March 8, 1938. R. G. GRIFFITH 2,110,506

START-STOP TELEGRAPH

Original Filed May 29, 1935 2 Sheets-Sheet 1

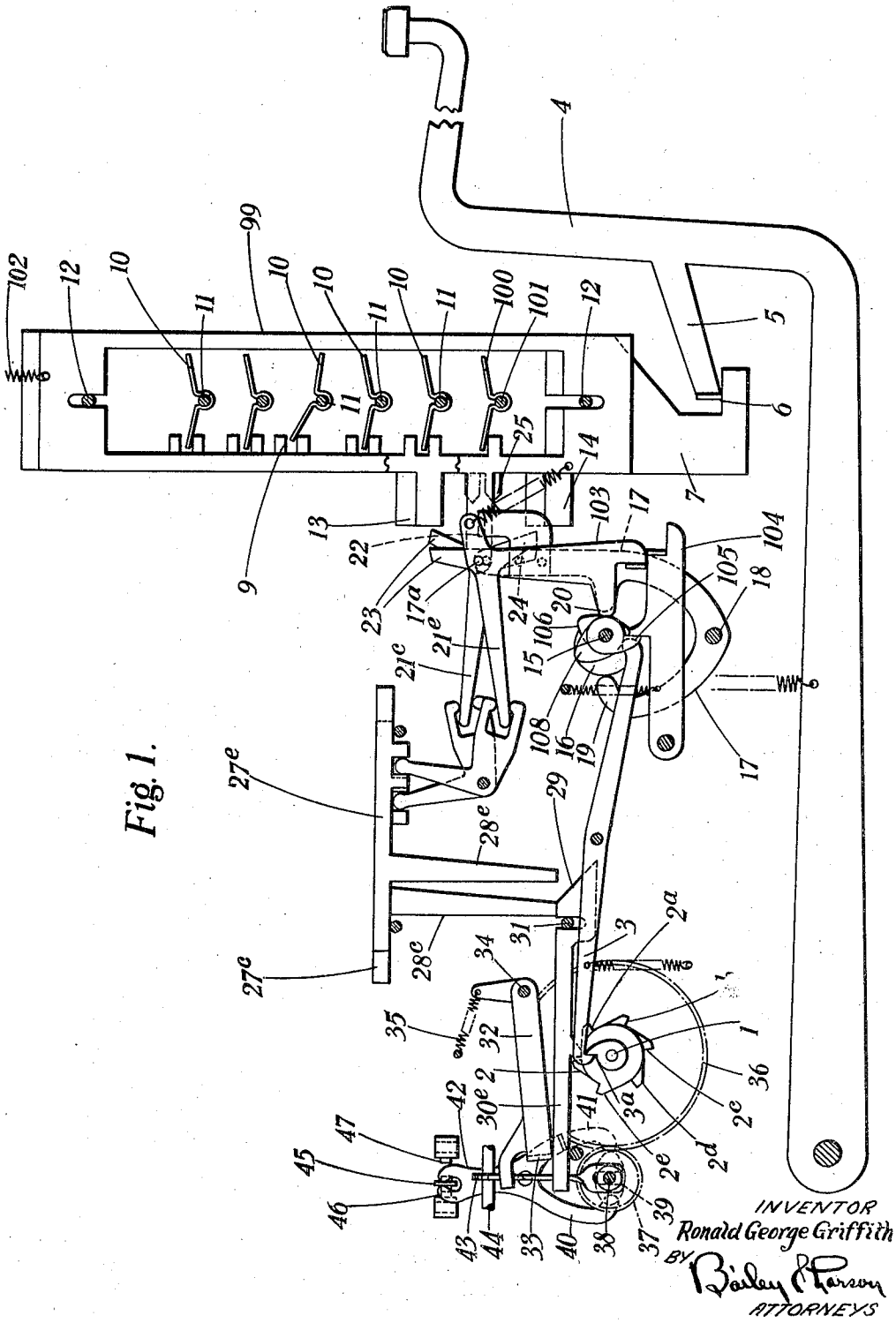

Fig. 1.

