

July 28, 1931.

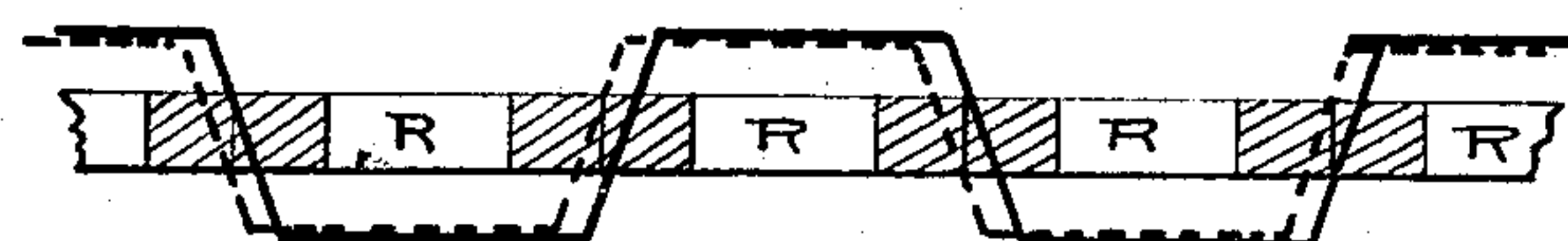
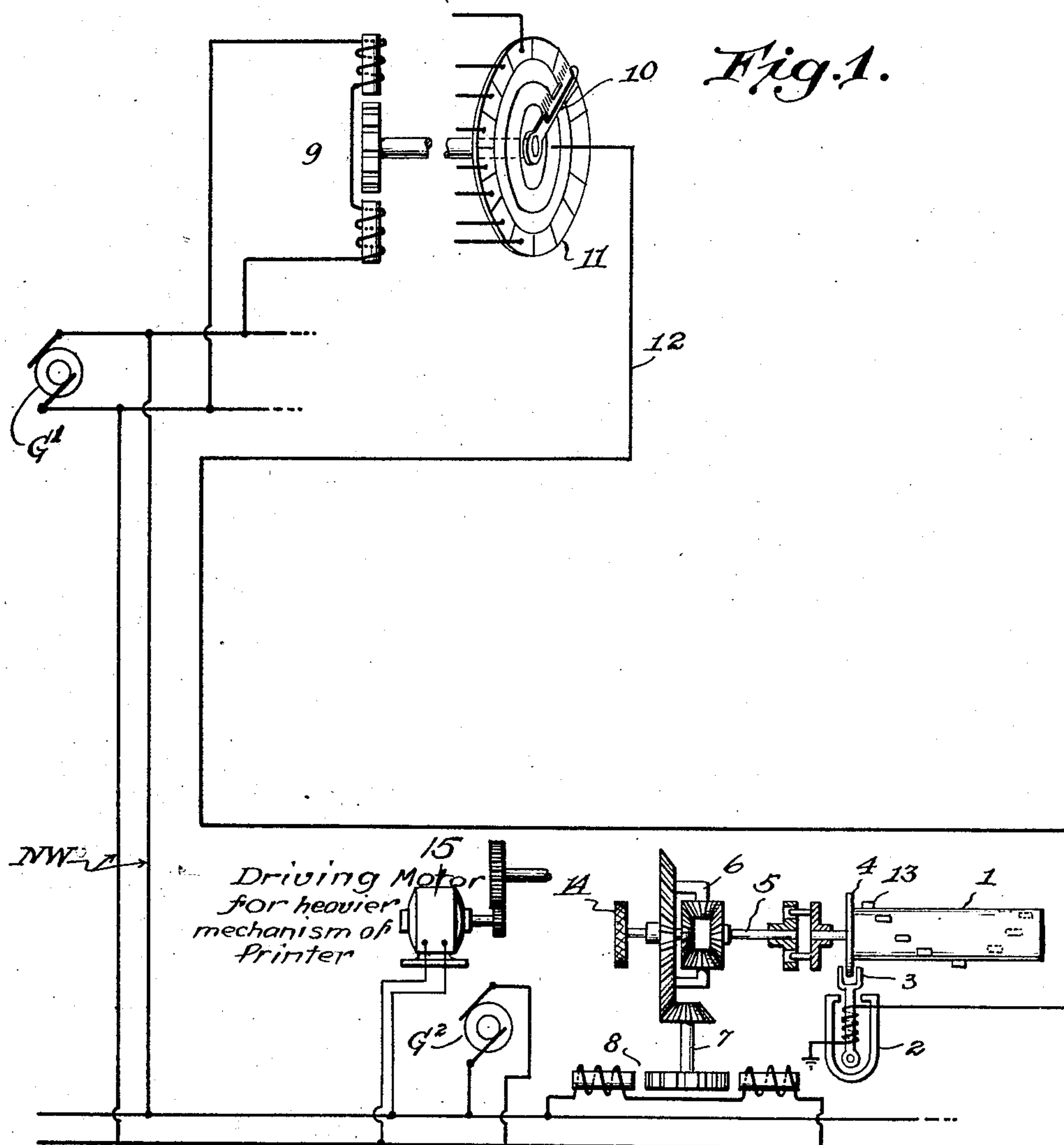
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1,815,969

