Sept. 4, 1928. 1,683,301

H. RASSOW

DEVICE FOR SYNCHRONIZING INDIVIDUALLY DRIVEN PARTS AT A TRANSMITTER AND A RECEIVER STATION

Filed Aug. 28, 1926 2 Sheets-Sheet 1

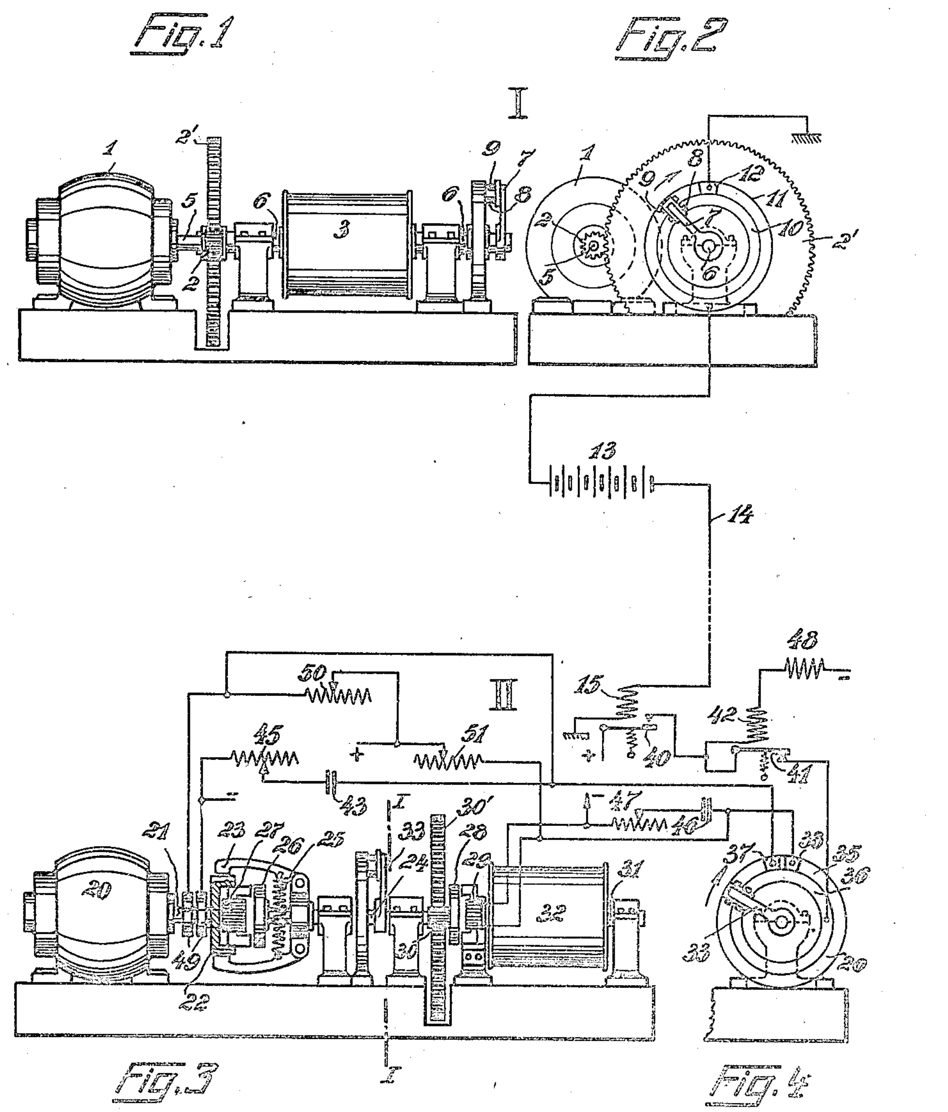

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Fig. 5

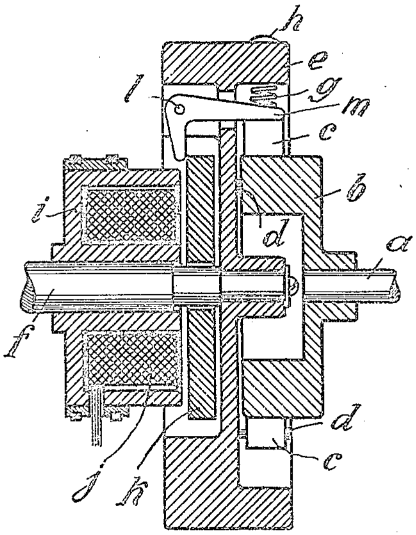


Fig. 6

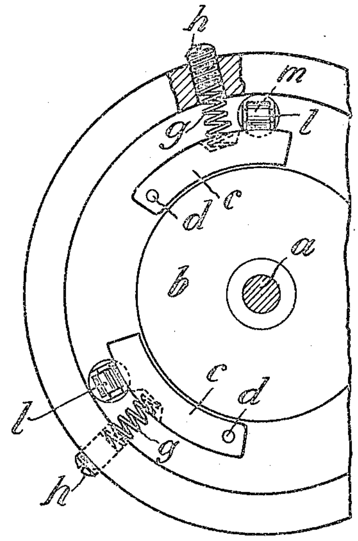


Fig. 7

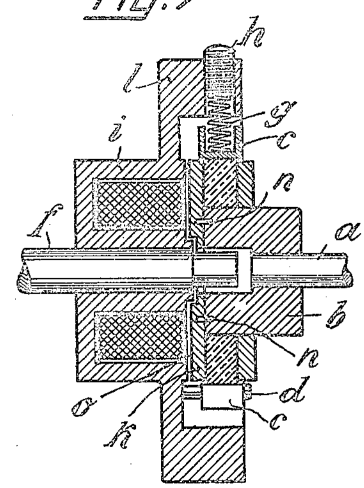
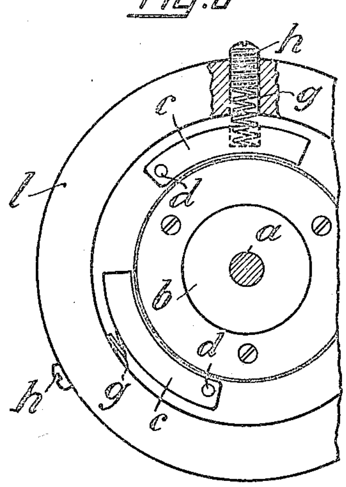


Fig. 8



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UNITED STATES PATENT OFFICE.

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DEVICE FOR SYNCHRONIZING INDIVIDUALLY-DRIVEN PARTS AT A TRANSMITTER AND A RECEIVER STATION.

Application filed August 28, 1926, Serial No. 132,164, and in Germany September 12, 1925.

The invention relates to telegraph apparatus, and more particularly to a device or system for synchronizing parts continuously driven by individual motors at a transmitter and a receiver station, synchronizing current impulses being sent from the transmitting station across the connecting line of the two stations. These current impulses may in known manner be released by a special contact being provided on the distributor at the transmitter station, which during each revolution, for instance, is closed once. Upon the distributor of the receiver there are provided two contacts, one of which at a time closes a local circuit controlled by the synchronizing current impulse, and which circuit brings about a corresponding correction of the speed of the apparatus at the receiving station.

The device or system is intended for the transmission of telegraphic signals, as for type printing telegraphs, or for the transmission of other signals and more particularly also for the telegraphic transmission of pictures. Just in this kind of telegraphy not only synchronism but also the maintenance of accurate phase-coincidence between the transmitter and the receiver is of the greatest importance. The synchronizing current impulse is in this case given during the time which corresponds with the seam of the picture.