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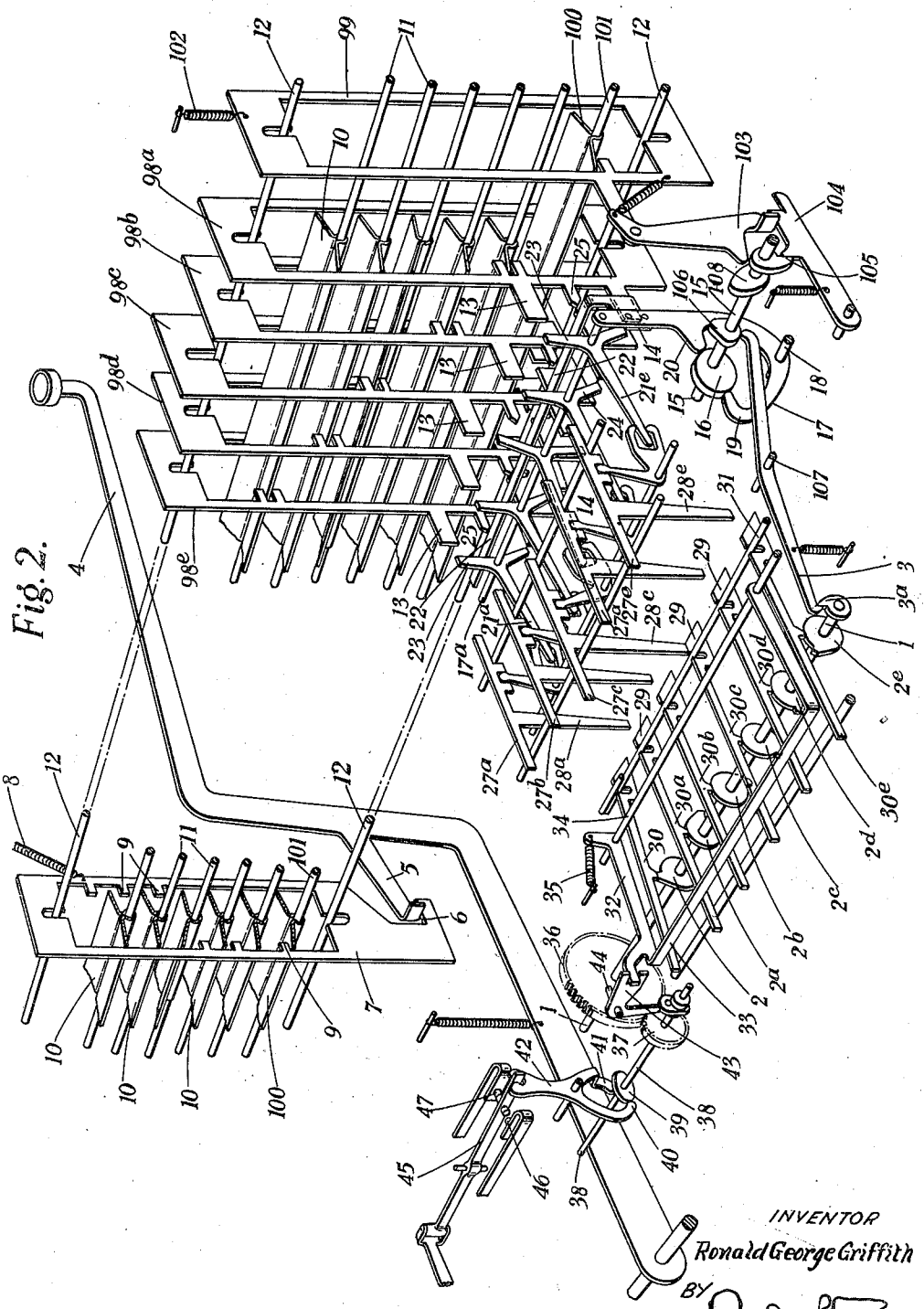

Fig. 2.

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Patented Mar. 8, 1938 2,110,506

UNITED STATES PATENT OFFICE

2,110,506

START-STOP TELEGRAPH

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Original application May 29, 1935, Serial No. 24,153, now Patent No. 2,075,712, dated March 30, 1937. Divided and this application January 20, 1936, Serial No. 59,948. In Great Britain November 12, 1934

8 Claims. (Cl. 178—53.1)

This invention relates to start-stop telegraph systems and comprises matter divided from application for Letters Patent No. 2,075,712, March 30, 1937; it is particularly concerned with the transmitting mechanism of start-stop printing telegraphs employing an equal length code. In such systems, the transmission of each character involves the sending of a starting impulse, a number of permuted code impulses followed by a stop impulse.

