TAPE FEED CONTROL APPARATUS

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ABSTRACT
A tape feed control apparatus which comprises a pair of rotary members which rotates in accordance with feed of a tape, said rotary members being adapted to be independently reset to the specified positions by respective resetting means and provided with a signal generating means which generates a signal when said rotary members rotate exceeding the resetting positions and is adapted so that the tape feed is changed over when one of said rotary members is reset and passes through the resetting position and changed over again when the other rotary member passes through the resetting position.

12 Claims, 15 Drawing Figures
FIG. 3

Signal Selection Circuit 4
First Trigger Circuit 31
Tape Feed Direction Control Circuit 2
Second Trigger Circuit 32

FIG. 4

S1
S2

4  A1

31

A2

32

2
TAPE FEED CONTROL APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a control apparatus which is capable of automatically controlling at a desired position a feed direction of a tape set on a tape recorder or tape player.

Conventionally, as this type of apparatus, there have been apparatuses which use a magnetic tape onto which a silver foil is applied in advance to form a conductive surface and were adapted so that the feed direction of the tape is changed over when the contact detects said silver foil applied onto the tape. However, this type of a control apparatus is disadvantageous in that a conductive surface should be formed in advance and the tape should be stopped to remove the conductive part of the tape and therefore the tape being fed cannot be controlled at a desired position.

The primary object of the present invention is to provide a control apparatus which permits setting of the range of tape feed during tape feed and easy releasing of the setting, without setting in advance.

The secondary object of the present invention is to provide a control apparatus which permits automatic repeating of the tape feed in a certain range which is set during tape feed and simple changing over of a control mode to prevent further change over after the tape is changed over.

SUMMARY

A tape feed control apparatus comprising the first rotating means which rotates in accordance with feeding of a magnetic tape and rotates in an opposite direction each time the tape is put in the forward feed or in the reverse feed, for example, the first counter which performs addition in the forward feed; and second rotating means which rotates in accordance with feed of a tape and rotates in an opposite direction each time the tape is put in the forward feed or in the reverse feed, for example, the first counter which performs addition in the reverse feed; the first resetting means which resets said first rotating means to a specified position independently of said second rotating means, for example, a resetting means which resets the first counter to the zero indicating position; the second resetting means which resets said second rotating means to a specified position independently of said first rotating means, for example, a resetting means which resets the second counter to the zero indicating position; the first signal generating means which generates the first change-over signal when said first rotating means rotate exceeding the resetting position; the second signal generating means which generates the second change-over signal when said second rotating means rotate exceeding the resetting position; the tape feed direction control circuit which alternatively sets a feed mode to generate the forward feed signal for forward feeding of the tape and a feed mode to generate the reverse feed signal for reverse feeding of the tape; and a coupling means which transmits said first change-over signal to said tape feed direction control means so that said tape feed direction control circuit comes in the forward feed mode when said first signal generating means generates the first change-over signal and transmits said second change-over signal to said tape feed direction control circuit so that said tape feed direction control circuit comes in the reverse feed mode when said second signal generating means generates the second change-over signal.

BRIEF DESCRIPTION OF DRAWINGS

The present invention is illustrated in detail by the accompanying drawings wherein:

FIG. 1 is a plan view of the first and second rotating means to be employed in the apparatus according to the present invention, showing an embodiment in which both rotating means form the counters which are provided with the resetting means and the switching means,

FIG. 2 is a side view as seen from the left side of the view in FIG. 1,

FIG. 3 is a block diagram illustrating the principle of the apparatus of the present invention,

FIG. 4 is an example view of the signal selection circuit,

FIGS. 5a and 5b show jointly a connection diagram illustrating a practical example of circuit of the apparatus according to the present invention when FIG. 5b is connected to the lower end of FIG. 5a.

FIGS. 6a to 6d show respectively the relationship between the signal waveforms in accordance with lapse of time in the circuits of FIGS. 5a and 5b and the digital values indicated on the counters,

FIG. 7 is a perspective view illustrating an embodiment of the first and second rotating means which are comprised of rotary members which are not counters, for the apparatus according to the present invention.

FIGS. 8a and 8b are respectively a sketch showing the resetting position of said rotary members shown in FIG. 7,

FIG. 9 is a partial circuit diagram illustrating another embodiment of the signal selection circuit, and,

FIG. 10 is a partial circuit diagram illustrating another embodiment of the first trigger circuit and simultaneously an embodiment of the second trigger circuit with a number in parentheses.

DETAILED DESCRIPTION

Referring to FIG. 1, there are shown first counter 11 and second counter 12 which are employed as the means which rotate as the tape is fed.

First counter 11 is adapted to be provided with a plural number of rotary digit wheels 11a, 11b, 11c and 11d which are marked or engraved with numerals 0 to 9 on their peripheral surfaces and are mounted rotatably on shaft 111 on which said digit wheels are coupled with the digit forward-carrying means such as carry gears 112, thereby the digit wheel at a higher digital position advances by one count each time any digit wheel lower next to said digit wheel turns fully once.

Second counter 12, as said 1st counter, is provided with rotary digit wheels 12a, 12b, 12c and 12d which are mounted rotatably on shaft 121 and are coupled with the digit forward-carrying means such as carry gears 122.

Said both counters 11 and 12 are designed so that the rotation of the reel shaft is transmitted to the rotary digit wheels of the both counters by transmitting means 13 and these counters rotate individually in opposite directions when the tape is fed, that is, one counter carries out addition and the other does subtraction.

Said transmitting means comprises worm gear 132 connected to pulley 131, a pair of gears 133 and 133' which engage with said worm gears and drive gears 134
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and 134° which engage with said gears and are arranged with said carry gears 112 and 122.

Said digit wheels are provided with heart-shaped resetting cams 141 at their lateral sides and the operating means such as resetting levers 142 are provided oppositely on said cams.

The resetting means consisting of these cams and levers rotates to reset the rotary digit wheels so that said digit wheels indicate zero (0) simultaneously. In other words, the resetting means are designed so that the counters are reset to zero. When resetting buttons 143 which actuate simultaneously resetting levers 142 are depressed, said carry gears 112 and 122 and drive gears 134 and 134° are rotated around pivotal shafts 155 of said levers 142 and disengaged from the digit wheels and the digit wheels are reset to the zero indicating position.

Said resetting means are provided on both counters 11 and 12 respectively to allow said both counters 11 and 12 to be reset individually.

Most significant digit (MSD) wheels 11a and 12a of said both counters 11 and 12 are provided with switching means S1 and S2 which operate when all these digit wheels indicate 9. Said switching means S1 and S2 are provided to generate the tape feed direction change-over signal when MSD wheels rotate from the resetting positions to the 9-indicating positions in their respective rotation. Switching means can be freely adapted so that, for example, projection 144 which is provided at the specified position of digit wheel 11a as shown in FIG. 2 pushes and actuates contact plate 145 when said digit wheel 11a indicates 9. Otherwise said switching means can be constructed by fixing a magnet at the side of said digit wheel so that the contact plate of the switch is actuated by means of an attracting force of said magnet or by providing a non-contact switch using a magneto-resistance effect device.

Hereupon, during forward feed of a tape, the first counter indicates the value of addition and the second counter indicates the value of subtraction while during reverse feed of a tape, the first counter indicates the value of subtraction and the second counter indicates the value of addition.

First switching means S1 and second switching means S2 are connected to the circuit section shown in FIG. 3 Principle Diagram.

This circuit section actuates selectively the control section such as the relay provided at the drive mechanism of the tape recorder through operation of said both switching means S1 and S2, changes over feeding of the tape in accordance with the indication of the counter and repeats the reproduction of a record in a certain part of the tape.

This is described in the following.

