Jan. 1, 1935. R. F. DIRKES ET AL 1,986,768

MULTICHANNEL TELEGRAPH PRINTER

Filed Dec. 13, 1932 5 Sheets-Sheet 1

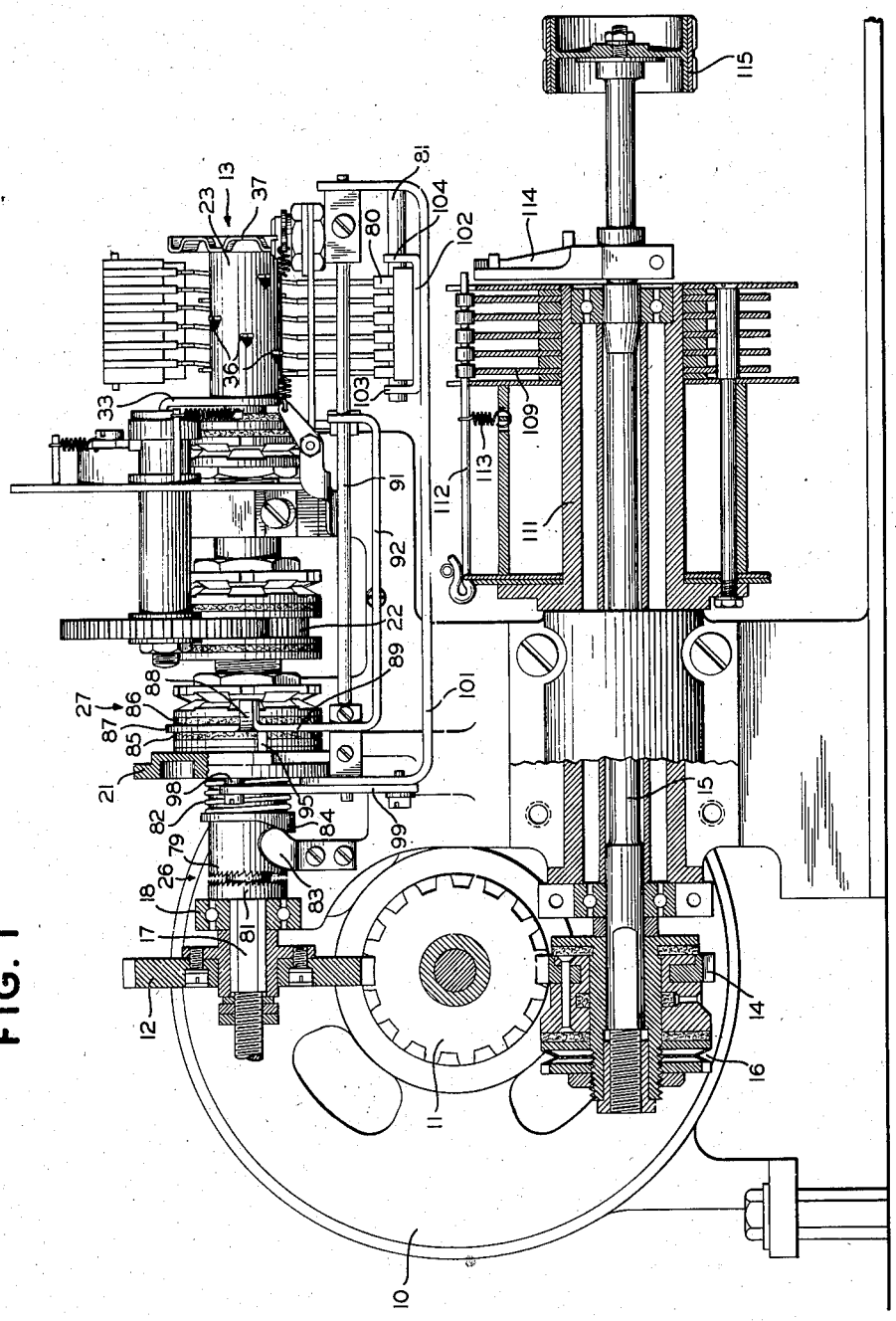



FIG. 1

INVENTORS
R. F. DIRKES
R. WENTWORTH

BY Eugene C. Brown
ATTORNEY

Jan. 1, 1935. R. F. DIRKES ET AL 1,986,768

MULTICHANNEL TELEGRAPH PRINTER

Filed Dec. 13, 1932 5 Sheets-Sheet 2

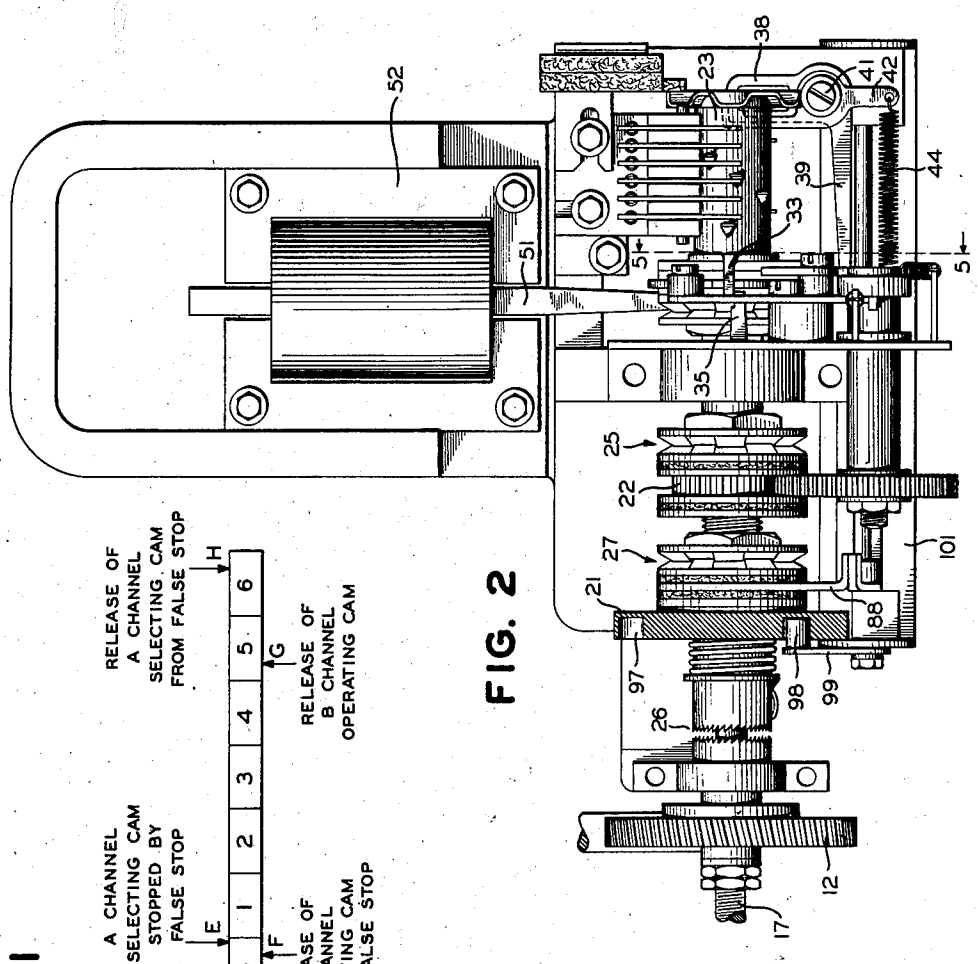



FIG. 2

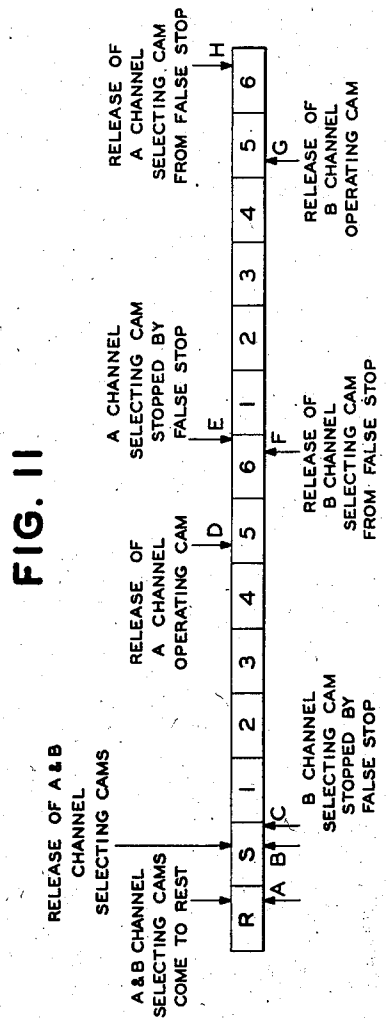



FIG. 11

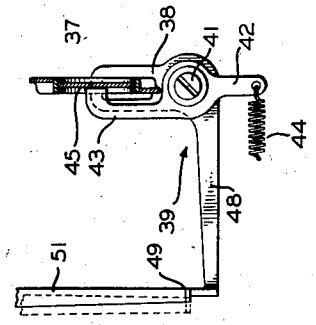



FIG. 6

INVENTORS
R. F. DIRKES
R. WENTWORTH
BY Eugene C. Brown
ATTORNEY

Jan. 1, 1935. R. F. DIRKES ET AL 1,986,768

MULTICHANNEL TELEGRAPH PRINTER

Filed Dec. 13, 1932 5 Sheets-Sheet 3

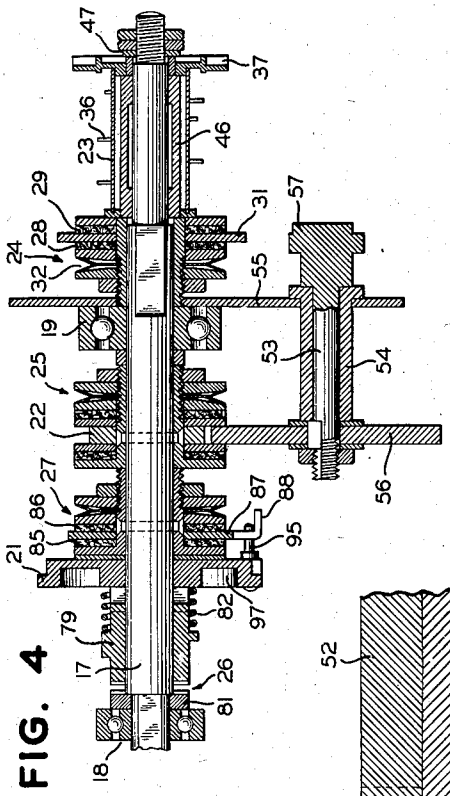


FIG. 4

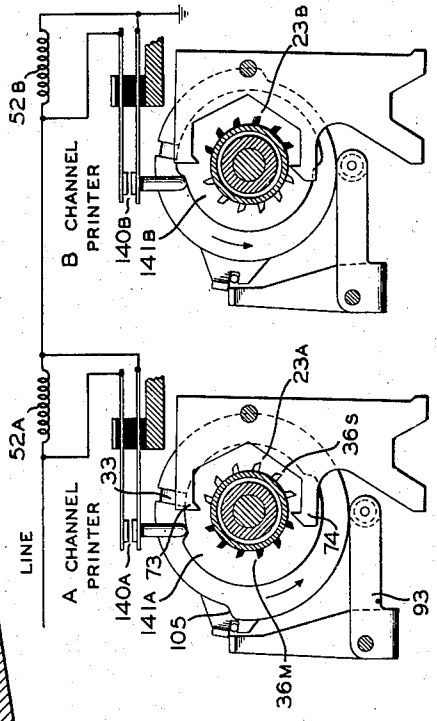



FIG. 13

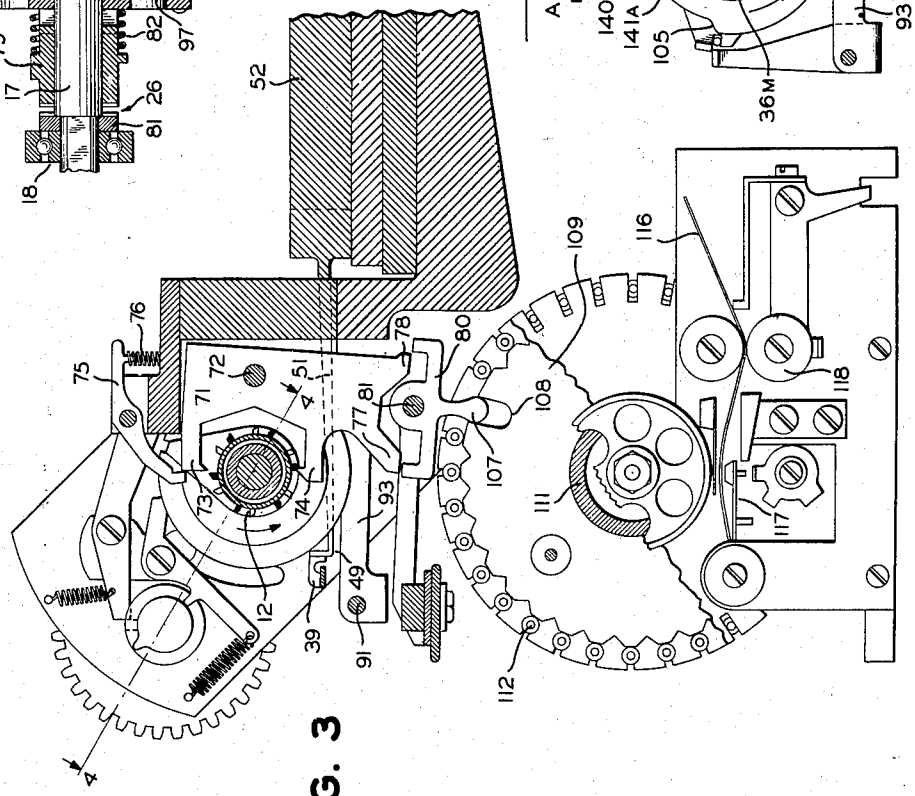


FIG. 3

INVENTORS
R. F. DIRKES
R. WENTWORTH
BY Eugene C. Brown
ATTORNEY

Jan. 1, 1935. R. F. DIRKES ET AL 1,986,768

MULTICHANNEL TELEGRAPH PRINTER

Filed Dec. 13, 1932 5 Sheets-Sheet 4