SYNCHRONOUS COMMUNICATION SYSTEM

Filed Jan. 30, 1929

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

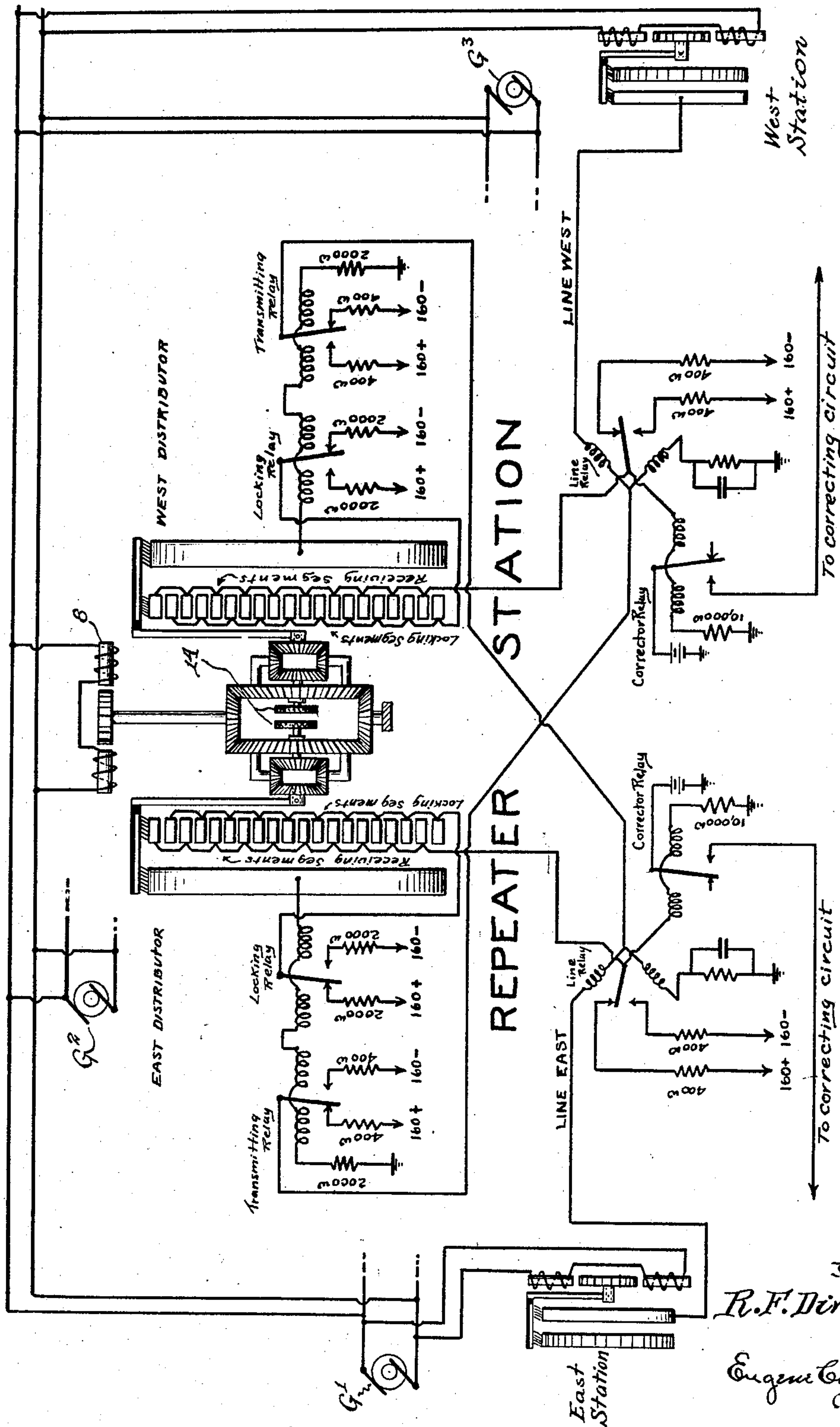


Fig. 4.

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UNITED STATES PATENT OFFICE

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SYNCHRONOUS COMMUNICATION SYSTEM

Application filed January 30, 1929. Serial No. 336,272.

This invention relates to a system of synchronizing a plurality of units located at distant points from each other on a circuit established for communication.

5 An object of this invention is to devise a system whereby power station net-works or other regular outside sources of uniform frequency may be used for synchronizing the elements in a synchronous communication
10 system.

This invention will be explained as applied to (1) a start-stop telegraph system, and (2) a multiplex telegraph system. It is obvious, however, its application could be
15 made to any communication system in which it is necessary to provide synchronism between the sender and receiver.

As is known to those versed in the art, all start-stop printing mechanisms operated to-
20 day drive their signal receiving shaft by a coupling arrangement attached to the main driving unit. It is also known that at different parts of the revolution of the main driving motor, there is a speed change due to:
25 (a) differences in load application at the different parts of the cycle, (b) differences in speed variation of the motor due to fluctuations of voltage, and (c) differences in speed variation of the motor due to surging