First switching means S1 and second switching means S2 are set so that the output level varies depending on the operating or non-operating condition. In other words, while the digit wheel provided with the switching means indicates 9, the switching means generates the first level output, and while said digit wheel does not indicate 9, the switching means generates the second level output. Thus, first switching means S1 and second switching means S2 are adapted so that the output level varies when they are turned on or off.

In the following description, first switching means S1 and second switching means S2 are set so that the second level output when the both switching means S1 and S2 are not operating is a high level output (hereinafter referred to as the H output) and the first level output when both switching means S1 and S2 are operating is a low level output (hereinafter referred to as L output).

In forward feed, first counter 11 performs addition and first switching means S1 turns on to generate a HL fall-down signal when the first counter counts through 9999 and turns off to generate a LH rise signal when the counter counts through 9999. On the other hand, since second counter 12 performs subtraction, second switching means S2 turns on to generate a HL fall-down signal when the second counter counts through 9999 and turns off to generate a LH rise signal when the counter counts through 9999.

Contrary to the above, in the reverse feed, first switching means S1 generates the HL signal when the counter counts through 9999 and the LH signal when the counter counts through 9999. On the other hand, second switching means S2 generates the HL signal when the counter counts through 9999 and the LH signal when the counters count through 9999.

Tape feed direction control circuit 2 generates alternatively the forward feed signal or a reverse feed signal which determines the feed direction of the tape. In other words, the tape feed direction control circuit is usually kept in one of the forward feed mode in which the forward feed signal is generated and the reverse feed mode in which the reverse feed signal is generated.

Said tape feed direction control circuit 2 is adapted to generate the forward feed signal when fast forward switch Sff or slow forward switch Ssf is operated and to generate the reverse feed signal when fast reverse switch Srf or slow reverse switch Srp is operated.

Said fast forward switch Sff is used to perform the fast forward feed, said slow forward switch Ssf to perform the slow feed for "play" or "record," said fast reverse switch Srf to perform the fast reverse feed for "rewind" and said slow reverse switch Srp to perform reverse feed for "reverse play" or "reverse record."

First trigger circuit 31 and second trigger circuit 32 are connected to said tape feed direction control circuit 2, in addition to said switches. First trigger circuit 31 triggers tape feed directions control circuit 2 to generate the forward feed signal from the state where the reverse feed signal is generated while said second trigger circuit 32 triggers said tape feed direction control circuit 2 to generate the reverse feed signal from the state where the forward feed signal is generated.

First trigger circuit 31 operates with the operation of first switching means S1 and second trigger circuit 32 operates with the operation of second switching means S2. Signal selection circuit 4 is connected between both trigger circuits 31 and 32 and both switching means S1 and S2.

Said signal selection circuit 4 is adapted to select from the signals with four types of levels for first switching means S1 so that at least a signal to be generated when the counter counts through 9900 in reverse feed, that is, the LH signal is not transmitted to the first trigger circuit and at least a signal to be generated when the counter counts through 9999 in reverse feed, that is, the HL signal is transmitted to the first trigger cir-
cuit. Moreover, signal selection circuit 4 selects from the signals with four types of levels for second switching means S2 so that at least a signal to be generated when the counter counts through 9000 in forward feed, that is, the LH signal is not transmitted to the second trigger circuit and at least a signal to be generated when the counter counts through 9999 in forward feed, that is, the HL signal is transmitted to the second trigger circuit.

When the second counter counts through 9999 in forward feed, second trigger circuit 32 operates with the HL signal of second switching means S2, the positioning of tape feed direction control circuit 2 is changed from the forward feed mode to the reverse feed mode. With this operation, the tape is changed from forward feed to reverse feed. On the other hand, when the second counter counts through 9000 in forward feed, second trigger circuit 32 does not operate and therefore the tape feed is not reversed.

Since the second trigger circuit changes the state of the tape feed direction control circuit from the forward feed mode to the reverse feed mode, the feed direction is not changed in any case that second trigger circuit 32 operates or does not operate when second counter 12 counts through 9000 and 9999 in reverse feed.

First trigger circuit 31 operates with the HL signal of first switching means S1 when the first counter counts through 9999 in reverse feed and tape feed direction control circuit 2 is changed over from the reverse feed mode to the forward feed mode, thereby the tape is changed over from the reverse feed to the forward feed. When the counter counts through 9000 in reverse feed, the signal is not transmitted to the first trigger circuit and therefore the feed direction is not reversed.

Since the first trigger circuit changes over the state of the tape feed direction control circuit from the reverse feed to the forward feed, the tape feed direction is not changed regardless of the operation of the first trigger circuit even though the first switching means generates a signal when the first counter counts through 9000 and 9999 in forward feed.

In the construction based on the principle described above, if the second counter is reset when first counter 11 performs addition to count through 7164 and second counter 12 performs subtraction to count through 2836 while the tape is forwarded, the second counter 11 indicates 0000. Afterwards, while the second counter counts through 9999, second switching means S2 turns on to generate the HL signal. With this operation, the tape feed direction is changed over to the reverse feed. In this case, the tape is actually reversed after the second counter exceeds 9999 and the second counter performs change-over addition to count 9999 after change-over to the reverse feed, and second switching means S2 turns off. However, in the reverse feed, the tape feed is not reversed with the signal of second switching means S2.

Since the first counter performs subtraction in the reverse feed, the first counter counts a little later through 0000 to 9999 and first switching means S1 turns on to generate the HL signal. With this signal, the tape feed direction is changed over to the forward feed. Thus, the tape is repetitively fed in the range set by resetting one of the counters to zero.

Referring to FIG. 4, there is shown an embodiment of signal selection circuit 4 in case that first trigger circuit 31 and second trigger circuit 32 operate with a negative trigger pulse. Signal selection circuit 4 comprises differentiation circuit A1 connected between first switching means S1 and first trigger circuit 31 and differentiation circuit A2 connected between second switching means S2 and second trigger circuit 32.

In this arrangement, both trigger circuits do not operate with the LH output signal of the switching means and operate with the HL signal. In other words, the HL signal when the counter counts through 9000 in the forward feed and the HL signal when the counter counts through 9999 in the reverse feed actuate the first trigger circuit. As described above, the operation of the first trigger circuit in the forward feed does not affect the tape feed direction and accordingly only the HL signal when the counter counts through 9999 in the reverse feed is effective for the first switching means to reverse the tape feed direction.

The HL signal from second switching means S2 when the counter counts through 9000 in the reverse feed and the HL signal when the counter counts through 9999 in the forward feed actuate second trigger circuit 32. Since the operation of the second trigger circuit in the reverse feed does not affect the tape feed direction, only the HL signal from the second switching means is effective when the counter counts through 9999 in the forward feed.

In the embodiment shown in FIG. 4, the LH signal from the first switching means when the counter counts through 9999 in the forward feed and the LH signal from the second switching means when the counter counts through 9999 in the reverse feed are not transmitted. These signals are not required for the tape feed direction control such as repeat control or tape control for one-time reversal but they are required, as described below, to stop the tape started from fast rewind or fast forward feed or to feed the tape at a low speed after temporary stop. FIGS. 5a and 5b show the circuit which admits these signals from the bypass circuit.

Referring to FIGS. 5a and 5b, there is shown first switching means S1 and second switching means S2 which are adapted to ground switch terminals T1 and T2 while the MSW wheel of each counter indicates 9 and to generate the L output. Said switch terminals T1 and T2 are connected respectively to the power supply line L1 through the load resistors R1 and R2.

Slow forward switch Sfp, slow reverse switch Srf, fast forward switch Sff and fast reverse switch Srf are adapted to ground switch terminals Tfp, Tsr, Tff and Trf and to provide the L output when said switches are operated.