According to my invention a magnet clutch is added to the well known centrifugal clutch between the motor of the receiving apparatus and the part driven by it, which magnetic clutch is strengthened in its action when the receiving apparatus lags so that a more intimate coupling is effected with the motor running with over-synchronous speed from the beginning and the time lag is compensated thereby. Preferably a magnetic brake is also provided upon the receiving apparatus which in case of excessive speed of the parts of the receiving apparatus is augmented in its action and retards the receiving apparatus correspondingly. The additional actions of the magnetic clutch and the magnetic brake are released by the action of the synchronizing current impulse and are of very short duration, preferably they are caused by the discharge current of a condenser each for the clutch and the brake. Preferably the drive of the transmitting apparatus is also effected across a centrifugal clutch, so that the driving speeds of the transmitter and the receiver are as uniform as possible.

When employing a magnetic clutch and a magnetic brake the arrangement is preferably such that when the transmitter and the receiver run in absolute uniformity both exert additional actions which compensate or balance each other while in the case of low speed differences the condensers are charged differently and a differential action is exerted upon the receiver. The regulation is thus then proportional to the degree of deviation for the time being.

In the drawings attached hereto an embodiment of my invention is diagrammatically illustrated by way of example. Two picture cylinders are here synchronously driven, the wiring for the transmission proper of the pictures being omitted for the sake of clearness. In the drawings illustrates:

Fig. 1, the transmitter in side elevation,
Fig. 2, the same in front elevation,
Fig. 3, the receiver in side elevation,
Fig. 4, a section along line I—I of Fig. 3,
Fig. 5, a cross-section through a magnetic centrifugal clutch,
Fig. 6, an end elevation of the same,
Fig. 7, a cross-section through a modified construction, of magnetic centrifugal clutch, and
Fig. 8, an end elevation of the same.

Referring to the Figs. 1 to 4, it will be noted that the wiring is distributed over the Figs. 2 to 4 in order to show the connections at the distributor discs in their front elevation.