30 of the governor, when a governor is used. It is necessary, therefore, on the phasing of such a machine to compensate for these differences as far as possible. This is most generally accomplished by the insertion of a so-
35 called "rest" pulse in the coding, to allow the mechanism to actually come to rest for a very short period, and at the same time to run the receiving motor at a slightly faster speed than that of transmission. This, of course,
40 is not all that is to be desired, since with changes of load, voltage, etc., only an approximation can be made as to the proper speed for the receiving unit shaft.

A further object of my invention is to
45 eliminate these difficulties by the method explained below, and also to make possible in one case, the elimination of all impulses excepting those used for intelligence, and in another the elimination of what is commonly
50 known as the "rest" impulse. As is well

known to those versed in the art, all so-called start-stop receiving printing units employ a light receiving shaft which is kept in synchronism and phase with the signals transmitted to said receiving unit. My invention
55 employs this same shaft but differs from the standard practice, in that I do not drive the receiving shaft from the same source of power for all the heavier mechanism in the printer, but rather insert a new source of driving
60 power as explained below.

In the following description I shall refer to the accompanying drawings in which:

Figure 1 illustrates my invention as applied to a start-stop system;

Figures 2 and 3 are diagrams serving to illustrate the proper operation of my invention, and

Figure 4 illustrates my invention as applied to a repeater station in a multiplex sys-
70 tem.