The object of the invention is to provide a mechanism of simple construction in which, in the transmitting mechanism, a minimum distortion of the transmitted signals shall be produced with a given amount of manufacturing irregularities. Then a greater part of the margin of signal distortion provided for in the receiving apparatus may be utilized to allow for the distortion produced in the connecting media, that is to say, a telegraph line or the radio link.

According to the present invention, a rotating member, such as a cam shaft, is provided for the transmitter and is arranged to form or to control a signal member arranged to select each transmitted impulse mechanically, and that rotating member is driven at such an angular velocity that it executes one revolution in a time equal to one or more signal impulse periods but not exceeding the time of all the code impulses of one complete character signal. It is preferred for the rotating member or cam shaft to be driven so as to complete one revolution or a half revolution in the time required for transmitting each permuted code impulse. Thus, a selecting cam shaft is provided, arranged when released to make a predetermined amount of angular motion, usually one complete revolution or a half revolution. The selecting cam shaft is associated with means for operating different selecting devices provided for dealing with successive impulses at regular intervals in its rotation and the transmitting cam shaft is geared to the selecting cam shaft with such a ratio that the transmitting shaft rotates more quickly than the selecting cam shaft, and preferably so that it makes one revolution during each angular movement of the selecting cam shaft equivalent to one signal impulse. In other words, one revolution or a half revolution of the transmitting cam shaft is equal to an exact multiple of the impulse submultiples of the selecting cam shaft.

The cam shaft may be mounted so as to be capable of motion in the direction of its axis and capable of taking up one of two positions corresponding to the two kinds of impulses to be transmitted. The invention may be applied to various kinds of start-stop transmitters, such as keyboard controlled apparatus, tape controlled apparatus and so forth. The operation of the transmitter in any event controls the successive axial positions of the cam shaft and the latter may then be provided with a cam so that at each revolution of the shaft corresponding to one impulse of a character signal, the cam, depending upon the axial position of its shaft, co-operates to move a contact-making member in one direction or the other for effective transmission of the two forms of impulse constituting the complete series representing a transmitted character signal.

In order that the invention may be clearly understood and readily carried into effect, it will be more fully explained by way of example in its application to a keyboard controlled printing telegraph transmitter, with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation of the essential parts of the transmitter; and

Figure 2 is a perspective view of the main parts of the transmitter.

Referring to the drawings, the selecting cam shaft is shown at 1 and the five selecting cams at 2^a, 2^b, 2^c, 2^d, and 2^e with the start cam at 2. The shaft is driven through a friction clutch, capable of slipping, from a shaft constantly driven at a suitable speed, but when a character is transmitted by the depression of any key, a mechanism is arranged to withdraw the usual detent 3 from a stop surface 3^a carried by the shaft 1, so that the latter is frictionally driven through one complete revolution, whereupon the detent holds it up again. Thus, the shaft 1 makes one complete revolution for each character transmitted. Actually, before the five code cams 2^a . . . 2^e come into operation, the additional start cam 2 first of all sends a starting impulse and when the five cams 2^a . . . 2^e have operated, a stopping impulse may be sent.

One of the key levers is indicated at 4 and each has an extension 5 engaging a notch 6 in a lower extension of the corresponding selector frame 7. There are consequently a number of selector frames 7 equal to the number of characters provided on the keyboard. When a key is depressed, the extension 5 draws down the corresponding selector frame 7 against the action of a tension spring 8 and, as a result, certain internal projections 9 on the frame 7 operate upon a series of vanes 10 carried on spindles 11, the frame 7 at this time being guided on fixed

pins 12. The number of the vanes 10 provided depends on the number of code elements used. In the case illustrated five are provided. As a result, according to the particular combination set by the key which has been depressed, certain of the five vanes 10 are turned clockwise and certain of them counter-clockwise.

Spaced from the frames 7 along the spindles 11, there are further five frames 98a, 98b, 98c, 98d and 98e, each of which has one projection corresponding to those shown at 9 in position to be engaged by one of the vanes 10. Thus, these additional frames 98a . . . 98e each correspond to one of the five vanes 10 and by means of the vanes each will be caused to take up an upper or lower position at each selection on the depression of one of the keys 4. These five additional frames have projections to the rear, shown at 13, 14, which are moved to the upper or lower position with the frame in question.

