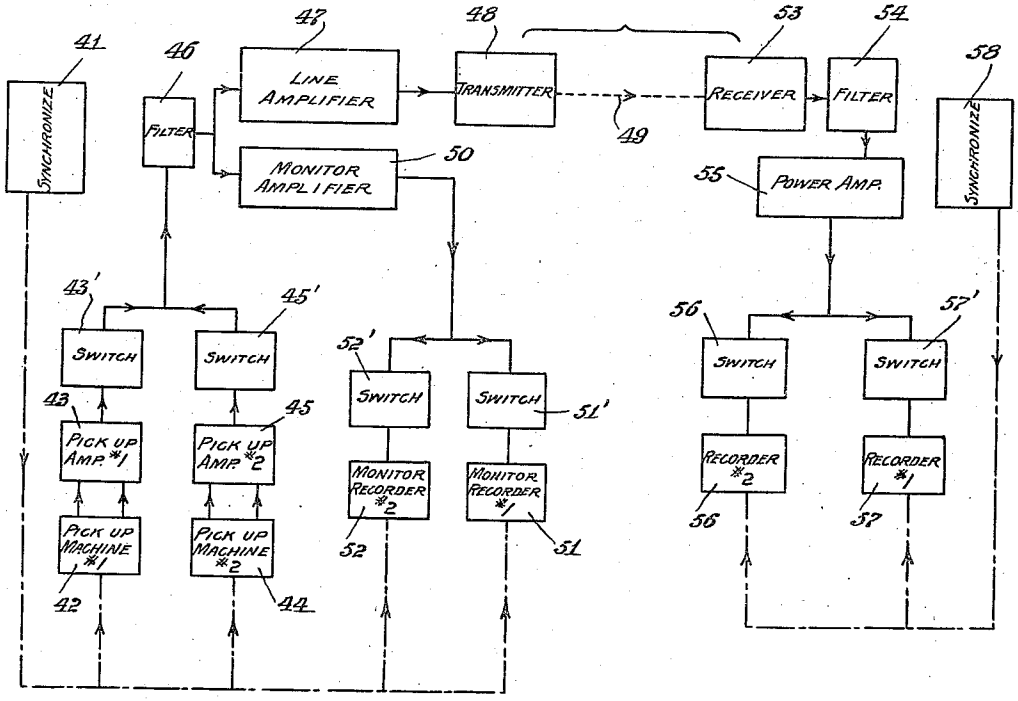
Jan. 10, 1939. H. G. MILLER 2,143,081

FACSIMILE SYSTEM

Filed Aug. 19, 1937



INVENTOR

Horace G. Miller

BY

ATTORNEY

Patented Jan. 10, 1939

2,143,081

UNITED STATES PATENT OFFICE

2,143,081

FACSIMILE SYSTEM

Horace G. Miller, Philadelphia, Pa., assignor to Radio Inventions, Inc., New York, N. Y., a corporation of New York

Application August 19, 1937, Serial No. 159,853

1 Claim. (Cl. 178—5)

This invention relates to a method of and means for multiplex transmission and reception of facsimile signals or the like.

The present invention contemplates the connection to a single transmission channel, of a plurality of transmitting scanners and an equal number of receiving recorders, each individual transmitting and receiving scanner being operative during not over one-half of the total time required to transmit an image. In case that more than two transmitting and two receiving scanners are used, the time that each pair of scanners is connected to the transmission channel must be proportionately reduced. In the latter case, the time during which each such pair is actively connected thereto may be represented by

$$\frac{T}{N}$$

where T represents the total time of a complete scanning cycle and where N represents the total number of such pairs of scanners which are to be operated.

In my co-pending application, Serial No. 11,770, filed Nov. 20, 1936, I have disclosed facsimile apparatus and circuits which may be applied to scanning devices in order that such scanning devices shall be effectively connected to the transmission channels only during the time that scanning is actually taking place. The method and apparatus disclosed in this co-pending application may conveniently be utilized in connection with the operation of the present invention, but I am not confined to such particular apparatus or methods, as will be hereinafter more fully explained.

An object of this invention is to provide a simple multiplex facsimile transmitting and receiving system wherein two or more transmitting scanners and two or more receiving scanners cooperate in a manner to permit multiplex operation over a single transmission channel.

Another object is to provide multiplex operation with minimum of apparatus at both transmitter and receiver.

A still further object is to utilize with essentially 100 percent efficiency a transmission channel by utilizing N transmitter scanners and N receiver scanners operating in sequence in which each transmitter scanner and a corresponding receiver scanner operate for a fraction of time T/N where T is a predetermined short interval of time.

Referring now to the diagram, I have here shown one application of my invention to a facsimile transmission system which will allow diplex operation thereof.