Said switch terminals T1 and T2 are connected to signal selection circuit 4. Signal selection circuit 4 comprises a pair of inverters 411 and 431, two pairs of NAND gates 41, 42, 43 and 44 with two input terminals, differentiation circuits 413, 423, 433 and 443 and additional differentiation circuits 412 and 432 available for a request. In other words, switch terminal T1 is connected to first input terminal 41a of NAND gate 41 through inverter 411 and differentiation circuit 412 and differentiation circuit 413 is connected in series to output terminal 41c of said NAND gate 41. Said switch terminal T1 is connected directly to first input terminal 42a of NAND gate 42 and differentiation circuit 423 is connected in series to first terminal 42c of said NAND gate 42. Other switch terminal T2 is connected to first input terminal 43a through inverter 431 and differentiation circuit 432 and differentiation circuit 433.
is connected in series to output terminal 43c of said NAND gate 43. Said switch terminal T2 is directly connected to first input terminal 44a of NAND gate 44 and differentiation circuit 443 is connected in series to output terminal 44c of said NAND gate 44.

First trigger circuit 31 forms the monostable multivibrator consisting of a pair of NAND gates 311 and 312 and differentiation circuits 313. That is to say, first trigger circuit 31 is formed by connecting second input terminal 311b of NAND gate 311 and output terminal 312c of NAND gate 312 and by connecting differentiation circuit 313 between output terminal 311c of NAND gate 311 and second input terminal 312b of NAND gate 312.

Second trigger circuit forms similarly the monostable multivibrator consisting of NAND gates 321 and 322 and differentiation circuit 323.

Fourth input terminals 312d and 322d of NAND gate 312 of said first trigger circuit and NAND gate 322 of said second trigger circuit are connected to power supply line L1 through common resistor R3 and to main switch SM. Main switch SM is used to change over grounding and releasing of said both input terminals 312d and 322d. When grounding said both input terminals, the control by means of the counters is made impossible by making both NAND gates 312 and 322 unable to operate, that is, both trigger circuits 31 and 32 unable. Accordingly, when controlling the tape feed by the counters, said main switch is to be kept released.

The output sides of differential circuits 413 and 423 in said signal selection circuit 4 are connected to first input terminals 311a of NAND gate 311 and first trigger circuit 31 through diodes 414 and 424 while the output side of differentiation circuits 433 and 443 are connected to first input terminal 321a of NAND gate 321 in second trigger circuit 32 through diodes 434 and 444.

Said diodes 414, 424, 434 and 444 are connected in the forward direction from respective trigger circuits to signal selection circuit 4.

Hereupon, the circuit comprising NAND gate 42, differentiation circuit 423 and diode 424 forms a bypass of the circuit ranging from inverter 411 to diode 414 and transmits the signal from first switching means S1 when the counter counts through 9999 in reverse feed. Accordingly, the circuit is unnecessary in a case that only the feed direction is controlled and the stop control is not to be performed. The circuit comprising NAND gate 44, differentiation circuit 443 and diode 444 forms the bypass of the circuit ranging from inverter 431 to diode 434 and transmits the signal from second switching means S2 when the counter counts through 9999 in reverse feed. Accordingly, this circuit is not required in such a case as above. However, the feed direction control which is the principal purpose of the present invention is not affected regardless of existence of said bypass and the following describes the construction of the apparatus including these bypasses.

Tape feed direction control circuit 2 forms the flip-flop circuit consisting of a pair of NAND gates 21 and 22 and capacitor 23 connected between output terminals 21e and 22e of said both NAND gates. Said tape feed direction control circuit is formed by connecting fourth input terminal 21d of NAND gate 21 to output terminal 22c of NAND gate 22 and first input terminal 22c of NAND gate 22 to output terminal 21c of NAND gate 21.

In the tape feed direction control circuit, the H output of output terminal 21c and the L output of output terminal 22c are the forward feed signal for forward feeding of the tape whereas the L output of output terminal 21c and the H output of output terminal 22c are the reverse feed signal for reverse feeding of the tape.

Output terminal 312c of NAND gate 312 of first trigger circuit 31 is connected to second input terminal 22b of NAND gate 22 in tape feed direction control circuit 2 while output terminal 322c of NAND gate 322 of second trigger circuit 32 is connected to third input terminal 22c of NAND gate 22 in tape feed direction control circuit 2.

Moreover, switch terminal Tfp of slow forward switch Sfp is connected to first input terminal 21c of NAND gate 21 in said tape feed direction control circuit 2 and switch terminal Tfp of fast forward switch Sff to third input terminal 21c of said NAND gate in said circuit. On the other hand, switch terminal Tfp of slow reverse switch Srp is connected to fourth input terminal of NAND gate 22 in said tape feed direction control circuit 2 and switch terminal Tfp of fast reverse switch Srf to second input terminal 22b.

Tape speed control circuit 5 forms the flip-flop circuit consisting of a pair of NAND gates 51 and 52 and capacitor 53 connected between output terminals 51c and 52e of said NAND gates. Switch terminal Tfp of said slow forward switch Sfp is connected to first input terminal 51a of NAND gate 51 of said flip-flop circuit and switch terminal Tfp of said slow reverse switch Srp to second input terminal 51b while switch terminal Tfp of said fast reverse switch Srf is connected to second input terminal 52b and switch terminal Tfp of said fast forward switch Sff to third input terminal 52c of said NAND gate 52.

In the tape speed control circuit, the H output of output terminal 51c and the L output of output terminal 52c are the slow feed signal for slow feeding of the tape whereas the L output of output terminal 51c and the H output of output terminal 52c are the fast feed signal for fast feeding of the tape.

The above describes the basic construction of the apparatus of the present invention and the following describes the basic operation, which can be referred to FIGS. 6a to 6d, of the apparatus of the present invention in accordance with this construction.

When slow forward switch Sfp is operated, the L input is supplied from switch terminal Tfp respectively to first input terminal 322a of NAND gate 322 of second trigger circuit 32, first input terminal 21a of NAND gate 21 of tape feed direction control circuit 2 and first input terminal 51a of NAND gate 51 of tape speed control circuit 5. Accordingly, in tape feed direction control circuit 2, the H output is obtained at output terminal 21c of NAND gate 21 and the L output is obtained at output terminal 22c of NAND gate 22 and the tape feed is controlled in the forward direction. On the other hand, in tape speed control circuit 5, the H output is obtained at output terminal 51c of NAND gate 51 and the L output is obtained at output terminal 52c of NAND gate 52, and the tape is controlled in slow feed. In other words, the tape is fed in slow forward speed mode. In this case, the output from NAND gate 322 of second trigger circuit 32 is H.

Since the L output of NAND gate 22 of tape feed direction control circuit 2 is input, under this condition, to input terminals 41b and 44b of NAND gates 41 and
44 of signal selection circuit 4 and therefore NAND gates 41 and 44 cannot operate. The outputs of NAND gates 41 and 44 are held at H. On the other hand, the H input is input to second input terminals 42b and 43b of NAND gates 42 and 43 of said signal selection circuit 4 and these NAND gates can therefore operate. Needless to say, this is the same when fast forward switch Sff is operated.

When the second counter counts through 0000 to 9999 while the tape is forwarded, the HL output signal which falls down from H to L shown with line c in FIG. 6a is obtained from second switching means S2. This signal is inverted by inverter 431 and differentiated by differentiation circuit 432 and the positive LH rise pulse shown with line b in FIG. 6a is input to first input terminal 43c of NAND gate 43. Accordingly, the HL fall-down signal shown with line c in FIG. 6a is obtained from NAND gate 43, converted to a signal shown with line d in FIG. 6a through differentiation circuit 433 and diode 434 and applied to second trigger circuit 32. Then, second trigger circuit 32 is triggered and the output falls down from H to L. Since the HL signal is given to third input terminal 22c of NAND gate 22 of tape feed direction control circuit 2, the output from output terminal 22c of NAND gate 22 in tape feed direction control circuit 2 is changed from L to H and the output of output terminal 21e of NAND gate 21 changes from H to L, thereby the tape feed is changed over from the forward direction to the reverse direction.