A cam shaft 15, bearing an eccentric cam 16, is also released and actuates a lever 17 pivoted at 18. The lever 17 has a pair of horns 19, 20 co-operating with the cam 16, the former providing for positive forward motion of the lever 17 and the latter for positive return motion. Thus, at each selection the lever 17 is moved forward and five further levers 21a . . . 21e, each carried on a pin 17a projecting from the upper end of the lever 17, are thrust forward and are caused to co-operate with the projections 13, 14 of the corresponding permutation frame 98a . . . 98e. Each lever 21a . . . 21e has a transverse bar 22 and two forward projections 23, 24. The purpose of the transverse bar 22 is to engage with a pointed projection 25 on each of the permutation frames so that if it chances that any one of the permutation frames has not been quite fully moved to the upper or lower position, the bar 22 engages above or below the corresponding projection 25 and positively thrusts the permutation frame into its full upper or lower position. If a permutation frame is in the full upper position then the corresponding projection 24 abuts against the projection 14 of the corresponding frame so that the lever 21e is rocked upwards into the position seen at 21c in Figure 1. If, previously, it were in the position shown at 21e in Figure 1, it moves as described and rocks over the pivoted connecting member 26e and consequently moves the corresponding selector bar 27e from the position shown towards the left. Of course, if the permutation bar is already in that position, no movement takes place. If, however, the corresponding permutation frame is in the lower position, then the projection 23 abuts against the upper projection 13 of the corresponding permutation frame and the lever 21a . . . 21e is rocked counter-clockwise into the position shown at 21e in Figure 1.

The gear for tripping the shaft 15 and the detent 3 is controlled from an additional sliding frame 99. There is an additional vane 100 below the five vanes 10 and the projections 9 on the frames 7 are so arranged that when any key lever is depressed, the vane 100 is tilted, its shaft 101 being rocked slightly counter-clockwise. This causes the additional frame 99 to be thrust down against the tension of the spring 102. Then through the arm 103, a detent 104 is depressed, releasing the stop surface 105 on the shaft 15. The latter is driven and, at a certain point in its revolution, a cam 106 depresses the right hand end of the detent 3 which is pivoted at 107 so that the shaft 1 is released. In due course, the arm 103 is restored by a cam 108.

The result therefore on depressing a key lever 4 is first of all that the five selector bars 27a . . . 27e are each set either in the position to the right as shown at 27e in the drawings, or in a position more to the left as shown at 27c, with the result that a projecting tail 28a . . . 28e of each selector bar either registers with a rear extension 29 of the corresponding selecting lever 30a . . . 30e or the tail 28 is moved to the right with the selector bar 27 and leaves the projection 29 free.

As illustrated, the selecting devices consist of five levers 30a . . . 30e each pivoted at 31 and each allocated so as to co-act with the corresponding selecting cam 2a . . . 2e. There is an additional lever 30 also pivoted at 31 and co-operating with the cam 2 for giving the "start" impulse but not co-operating with any selector bar such as 27a . . . 27e. When the shaft 1 starts rotating, the cam 2 co-operates with the corresponding selecting lever 30, the latter is allowed to fall down the step of the cam 2 and thus move towards the centre of the shaft 1, being urged in that direction by the pressure of a common pivoted member 32 which has a bar 33 extending over all five of the selecting levers 30a . . . 30e and over the lever 30. The common member 32 is pivoted at 34 and tends to be moved counter-clockwise by a tension spring 35. As the levers 30a . . . 30e are all in their lower positions at this time, the member 32 is rocked by the spring 35 and the bar 33 descends to give the "start" impulse as will be described below. The cams 2a . . . 2e in succession come into the positions in which they tend to lift the corresponding levers 30a . . . 30e and whether they are able to lift them or not depends on the position of the respective selector bars 27a . . . 27e. In Figures 1 and 2, the selector bar 27c is shown displaced to the right with its tail 28c immediately above and therefore in registration with the extension 29 of the lever 30c. Thus, when cam 2c comes into position to lift this lever, the right hand end of the latter cannot rise and, therefore, its left hand end is forced up and lifts the common bar 33. The other four levers 30a, 30b, 30d and 30e are not restrained at their right hand ends by the tails of their selector bars, so that when their respective cams come into action, their right hand ends are free to rise and these levers do not lift the common bar 33.

