

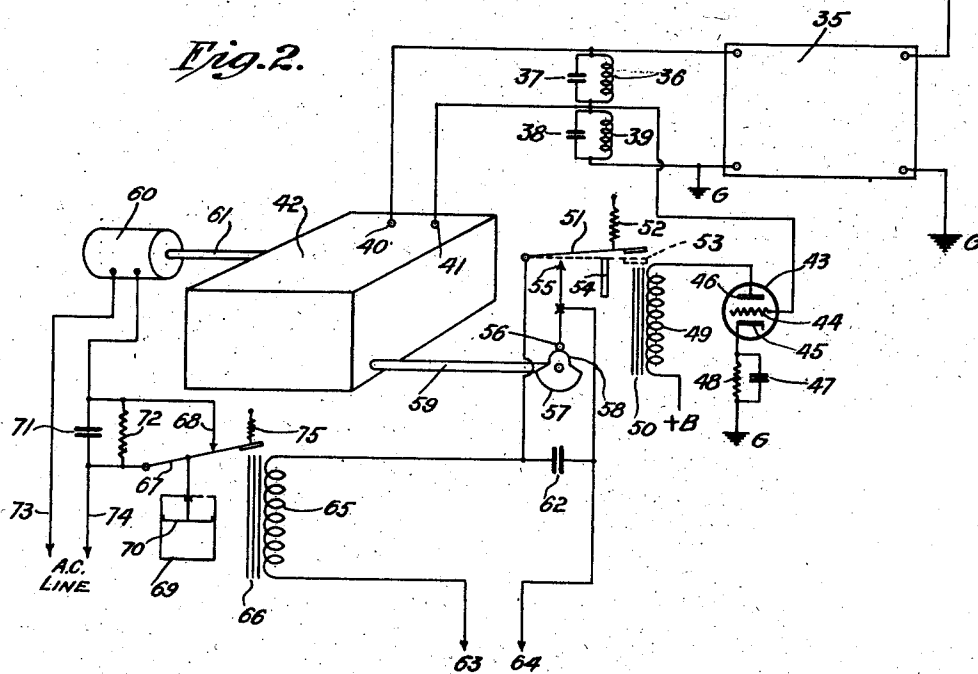
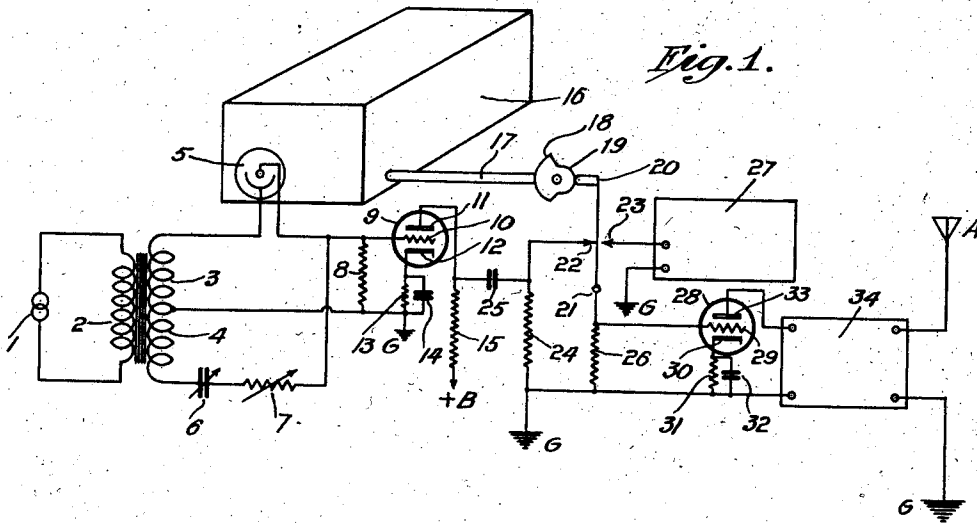
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FACSIMILE APPARATUS

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FACSIMILE APPARATUS

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The present invention relates to phasing of synchronized moving bodies and in particular to framing of facsimile systems and the like.