FIG. 7

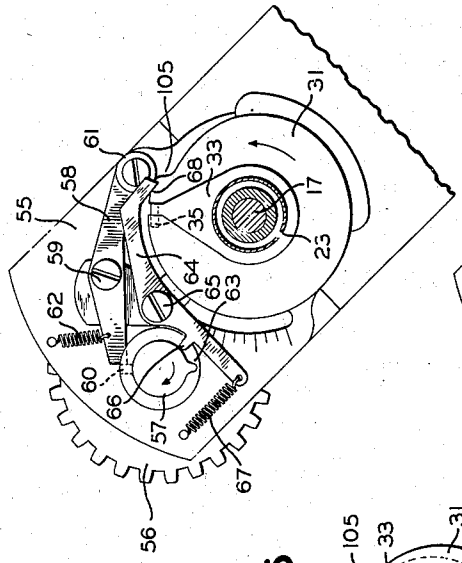



FIG. 8

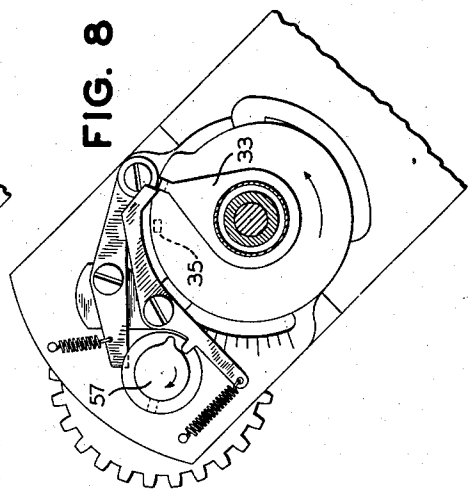



FIG. 5

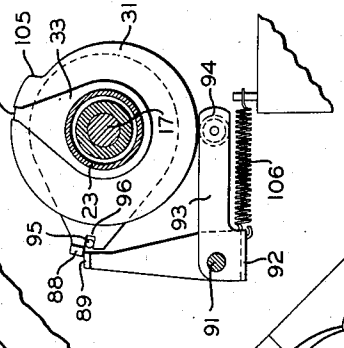



FIG. 9

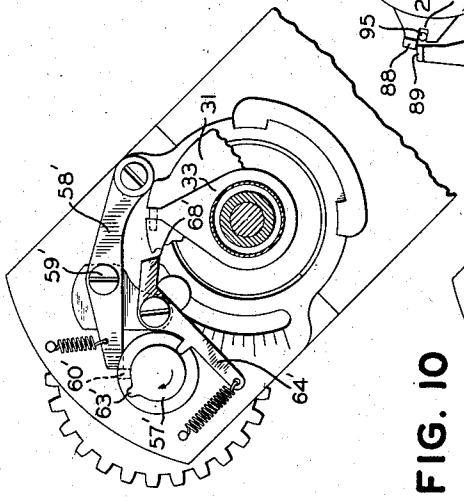
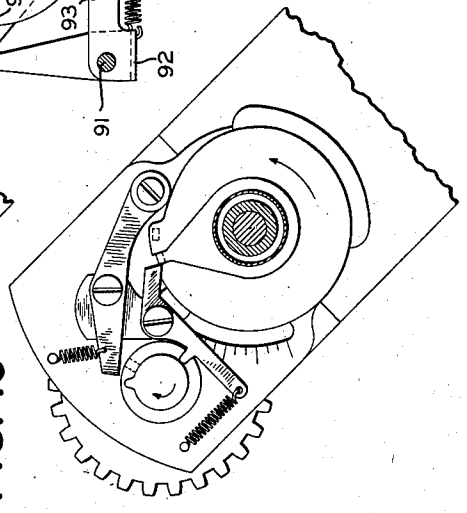



FIG. 10



INVENTORS
R. F. DIRKES
R. WENTWORTH

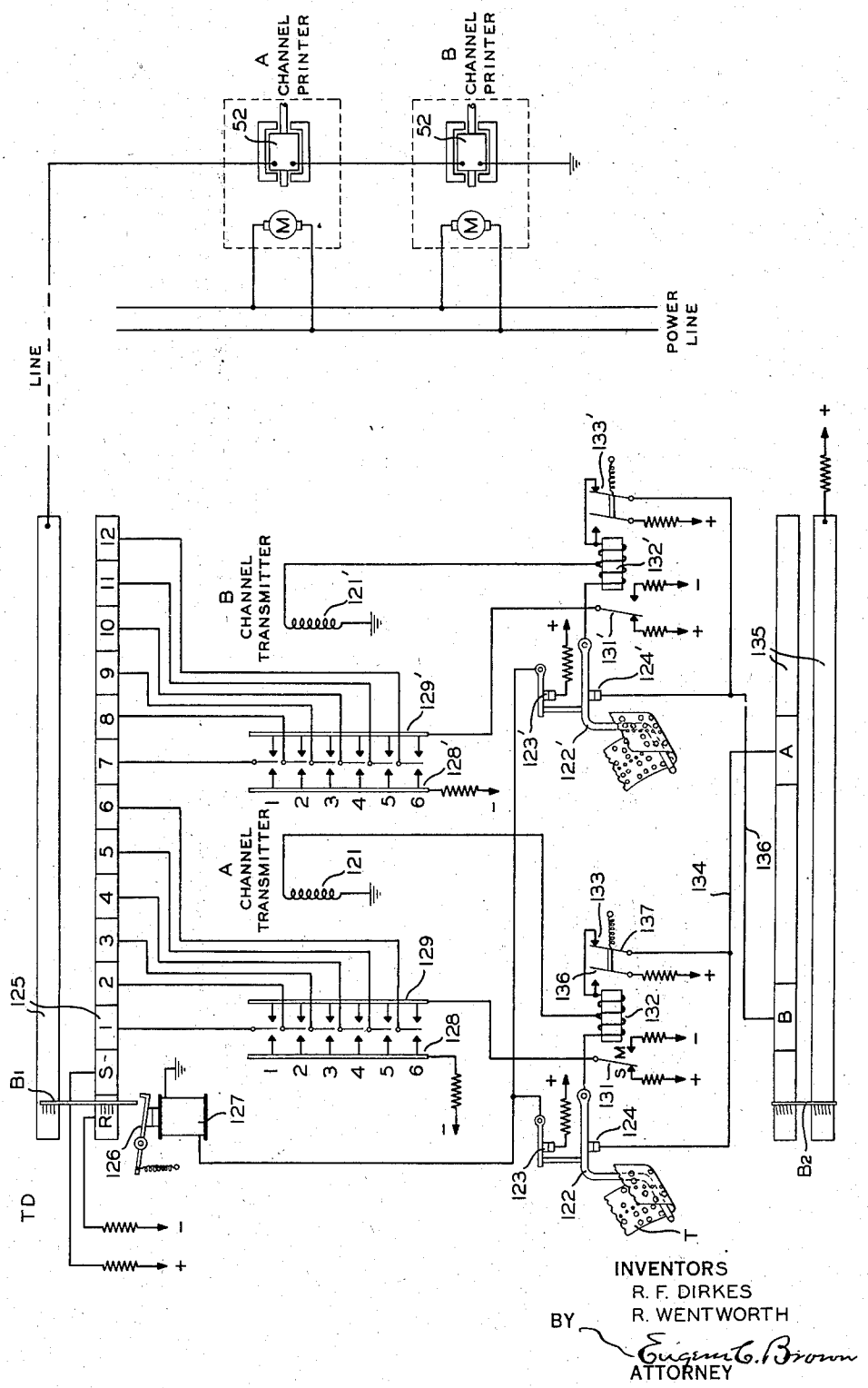
BY Eugene C. Brown
ATTORNEY

Jan. 1, 1935. R. F. DIRKES ET AL 1,986,768

MULTICHANNEL TELEGRAPH PRINTER

Filed Dec. 13, 1932 5 Sheets-Sheet 5

FIG. 12




INVENTORS
R. F. DIRKES
R. WENTWORTH

BY Eugene C. Brown
ATTORNEY

Patented Jan. 1, 1935 1,986,768

# UNITED STATES PATENT OFFICE

1,986,768

## MULTICHANNEL TELEGRAPH PRINTER

Robert F. Dirkes, New York, N. Y., and Rollins Wentworth, Verona, N. J., assignors to The Western Union Telegraph Company, New York, N. Y., a corporation of New York

Application December 13, 1932, Serial No. 647,060

47 Claims. (Cl. 178—53.1)

This invention relates to a telegraph printer and more particularly to a printer adapted to be operated alternately with another printer or in succession with a plurality of other printers over a single line.

Start-stop printers as heretofore employed have been operated on a single channel telegraph system, the printer operation being started upon transmission of the first or start impulse of a character code signal and being stopped after the last selecting impulse of the group. This requires a separate line for each printer channel.

One of the objects of the present invention is to provide a start-stop printer which may be used in a two or more channel system in which each printer is controlled over one of the channels.

Another object is to provide a transmitting system arranged to control a plurality of start-stop printers in succession over a single line.

Another object is to enable a plurality of simplex printers to be operated selectively over a single line.

A still further object is to effect economy in line time.

Other objects and advantages of the invention will hereinafter appear.