A spur wheel 36 is fixed to the shaft 1 and engages with a small pinion 37 fixed to the transmitting cam shaft 38. The gear ratio is such that the transmitting cam shaft 38 makes three and a half revolutions for each character transmitted, that is, one half a revolution for each code impulse, one half a revolution for "start" and one half a revolution for "stop". The shaft 38 is mounted so as to be slidable in the direction of its axis and carries a cam 39 arranged to operate selectively one or other of a pair of arms 40, 41 of a pivoted contact member 42. As can be best seen in Figure 2, the arm 41 is cranked so that the ends of the arms 40, 41 are staggered or displaced relatively to one another in the direction of the axis of the transmitting shaft 38.

As seen in Figure 2, this shaft is moved in the axial direction depending upon the position of the common bar 33. The forward end of the member 32 engages a fork in a bell crank 43 which is pivoted about an axis 44 at right angles to the axis of the shaft 38. Thus, when the selecting cams 2 allow the member 32 to rock

slightly counter-clockwise, the forward end of the latter descends and through the bell crank **43** moves the shaft **38** to the left in Figure 2; then the cam **39** presses against the arm **41** and the member **42** is rocked counter-clockwise and, at its upper end, makes contact between members **45** and **46** which results in sending an impulse of one sign, for example a "marking" impulse, to the line. As the cams 2^a and 2^b do not lift the bar **33**, the contacts **45**, **46** remain closed and two more "marking" impulses are sent. As, however, the next selector bar 27^c prevents the lever 30^c from lifting at its right hand end, it lifts the common bar **33** and causes the member **32** to rock clockwise and the member **32** through the bell crank **43** moves the transmitting shaft **38** back to the right until the cam **39** is opposite the arm **40** and during the following half revolution of the shaft **38**, the cam **39** presses on the arm **40** thereby swinging over the member **42** and bringing the contacts **45** and **47** together so as to transmit to the line an impulse of opposite sign, that is to say, a spacing impulse. Finally, the cam **2** completes a whole revolution and lifts the bar **33** to send the "stop" impulse. The result is that when a key is depressed, the shaft **1** makes a complete revolution, the shaft **38** makes three and a half revolutions and the cam **39** during those revolutions makes five code contacts in addition to the "start and stop", so that the impulses are sent to the line representing the combination which corresponds to the character whose key has been depressed.

I claim:—

1. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, means for intermittently rotating said selecting cam shaft, a signal transmitting mechanism, a single rotary member operatively connected to actuate said signal transmitting mechanism and connecting gearing between said rotary member and said cam shaft, the ratio of said gearing being such that one revolution of said rotary member occupies a time equal to an integral number of the signal impulse periods but not exceeding the time period of all the code impulses of one complete character signal.

2. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, means for intermittently rotating said selecting cam shaft, a signal transmitting mechanism, a single rotary member operatively connected to actuate said signal transmitting mechanism and connecting gearing between said rotary member and said cam shaft, the ratio of said gearing being such that said rotary member is rotated by an amount of a half revolution during the time occupied by each permuted code impulse.

3. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, means for intermittently rotating said selecting cam shaft, a pivoted signal transmitting lever, marking and spacing contacts mounted to co-operate with said transmitting lever during the rocking movements thereof, a single rotary member operatively connected to actuate said transmitting lever in accordance with the respective signal impulses to be transmitted and connecting gearing between said rotary member and said cam shaft, the ratio of said gearing being such that one revolution of said rotary member occupies a time equal to an integral number of the signal impulse periods but not exceeding the time period of all the code impulses of one complete character signal.

4. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, means for intermittently rotating said cam shaft, marking and spacing contacts, a transmitting cam shaft mounted for rotation and for movement in the direction of its axis, a pivoted transmitting lever formed with two operating projections relatively spaced in the direction of the axis of said transmitting cam shaft, means for shifting said transmitting cam shaft axially into either of two positions in accordance with the respective signal impulses to be transmitted, a transmitting cam fixed to said transmitting cam shaft and located to cooperate respectively with said two operating projections in the two axial positions of said transmitting cam shaft to rock said transmitting lever into cooperation respectively with said marking and spacing contacts, and connecting gearing between said two cam shafts, the ratio of said gearing being such that one revolution of said transmitting cam shaft occupies a time equal to an integral number of the signal impulse periods, but not exceeding the time period of all the code impulses of one complete character signal.

5. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, means for intermittently rotating said selecting cam shaft, marking and spacing contacts, a transmitting cam shaft mounted for rotation and for movement in the direction of its axis, a pivoted transmitting lever formed with two operating projections relatively spaced in the direction of the axis of said transmitting cam shaft, means for shifting said transmitting cam shaft axially into either of two positions in accordance with the respective signal impulses to be transmitted, a transmitting cam fixed to said transmitting cam shaft and located to cooperate respectively with said two operating projections in the two axial positions of said transmitting cam shaft to rock said transmitting lever into cooperation respectively with said marking and spacing contacts, and connecting gearing between said two cam shafts, the ratio of said gearing being such that said transmitting cam shaft is rotated by an amount of half a revolution in the time occupied by each permuted code impulse.

6. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, means for intermittently rotating said selecting cam shaft, a transmitting cam shaft mounted for rotation and

for movement in the direction of its axis, a pivoted transmitting lever formed with two operating projections relatively spaced in the direction of the axis of said transmitting cam shaft, means for shifting said transmitting cam shaft axially into either of two positions in accordance with the respective signal impulses to be transmitted, a transmitting cam fixed to said transmitting cam shaft and located to cooperate respectively with said two operating projections in the two axial positions of said transmitting cam shaft to rock said transmitting lever into cooperation respectively with said marking and spacing contacts, connecting gearing between said two cam shafts, the ratio of said gearing being such that one revolution of said transmitting cam shaft occupies time equal to an integral number of signal impulse periods, but not exceeding the time period of all the code impulses of one complete character signal, and keyboard controlled mechanism for shifting said transmitting cam shaft in the direction of its axis in accordance with the signal impulses constituting each character transmitter.

7. In a transmitting mechanism for a start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, a plurality of cams fixed to said shaft for sending the start and code impulses, means for intermittently rotating said selecting cam shaft, marking and spacing contacts, a transmitting cam shaft mounted for rotation and for movement in the direction of its axis into either of two positions in accordance with the respective signal impulses to be transmitted and located to cooperate respectively with two of said operating projections in the two axial positions of said transmitting cam shaft to rock said transmitting lever into cooperation respectively with said marking and spacing contacts, a plurality of pivoted selecting levers each in operative relation with one of said plurality of cams, a plurality of permutation bars movable to control respectively the movements of said selecting levers, a keyboard controlled mechanism arranged to effect the movement of said permutation bars, mechanism operable in succession by each of said selecting levers for shifting axially said transmitting cam shaft, a transmitting cam fixed to said transmitting cam shaft and located to cooperate respectively with said two operating projections in the two axial positions of said transmitting cam shaft to rock said transmitting lever into cooperation respectively with said marking and spacing contacts, and connecting gearing between said two cam shafts, the ratio of said gearing being such that one revolution of said transmitted cam shaft occupies a time equal to an integral number of the signal impulse periods, but not exceeding the time period of all the code impulses of one complete character signal.

8. In a transmitting mechanism for start-stop telegraph adapted and arranged to transmit in addition to starting and stopping impulses, a plurality of code impulses of equal time periods to constitute each character signal, the combination of a selecting cam shaft, a plurality of cams fixed to said shaft operative in succession for sending the start and code impulses, means for intermittently rotating said selecting cam shaft, a transmitting cam shaft mounted for rotation and for movement in the direction of its axis into either of two positions in accordance with the respective signal impulses to be transmitted, a transmitting cam fixed to said transmitting cam shaft, a pivoted transmitting lever formed with two projections located to co-operate with said transmitting cam respectively in the two axial positions of said transmitting cam shaft, a plurality of pivoted selecting levers each in operative relation with one of said plurality of cams, a plurality of permutation bars movable to control respectively the movements of said selecting levers, a keyboard controlled mechanism arranged to effect the movement of said permutation bars, a member common to said selecting levers and in operable relationship therewith, a pivoted bell crank operatively connected with said common member and with said transmitting shaft to shift the latter axially upon movement of said common member and connecting gearing between said two cam shafts, the ratio of said gearing being such that one revolution of said transmitting cam shaft occupies a time equal to an integral number of the signal impulse periods, but not exceeding the time period of all the code impulses of one complete character signal.

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