Since NAND gate 44 in signal selection circuit 4 cannot operate, said NAND gate 44 is not affected by the signal from second switching means S2.

When the second counter counts through 9999 to 0000 while the tape is forwarded, the signal output which rises from L to H as shown with line e in FIG. 6b is obtained from second switching means S2. This signal is inverted by inverter 431 and differentiated by differentiation circuit 432 and the fall-down pulse as shown with line f in FIG. 6b is input to NAND gate 43. In this case, this signal is a negative pulse, and therefore the output of NAND gate 43 is a rise pulse. Accordingly, since there is not the HL signal input in second trigger circuit 32, this circuit does not operate and is not therefore affected by tape feed direction control circuit 2 and forward feed is continued.

On the other hand, when the first counter counts through 0999 to 9000 during addition in forward feed, the signal which falls down from H to L as shown with line g in FIG. 6c is obtained from first switching means S1 and the rise signal as shown with line h in FIG. 6c is obtained from output terminal 42c of said NAND gate 42. This signal is differentiated by differentiation circuit 423 to obtain a positive pulse shown with line i in FIG. 6c but the first trigger circuit does not operate and the feed direction is not changed since there is not the HL input signal in first trigger circuit 31.

Similarly, when the first counter counts through 9999 to 0000 in forward feed, the signal which rises from L to H as shown with line j in FIG. 6d is obtained from first switching means S1 and supplied to NAND gate 42 and the fall-down signal as shown with line k in FIG. 6d is obtained from output terminal 42c of said NAND gate 42. This signal is differentiated by differentiation circuit 423, the negative pulse shown with line l in FIG. 6d is applied to first trigger circuit 31 through diode 424 and the output of the first trigger circuit is triggered at L. This HL signal is supplied to second input terminal 21b of NAND gate 21 of tape feed direction control circuit 2. Since fourth input terminal 21d of NAND gate 21 is L and output terminal 21e is H in forward feed as described above, the condition of tape feed direction control circuit 2 does not change.

On the other hand, when slow reverse switch Srf is operated, the L signal is input to fourth input terminal 22d of NAND gate 22 of tape feed direction control circuit 2, first input terminal 31a of NAND gate 31 of first trigger circuit 31 and second input terminal 51b of NAND gate 51 of tape speed control circuit 5, thereby the slow reverse feed is performed and the H output of first trigger circuit 31 becomes or is H, since the output of output terminal 21e of NAND gate 21 of tape feed direction control circuit 2 is L. Under this condition, second input terminals 42b and 43b of NAND gates 42 and 43 of signal selection circuit 4 are L and therefore NAND gates 42 and 43 cannot operate. NAND gates 41 and 44 can operate since the H output of NAND gate 22 of said tape feed direction control circuit 2 is supplied to said NAND gates 41 and 44. This is the same when fast reverse switch Srf is operated.

As described above, the first counter performs subtraction while reverse feed is performed.

When the first counter counts through 0000 to 9999 in reverse feed, the signal output which falls down from H to L is obtained. In other words, this output is completely the same as the output of second switching means S2 in said forward feed. Accordingly, a negative pulse is obtained through inverter 411, differentiation circuit 412, NAND gate 41 and differentiation circuit 413 and this pulse triggers first trigger circuit 31 through diode 414. With the above, the output of the first trigger circuit is triggered from H to L and the L input is given to NAND gate 21 of tape feed direction control circuit 2. Accordingly, tape feed direction control circuit 2 is changed over and the output of NAND gate 21 becomes H and the output of NAND gate 22 becomes L. Thus, the tape feed is changed over from reverse to forward.

When the first counter counts through 9999 in reverse feed, the output of first switching means S1 is a negative pulse to be given to NAND gate 41 as when the second switching means counts through 9999 in forward feed and the output of NAND gate 41 is not obtained. Accordingly, first trigger circuit does not operate. Tape feed direction control circuit 2 does not change and the reverse feed is continued.

On the other hand, when the second counter counts through 9999 to 9000 during addition in reverse feed, the signal which falls down from L to H is obtained from second switching means S2. As in case of first switching means S1 of the first counter in forward feed, a positive pulse is obtained through NAND gate 44 and differentiation circuit 443 but second trigger circuit 32 does not operate and the condition of tape feed direction control circuit 2 does not change. Accordingly, the reverse feed is continued.

When second counter counts through 9999 to 0000 in reverse feed, second switching means S2 outputs the signal which rises from L to H. As first switching means S1 in forward feed, second trigger circuit 32 is triggered, its output becomes L and the L is supplied to third input terminal 22b of NAND gate 22 of tape feed direction control circuit 2. Since the output of NAND gate 22 of said tape feed direction control circuit 2 is
H in advance in reverse feed, the condition of tape feed
direction control circuit 2 does not change and there-fore the reverse feed is continued.

As know from the above, when the first and second
counters count through 9000, both trigger circuits do
not operate regardless of the forward feed or reverse
feed and accordingly the feed direction is not changed
over.

On the other hand, when the counters count through
9999, the corresponding trigger circuit operates re-gardless of the tape feed direction. In forward feed, the
operation of second trigger circuit 32 according to the
signal transmitted from second switching means S2
through NAND gate 43 changes over the tape feed di-
rection while the operation of first trigger circuit 31 ac-
cording to the signal transmitted from first switching
means S1 through NAND gate 42 does not change over
the tape feed direction. In case of reverse feed, the op-
eration of first trigger circuit 31 according to the signal
transmitted from first switching means S1 through
NAND gate 41 changes over the tape feed direction
while the operation of second trigger circuit 32 according
by the signal transmitted from second switching means S2 through NAND gate 42 does not change over
the tape feed direction.

Since the signals transmitted through NAND gates 42
and 44 do not affect the tape feed direction, it is clearly
known that NAND gates 42 and 44 can be omitted for
only control of the tape feed direction.

The following describes the circuit to be added to the
above circuits.

Tape feed direction memory circuit 6 forms the flip-
flop circuit comprising a pair of NAND gates 61 and 62
and capacitor 63 connected between the output ter-
rinals of these NAND gates. Fast forward switch SF
and slow reverse switch Sr are connected to the input
terminal of NAND gate 61 of said tape feed direction
memory circuit 6 through diodes 641 and 642 respect-
ively and fast reverse switch Sr and slow forward
switch SF are connected to the input terminal of
NAND gate 62 through diodes 643 and 644 respect-
ively. These diodes are connected in the forward di-
rection from said memory circuit 6 to each switch. On
the other hand, repeat control circuit 7 forms the flip-
flop circuit comprising a pair of NAND gates 71 and 72
and capacitor 73 connected between the output ter-
rinals of these NAND gates. The input terminal of
NAND gate 71 of said repeat control circuit is con-
ected to the output terminal of NAND gate 61 of tape
feed direction memory circuit 6 through diode 741 and
the output terminal of NAND gate 62 of tape feed di-
rection memory circuit 6 is connected to the input ter-
rinal of NAND gate 72 through diode 743. Said both
input terminals are connected to the output side of re-
peat inhibit/release circuit 300 through diodes 742 and
744 and the input side of said repeat inhibit/release cir-
cuit is connected to contact terminal Ta of selector
switch SA.

Repeat inhibit/release circuit 300 comprises NAND
gate 301 whose output terminal 301c is connected to
said diodes and inverter 302 connected between input
terminal 301a of said NAND gate and contact terminal
Ta.

The output of record control circuit 200 which is de-
scribed in the following is applied to input terminal
301b of NAND gate 301. The output terminal of
NAND gate 71 of repeat control circuit 7 is connected
to third input terminal 322c of NAND gate 322 of sec-
ond trigger circuit 32 through diode 751 and the output
terminal of NAND gate 72 is connected to third input
terminal 312c of NAND gate 312 through diode 752.