One object of the present invention is to provide a phasing or framing method and apparatus useful in motor driven systems such as those employed in facsimile transmission and reception.

Another object is to provide a phasing system which operates in steps to equalize the phase between a control and a controlled system.

A particular object is to provide means for framing a synchronized facsimile receiver through the action of a transmitted signal.

Still another object is to control the magnitude of the steps by which the phasing is accomplished, and in particular to equalize such steps under certain conditions of operation.

These and other objects of the invention will be evident from the detailed description of the various figures of the drawing.

There are many systems involving a local controlling station and a remote controlled station. In general a facsimile receiving system, for instance, must reproduce signals bearing information in a very precise relation to the transmitter. In order to describe the present invention, it is proposed to define this relation as being made up of a rate of operation called synchronization and a phase of operation called framing. The rate of operation for instance in a facsimile system employing a long sheet of transmitted and received material will determine how received characters are related when compared to the transmitter character relations. The phase of operation will determine how the characters fall with respect to the sheet. While there are a number of ways in which the rates of operation of a facsimile transmitter and receiver may be equalized, one of the simplest is to operate motors driving the transmitter and receiver scanners from a common power source. In a system so synchronized, however, the phase or framing of the receiver will depend upon the instant of turning it on and the time it takes for it to reach synchronism. The present invention concerns a novel method and apparatus for phasing or framing a system as described above which is synchronized as to the rate of operation by any one of a number of means.

Essentially, the invention comprises transmitting facsimile or other signals to be recorded during a marking interval and transmitting a framing signal during a non-marking interval. At the receiver the marking signals are applied to a marking member and the framing signals are

separated out and are applied to a phasing mechanism. The phasing mechanism is rendered operable during the marking interval of the receiving recorder and is operated if framing signals are present during the operable or marking interval. The phasing mechanism in operation may introduce an impedance in series with the power supply of the receiving recorder motor allowing it to slow down. In such a case the amount by which the motor slows down depends on the duration of the framing signal in the marking interval or the amount of slowing may be made up of equal increments by operating the motor circuit switch in such a manner that each time it is opened it stays open a predetermined length of time. The process described above repeats itself until framing signals are not present during the marking interval, indicating that the receiver recorder is in frame with the transmitter recorder.

In the drawing:

Fig. 1 shows a schematic diagram of portions of a facsimile transmitter embodying one form of the invention.

Fig. 2 shows a schematic diagram of portions of a facsimile receiver embodying one form of the invention.

The transmitter as shown in Fig. 1 comprises marking signal generating means of conventional design which may consist in a source of sub-carrier signal 1 coupled to a pick-up photo-electric cell 5 and a balance network 6—7 by means of the transformer 2—3—4. Photo-electric cell 5 is contained in the pick-up scanner 16. The sub-carrier voltage modulated by the photo-electric cell is applied across grid resistor 8 to an amplifier tube 9 having a grid 10, plate 11, and cathode 12. Cathode 12 may receive bias from cathode resistor 13 by-passed by condenser 14, and plate 11 may be loaded by resistor 15 and energized from any convenient source of plate voltage +B. The amplified modulated sub-carrier signal output from tube 9 appearing across plate load resistor 15 is fed to a resistor 24 thru blocking condenser 25. The voltage across resistor 26 is placed on grid 29 of amplifier tube 28 which also has cathode 30 and plate 33. Cathode 30 receives bias from resistor 31 by-passed by condenser 32 and plate 33 feeds further amplifiers, carrier modulators, etc. 34 comprising the transmitter feeding antenna A. In the case of a wire, line 34 may be any coupling system suitable to the particular type of line.

