

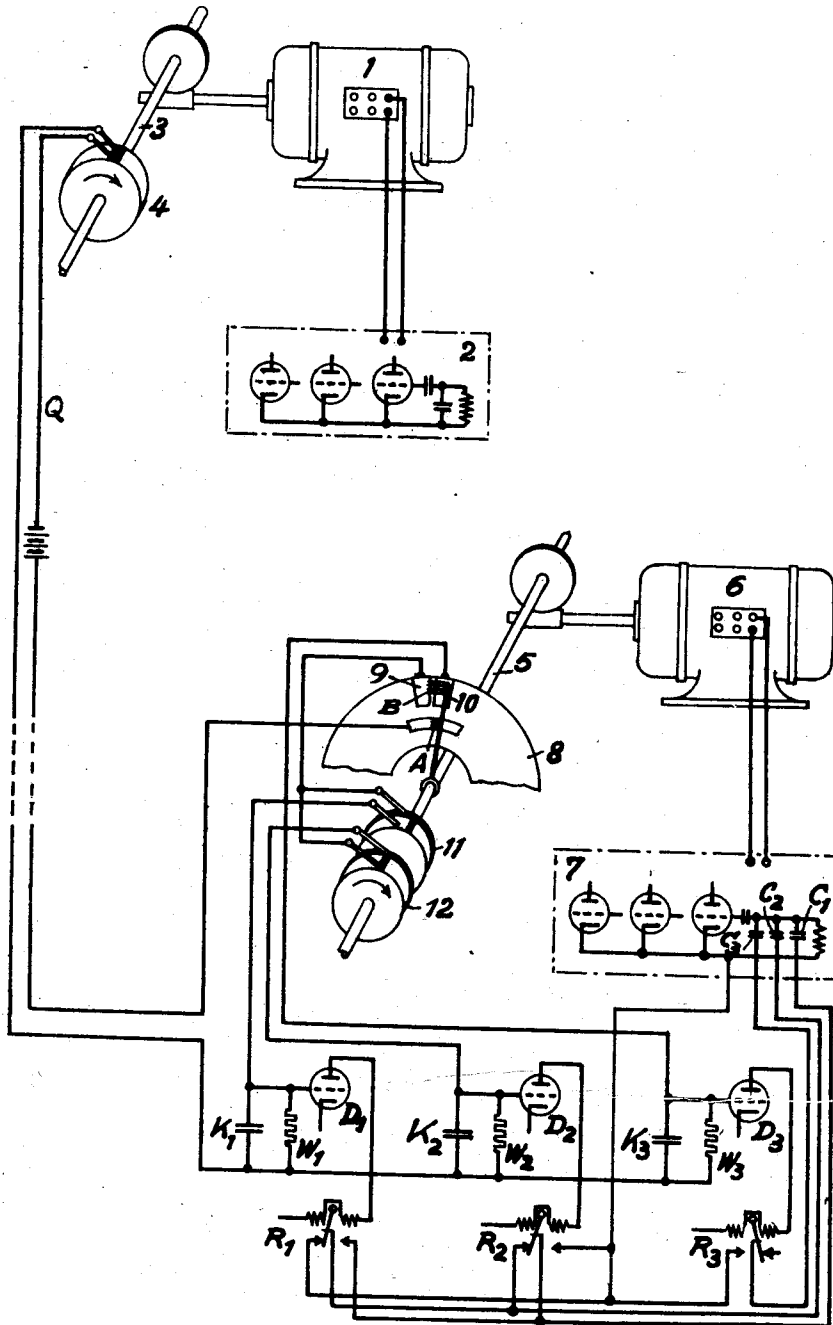
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SYNCHRONIZING ARRANGEMENT

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SYNCHRONIZING ARRANGEMENT

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3 Claims. (Cl. 172-293)

This invention relates to arrangements for maintaining a synchronous and cophasal rotation of shafts.

Synchronizing arrangements are known which have time or cadence tappers, constructed as mechanical vibrators or electron tube generators, for instance, and arranged on both the transmitting side and the receiving side. Such time tappers are able to maintain a synchronous and cophasal motion of sender and receiver for a short period. Where the synchronous and cophasal rotation of a controlled shaft in the receiver is to be maintained during a longer time without requiring any manual readjustment, current impulses may be conveyed to the receiver in order to compensate for disturbances of synchronism.

In many devices of this kind a control shaft of the receiver is given a small continuously acting advance by means of a local time taper. The control impulses arriving from the sender balance this advance and thereby insure synchronism and correct phase conditions. As these control devices require the controlled shaft to be either leading or lagging, the synchronism will be disturbed whenever such leading or lagging ceases for any reason. Equally, the synchronism will be impaired whenever no control impulse arrives from the sender, the receiver thus being allowed to lead or lag.

According to the present invention, the synchronous and cophasal rotation of the shafts is maintained by the control impulse from the sender determining the local synchronizing frequency for the receiver with the aid of a storing device. Contrary to the aforesaid known systems the invention does not provide for a leading or lagging motion of the control shaft but provides for compensating small leading or lagging motions of anyone of the two shafts and also does away with changes of rotation which the two shafts may undergo simultaneously. Changes of this kind may be due to the temperature of the time taper varying or may be due to other causes entailing small variations of the local synchronizing frequency.

Whenever no control impulse arrives for any reason then in the novel arrangement the control device becomes ineffective. In such case the synchronization of the controlled shaft is effected by the local synchronizing device, the accuracy of synchronization in this event depending upon this local device until an impulse from the sender acts again to operate the control device provided by the invention.

The accompanying drawing is a circuit diagram showing one embodiment of the invention.