In accordance with the present invention we employ the start-stop principle of synchronism, a single start impulse and a single rest impulse being utilized to control the operation of a plurality of printers operating one at a time. In other words, between each start and rest impulse a plurality of character code signal groups are transmitted, each character code group being recorded upon a separate printer as in ordinary multiplex systems. The invention is described hereinafter in connection with the operation of two printers alternately but of course any desired number of printers may be so operated in succession limited only by the degree of speed regulation obtainable. Both printers in the present instance are conditioned for operation upon reception of the start impulse, one printer being effective to select the first character code group and being uninfluenced by the succeeding character code group and the second printer being ineffective to select until the second character code group is received. Both printers come to rest during the rest impulse. For convenience, the first printer to operate will be termed the A channel printer and the second to operate will be termed the B channel printer.

In order that the invention may be more fully understood, reference will be had to the accompanying drawings in which:

Figure 1 is a side elevation of a printer embodying our invention;

Figure 2 is an elevation of the selecting cam shaft showing the channel controlling mechanism associated therewith;

Figure 3 is an end view, partly in section, of the printer;

Figure 4 is a sectional view of the selector and channel controlling shaft assemblies taken on the line 4—4 of Figure 3;

Figure 5 is a sectional view on the line 5—5 of Figure 2, showing the mechanism for releasing the operating cam of the printer;

Figure 6 is a detailed view of the flutter lever and flutter cam;

Figure 7 is a sectional view also taken approximately on the line 5—5 of Figure 2 showing the rest position of the channel controlling mechanism of the A channel printer;

Figure 8 is a similar section showing the position of the A printer channel controlling mechanism during the period of reception of the B channel signals;

Figure 9 is a similar section showing the channel controlling mechanism of the B channel printer in its normal rest position;

Figure 10 is a similar section of the B channel printer mechanism showing the position thereof during the reception of the A channel signals;

Figure 11 is a diagram showing the timing of the individual functions of the A and B channel printers;

Figure 12 is a wiring diagram of a transmitting and receiving system embodying the invention; and

Figure 13 shows a modification in which the channel control is effected entirely by the selecting cam shaft.

Referring to Figure 1, the printer includes a constantly running motor 10 which, through a pinion 11, drives a gear 12 associated with the selecting unit, generally indicated at 13, and a gear 14 connected to a type wheel shaft 15 through a friction clutch 16.

The selecting unit comprises the driving gear 12 rigidly secured to shaft 17, extending through bearings 18 and 19 (see Figure 4). Mounted upon the shaft for relative rotation thereon is an operating cam 21, a gear 22 and a selector cam drum 23. The selector cam drum is arranged to be driven from the shaft 17 by a friction clutch 24; the gear 22 is driven from

the shaft by a friction clutch 25, and the operating cam 21 is driven from the shaft by a ratchet clutch 26. A second friction clutch 27 causes an initial rotation of the operating cam to effect engagement of the ratchet clutch.

The friction clutch 24 comprises a pair of spaced friction disks 28, 29, between which is loosely mounted a clutch driven disk 31 for relative rotation. The friction disks 28, 29 are pressed into engagement with the driven disk 31 by a spring washer 32.

Secured to the rear end of the cam drum 23 is an L shaped stop arm 33 (Figure 5) having its free end extending through a slot 34 in the periphery of the driven clutch disk 31. The end of the arm 33 normally engages a fixed abutment 35 (Figure 2) which retains the cam drum and driven disk 31 against rotation under the drag of the friction disks 28 and 29.

The selector cam drum consists of a hollow cylinder having twelve cams 36 projecting from its outer surface. These cams are arranged in two spiral rows, six of the cams forming one spiral row being marking cams and the other six, forming the second spiral row, displaced 180 degrees from the first row, being spacing cams.

Secured to the front of the selecting cam drum is a crimped disk or flutter cam 37 having fourteen crimps or cam faces, seven of which project rearward and seven frontward. The flutter cam revolves with the drum and passes between the forked arm 38 of a lever 39 (Figure 6), pivoted at 41.

Pivoted at the same point is a cam drum return lever 42, the right end 43 of which bears under the action of a spiral spring 44 against an annular plane surface 45 on the back of the flutter cam adjacent the hub thereof.

The selector cam is mounted so as to slide back and forward on a sleeve 46 on the shaft 17, the spring 44 serving to move it to the right against the front stop 47. Consequently if the forked end of the flutter lever is held stationary as the flutter cam revolves, it causes the drum to move backward and forward and if the flutter lever is left free to rock on its pivot, the cam return lever 42 retains the selector drum to the right, the flutter lever 39 rocking idly on its pivot as the flutter cam rotates.

The long arm 48 of the flutter cam projects to the rear and is of such length that when the upturned end 49 of the armature extension 51, of the selecting magnet 52, is in its marking or right hand position it will engage the end of the flutter lever, as shown in Figure 6, and thus prevent the lever from rocking clockwise. In this position the selector cam moves backward and forward as it revolves. However, when the armature 51 is in its spacing or left hand position, it clears the end of the flutter lever permitting the same to rock idly under the action of the flutter cam, the selector drum being retained in its right hand position by the cam return lever 42.

In its rest position, with marking current on the line, the flutter lever rests against the end of the armature 51 with the forked arm 38 holding the cam drum in its rear or left hand position so as to cause engagement of the stop arm 33 with the abutment 35.

The start signal which precedes each group of character signals is of spacing polarity and upon receipt thereof the armature 51 is moved to the left away from the end of the flutter lever 39, thereby permitting the same to rock inwardly, whereupon the lever 42 moves the cam drum to the right freeing the stop arm 33 from the abutment 35 and permitting the drum to be rotated by the friction clutch 24.

The sequence of operation of the A and B channel printers is somewhat different and consequently the channel controlling mechanism of each printer is modified to effect the proper printer control. The channel controlling mechanism for the A channel printer will first be described. This mechanism is shown in Figures 4, 7 and 8. A shaft 53 is mounted in a bearing 54 carried by a plate 55 rigidly secured to the frame of the machine in any desired manner. The shaft 53 has on one end a gear 56 keyed thereto and meshing with the gear 22. A cam 57 is formed on the opposite end of shaft 53. Shaft 53 is normally held against rotation by a stop arm 58, pivoted at 59, on the plate 55. The left hand end of the stop arm 58 (Figure 7) engages a stop lug 60 on the cam shaft when the selecting cam drum 23 is at rest. The arm 58 is held in engagement with the lug 60 by the raised portion of the cam disk 31 which engages a roller 61 carried on the right hand end of the arm 58. The stop arm is normally urged out of engagement with the lug 60 by a spring 62. The cam 57 is provided with a single projection 63 disposed approximately 180 degrees from the stop lug 60.

An auxiliary or false stop arm 64, pivoted to the plate 55 at point 65, has a raised portion 66 extending into the path of the cam projection 63, as it revolves in a clockwise direction. A spring 67 retains the lever 64 in contact with the face of the cam. The opposite end 68 of lever 64 normally extends into the path of the stop arm 33.

With the selecting cam 23 at rest and no character signals being received, the parts are in the position shown in Figure 7. As stated, upon the reception of the start impulse preceding a character group, stop arm 33 is released from the stop 35 and the disk 31 and the cam drum 23 are permitted to rotate counterclockwise. As the disk 31 starts to rotate the drop therein comes opposite the roller 61 of the arm 58 permitting this arm to trip the cam 57 for one revolution. The cam 57 is geared to make half a revolution for each revolution of the cam disk 31.

The disk 31 and cam drum 23 revolve in substantial synchronism with the succeeding first or A channel code signals so that as each code impulse is received by the selecting magnet 52, each succeeding pair of cams 36 is brought into selecting position. If the impulse is spacing the drum will rest against its right hand stop at the time the impulse is received and if marking it will rest against its left hand stop.

Disposed along the selecting cam drum are six selecting levers 71 pivoted at 72 and having two spaced arms 73 and 74, the former being disposed above the cam drum and the latter below the cam drum. The ends of these arms are offset with respect to each other, the lower or marking arm being offset towards the back and the upper or spacing arm being offset towards the front. This is done so that when the marking cams line up with the marking arms the spacing cams will pass to the rear of the spacing arms and when the spacing cams are in line with the spacing arms, the marking cams will pass to the front of the marking arms.