Said selector switch SA is to select the repeat mode by
which the tape feed is repeated within a specified range
in play, that is, slow feed or the reversal mode by which
the tape feed is not changed over after the tape has
been reversed at the first operating point where the
tape passes through and to ground alternatively said
both contact terminals Ta and Ta'.

With respect to said tape feed direction memory cir-
cuit 6, if slow forward switch Srp is operated in advance
and slow forward feed of the tape is performed, the out-
put terminal of NAND gate 62 is H and the output ter-
minal of NAND gate 61 is L since the L signal is input
in advance into input terminal of NAND gate 62. On
the other hand, if slow reverse switch Srp is operated
and slow reverse feed is performed in advance, the out-
put terminal of NAND gate 61 is H and the output ter-
minal of NAND gate 62 is H since the L signal is input
in advance into NAND gate 61.

Record control circuit 200 forms the flip-flop circuit
comprising a pair of NAND gates 201 and 202 and ca-
pacitor 203 connected between output terminals 201c
and 202c by connecting second input terminal 201b of
NAND gate 201 to output terminal 202c of NAND gate
202 and input terminals 202a and 202b of NAND gate
202 to output terminal 201c of NAND gate 201.

Record switch SC is connected to first input terminal
201a of said NAND gate 201. Said switch SC is so
adapted that one terminal is connected to power supply
line L1 through resistor R6 and the other terminal is
grounded so as to input the L signal into said input ter-

When said record switch SC is operated, said record
control circuit 200 is triggered so that the output of
NAND gate 201 becomes H and the output of NAND
gate 202 becomes L. Such the output is the record con-
trol signal to set the recording condition. While record
switch SC is not operated, the output of NAND gate
201 is L and the output of NAND gate 202 is H.

Output terminal 202c of NAND gate 202 is con-
nected to input terminal 301c of NAND gate 301 of said
repeat inhibit/release circuit.

Accordingly, in non-recording conditions, that is,
tape feeds in which record switch SC is not operated,
for example play, reverse play, fast forward feed and
rewind, the H signal is input to input terminal 301b of
NAND gate 301 and therefore the output of NAND
gate 301 varies with the input signal of input terminal
301a. In this case, the signal from contact terminal Ta
of switch SA is supplied to NAND gates 71 and 72 of
repeat control circuit 7 through inverter 302, NAND
gate 301 and diodes 742 and 744 and consequently
switch SA can be considered directly connected to di-
odes 742 and 744.

The following describes the tape feed control in rela-
tion to operation of selector switch SA with respect to the
non-recording condition.

When said selector switch SA is set to the repeat side,
that is, contact terminal Ta side, the input terminal of
both NAND gates 71 and 72 of repeat control circuit
7 is locked at L by said selector switch SA and the out-
puts of both NAND gates are held at H; accordingly,
third input terminal 312c of first trigger circuit 312 and
third input terminal 322c of second trigger circuit 322 are held at H and both trigger circuits are ready to operate.

In this case, said basic operations are repeated as shown Table 1.

<table>
<thead>
<tr>
<th>Tape feed mode</th>
<th>Operation of S1 and S2</th>
<th>Indication of 2nd counter</th>
<th>Indication of 1st counter</th>
<th>Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward feed</td>
<td>8705</td>
<td>1295</td>
<td>1295</td>
<td>Reset of 2nd counter</td>
</tr>
<tr>
<td>Change-over</td>
<td>9999</td>
<td>1298</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse feed</td>
<td>1295</td>
<td>0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change-over</td>
<td>1296</td>
<td>9999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward feed</td>
<td>1297</td>
<td>9998</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If the second counter is reset to 0000 when second counter 12 indicates 8705 and first counter indicates 1295 under the condition where slow forward switch S/F is operated and the slow feed is performed, the second counter counts through 9999. As described above, in this case, the tape feed direction is changed over by operation of second trigger circuit 32 and the reverse feed is performed. Since the forward feed is, in fact, slightly continued due to mechanical inertia, the tape feed is changed over after the second counter counts through, for example, 9997. The second counter counts again through 9999 after the reverse feed starts and second trigger circuit 32 operates but the tape feed direction is not changed over as described above.

When the tape feed is thus changed over to reverse feed, the first counter performs subtraction, the first counter counts through 9999 at a later timing and the tape is changed over again to forward feed according to the operation of first trigger circuit 31. Also in this case, the tape feed is changed over when the first counter counts through approximately 9997, then, the first trigger circuit operates when the counter counts through 9999 during forward feed, whereby the tape feed is not changed over as described above.

As described above, the tape feed is repeated within the range set by both counters, that is, between approximately 0000 and 1295 in the above application.

When said selector switch SA is set to the “one-time reversal” side, that is, contact terminal side Ta's side, repeat control circuit 7 is controlled by tape feed direction memory circuit 6 in the preceding stage since both NAND gates 71 and 72 become ready to operate.

When slow forward switch S/F is operated in advance and the slow forward feed is performed, the output terminal of NAND gate 61 of tape feed direction memory circuit 6 is L and the output terminal of NAND gate 62 and the L output of NAND gate 61 is applied to the input terminal of NAND gate 71 of repeat control circuit 7 through diode 741 whereby the output of NAND gate 71 is H and the output of NAND gate 72 is L. Since the L output of NAND gate 72 is applied to input terminal 312c of NAND gate 312 of first trigger circuit 31 through diode 752, the output of NAND gate 312 is locked at H and first trigger circuit 31 cannot operate. In other words, only second trigger circuit 32 can operate.

Since said second trigger circuit, as described above, operates according to the operation of second switching means S2 to trigger tape feed direction control circuit 2 so as to change over the tape feed direction from forward feed to reverse feed, the tape feed is changed over only when the second counter counts through 0000 to 9999. The tape feed is not changed over when the first counter counts through 9999 after the second counter counts through 9999 in Table 1 and the tape is changed over from forward feed to reverse feed.

When the tape feed is commenced from reverse feed, only first trigger circuit 31 can operate contrary to the above and the tape feed is not changed over when the second counter counts through 9999 after the first counter counts through 9999. As described above, the “repeat” mode or “one-time reversal” mode in slow feed is selected by changing over selector switch SA.

Since the output of NAND gate 51 of tape speed control circuit 5 becomes L in fast feed, the input terminals of NAND gates 71 and 72 of said repeat control circuit 7 become L through diodes 745 and 746 connected to output terminal 51e of said NAND gate and therefore circuit 7 does not operate. In other words, the tape feed is not affected even when said selector switch is operated in fast feed.

When fast forward switch S/F or fast reverse switch S/F is operated during “repeat” mode or “one-time reversal” mode as described above, the L signal is input into fourth input terminals 312d and 322d of NAND gate 312 and NAND gate 322 and therefore both trigger circuits 31 and 32 cannot operate while the contacts of said switches S/F and S/F are closed. Accordingly, the operation of fast forward switch S/F or fast reverse switch S/F is performed preferentially.

In the recording mode, that is, when record switch SC is operated, the input of input terminal 301b of NAND gate 301 of the repeat inhibit/release circuit is L and the output of NAND gate 301 is therefore held at H. The output of NAND gate 301 is not affected even though selector switch SA is set to the reverse side or the reversal mode side.

In this case, NAND gates 71 and 72 of repeat control circuit 7 are controlled by tape feed direction memory circuit 6. In other words, the condition is the same as the condition of the one-time reversal mode in said non-recording condition. Accordingly, the repeat is not performed and one-time reversal feed is performed even though selector switch SA is set to repeat side contact terminal Ta in recording.