1 denotes a driving machine synchronized by a local synchronizing device 2 which, for instance, may comprise a tuning fork or a quartz device and which in the case represented by way of example is an electron tube generator. Machine 1 serves to drive a shaft 3 whose rotation is to synchronize that of a shaft 5, shaft 3 thus forming part of the sender, while shaft 5 forms part of the receiver. The shaft 3 is combined with an impulse sender 4 which at the end of each revolution of shaft 3 acts to send an impulse over a line Q or by wireless to the receiver, that is, the arrangement to be controlled. The controlled shaft 5 is driven by a machine 6 synchronized by a local synchronizing device 7.

An impulse produced by the device 4 is conveyed by brushes A, B of a distributor 8 either to a segment 9 or a segment 10 thereof and may happen to be of different lengths in relation to segment 9, as will be seen from the following statement according to which there are four possibilities of operation.

1. The shafts 3 and 5 rotate synchronously and in phase coincidence. As soon as the brush B begins to sweep over the segment 9 the impulse from 4 is conveyed by a contact disc 11 to a condenser K₁ in order to be stored here. The condenser K₁ then discharges over the grid leak resistance W₁ of an electron tube D₁. During the discharge period of condenser K₁ the tube D₁ causes a polarized relay R₁ to be switched as shown in the drawing and thereby to enable the desired automatic control action to take place. When brush B is about to leave the segment 9 the impulse is also conveyed through a contact disc 12 to a condenser K₂, disc 12 being somewhat offset with respect to disc 11. Condenser K₂, which is thus likewise charged, discharges over the grid leak resistance W₂ of an electron tube D₂, whereby a polarized relay R₂ brings its contacts into the position likewise represented in the drawing. In consequence of the shafts 3, 5 rotating synchronously and in phase coincidence the impulse acts over segment 9 only. The segment 10 is not acted upon by the impulse. A polarized relay R₃, associated with an electron tube D₃, a grid leak resistance W₃ and condenser K₃, hence is not caused to respond. The frequency effective in the synchronizing device 7 in order to synchronize the machine 6 is determined by capacities C₁, C₂, C₃ of device 7, namely, those of these capacities which in their turn are determined with the aid of the relays R₁, R₂, R₃

as far as these have been energized as described. In the present case therefore, in which the shafts 3, 5 rotate in synchronism and phase coincidence, the capacity effective in device 7 is $C=C_1+C_2$.

2. With increasing speed of the shaft 3 the impulse arises before the brush B reaches the segment 9. As soon as brush B begins to sweep over the segment 9 the contact disc 11 again receives the impulse. The contact disc 12, however, does not receive it because the impulse has ceased when the disc 12 has assumed the position in which it is connected to segment 9. Relay R_2 consequently returns to normal. Relay R_3 remains in its normal state since the impulse has not reached the segment 10. The capacity effective in the device 7 to determine the synchronizing frequency therefore is $C=C_2$. It will be seen that the capacity is now smaller than in the case before. The synchronizing frequency is therefore higher, whereby the machine 6 runs quicker until condenser K_2 is charged over segment 9 and contact disc 12.

3. If the rotation of shaft 3 becomes slower the control impulse is received by segment 10 and hence also actuates relay R_3 . The synchronizing frequency effective in device 7 is hence determined by the capacity $C=C_1+C_2+C_3$. The frequency will thus be lower, that is to say, the machine 6 will run more slowly until no further impulse reaches the segment 10.

4. In case no impulse arrives from 4 the synchronizing frequency for machine 6 is determined by the capacity $C=C_1+C_2$ since the relays R_1 , R_2 , R_3 are not supplied with current and therefore remain in their state of rest. In such event the rotation of the shaft 5 is controlled by the synchronizing device 7 alone. It will be understood that polarized relays R_1 and R_3 are slightly biased, by any suitable means, so that the tongues thereof return to their right hand contacts when the plate current of the associated tube drops below a predetermined level.

What is claimed is:

1. A synchronizing and phase correcting arrangement for printing telegraph circuits and the like comprising a transmitter having a rotary shaft, a receiver, a transmission line connecting said transmitter and receiver, a contact member associated with said transmitter arranged to

transmit over said line with each revolution of said shaft a synchronizing and phasing impulse at a predetermined point in the shafts cycle, a rotary shaft at said receiver, means to drive said shafts at substantially the same speed, means at said receiver to compensate for relative speed variation of said shafts, comprising a brush secured to the receiver shaft, a distributor having a pair of segments cooperating with said brush, a pair of circuits extending from the first of said segments, a vacuum tube in each circuit, a relay connected in the output circuit of each of said vacuum tubes, a rotary member on said receiver shaft for closing said circuits in succession while said brush is passing over said first segment, means to operate said tubes and said relays by said impulse when substantially all of the latter is received while said brush is passing over said first segment, speed regulating means jointly controlled by said relays when operated for maintaining the speed of said shaft unchanged, means for operating but one of said relays when due to relative acceleration of the transmitter shaft only part of said impulse is received when said brush is passing over said first segment, means controlled by said relay to accelerate said receiver shaft, a circuit including a vacuum tube connected to the second of said segments, a third relay connected in the output circuit of said vacuum tube, means to operate the last mentioned tube and said third relay when due to a lag in the speed of said transmitter shaft in relation to said receiver shaft said synchronizing impulse is received on the second of said segments, and speed retarding means controlled by said third relay for adjusting the speed of said receiver shaft to correspond to that of the transmitter.

2. A synchronizing and phase correcting arrangement according to claim 1 in which the speed adjustment made by the joint operation of the first mentioned relays is the same as if no synchronizing impulse had been received.

3. A synchronizing and phase correcting arrangement according to claim 1 in which a grid leak and condenser is shunted across the input of each tube to maintain the tubes in operated condition for the duration of the condenser charge.

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