The marking cams are the series of six cams

located spirally around the drum 23, the number one cam, when the drum 23 is at rest, being the rearmost cam on the underneath side of the drum, adapted to engage the lower arm 74 of the first or rearmost selector lever, the remaining five marking cams extending spirally around the drum in a clockwise direction, looking at the right end of the cam drum. The spacing cams are the series having the number one cam placed on the upper side of the drum just to the right of the stop arm (Figure 1).

The selecting levers will be rocked either clockwise or counterclockwise as the cam drum revolves, depending upon whether the cam drum is shifted to the right in response to a spacing signal so as to cause the spacing cam to line up with the spacing arm, or to the left in response to a marking signal so as to cause a marking cam to line up with one of the marking arms. The selector levers are thus set up in succession as each impulse is received and they are held in their set position by individual detents 75 engaging either with the top or the front thereof, under the pressure of detent springs 76.

By way of a specific example supposing the code combination representative of the fraction ½, consisting of two marking impulses, two spacing impulses and two marking impulses is received, following the start impulse. The start impulse releases the cam drum for a single revolution and the first code impulse, being marking, moves the selector magnet armature 51 to the marking or right hand side. As the cam drum rotates the flutter lever will be moved outwardly, permitting the armature to move into the path of the lever and block it. When the flutter lever is blocked by the armature the forked arm 39 guides the flutter cam as it rotates so that the number one marking cam on the drum will be moved into line with the marking arm of the first selecting lever and the cam will move the lever downward to the marking position.

The second impulse also being marking the armature lever remains in the right hand marking position and the number two marking cam is brought into line with the marking arm of the second selector lever, causing this lever to move downward into marking position.

The third impulse is spacing. Therefore, the armature is moved to the spacing or left hand side, whereby the flutter lever is released and the cam drum permitted to move to its front stop, by means of the lever 42, so that the number three spacing cam will be in line with the third selector lever, so as to move the same upwardly to spacing position.

The fourth impulse also being spacing the number four selector lever will be moved upwardly.

The fifth and sixth impulses are marking. Consequently the armature is again moved to its marking or right hand side, causing the fifth and sixth marking cams to line up in succession with the marking arm to shift the same to the marking position.

The two transfer arms 77 and 78 of the selecting levers are disposed above the spaced arms of a series of six transfer levers 80 (Figure 3), carried on a pin 81, capable of being raised after the selection has been set up, to rock the transfer levers either clockwise or counterclockwise by engagement of one of their spaced arms with one or the other of the arms 77 and 78.

The transfer levers are raised through the action of the operating cam 21, controlled by mechanism now to be described.

The operating cam 21 is secured to the driven member 79 of the ratchet clutch 26, the driving member 81 of which is rigid with the shaft 17. The clutch members are normally held disengaged against the action of a spring 82, by a fixed arm 83 engaging a cam surface on the annular shoulder 84 of the driven clutch member 79.

The friction clutch 27 is similar to the clutch 24 and comprises two friction disks 85, 86 secured to the shaft 17, to rotate therewith, and having loosely mounted therebetween the driven clutch disk 87, provided with a forwardly extending stop member 88, normally engaged by a stop arm 89 (Figure 5), pivoted on a rod 91 and having a U-shaped extension 92 provided with an inturned arm 93 projecting under the driven disk 31 of the clutch 24. A roller 94 carried by the arm 93 extends beneath the cam disk 31, the raised portion of the cam normally engaging the roller 94 to hold the stop arm 89 in engagement with the stop member 88. A pin 95 carried by the operating cam 21 extends into a slot 96 in the driven clutch disk 87 and locks the cam and clutch disk for rotation together.

The operating cam 21 has an internal eccentric cam groove 97 in which rides a roller 98 (Figure 2), carried upon one arm 99 of a U-shaped lever 101. The lever 101 is pivoted at each end upon the rod 91 and has a U-shaped bracket 102 mounted thereon. The pin 81 carrying the transfer levers 80 extends between the upwardly projecting arms 103, 104 of the bracket 102.

The operation of the transfer mechanism is as follows. During the rotation of the cam drum 23 and just after the reception of the fourth impulse of the first channel signal, the depression 105 in the edge of the driven clutch disk 31 comes opposite the roller 94 carried by the lever 92, permitting the lever to be rocked outwardly by the spring 106 so as to move the stop arm 89 out of engagement with the stop member 88, thus permitting the clutch disk 87 of the clutch 27 to rotate, carrying with it the operating cam 21. After the operating cam is rotated a few degrees, the ratchet clutch 26 is brought into engagement by movement of the cam face of the collar 84 away from the arm 83, whereupon the operating cam is positively driven nearly to the end of its revolution, at which point the ratchet clutch is again disengaged and the operating cam is driven by the friction clutch 27 until it is again stopped by engagement of the stop member 88 with the stop arm 89.

As the operating cam revolves it rocks the U-shaped bracket 101 so as to move the transfer levers 80 upwardly against the ends of the selector levers 71.

The depending arm 107 of each of the transfer levers engages in a recess 108 in individual notched disks 109 mounted on a sleeve 111, surrounding the type wheel shaft 15. The disks 109 are therefore shifted to the right or to the left (Figure 3) by the transfer levers and in so moving align one row of notches in the disks. The disks are surrounded by an annular row of stop bars 112 urged towards the disks by individual springs 113. The faces of the notches in the disks 109 are inclined so that as the disks shift one stop bar will be cammed out of position and another one permitted to drop into the aligned notches. One of the stop bars is thus positioned

in the path of a type wheel stop arm 114, carried by the type wheel shaft 15. The shaft 15, as stated, is driven through friction clutch 16 so that upon the camming out of one stop bar the shaft immediately starts into rotation, being stopped by contact with the newly positioned stop bar. A type wheel 115 is carried on the shaft 15.

Printing is effected from the type wheel onto a tape 116 by a hammer 117 operated by an external cam face on operating cam 21 through mechanism not shown, and the tape is advanced one character following each printing operation by feed rollers 118 also operated by cam 21.

All of the above operations occur during or immediately following the reception of the A channel signals.

Referring back to Figures 7 and 8, the sixth or last impulse of the A channel group is received just as the selecting cam 23 is nearing the end of its revolution. Consequently immediately following the last selection the stop arm 33 will be brought into contact with the end 68 of the auxiliary or false stop lever 64, as shown in Figure 8, thereby bringing the selector cam 23 to rest in advance of its normal rest position (determined by the fixed stop 35). At this time cam 57, which it will be recalled rotates at half the speed of cam 23, will have completed approximately half a revolution and the cam projection 63 thereof will be at the top of its revolution.

The B channel signals are received immediately following the A channel signals, that is, without the intervention of any synchronizing impulses. As they come over the line the magnet 52 responds thereto but since the cam drum 23 is held stationary at this time, by engagement of stop arm 33 with the false stop 69, the selecting mechanism does not respond to the signals. During or immediately following the reception of the last impulse of the B channel signals the cam 57 will have revolved into contact with the lever 64, tripping the same and releasing the stop arm 33, thus enabling it to continue its revolution.

Following the last selecting impulse a stop or marking impulse is received which causes the cam drum 23 to be moved to the left so as to bring the stop arm 33 into the path of the fixed stop 35. This causes the cam drum to come at rest as it completes its revolution, remaining stationary until the succeeding start impulse is received. It will be noted, therefore, that when two character code signals are received between a single start and rest impulse, the A channel printer will respond to the first or A channel signals but will not respond to the second or B channel signals. The mechanism is arrested in advance of its normal rest position during the reception of B channel signals and is not permitted to complete its revolution until after the last selecting impulse of the B channel signals has been received. Therefore it cannot be improperly released by a spacing condition occurring in the B channel signals.