In this diagram a synchronizing element **41** supplies suitable signals or driving impulses, according to the control system employed, to a pick-up scanner **42**, whose output is amplified by amplifier **43** and enters filter **46**. Between amplifier **43** and filter **46** there is schematically shown a switching device **43'**, but, as hereinafter explained, this switching device may not necessarily be physically present, since its equivalent action may be secured by the action of the scanner itself. Another pickup scanner **44** likewise is controlled by synchronizer **41** and feeds its output through another amplifier **45** and another switching device **45'**, or its equivalent, into filter **46**. Switches **43'** and **45'** are operated in such a manner that only one is closed at any given instant. Each switch must remain open for an interval at least equal to the interval during which it is closed and their operation must be phased so that while one is open the other is closed. Due to the fact that at any given instant of time only one of the two pickups is effectively connected to the filter **46**, there will be present in this filter at that instant, only a single set of signals, notwithstanding its apparent connection to two different feeding circuits. The output of filter **46** passes through a line amplifier **47** and is delivered by transmitter **48**, to the transmission channel **49**.

It is to be understood that in case transmission takes place over a wire or directed channel, elements **47** and **48** may be suitably adapted to that use, as well understood in the art. A portion of the outfit of filter **46** may be fed through a monitor amplifier **50** and the output of this amplifier fed into two monitor recorders **51** and **52**, through controlling switches **51'** and **52'**, or their equivalents. The use of this monitor system, while a great convenience and contributory toward the efficient adjustment and operation of my invention, is not an essential part thereof nor necessary to the practice thereof.

Referring now to the receiver portion of the diagram, a receiver **53** of a type suitable for picking up signals from the particular transmission channel **49**, which may be employed, feeds its output to another filter **54**, which in turn passes on the signals to a power amplifier **55**. In case that the particular facsimile reproduction system employed demands a unidirectional current for its operation, a suitable rectifying device may be incorporated in the power amplifier **55**. It is to be understood that the various filters, amplifiers, transmitters and receivers here shown

form no essential part of my invention and may be of any suitable types, as well known in the art. It will also be apparent to those skilled in the art that the function of some of these elements may be combined with those of other elements and therefore that certain of the specific elements may be dispensed with under certain circumstances.

The output of power amplifier **55** reaches recorders **56** and **57** through time controlling switches **56'** and **57'**, or their equivalent, and as explained in connection with the pickup scanners at the transmitter, only a single one of these two recorders is at any given instant operatively associated with the power amplifier **55**.

In connection with the distribution of time to the various elements of my system, it will be evident that if additional time over the transmission channel be needed for the transmission of special signals for other purposes, such as synchronization, framing, lift of a recording stylus, etc., such additional time may readily be secured by reducing the percentage of a complete time cycle during which each set of pickup and receiving scanners are connected to the transmission channel, below the theoretical maximum percentage, which would result from the equation previously given. For example, in the case of triplex operation, each set of scanners may be connected to the transmission channel for only 30% of the total time, thus giving a total excess margin of 10% of time available upon the transmission channel for such purposes other than image transmission as may be needed.

While I have in the above description referred to switching devices inserted between the pickups or the recorders and their respective outputs, and while I have referred to my co-pending application for a description of one form of such switching devices, yet it can be seen that such switching devices may be dispensed with, provided that the equivalent function be provided by reason of the fact that transmitting and receiving scanners are so designed that they will be effectively operative during only a portion of a complete scanning time cycle.

For example, if a photocell at the transmitting scanner is moved relatively to an image to be transmitted, so that it passes across such image in one direction while scanning and so that it is then returned to its starting point again, while not being exposed to any light proceeding from the image, during such return stroke, it will be apparent that no signals will proceed from such a pickup during the time that such return is taking place. Under such conditions, it will be evident that no external or additional switching device may be necessary to disconnect electrically such a scanner from the communication channel, provided that the relative times of the scanning stroke and the return stroke are adjusted so as to be in agreement with the relative times required according to the principles of my invention, as above explained in detail.

A similar case may exist at the fascimile recorder in cases where the recording stylus is reciprocatingly operated and where a break of the electric circuit takes place during substantially the entire return stroke, such as that brought about by the lifting of a recorded stylus from the surface of an electrolytic recording paper. Alternatively in the case of the records, provided that the power amplifier feeding these recorders is capable of furnishing operative signal energy sufficient for both recorders at the same time, it may be sufficient simply to render at any given instant all recorders except one effectively inoperative. This may be brought about, for example, by the lifting of a stylus, and in such case it will be evident that, although during its return stroke such stylus will be influenced by extraneous signals not pertinent to its own record, yet these signals will not appear upon its recorded output.

Other modifications and embodiments of my invention will be apparent to those skilled in the art and accordingly I do not limit the scope of my invention, except as defined by the hereunto appended claim.

I claim:

A fascimile system utilizing a single channel of communication for the simultaneous operation of a plurality of transmitters and receivers, including a plurality of pick-up scanners, each yielding signals for not over one-half of a given time cycle, means for synchronously connecting each of said scanners to said channel at the time when said scanner is yielding signals, a plurality of recorders, each requiring signals for not over one-half said time cycle, and means for connecting each of said recorders to said channel at the time when said recorder is requiring signals.

HORACE G. MILLER.