The output side of first trigger circuit 31, that is, output terminal 312e of NAND gate 312 and the output side of second trigger circuit 32, that is, output terminal 322e of NAND gate 322 are connected respectively to trigger operation memory circuit 8 through diodes 88 and 89. The trigger operation memory circuit memorizes the operations of both trigger circuit 31 and 32 in fast feed and forms the T-flip-flop circuit comprising a pair of NAND gates 81 and 82, capacitor 83 connected between the output terminals of said both NAND gates, a pair of capacitors 84 and 85 connected in series between the input terminals of said both NAND gates and resistor 86 connected between the input and output terminals of NAND gate 81.
The output side of said both trigger circuits 31 and 32 is connected between said series-connected capacitors 84 and 85 through said diodes 88 and 89 and output terminal 52e of NAND gate 52 of tape speed control circuit 5 is connected to the input terminal of NAND gate 82 through diode 87.

Accordingly, in slow feed, said trigger operation-memory circuit 8 is adapted so that the output of NAND gate 81 is locked at L since the L output of NAND gate 52 of said tape speed control circuit 5 is input into NAND gate 82. On the other hand, in fast feed, said trigger operation memory circuit 8 can operate since the output of NAND gate 52 of tape speed control circuit is H.

When the second counter counts through 0000 to 9999 in fast feed, for example, fast forward feed, second trigger circuit 32 operates through NAND gate 43 as known from the description of the basic operation, hereby tape feed direction control circuit 2 is changed over from forward feed to reverse feed. In this case, the output of second trigger circuit 32, that is, the HL signal is input into said trigger operation memory circuit 8 and the output of this circuit becomes H.

The second counter counts through 9998 to 9999 after the tape feed direction is changed over. In this case, the second trigger circuit operates through NAND gate 44 but tape feed direction control circuit 2 is not affected as described above. The HL signal of second trigger circuit 32 is input into said trigger operation memory circuit 8 and the output of this circuit changes from H to L.

The output side of said trigger operation memory circuit 8, that is, the output terminal of NAND gate 82 is connected to differentiation circuit 80 and the output side of said differentiation circuit is connected to selector switch SB. Contact terminal Tb of a pair of contact terminals of said selector switch SB is connected to third input terminal 51c of NAND gate 51 of tape speed control circuit 5 and other contact terminal Tc is connected to the input of stop control circuit 91. Said stop control circuit 91 can be designed to generate a specified stop signal such as, for example, the L signal which stops the drive mechanism when a L signal is input into said circuit and can form a flip-flop circuit as said tape feed direction control circuit 2 and tape speed control circuit.

Temporary stop circuit 92 is connected to output terminal 52e of NAND gate 52 of said tape speed control circuit 5.

Said temporary stop circuit 92 generates a temporary stop signal which temporarily stops the tape when the tape is changed over from slow feed to fast feed and can be designed to be provided with a time constant circuit to generate a stop signal output such as, for example, the L output for a predetermined time from the change of the output of NAND gate 52 of said tape speed control circuit 5 from H to L as the starting point.

When said selector switch SB is set to the stop side, that is, contact terminal Tc side, the second counter counts through 9999 in forward feed and the tape feed is changed over from forward feed to reverse feed; then the output of trigger operation memory circuit 8 changes from H to L when the second counter counts through 9999 during reverse feed. This variation of the output is differentiated by differentiation circuit 80 and input into stop circuit 91 through selector switch SB. The tape feed is stopped by this output.

On the other hand, when selector switch SB is set to the temporary stop side, that is, contact terminal Tb, the L input is applied to NAND gate 52 of tape speed control circuit 5 by virtue of variation of the output of trigger operation memory circuit 8 from H to L when the counter counts through 9999 during reverse feed described above. With this operation, tape speed control circuit 5 is triggered so that output terminal 52e of NAND gate 52 becomes L, that is, slow feed of the tape is performed. In this case, temporary stop circuit 92 connected to said output terminal 52e temporarily stops the tape by said L output. Since temporary stop circuit 92 stops its functioning after lapse of a specified time, the slow feed is commenced.

As described above, the tape feed direction is not changed before and after temporary stop.

The operation which is commenced from fast reverse feed is similarly performed in accordance with the counting of the first counter.

Table 2

<table>
<thead>
<tr>
<th>Tape feed mode</th>
<th>Fast reverse</th>
<th>Fast forward</th>
<th>Temporary stop</th>
<th>Slow forward (play)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication of 1st counter</td>
<td>0000</td>
<td>9976</td>
<td>9999</td>
<td></td>
</tr>
</tbody>
</table>

The following describes the operations according to Table 2 Time Chart. When the first counter counts through 0000 to 9999 in fast reverse feed, that is, rewind, first trigger circuit 31 operates, thereby the tape is changed over to fast forward feed when the counter counts through 9976 after 9999, and when the first counter counts through 9999 to 0000, the tape is stopped temporarily by the operation of first trigger circuit 31. Then, the slow forward feed is started.

Hereupon, trigger operation memory circuit 8 actuates temporary stop circuit 92 or tape speed control circuit 5 with the second triggering operation of first trigger circuit 31 or second trigger circuit 32, that is, the HL signal and should be adapted so that the output of NAND gate 81 is changed from H to L by the second triggering operation, and therefore, when the fast feed is started, the output of NAND gate 81 should be L and the output of NAND gate 82 should be H. The circuit shown in Fig. 5b is reset by a signal transmitted through diode 87 so that the output of NAND gate 81 starts from L when the tape feed is changed over from slow feed to fast feed or changed to fast feed after stopping.

When first switching means S1 is open, that is, the output of the first switching means is H, the H signal is input into first input terminal 42a of NAND gate 42 of signal selection circuit 4. When fast forward switch Sff is operated in reverse feed, the output signal of NAND gate 21 of tape feed direction control circuit 2 changes from L to H, this signal is applied to second input terminal 42b of NAND gate 42, the HL signal is therefore generated at the output terminal of NAND gate 42 and first trigger circuit 31 operates with HL signal. In this case, the tape feed direction is not changed but trigger operation memory circuit 8 may be triggered.

If fast reverse switch Sr is operated in forward feed when second switching means S2 is released, that is, the
output of the second switching means is H, the HL signal is generated from the output terminal of NAND gate 44 and second trigger circuit 32 operates. In this case, the tape feed direction is not changed but trigger operation memory circuit 8 may be triggered.

To avoid such rare possibility of triggering, fast reverse switch Srf and fast forward switch Sff are connected to the input terminals of NAND gate 82 of trigger operation memory circuit 8 through diodes 110 and 111. Since the input terminal of NAND gate 82 is locked at L while fast reverse switch Srf or fast forward switch Sff is operated in the above construction, trigger operation memory circuit 8 is not triggered by operation of both trigger circuits 31 and 32.

Said trigger circuits 31 and 32 are controlled by fast feed direction memory circuit 10 so that only second trigger circuit 32 operates when the tape feed is commenced from the fast forward feed in fast feed and only first trigger circuit 31 operates when the tape feed is commenced from the fast reverse feed in fast feed. Said fast feed direction memory circuit 10 forms the flip-flop circuit comprising a pair of NAND gates 101 and 102, and capacitor 103 connected between the output terminals of these NAND gates, whereby the input terminal of one NAND gate 101 is connected to fast forward switch Sff through diode 104 and to output terminal 52e of NAND gate 52 of said tape speed control circuit 5 through diode 105, the input terminal of the other NAND gate 102 is connected to fast reverse switch Srf through diode 107 and to output terminal 52c of said NAND gate 52 through diode 106, the output terminal of NAND gate 101 is connected to third input terminal 322c of NAND gate 322 of second trigger circuit 32 through diode 108 and the output terminal of NAND gate 102 is connected to third terminal 312c of NAND gate 312 of first trigger circuit 31 through diode 109.