Reference will now be had to Figures 9 and 10 which show the construction of the channel controlling mechanism for the B channel printer. This printer responds to the second or B channel signals but not to the A channel signals. The cam extension 63′ of cam 57′ is positioned differently relative to the stop lug 60′ in the B channel printer, being offset slightly to the left thereof as shown in Figure 9, and the auxiliary stop arm 64′ is shortened so that the end 68′ thereof terminates to the left of the normal rest position of the stop arm 33. Otherwise the mechanism for the A and B channel printers is the same.

In operation of the B channel printer, upon reception of the start impulse preceding the A channel signals, the cam 31 is released for rotation as with the A channel printer, tripping the cam 57′ for one revolution. Immediately thereafter, however, the stop arm 33 engages the end 68′ of the false stop arm 64′ bringing the cam drum 23 to rest, as shown in Figure 10. This occurs before the cam drum reaches the first selecting position. The drum 23 is held at rest during the entire period of reception of the A channel signals. During this period the cam 57′ makes half a revolution bringing the projection 63′ into contact with the stop arm 64′ and tripping the same just prior to the first impulse of the B channel signals. The stop arm 33 is thus released permitting the cam drum 23 to complete its revolution in synchronism with the B channel signals. These signals operate the selecting mechanism as described with reference to the A channel printer, and at the proper time in the cycle, the operating cam 21 is released to effect the transfer and printing operations.

The timing of the operation of the A and B channel printers is shown in Figure 11. With the brush of the transmitting distributor on its rest segment R, the selecting cams of both printers come to rest at the point A, remaining at rest until a start impulse is transmitted during which time both selector cams are released simultaneously at the point B. The B channel selector cam almost immediately comes to rest at point C against its false stop. The A channel selector cam continues to rotate during the transmission of the first six impulses. At the end of the fourth impulse or at the beginning of the fifth impulse, that is, at point D, the A printer releases its operating cam 21 and near the end of the sixth impulse of the A channel signals, that is at point E, in the chart the A channel selector cam is brought to rest against its false stop. At this time or slightly in advance thereof (at point F) the B channel selector cam is released from its false stop and permitted to make a revolution. Printing is effected by the A channel printer during reception of the B channel signals. At about the end of the fourth impulse of the B channel signals, at point G, the operating cam of the B channel printer is released and towards the end of the sixth impulse, at point H, the selecting cam of the A channel printer is released from its false stop, both cams coming to rest against the fixed or normal stop 35 at the point A, during the rest period.

A system for transmitting start-stop multichannel signals for the operation of the A and B channel printers is shown in Figure 12. Two transmitters marked "A channel transmitter" and "B channel transmitter", respectively, are shown. Each transmitter has a set of contacts 1 to 6 adapted to be operated in code combinations under the control of a perforated tape T. Tape stepping magnets 121 and 121′ are provided for the A and B channel transmitters respectively. Each transmitter has an auto control arm 122 and 122′ riding in a loop of tape and controlling the contacts 123, 124 and 123′, 124′. The 1 to 6 contacts of the A channel printer are connected to segments 1 to 6 of the transmitting rings 125 of the distributor TD and the contacts 1 to 6 of the B channel printer are connected to segments 7 to 12 of

rings 125. The transmitting rings are also provided with a rest segment R connected to marking or negative battery and a start segment S connected to positive or spacing battery. The solid ring is connected to a line which passes at the distant station, in series, through the selecting magnets 52 of the A and B channel printers.

A brush B1 engages the rings 125 and is adapted to be held at rest on the rest segment R by a latch 126, controlled by a stop magnet 127. The winding of magnet 127 is connected in parallel through the contacts 123 and 123' of the A and B channel auto-control arms and thence to battery.

Contacts 1 to 6 of the A channel transmitter operate between a marking bus bar 128 having marking battery directly applied thereto, and a spacing bus bar 129, normally connected to spacing battery through the tongue 131 and spacing contact S of a differential relay 132. The relay 132 has one terminal connected to the auto-control arm 122 and the opposite terminal connected through back contact 133 of the relay and conductor 134 to the A segment of local rings 135. Similarly the spacing bus bar 129' of the B channel printer is connected to the tongue 131' of relay 132', the left terminal of this relay being connected through its back contact 133' and conductor 136 to the B segment of rings 135. The contacts 124 and 124' are connected respectively to the A and B segments of the local rings.

The operation of the transmitter is as follows. Assuming the brush B1 to be on segment R with a code combination set up on the contacts of the A channel transmitter and with each of the auto-control contacts 123 and 123' closed, magnet 127 will be continuously energized and latch 126 withdrawn from the path of the brush B1. The brush B1 then passes directly from the rest segment onto segment S transmitting a spacing or start impulse to line followed by the six selecting impulses set up on the first six segments thereof. During the transmission of the A channel signals, as local brush B2 engages segment B, an impulse is supplied equally through the opposed windings of relay 132' to the tape stepping magnet 121' of the B channel transmitter, setting up a new combination thereon and hence on the segments 7 to 12 of rings 125. Consequently as the brush B1 continues across segments 7 to 12, a second character code combination will be transmitted. During this time the A channel transmitter is stepped as brush B2 engages local segment A. This operation continues as long as both transmitters are supplied with tape.

If one transmitter, for instance the A transmitter, uses up its tape supply, causing contacts 123 and 124 to open, current from the local A segment passes through the left winding only of relay 132, unbalancing the same and causing its tongues 131, 136 and 137 to operate thereby (1) connecting marking battery to the spacing bus bar 129, (2) opening contact 133 to interrupt the circuit to the right half of winding 132, and (3) applying locking battery to the right hand winding of relay 132 through the tongue 136. The distributor TD continues to operate, however, as long as the B channel transmitter is supplied with tape, but since the A channel segments are all connected to marking battery, rub-out or all marking signals are supplied to the A channel printer. These signals are not effective to operate the printer as is well known by those versed in the art. If the supply of tape to the B channel transmitter also becomes exhausted, contacts 123' will also open, thus interrupting the circuit to the start magnet 127 and releasing the latch 126 for movement into the path of the brush B1 which is thus brought to rest on segment R. The distributor remains at rest until either one or the other of the transmitters is again supplied with tape.

It will be noted that an arrangement has been provided in which either the A or B printers may be operated separately, by supplying tape to one only of the transmitters or both may be operated during each revolution of the distributor, by supplying tape to both transmitters.

In Figure 13 we have shown a modification in which the timing cam 57 of both the A and B channel printers is eliminated and the channel control is effected entirely by the selecting cams. In this modification the cam 23A of the A channel printer has six marking cams 36M (shown in solid color) distributed over approximately one-half the circumference thereof, and six spacing cams 36S arranged 180° therefrom. In the rest position of the cam drum, the number 1 marking and spacing cams are adjacent the marking and spacing arms 74 and 73, respectively, of the selecting levers 71. The cam drum is released by the start impulse and is geared to make one revolution during the reception of both the A and B channel signals. During the reception of the A channel signals, the marking and spacing cams revolve past their marking and spacing arms being shifted axially to select the levers 71 in accordance with the combination being received. During the reception of the B channel signals, the marking cams rotate past the spacing arms and the spacing cams rotate past the marking arms. Since each set of cams is offset relative to these arms, they do not operate the selecting lever. The cam disk 31A has its drop portion 105 disposed approximately between the fourth and fifth marking cam so that the lever 93 is tripped just after the fourth impulse has been received to thereby release the operating and transfer cam 21.

In the B channel printer the construction is exactly the same with the exception that the cam drum 23B and the cam disk 31B is shifted approximately 180° relative to the stop arm 33. Consequently, during the reception of the A channel signals, the marking cams 36M of the B channel printer rotate idly past the spacing arms 73 of the selecting lever, and the spacing cams 36S rotate idly past the marking arms 74. The number 1 marking cam is not brought opposite the marking arm of the first selecting lever until the first impulse of the B channel signals is received. During the reception of the B channel signals, however, the marking and spacing cams are brought successively past the corresponding arms of the levers 71 to selectively operate the same. Therefore, the B channel printer selects only the B channel signals and the A channel printer selects only the A channel signals.