Referring to Figure 1, a pin barrel 1 may represent the receiving unit which is utilized in most forms of start-stop receiving units. This pin barrel may be actuated in any one
75 of several different ways to designate between a marking signal and a spacing signal to be imparted to the printing unit. Only one method is illustrated in the drawings in which, 2 is a permanent magnet provided
80 with a pivoted forked armature 3, working on a collar 4 of pin barrel 1, said pin barrel being slidably connected to shaft 5. Thus, upon actuation of magnet 2, pin barrel 1 is
85 slid to the right or left along shaft 5 depending upon the polarity of the received signal. For purposes of explanation at this time, let us disregard planetary gear unit 6 on shaft
90 5 and consider shaft 5 and motor shaft 7 as one revolving unit. Motor 8 may be a small synchronous motor, such as is used in the present day clock systems. It is, of course,
95 understood that under the proper power influence, that is, alternating current from a commercial power source or other source, any number of these motors can be kept in syn-
100 chronism and phase for extensive periods of time.

It is obvious, therefore, that such a small clock motor could be kept in synchronism and

phase either by attachment to a chain power service or by actuation from a separate power line fed from a central source. It is, of course, obvious that the better and more economical method of so phasing and synchronizing these motors would be from a chain-connected power system. Let us suppose, that motor 9 is connected to a source of alternating current power of the same frequency as motor 8, and that motor 9 is the driving source for a light transmitter brush 10 which travels over a segmented face plate 11 from which the intelligence signals for the printing element are sent. G^1 and G^2 represent alternating current power generators located at distant points (for example in different cities) and connected together by a distribution net-work represented by conductors NW.

Inasmuch as motors 8 and 9 are being driven from the same or similar source of power of the same frequency, they will keep in exact phase relation with each other, and the signals sent over line 12, actuating line magnet 2, can be made, through pins 13, to actuate mechanisms commonly used in start-stop printing systems, which in turn govern the actuation of the printers. Thus, it is unnecessary as far as phasing is concerned, to introduce any start or rest pulse into the code, inasmuch as both the sending and receiving shafts are always in absolute phase relation with each other. Accordingly, such a system could actually be run on only the intelligence impulses, providing the actuation and vibrating of the printing element on non-sending of "intelligence" signals is not a factor. If this arrangement were not satisfactory, due possibly to the peculiar mechanical construction of the printing element to which this might be applied, the "start" pulse could be introduced, the polarity of which could be governed in the same way that such polarity is now governed in simplex or start-stop systems. In no case, however, would it be necessary to add the "rest" pulse, inasmuch as perfect phase and synchronism is always maintained between motors 9 and 8. It can readily be seen now, that if the receiving shaft of said printing element is actuated in the manner described, any ungoverned motor indicated at 15, through proper gearing, can be used to operate the heavier mechanisms of the printing element, namely, printer element, tape feed element, letters and figures shift element, any transfer elements, etc.

It is possible that in starting in the morning or at any other time, motor 8 will not be started at exactly the same time as motor 9. The result might be that although the motors are in perfect speed synchronism, the phase relationship between the armatures of said motors is not correct. I have therefore interposed between shafts 7 and 5, the planetary

gear unit 6. To those versed in gearing, it is known that in planetary gearing, one element of the unit may be kept turning while the other element is stationary, without any tendency to jam or load up any of the gear units. This system can be readily applied to this printer, and considering the knob 14 as a stationary element in this planetary gearing, it is obvious that by turning knob 14 a certain amount, we can change the phase relationship between shafts 7 and 5 and thus very readily bring pin barrel 1 into exactly the right phase relationship with the signals supplied from sending brush 10.

As is known to those versed in the art, the multiplex system now in use in this country maintains synchronism by the use of a method of correcting the position of the receiving distributor brushes from the reversals of current on the line. That is, the receiving distributor is run slightly faster than the sending distributor, and the receiving brushes are set back a certain amount every time the brushes are out of phase with the signal. This results in the following difficulties; (a) loss of synchronism due to line hits when no reversals are sent for a short period over the line, and (b) shifting of the brushes on the distributor head, causing a lessening of the printing margin as the brushes surge from one end of a received signal to the other. These difficulties are overcome by my invention.