Since the L output of NAND gate 52 of tape speed control circuit 5 is input into said fast feed direction memory circuit 10 in slow feed and the input terminals to both NAND gates 101 and 102 are locked at L, the outputs of both NAND gates 101 and 102 become H and do not affect NAND gates 312 and 322 of both trigger circuits.

On the other hand, in case of the tape feed commenced from for example, fast forward feed in fast feed, the output of NAND gate 102 is triggered at L since the L output is applied to the input terminal of NAND gate 101 when fast forward switch Sff is operated in advance. Accordingly, NAND gate 312 of first trigger circuit 31 cannot operate. In other words, only second trigger circuit 32 can operate.

Contrary to this, in case of the tape feed commenced from the fast reverse feed, only first trigger circuit 31 can operate since the output of NAND gate 101 is triggered at L.

Accordingly, in said embodiment of the present invention, the tape feed does not become the repeat mode in which the change-over of tape feed is repeated in the fast feed. For instance, with respect to the time chart relating to the first counter shown in Table 2, even though the second counter counts through 9999 in the period from the time when the fast reverse feed is commenced till the time when the tape is temporarily stopped at 9999 after the tape feed is changed over to the fast forward feed at 9976, the second trigger circuit does not operate and therefore the tape is not changed over again.

When fast forward switch Sff is connected to the input terminal of NAND gate 61 of said tape feed direction memory circuit 6 through diode 641 and fast reverse switch Srf to the input terminal of NAND gate 62 through diode 643 as shown in FIG. 5b, the initial feed direction of fast feed is memorized in said tape feed direction memory circuit 6.

Accordingly, for instance, when the fast reverse feed is started by operating fast reverse switch Srf, the L output is input into the input terminal of NAND gate 62 and therefore the output terminal of NAND gate 61 is triggered at L. Though fast feed, repeat control circuit 7 is disabled to operate by the L output of NAND gate 51 of tape speed control circuit 5, said repeat control circuit 7 is enabled to operate and the L output of NAND gate 61 is input into NAND gate 71 when the tape is changed over from fast reverse feed to fast forward feed and is further changed over to slow forward feed after temporary stop. Accordingly, the output of NAND gate 72 is triggered at L thereby third input terminal 312c of NAND gate 312 of first trigger circuit 31 becomes L and first trigger circuit 31 is disabled to operate. Therefore, only the second trigger circuit is enabled to operate and the tape is changed over again to slow reverse feed when the second counter counts through 9999 in slow forward feed. That is to say, the same operation as that when selector switch SA is set to "one-time reversal" side, that is, terminal Td' side is performed.

Hereupon, in fast feed direction memory circuit 10, when the operation is changed over from the fast feed to the slow feed after temporary stop, the L output of NAND gate 52 of tape speed control circuit 5 is input into both NAND gates 101 and 102 and the outputs of these NAND gates become H and accordingly, the above operation can be performed.

The above description relates to an embodiment of the present invention according to which the digit wheels of the counters are provided with the first and second switching means, that is, the first and second signal generating means for generating the tape feed change-over signals.

To complete the object of the present invention, however, the signal generating means need not be provided on the digit wheels of the counters, a pair of signal generating means such as, for example, switches can be provided on both rotary means which rotate in accordance with the tape feed and can be independently reset to a specified position, and said rotary means need not be the counters which measure the length of a tape which has been fed.

For example, as shown in FIG. 7, rotary members 151 and 152 are made as discs without digital numbers on their peripheries and are adapted to rotate with rotation of the pulley shafts (not shown) which is transmitted by transmitting means 13.

In this case, the first rotary member is adapted to rotate clockwise during forward feed and counterclockwise during reverse feed while the second rotary member is adapted to rotate counterclockwise during forward feed and clockwise during reverse feed.

First rotary member 151 and second rotary member 152 are provided respectively with resetting means 14 similar to that of the embodiment shown in FIG. 1 and are adapted so that drive gears B4 and B4' of said transmission means are disengaged from the rotary members
when reset button 143 is operated and are independently reset to the specified positions. Both the rotary members are provided respectively with signal generating means 16 and 17 which generate the signal when the rotary members rotate exceeding the resetting positions. These signal generating means comprise conductive surfaces 161 and 171 which are made in an annular form and partly provided detecting parts 161a and 171a which are extended toward the circumference, contacts 162 and 172 which always contact said conductive surfaces and contacts 163 and 173 which can contact said detecting parts 161a and 171a of said conductive surfaces when said rotary members are at the specified positions.Contacts 163 and 173 are arranged at the positions where said contacts are located close to the extreme ends of the counterclockwise side of detecting parts 161a and 171a of the conductive surfaces when the rotary members are at the resetting positions as shown in FIG. 8a. Accordingly, when first rotary member 151 rotates counterclockwise over the resetting position and contact 163 contacts detecting part 161a, contacts 162 and 163 become conductive and generate the ON signal. Similarly, when the second rotary member 152 rotates counterclockwise over the resetting position, contacts 172 and 173 become conductive and generate the ON signal. The circuit sections can be formed as same as said embodiment and its operation is basically identical to the embodiment except that the rotary members are the digit wheels of the counters or not.

Both rotary members 151 and 152 can be adapted so that these rotary members rotate in the same direction, that is, first rotary member 151 and second rotary member 152 rotate clockwise in forward feed and counterclockwise in reverse feed. In this case, as shown in FIG. 8b, when first rotary member 151 is in the resetting position, contact 163 is provided at a position close to the counterclockwise extreme end of detecting part 161a of the conductive surface and, when second rotary member 152 is in the resetting position, contact 173 is provided at a position close to the clockwise extreme end of detecting part 171a of the conductive surfaces.

Referring to FIG. 9, there is shown another embodiment of signal selection circuit 4. Capacitor Cq of differentiation circuit 412 is connected to terminal T1 of first switching means S1 and inverter 411 is connected between said capacitor Cq and NAND gate 41. Resistor Rq of differentiation circuit 412 is connected to power supply line L1. Capacitor Cb to prevent noise is connected between contact terminal T1 and the ground. Similarly, differentiation circuit 432 and inverter 431 are connected between second switching means S2 and NAND gate 43 and capacitor Cd to prevent noise is connected.

The circuit of the construction described above operates as the circuit shown in FIG. 5a. The former circuit increases the stability against temperature variation more than in the latter circuit. Referring to FIG. 10, there is shown a circuit in which NPN transistor 314 is connected between differentiation circuit 313 and NAND gate 312 of first trigger circuit 31. NPN transistor 324 can be connected to second trigger circuit 32 as shown with a number in parentheses in FIG. 10. In this arrangement, the stability against temperature variation of both trigger circuits is increased as compared with the circuit shown in FIG. 5a.

As described so far, the apparatus according to the present invention is adapted so as to be capable of changing over the feed direction of a tape by resetting one of the rotary members and repeating the tape feed in the same range which is specified. Furthermore, if the tape feed direction memory circuit and the repeat control circuit are provided, said apparatus can perform the "one-time reverse" operation as well as the repeat operation.

Accordingly, said apparatus is advantageous in that the presetting of the range of the tape as in the control by means of the conventional sensing tape is not required and it is unnecessary to remove the sensing tape.

