means transmits a shift or unshift code of signals.

40. In a telegraphic code controlled mechanism, a first pivoted lever operable cyclically in accordance with an element of a code, a second pivoted lever operable by said first pivoted lever, a pivot for said first lever, and a pivot for said second lever, said pivots being arranged in angular relation with each other.

41. A mechanism as described in claim 40, in which said first lever has two strikers and functions in three positions to present one or the other or neither of said strikers into the plane of said second lever in accordance with the selected position of said first lever.

42. In a telegraphic code controlled mechanism, a first means operable in accordance with an element of a code, a second means operable by said first means, said first means having three positions and said second means being operable by said first means in either of two of its said three positions.

43. In a telegraphic code controlled mechanism, a first pivoted lever operable cyclically in accordance with an element of a code, a second pivoted lever operable by said first pivoted lever, strikers on said first lever for operating said second lever, a pivot for said first lever, and a pivot for said second lever, said pivots being arranged in angular relation with each other whereby said strikers of said first lever are moved into and out of the plane of said second lever in accordance with the selective position of said first lever.

44. In a telegraphic tape controlled mechanism, a tape sensing member having three positions, away from the tape, against the tape, and through the tape, a first transfer lever controlled by said tape sensing member and also having three positions, and a second transfer member having two positions and controlled by said first transfer member when in either of two of its three positions.

45. The method of translating intelligence from one telegraphic code into another, which com-

prises the following steps: assigning a first character and a second character to each of a plurality of character codes in a system of codes of equal length combinations of signals, each character code representing both a first character and a second character, assigning an area of recording tape for receiving records of character codes, assigning another area of recording tape for receiving further records to indicate character classification whereby first and second character classes are identified, assigning a first master code of signals to indicate only first characters and assigning a second master code of signals to indicate second characters, sensing first said further record, and transmitting in response thereto the code signals of either said first master code or said second master code as indicated by the sensed further record, then sensing said recorded character code and transmitting in response thereto the corresponding code of signals.

46. A method of converting telegraphic intelligence from one system of codes to another system of codes which comprises: assigning a longitudinal area of recording tape for recording character codes, assigning a longitudinal area of the said recording tape for recording shift and unshift codes, sensing the shift and unshift area of the tape and transmitting a shift or unshift code of signals in accordance therewith, then sensing the character area of the tape and transmitting a character code of signals in accordance therewith.

47. A method of converting telegraphic intelligence from one system of codes to another system of codes which comprises: assigning a longitudinal area of a recording tape for recording character codes, assigning a longitudinal area of the said recording tape for recording shift and unshift codes, sensing the shift and unshift area of the tape, comparing the instant sensing with the immediately preceding sensing of said shift and unshift area of the tape, and, in the event that an instant sensing is found to be different from the immediately preceding sensing of said shift and unshift area of the tape, transmitting a shift or unshift code of signals in accordance therewith, then sensing the character area of the tape and transmitting a character code of signals in accordance therewith.

48. A method of telegraphy for converting a permutation code system having a given number of constituent impulses into a permutation code system having a different number of constituent impulses, which comprises the steps of converting those impulses by which one system differs from the other into complete permutation signals, and interjecting said signals into a message in accompaniment with the principal code signals to which they are associated.

49. In a telegraph transmission system, means for issuing telegraph signals of a code having a basic number of impulse intervals, means responsive to certain ones of said impulse intervals for establishing corresponding signals of a code having a different basic number of impulse intervals, and means for indicating the difference between said codes with respect to the differential intervals in terms of additional signals having a number of impulse intervals corresponding to said different basic code.

50. In a telegraph system, a source of permutation telegraph signals constituting various combinations of a basic unit code, means responsive to predetermined units of each signal for establishing corresponding signals having units in the

same order of occurrence but in a lesser basic unit code, and means responsive to the differential units for interjecting a code combination of units indicative of a change of case.

5 51. The method of signalling which comprises the steps of preparing a physical code storage device with consecutively arranged signals, sensing a plurality of said signals concurrently, and determining a selection by the composite manifestations of said plurality of signals.

10 52. In a record reader mechanism for sensing transversely arranged rows of perforations in a tape, means to sense some of the perforations of one row simultaneously with some of the perforations of another row, and means for determining an ultimate selection by the composite attributes of said perforations.

15 53. In a telegraph transmitting apparatus, a tape sensing mechanism including a set of feelers, a signal distributor for issuing electrical potentials in accordance with the manifestations of said feelers, means for correlating the operation of said feelers and said distributor in timed sequence, and means under the control of special signals to vary the time interval between said operations.

20 54. The method of controlling a telegraph transmitter operative on a permutation code of a lower numerical order under the supervision of a control tape having indicia in accordance with a permutation code of a higher numerical order, which comprises the insertion in the transmission of code signals of case determining signals

representing the numerical difference between corresponding code signals.

55. The method of controlling a telegraph transmitter designed for a permutation code of a lower numerical order under the supervision of a control form having perforations based upon a permutation code of a higher numerical order which comprises the steps of assigning case shift signals to represent the numerical difference between corresponding code signals, and inserting a case determining signal with each group of consecutive code signals relating thereto.

56. In a telegraph apparatus, a rotatable shaft, driving means frictionally associated with said shaft, means for performing a selective function in accordance with the angular position of said shaft, signal controlled means for determining the angular position of said shaft comprising an escape wheel secured to said shaft having a plurality of escape teeth, a pallet member having alternative engagement elements to be associated with said escape wheel, and signal controlled means for reciprocating said pallet member to present its elements to said escape wheel alternatively.

57. In a telegraph apparatus, signal initiating means, a rotatable shaft, elements carried by said shaft for controlling said signal initiating means, a source of power, frictional coupling means between said source of power and said shaft, and means for determining the angular position of said shaft comprising an escape wheel and a pallet cooperating therewith.

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