A clear and concise description of the operation of the method generally used for correction in multiplex systems can be had by reference to Patent 1,253,889 issued to S. W. Rothermel on January 15, 1918.

It can readily be seen that the use of the method therein described will result in a relative shift of the brush with relation to the signal as shown in Figs. 2 and 3 and a resultant loss in the margin, dependent upon the amount of brush shift for the correction.

In Fig. 2 I have shown the preferred relation between the incoming signals and the passing of the brushes over the distributor segments. Perfect operation would result in this state at all times. This effect and the resultant full margin will be secured by application of my invention to the sending and receiving distributors.

Fig. 3 shows the result of brush shifting. The full line represents the incoming wave position relative to the brushes passing over the receiving segments before correction, while the dotted line represents the relative positions of wave and brush after correction. It is seen therefore that the shift is effectively the distance between the two wave representations which decreases the range margin the amount shown.

As stated before, my invention will overcome this difficulty and have the added advantage of not losing synchronism on line

hits or opens. It is merely necessary to employ synchronous motors driven from the same chain power source, for both the receiving and transmitting distributors, and to use the same differential geared coupling on the receiving brush shaft to find the correct phase.

While this changing relation between brush travel and signal is a bad factor in terminal operation of multiplex, it is much worse in rotary repeaters as it is really the factor which limits the number of rotary repeaters on a line.

It will readily be seen that in a repeater such as is shown in Fig. 4, any surging of the brushes on the segments of the distributor will tend to elongate said signal on which the surge occurs, and as a result will necessitate a correction on every repeater thereafter. Application of my invention to the distributors in use for these rotary repeaters eliminates this trouble and permits any number of rotary repeaters to be put on one circuit. As will be seen from Fig. 4, both distributor brushes at the repeater station may be operated from the same synchronous motor through a double differential gear. Each differential is provided with a phase adjusting knob 14 as described in connection with Fig. 1.

This system as above described, has only been shown in application to start-stop and multiplex telegraphy. It is obvious, however, that such a system could be very readily used in any communication system in which synchronous and correct phase operation is a vital factor. This scheme could very readily be used, for example, in telegraph picture transmission or in the so-called television machines of which there are a number, or in any system where a portion of a receiving mechanism must be maintained in synchronism with the transmitting element.

While my invention has been illustrated as employing a power net-work, such as the alternating current net-work for supplying a number of widely separated cities or communities with electric light and power, it will be understood that my invention may be practiced by employing so-called high or intermediate frequency carrier currents for maintaining the communication system in synchronism. This carrier current may be transmitted over a power net-work such as described above, or it may be transmitted over the same conductor with the intelligence signals but independently of them and of the other driving sources.

I claim:—

1. In a start-stop system, the combination of a transmitter, a receiver, and a line for transmitting signals between said elements, an alternating current circuit separate from said line, synchronous motors operated from said circuit for driving the pin barrels of said transmitters and receivers, and inde-

pendent motors for driving the other movable elements of said printers.

2. The method of operating a start-stop telegraph system which consists in maintaining the pin barrels of the printers in synchronism with each other by a source of power independent of the source of power for operating the printing mechanism of the printers, whereby it is necessary only to include in the code the start pulse and the intelligence signals.

3. In combination, a power system comprising a net-work of conductors supplied with current of a definite frequency from generators connected at separated points, a communication circuit extending between two points in said net-work and having synchronous transmitting and receiving apparatus at opposite ends, synchronous motors connected to said power system for driving the synchronous units of said transmitters and receivers, and independent motors for driving the remaining movable elements of said signal apparatus.

4. The method of operating a communication system wherein the sender and receiver embody motor-actuated line-connected transmitting and reproducing elements respectively that are essentially maintained in synchronous operation, which consists in actuating the motor-driven elements synchronously and maintaining exact phase relationship thereof by connection with a power system, actuating the reproducing elements of the receiver by impulses sent over the line from the transmitting element and independent motors for driving the remaining movable elements of the receiver.

In testimony whereof I affix my signature.

ROBERT F. DIRKES.

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