This invention as far as the transmitter is concerned comprises means for introducing a phas-

ing signal to the system during non-marking intervals of transmission. This is accomplished in one form as shown in Fig. 1 by means of switch 20—21—22—23, control cam 18—19 and a source of phasing signal 27. Cam 18—19 is operated from a shaft 17 geared to the transmitter scanning mechanism 16 in such a way that it revolves once for each line or scanning cycles. During the marking interval the plunger 20 of switch 20—21—22—23 rides on the smaller radius section 19 of cam 18—19 which closes contact 22 thereby feeding modulated sub-carrier signals from resistor 24 to resistor 26 and from there to the transmitter 34, causing marking signals to be emitted. During the remainder of the scanning cycle or non-marking interval the larger radius portion 18 of cam 18—19 opens switch contact 22 removing marking signals from the transmitter, and closes contact 23, placing phasing signals from source 27 on the transmitter. The frequency of source 27 is made sufficiently different from the frequency of sub-carrier 1 that the two signals and the modulations of carrier 1 may be differentiated on a frequency basis in the receiver. Thus, the transmitted signal is made up of marking signals and framing signals, although there may also be short intervals of zero signal between each switch-over while switch 20—21—22—23 is in a neutral position. This interval may be controlled by varying the slope of the cam surface between the smaller radius 19 and the larger radius 18, and by varying the space between contacts 22 and 23.

The receiver as shown in Fig. 2 comprises a conventional facsimile receiver 35 attached to antenna A. After amplification and detection the received signals consist of marking signal modulations of the first sub-carrier, intervals of no signal and the phasing signal sub-carrier impulses. This composite signal is applied to a separator circuit comprising tuned trap circuits 36—37 and 38—39. Trap 36—37 is tuned to the marking signal sub-carrier and the marking signals thereby established across it are applied to the receiver scanner 42 at points 40—41 where it may be further amplified and rectified and utilized to energize or operate a recording electrode or other mechanism. Trap circuit 38—39 is tuned to the phasing signal sub-carrier frequency and voltages appearing across it are applied to grid 44 of amplifier tube 43 also having a plate 46 and a cathode 45 connected to bias resistor 48 by-passed by condenser 47. The plate 46 feeds relay coil 49 and is energized from any suitable voltage source at +B. Thus, phasing signals operate the relay associated with coil 49 comprising a core 50, armature 51, return spring 52, contact 55 and stop 54. Recorder 42 is run by motor 60 from shaft 61. A counter-shaft 59 is provided which revolves cam 57—58 once for each scanning cycle as was the case of cam 18—19. Cam 57—58 moves contact 55 into and out of operating position thru roller 56. When roller 56 is on the smaller radius 58 as shown, contact 55 cannot be closed by phasing signals, but when roller 56 is on the larger radius 57, contact 55 may be closed by phasing signals. Thus, if phasing signals are received during the marking stroke of the receiver, that is while roller 56 is on larger radius 57, contact 55 will close with arm 51 and a circuit will be completed from wire 63 to wire 64 thru relay coil 55. Wires 63 and 64 are connected to a source of electrical energy suitable for energizing coil 65 to open contact 66 of relay 65—66—67—68. Armature 67 is nor-

mally held open to close contact 66 by spring 75. Contact 66 is placed across an impedance comprising condenser 71 shunted by resistor 72 in series with the scanner motor 60 and its power supply leads 73—74. Condenser 71 and resistor 72 are so chosen that when contact 66 is opened as described above, motor 60 slows down. The rate at which it slows down may be controlled over a range by the choice of condenser 71 and resistor 72. Thus, if phasing signals are received at the receiver during the marking interval, the driving motor 60 is slowed down. Motor 60 may be a synchronous motor operated from the same alternating current power source, as the transmitter or other synchronizing systems may be used to maintain rate synchronism as defined above. It will be seen that when in frame no mark will be produced on the back stroke, since the framing signal is not passed by trap circuit 36—37.

As described, the receiver motor 60 is slowed down during each cycle of scanning by an amount which depends upon the amount by which the receiver scanner is out of phase with the transmitter scanner. When the two are in phase, there will be no further action of the phasing system as long as synchronism is maintained uninterrupted.

Cams 18 and 57 have been shown cut for equal recording and non-recording intervals for each with small, no signal intervals provided for between marking and framing signals. In many cases it is desirable for efficiency of operation to mark for more than half the time and to transmit framing signals during only a small time interval, say for 15 percent of each scanning cycle. This may easily be accomplished by making the larger diameter of cam 18 54 degrees to transmit framing signals for 15 percent of each cam revolution and the smaller diameter portion 56 of the cam at the receiver likewise 54 degrees so that the phasing system is operable for 306 degrees, or the marking portion of each scanning cycle.