The modification shown in Figures 1 to 10 while less simple in construction than that of Figure 13, is preferable since it permits of greater angular spacing of the selecting cams and eliminates the operation of the flutter cam and the cam drum when signals are being received over the opposite channel.

In order to reduce this idle shifting of the

cam drum 33, we have provided a pair of contacts 140A and 140B which shunt out the windings of the selecting magnets 52A and 52B respectively, of each printer, during operation of the other printer. The contacts of each printer are open when the cams 23A and 23B are at rest so that each selecting magnet responds to the rest and starting impulses as well as its channel intelligence impulses to insure the cams being in proper phase relation with the received signals. Immediately on release of the cam 23B of the B channel printer, a cam 141B rotating with the cam drum 23B engages contacts 140B to close the same, shunting out the selecting magnet 52B so that it does not respond to the A channel signals. Contacts 140A of the A channel printer remain open, however, during reception of the A channel signals, being closed by a corresponding cam 141A after the last impulse of the A channel signals has been received to thereby shunt out the magnet 52A. At the same time the cam 141B permits contacts 140B to open and conditions the magnet 52B to respond to the B channel signals.

Obviously the same shunting arrangement can be applied to the modification shown in Figures 1 to 10 in which case the cams 141A and 141B could be mounted upon the timing shaft 52 of each printer.

Obviously, other transmitting arrangements may be devised and various changes may be made in the channel controlling mechanism of the printers. While we have shown the channel controlling mechanisms as applied to a particular form of printer, it is to be understood that they are equally adaptable to other types of printers, and therefore we do not desire to be limited to the particular details shown and described.

What we claim is:

1. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses preceded by a single start impulse and followed by a single rest impulse, a plurality of single magnet start-stop printers and channelling means incorporated in each of said printers for causing operation of a separate printer for each of said groups of impulses.

2. In a telegraph system a source of signals comprising a plurality of character code groups of impulses preceded by a single start impulse and followed by a single rest impulse, a plurality of start-stop printers and channelling means individual to each printer for causing operation of each printer in response to an individual group of impulses of the plurality.

3. In a telegraph system, a line circuit, a plurality of printers connected serially in said circuit, a source of signals arranged to transmit over said circuit a plurality of character code groups of impulses and a single start impulse common to said plurality of groups of impulses and means for causing said printers to operate in succession on successive groups of impulses.

4. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses having a single synchronizing impulse common thereto, a printer subject to all of said signals and means for rendering said printer unresponsive to all but one of said groups of impulses.

5. A telegraph printer comprising a printing mechanism, a selecting mechanism, a start-stop device controlling said selecting mechanism, means controlled by the start impulse of a succession of signal impulses for releasing said start-stop device and means for delaying the operation of said selector mechanism until a predetermined number of said signal impulses have been received.

6. A printer for operation on a multi-channel telegraph system comprising a printing mechanism and a selecting mechanism, and means individual to said printer for rendering said selecting mechanism responsive to the signals of its individual channel only.

7. A printer for operation on a multi-channel telegraph system comprising a printing mechanism, a selecting mechanism, a channelling mechanism, said channelling mechanism being entirely mechanical and serving to render said selecting mechanism responsive to signals received over a predetermined channel only.

8. In a telegraph printer, a selecting mechanism, an electro-magnetically controlled device therefor, means for operating said electro-magnetic device in response to a succession of received character code signals and means for operating said selecting device in accordance with only one of said character code signals.

9. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses received in continuous succession, a plurality of receiving printers each having a single selecting magnet responsive to all of said signal impulses, a selecting mechanism for each printer and means operable in synchronism with said received signals for rendering the selecting mechanism of each printer operable in succession, whereby each printer is operated in accordance with only one code group of impulses.

10. In a telegraph printer for a multi-channel system using signals comprising a start impulse followed by a plurality of character code groups of impulses, a printing mechanism, a selecting magnet, a selecting mechanism, start-stop cam means for operating said selecting mechanism under the control of said selecting magnet, said start-stop cam means having a normal rest position, means for releasing said cam from said position in response to the start impulse, means for rotating said cam means in synchronism with one group of character code selecting impulses only and means for arresting said cam means in an off-normal position during the reception of the remaining character code groups of selecting impulses.

11. In a telegraph printer for a multi-channel system using signals comprising a start impulse followed by a plurality of character code groups of selecting impulses and a rest impulse, a selecting cam means having a normal rest position, means for releasing said cam means from said rest position in response to the start impulse and for bringing the same to rest in said normal position during the rest impulse, selecting mechanism cooperating with said cam means during the reception of a single character group of impulses and printing means controlled by said selecting means.

12. In a telegraph printer for a multi-channel system using signals comprising a start impulse followed by a plurality of character code groups of selecting impulses and a rest impulse, a shaft normally at rest, means responsive to said start impulse for releasing said shaft for a cycle of operation extending over the period of reception of said plurality of character code groups of impulses, a selecting mechanism normally at rest and means controlled by said shaft for releasing

said selecting mechanism for movement during the period of reception of a single character code group of selecting impulses.

13. In a telegraph printer, a power shaft, a selecting mechanism and a channel controlling mechanism separately driven by said power shaft, signal control means for releasing said channel controlling mechanism for a cycle of operation and means operated by said channelling control mechanism, at an intermediate point in its cycle, for releasing said selecting mechanism for operation.

14. In a multi-channel telegraph system, a plurality of transmitters, a printer corresponding to each transmitter, means for transmitting a character code group of impulses in succession from each transmitter and control means individual to each printer for causing its associated printer to respond to the signals transmitted from its corresponding transmitter only.

15. In a multi-channel telegraph system, a transmitting distributor, a plurality of tape transmitters therefor operable in succession, means for operating said distributor as long as any of said transmitters is supplied with tape and means for stopping said distributor when the tape supply to each of said transmitters is exhausted.

16. In a multi-channel start-stop telegraph system, a transmitting distributor having a starting contact and a plurality of groups of code contacts, a transmitter associated with each group of code contacts, said transmitters being operable in succession to set up signal combinations on said code contacts whereby a start impulse followed by a plurality of character code groups of impulses is transmitted during each cycle of operation of the distributor, a tape-controlled mechanism for each transmitter and means controlled by each tape-controlled mechanism, when operated, to apply a uniform line condition to the corresponding contacts of the distributor and means actuated by operation of all of said tape-controlled mechanism for interrupting the operation of said distributor.

17. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses transmitted in continuous succession, a plurality of printers subject to said signals, a control impulse common to said plurality of groups of impulses and means controlled by said control impulse for rendering said printers selectively responsive to individual code groups of impulses.

18. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses transmitted in continuous succession, a plurality of printers, selecting mechanism therefor and a distributor individual to each printer, associated with said selecting mechanism for selectively distributing said groups of code impulses to said associated selecting mechanism.

19. In combination, a plurality of telegraph printers, a common line, a single selecting magnet for each printer in said common line, means for transmitting a plurality of groups of signals over said line in continuous succession and means for rendering the selecting magnet of each printer effective to respond to a predetermined one only of said plurality of groups of signals.

20. In combination, a plurality of telegraph printers, a common line, electromagnetic control means for each printer in said common line, means for transmitting a plurality of groups of signals over said line in continuous succession and a selecting mechanism for each printer, operable over a predetermined cycle, under the control of said electromagnetic means, said selecting mechanism acting to shunt out said electromagnetic means during a portion of said cycle.

21. In a telegraph system, a source of signals comprising a pair of character code groups of impulses, said pair being preceded by a single start impulse and followed by a single rest impulse, a pair of start-stop printers controlled directly by said start and rest impulses, one of said printers operating on the first group of impulses and the other printer operating on the second group of impulses.

22. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses transmitted in continuous succession and a single start impulse therefor, a plurality of printers each subject to all of said signals and means for causing said printers to operate in succession on successive groups of impulses.

23. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses having a single synchronizing impulse common thereto, a printer subject to all of said signals and means controlled by said synchronizing impulse for rendering said printer responsive to the first group of impulses and means for rendering the printer unresponsive to the succeeding groups of impulses.