What is claimed is:

1. A tape feed control apparatus comprising a first rotating means which rotates in accordance with feeding of a tape in a direction which is changed over to an opposite direction when said tape is changed over from forward feed to reverse feed and from reverse feed to forward feed, b. a second rotating means which rotates in accordance with feeding of a tape in a direction which is changed over to an opposite direction when said tape is changed over from forward feed to reverse feed and from reverse feed to forward feed, c. a first resetting means which resets said first rotating means to a specified position independently from said second rotating means, d. a second resetting means which resets said second rotating means to a specified position independently of said first rotating means, e. a first signal generating means which generates a first change-over signal when said first rotating means rotates exceeding the resetting position, f. a second signal generating means which generates a second change-over signal when said second rotating means rotates exceeding the resetting position, g. a tape feed direction control circuit which sets alternatively an operation mode for which a forward feed signal to perform forward feed of the tape is generated and an operation mode for which a reverse feed signal to perform reverse feed of the tape is generated, and h. a coupling means which transmits said first change-over signal to said tape feed direction control circuit so that the tape feed direction control circuit comes in the forward feed mode when said first signal generating means generates the first change-over signal and transmits said second change-over signal to said tape feed direction control means so that the tape feed direction control circuit comes in the reverse feed mode when said second signal generating means generates the second change-over signal.

2. An apparatus in accordance with claim 1, wherein said first signal generating means comprises a first switching means which turns on and off according to rotation of said first rotating means and said second signal generating means comprises a second switching means which turns on and off according to rotation of said second rotary means.

3. An apparatus in accordance with claim 1, wherein both said signal generating means are adapted to generate first level outputs when these signal generating
means operate and second level outputs when the signal generating means do not operate, thereby said first signal generating means is arranged at a position where said first rotating means moves so that the output changes from the second level to the first level when the first rotating means rotates from the resetting position in a direction in which the first rotating means rotates in the reverse feed of the tape and said second signal generating means is arranged at a position where said second rotating means moves so that the output changes from the second level to the first level when the second rotating means rotates from the resetting position in a direction in which the second rotating means rotates in the forward feed of the tape.

4. An apparatus in accordance with claim 3, wherein said coupling means comprises a first trigger circuit which operates to trigger said tape feed direction control circuit so that the tape feed direction control circuit comes in the forward feed mode, a second trigger circuit which triggers said tape feed direction control circuit so that the tape feed direction control circuit comes in the reverse feed mode and a signal selection circuit which is adapted to transmit selectively output signals having a varying level from said first switching means to the first trigger circuit to actuate said first trigger circuit, at least an output signal changing from the first level to the second level in the reverse feed does not actuate said first trigger circuit and an output signal changing from the second level to the first level in the reverse feed actuates said first trigger circuit as said first change-over signal, and to transmit selectively output signals having a varying level from said second switching means to actuate said second trigger circuit, at least an output signal changing from the first level to the second level in the reverse feed does not actuate said second trigger circuit and an output signal changing from the second level to the first level in the forward feed actuates said second trigger circuit as said second change-over signal.

5. An apparatus in accordance with claim 1 further comprising a forward feed switching means which sets said tape feed direction control circuit so that the tape feed direction control circuit comes in the forward feed mode, a reverse feed switching means which sets said tape feed direction control circuit so that the tape feed direction control circuit comes in the reverse feed mode, a tape feed direction memory circuit which memorizes the latest operation of operations of both said switching means and a repeat control circuit which controls said coupling means according to a signal memorized by said tape feed direction memory circuit, wherein said repeat control circuit controls the signal so that said coupling means does not transmit the signal from said first signal generating means to said tape feed direction control circuit when said tape feed direction memory circuit memorizes the operation of the forward feed switching means and controls the signal so that said coupling means does not transmit the signal from said second signal generating means to said tape feed direction control circuit when said tape feed direction control circuit memorizes the operation of the reverse feed switching means.

6. An apparatus in accordance with claim 5 comprising a switching-over means which changes over a state where said repeat control circuit is disabled to operate and a state where said repeat control circuit is enabled to operate, wherein the coupling means is adapted to be able to transmit the signals from both said signal generating means to said tape feed direction control circuit when said switching-over means selects a state in which said repeat control circuit is disabled to operate.

7. An apparatus in accordance with claim 6 comprising a record control circuit which generates a record signal to set a record mode and a record switch means which sets said record control circuit to generate a record signal, wherein said repeat control circuit is adapted to operate in a state where said record control circuit is generating the record signal regardless of selection by said switching-over means.

8. A tape feed control apparatus comprising:

a. a first counter which has a plurality of digit wheels which respectively indicate each digit of a counted multiple-digit number and a resetting means which simultaneously resets all digit wheels and is adapted so that said digit wheels rotate in a direction in which an indicated value increases when the tape is forwardly fed to count the feed length of the tape through addition and in a direction opposite to said direction in which an indicated value decreases when the tape is reversely fed to count the feed length of the tape through subtraction,

b. a second counter which has a plurality of digit wheels which respectively indicate each digit of a counted multiple-digit number and a resetting means which simultaneously resets all digit wheels and is adapted so that said digit wheels rotate in a direction in which an indicated value increases when the tape is reversely fed to count the feed length of the tape through addition and in a direction opposite to said direction in which an indicated value decreases when the tape is forwardly fed to count the feed length of the tape through subtraction,

c. a first signal generating means which is provided at any specified digit wheel other than the unit-position digit wheel of said first counter and generates the first change-over signal when said digit wheel rotates in the direction for subtraction from the resetting position and changes its digital indication,

d. a second signal generating means which is provided at any specified digit wheel other than the unit-position digit wheel of said second counter and generates the second change-over signal when said digit wheel rotates in the direction for subtraction from the resetting position and changes its digital indication,

e. a tape feed direction control circuit which sets alternatively an operation mode for which a forward feed signal to perform forward feed of the tape is generated and an operation mode for which a reverse feed signal to perform reverse feed of the tape is generated, according to an input signal, and

f. a coupling means which transmits a signal of said first signal generating means to said tape feed direction control circuit when said first signal generating means generates the first change-over signal and transmits a signal of said second signal generating means to said tape feed direction control circuit so that the tape feed direction control circuit comes in the reverse feed
mode when said second signal generating means generates said second change-over signal.

9. An apparatus in accordance with claim 8, wherein both said counters are adapted so that said specified digit wheels indicate zero at their resetting positions and each signal generating means generates the change-over signal when said specified digit wheel rotates from the resetting position to a position where the digit wheel indicates 9.

10. An apparatus in accordance with claim 8, wherein said first signal generating means comprises a first switching means which turns on and off with rotation of a specified digit wheel of said first counter and said second signal generating means comprises a second switching means which turns on and off with rotation of a specified digit wheel of said second counter.

11. An apparatus in accordance with claim 10, wherein said each switching means is adapted to generate an output of the first level while said specified digit wheel indicates 9 and an output of the second level different from said first level while said specified digit wheel indicates the other digit so that said switching means generate a signal with varying output level when the switching means turn on and off and said coupling means comprises the first trigger circuit which triggers said tape feed direction control circuit to cause the tape feed direction control circuit to come in the forward feed mode, second trigger circuit which triggers said tape feed direction control circuit to cause the tape feed direction control circuit to come in the reverse feed mode and a signal selection circuit which is adapted selectively to transmit signals having a varying level from said first switching means to the first trigger circuit, at least a signal changing from the first level to the second level in the reverse feed does not actuate said first trigger circuit and a signal changing from the first level to the second level in the reverse feed actuates said first trigger circuit as said first change-over signal, and to transmit signals having a varying level from said second switching means to said second trigger circuit, at least a signal changing from the first level to the second level in the forward feed does not actuate said second trigger circuit and a signal changing from the first level to the second level in the forward feed actuates said second trigger circuit as said second change-over signal.

12. An apparatus in accordance with claim 11, wherein said signal selection circuit comprises a first gate means which is located between said first switching means and first trigger circuit and is controlled by said forward feed signal so that signals with varying level from said first switching means are not transmitted to the first trigger circuit while said tape feed direction control circuit is generating the forward feed signal and a second gate means which is located between said second switching means and second trigger circuit and is controlled by said reverse feed signal so that signals with varying level from said second switching means are not transmitted to the second trigger circuit while said tape feed direction control circuit is generating the reverse feed signal.

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