A variation of the mode of operation described may be accomplished by delaying the closing of contact 66 once it is opened by means of a slow return plunger 70 operating in a dashpot 69. If impedance 71—72 is made to have only a small effect on the speed of motor 60 and the slow return mechanism of contact 66 is made to have a long period compared to half a line scanning cycle, the phasing will be accomplished by equal increments no matter how much or little the phasing is out, until perfect phasing is accomplished, or phasing increments may depend upon the amount by which phasing signals overlap the marking intervals when phasing is out by a large amount, and these increments may decrease as phasing is corrected to a limiting increment determined by the time of operation of the dashpot or a similar time delay device. If idle periods between the phasing and marking signals are provided, as described above, the phase relation will be corrected to be nearly perfect, but may be out by the amount of these idle periods. The idle periods may correspond to a margin in the received material, so that a quicker but less accurate phasing may be accomplished only at the expense of margin space. With increased marking time, the equal increments of phase correction become increasingly important.

One outstanding advantage of this present framing system is that once the system is framed, interference cannot affect the framing during a

part of each cycle. During the remainder of the cycle, only interference having strong components of the frequency of trap 38—39 can affect the framing. On the other hand, interference of a type which may excite trap 38—39 which occurs while the scanner is out of frame cannot retard framing and may even speed it up.

Other methods than frequency selection, as for instance, amplitude selection, may be used to separate marking and framing signals. Again framing signals may be transmitted for all or only a part of non-marking intervals. Short impulses of framing signals may be utilized in which case equal increments of framing may be utilized to full advantage by proper choice of time of operation of dash pot 69—70.

In Figs. 1 and 2 the letter G represents ground points or common points as is conventional in electrical circuit representations.

While one embodiment, with a few modifications, has been shown and described, the invention embraces these and other modifications as will be evident to those skilled in the art, as set forth in the appended claims.

What is claimed is:

1. In a facsimile system, the combination of, a facsimile receiver, a facsimile recorder, a synchronized motor for operating said recorder, independent means responsive to signals comprising two distinct groups of frequencies, means for dividing receiving periods into recording and non-recording intervals, means for slowing said motor in accordance with one of said groups of frequencies when received during said recording intervals and means for equalizing the slowing of said motor regardless of the duration of reception of said last groups of frequencies during said recording intervals.

2. In a facsimile receiving system, the combination of, a recorder, a synchronized motor for driving said recorder, means for dividing receiving periods into recording and non-recording intervals, means for receiving marking and phasing signals comprising two distinct groups of frequencies, means for separating said two groups

of frequencies, means for detecting the presence of phasing signals during said recording intervals, and means for changing the phase of said motor in response to said presence.

3. In a facsimile receiving system, the combination of, a recorder, a synchronized motor for driving said recorder, means for dividing receiving periods into recording and non-recording intervals, means for receiving marking and phasing signals comprising two distinct groups of frequencies, means for separating said two groups of frequencies, means for detecting the presence of phasing signals during said recording intervals, and means for shifting the phase of said motor by an amount proportional to the duration of said phasing signals present during said recording interval.

4. In a facsimile receiving system, the combination of, a recorder, a synchronized driving means for said recorder, means for dividing receiving periods into recording, non-recording and margin intervals, means for receiving frequency distinctive marking and phasing signals, and means for phasing said driving means in response to phasing signals received during said recording intervals whereby said marking signals are recorded during said recording intervals plus said margin intervals.

5. In a facsimile receiving system, the combination of, a recorder, a synchronized motor for driving said recorder, means for dividing receiving periods into recording and non-recording intervals, means for receiving marking and phasing signals comprising two distinct groups of frequencies, means for separating said two groups of frequencies, means for detecting the presence of phasing signals during said recording intervals, means for changing the phase of said motor in response to said presence, and means for controlling the amount of phase change to be produced relative to the duration of said phasing signals during said recording intervals.

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