24. In a telegraph system, a source of signals comprising a pair of character code groups of impulses having a single synchronizing impulse common thereto, a printer subject to both of said groups of impulses and means for rendering said printer operable in accordance with the second only of said groups of impulses.

25. A printer for operation on a multi-channel telegraph system comprising a printing mechanism, a channelling mechanism and a selecting mechanism, said channelling mechanism being entirely mechanical and serving to render said selecting mechanism responsive to signals received over a predetermined channel only.

26. A printer for operation on a multi-channel telegraph system comprising a printing mechanism, a channelling mechanism and a selecting mechanism, said channelling mechanism being entirely mechanical in operation and serving to render said selecting mechanism responsive to signals received over a predetermined channel only and start-stop means for maintaining said channelling mechanism in synchronism with the received signals.

27. A printer for operation over a multi-channel telegraph system comprising a printing mechanism, a selecting mechanism, electromagnetic means responding to signals received over all channels and means for rendering said selecting mechanism responsive to operations of said electro-magnetic means only in accordance with signals received over a predetermined channel.

28. A printer for operation over a multi-channel telegraph system comprising a printing mechanism, a selecting mechanism, said electromagnetic means responding to signals received over all channels and channelling mechanism maintained in synchronism with said received signals for rendering said selecting mechanism responsive to operations of said electro-mag-

netic means in accordance with signals received over a predetermined channel only.

29. In a telegraph system, a source of telegraph signals comprising a plurality of character code groups of impulses received in continuous succession, a printer having a single selecting magnet responsive to all of said signal impulses, a selecting mechanism for said printer and means operable in synchronism with said received signals for conditioning said selecting mechanism for operation only during the reception of a single group of impulses of the plurality.

30. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses received in continuous succession, a plurality of receiving printers each receiving all of said signal impulses, a selecting mechanism for each printer, including selecting cam means normally at rest and means operable in synchronism with said received signals for releasing the cam means of each printer for a cycle of operation as each group of impulses is received, whereby each printer responds to a single character code group only of the plurality.

31. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses received in continuous succession, a receiving printer corresponding to each of said groups of impulses, each printer having a single selecting magnet responsive to all of said signal impulses, a selecting mechanism for each printer normally at rest and means operable in synchronism with said received signals for starting the selecting mechanism of each printer into operation at the beginning of its corresponding group of impulses and means for stopping each selecting mechanism at the end of said group of impulses.

32. In a telegraph system, a source of telegraph signals comprising a plurality of character code groups of impulses received in continuous succession, and preceded by a single start impulse, a plurality of receiving printers, each having a single selecting magnet responsive to all of said signal impulses, a selector mechanism for each printer and channelling means started into operation by said start impulse and operated during the reception of said groups of impulses, said channelling mechanism serving to render the selecting mechanism of each printer operable in succession, as successive groups of impulses are received.

33. In a telegraph printer for a multi-channel system using signals comprising a start impulse followed by a plurality of character code groups of impulses, a printing mechanism, a selecting magnet, a selecting mechanism, start-stop cam means for operating said selecting mechanism under the control of said selecting magnet, said start-stop cam means having a normal rest position, means for releasing said cam from said position in response to the start impulse, means for rotating said cam means in synchronism with the first character code group of impulses and means for arresting said cam means in advance of said normal rest position during the reception of the remaining character code groups of impulses.

34. In a telegraph printer for a multi-channel system using signals comprising a start impulse followed by a plurality of character code groups of impulses, a printing mechanism, a selecting magnet, a selecting mechanism, start-stop cam means for operating said selecting mechanism under the control of said selecting magnet, said start-stop cam means having a normal rest position, means for releasing said cam from said position in response to the start impulse, means for arresting said cam means during the reception of the first character code group of impulses, and means for releasing the same for operation in synchronism with the second group of character code impulses.

35. In a telegraph printer for a multi-channel system using signals comprising a start impulse followed by a plurality of character code groups of selecting impulses and a rest impulse, a selecting cam means, a normal stop device therefor and an off-normal stop device, means controlled by said start impulse for releasing said selecting cam means from said normal stop device and channelling means for releasing said selecting cam means from said off-normal stop device, said latter stop device serving to limit the selecting movement of the cam means to a period of reception of a single character code group of impulses.

36. In a multi-channel start-stop telegraph system, a plurality of transmitters, a printer corresponding to each transmitter, means for transmitting a character code group of selecting impulses in succession from each transmitter, means for maintaining each of said printers in synchronism with said signal impulses and means for restricting the operation of each printer to the signals originating at its corresponding transmitter.

37. In a telegraph system, a source of signals comprising a plurality of character code groups of impulses transmitted in continuous succession, a plurality of printers, a single selecting magnet for each printer, selecting mechanism therefor and a distributor individual to each printer associated with said selecting mechanism and controlled by said selecting magnet for selectively distributing said groups of code impulses to the associated selecting mechanism.

38. In a telegraph system, a source of signals comprising a plurality of code groups of impulses transmitted in continuous succession, a printer, selecting mechanism therefor, a single magnet for controlling said selecting mechanism and means controlled by said magnet for rendering said selecting mechanism responsive to predetermined but not all of said groups of impulses.

39. In a telegraph printer, a selecting mechanism operating in predetermined cycles, signal responsive means for controlling the operation of said selecting mechanism and printing mechanism controlled by said selecting mechanism, said selecting mechanism performing its selecting function over only approximately half of said cycle.

40. In a telegraph printer, a selecting mechanism, operable in predetermined cycles, a single selecting magnet for controlling the operation of said selecting mechanism, printing mechanism controlled by said selecting mechanism, said selecting mechanism performing its selecting function only over a portion of said cycle and means for rendering said selecting magnet unresponsive to received signals during the remainder of said cycle.

41. In a telegraph system, a plurality of printers associated with a common line, means for transmitting groups of signals to said printers in succession and means individual to each printer

for causing the same to respond only to signals transmitted thereto.

42. In a telegraph system, a plurality of printers associated with a common line, means for transmitting groups of signals to said printers in succession and a selecting cam for each printer operable over a complete cycle in the time of transmission of signals to all printers, the selecting cam of each printer performing its selecting function only over the portion of its cycle corresponding to the period of reception of the signals transmitted thereto.

43. In combination, a plurality of telegraph printers, a common line, a single electromagnetic control means for each printer in said common line, means for transmitting a plurality of groups of signals over said line in continuous succession and means for rendering said electromagnetic means alternately effective and ineffective to respond to said signals, whereby each printer responds to different ones of said groups of impulses.

44. In combination, a plurality of telegraph printers, a common line, electromagnetic control means for each printer in said common line, means for transmitting a plurality of groups of signals over said line in continuous succession and means operating in synchronism with said signals for shunting out the electromagnetic control mean of each printer in succession, whereby each of said printers responds only to predetermined groups of impulses.

45. In a telegraph system, a pair of telegraph printers, a selecting mechanism for each printer operating over a predetermined cycle, means for transmitting character code groups of impulses to said printers in continuous succession, means for operating the selecting mechanism of each printer in synchronism with each other and with the signals, the selecting mechanism of one printer being effective to select only on a portion of its cycle and the selecting mechanism of the other printer being effective to select only on the remaining portion of the cycle.

46. In a telegraph system, a source of telegraph signals comprising a plurality of character code groups of impulses received in continuous succession, a plurality of receiving printers, each receiving all of said signal impulses, a selecting mechanism for each of said printers and means operable in synchronism with the received signals for conditioning the selecting mechanism of each printer only during the reception of a single group of impulses which is individual to said printer.

47. In a telegraph system, a signalling line, a source of signals therefor comprising a plurality of code groups of impulses transmitted in continuous succession, a plurality of receiving printers, each having a single selecting magnet normally in said line, a selecting mechanism for each printer and means operable in synchronism with said received signals for rendering the selecting mechanism of each printer operable in succession, whereby each printer is operated in accordance with only one code group of impulses.

ROBERT F. DIRKES.
ROLLINS WENTWORTH.