At the transmitter station I a motor 1, which has a speed of 1500 revolutions per minute, for instance, drives by a reduction gear 2, 2′ a picture cylinder 3 in such a manner, that this cylinder revolves with the tenth part of the speed of the motor viz, 150 revolutions per minute. The spindle 6 of the picture cylinder 3 may also be coupled with the driving pinion 2 by means of a centrifugal clutch. This pinion must then run with a somewhat higher speed. Upon the spindle 6 there is also mounted a brush arm 7 the two brushes 8 and 9 of which

move over stationary slip-rings 10 and 11 of the distributor disk. In the ring 11 a contact 12 is arranged in a location which corresponds with the seam of the picture and which is earthed. With the other slip-ring 10 is connected the line battery 13. While to the other pole of the battery is connected the line 14 which at the receiver station II contains the line relay 15 and is grounded behind the said relay.

At the receiver station a motor 20, which may have approximately double the speed as the motor 1 at the transmitter station and may thus make 3000 revolutions per minute, drives with its shaft 21 a disk 22 upon the circumference of which two clutch jaws or shoes 23 slip which are hinged upon a shaft 24 and stand under the control of a contracting spring 25. The clutch action is augmented by the action of a clutch magnet which consists of an iron disk 26 mounted upon the driven shaft 24 which under the action of an exciter magnet 27 mounted upon the disk 22 is forced against said magnet or better still against the edge of the disk 22. At the free end of the shaft 24 is mounted a second iron disk 28 which is controlled by a stationary exciter magnet 29 which exerts a braking action upon it and the shaft 24. The shaft 24 is coupled with the driving shaft of the picture cylinder 32 by means of a gear 30, 30'. The ratio of the gearing and the transmission conditions of the centrifugal coupling are so chosen that the shaft 24 runs on the average with half the speed of the motor 20 and the picture cylinder with one twentieth of its speed viz, 150 revolutions per minute like the picture cylinder 3 of the transmitter.

A brush arm 33 mounted upon the shaft 24 slips along two stationary rings 35, 36 on the distributor disk of the receiver, the former of which is provided with two contact pieces 37, 38. These contacts are so located that the brush arm touches both of them uniformly in the instant when the brush arm 7 at the transmitter station slides over the synchronizing contact 12.

The wiring will be clearly understood from the following description of the function of the apparatus: from the transmitter station I a current impulse will be dispatched across the line 14 during each revolution of the picture cylinder 3 through the brush 7 and the contact 12. Each time the line relay 15 attracts its armature 40 which is connected with the positive pole of a source of current. In this way a circuit across the armature 41 of a neutral relay 42 is completed. This circuit passes across contact ring 36, the two brushes of the arm 33 and, in the event that the receiver rotates too slowly, across the contact 37 of the second contact ring 35, across a condenser 43, a resistance 45 to the minus pole of the source of current, and the condenser is charged. In the event that the receiver has a slight lead the local circuit passes across the contact 38, a condenser 46 and a resistance 47 so that this condenser is charged. Simultaneously a second circuit is completed across the winding of the relays 42 and a resistance 48 to the minus pole, so that this relay attracts its armature 41 after a constant time dependent upon its electrical and mechanical delay and thereby interrupts the first mentioned circuit. Now the previously charged of the two condensers 43 or 46 discharges. In the first case the discharge impulse acts upon the clutch magnet 27 which also receives a weak exciter current permanently across slip rings 49 upon the motor shaft 21 across an adjustable series resistance 50. The action of the magnet coupling is momentarily augmented in such a manner that the shaft 24 has an acceleration imparted to it corresponding with retardation. In the event the condenser 46 had been charged, this condenser discharges across the brake magnet 28 which across an adjustable series resistance 51 also receives a permanent excitation but owing to the condenser discharge exerts such an augmented action momentarily that the driven shaft 24 is correspondingly retarded. The resistances 45 and 47 are also adjustable. The adjustability, particularly of the resistances 50, 51, enables a very accurate regulation of the speed and the phase of the driven shaft 24 during operation of the apparatus.

When the positions of the brush arms at the transmitter and the receiver coincide accurately both condensers 43 and 46 are charged uniformly, but to a less degree. The action of the discharge currents in the clutch and brake magnets is balanced in relation to the shaft 24.

In the event of small deviations in the positions of the brushes the two condensers are charged to a different extent and the supplementary action of one or the other magnet then correspondingly preponderates.

By the action of the centrifugal friction clutch alone a high degree of uniformity of rotation or synchronism between the picture cylinder of the transmitting apparatus and that of the receiving apparatus is obtained. The minute variations which still develop can be completely equalized by the supplementary actions or the difference of these actions of the clutch magnet or the brake magnet so that with suitable adjustment an accuracy may be obtained which satisfies the highest requirements in the electric transmission of pictures. The pre-magnetization of the magnets has proved very suitable, particularly for the differential action, but the condenser discharges or other short-time current impulses might equally well be applied to the magnet windings without any pre-excitation. The discharge current of the

condensers may, furthermore, also counteract the pre-magnetization. In this event the condenser charged during the retardation would have to control the brake magnet, the other the clutch magnet.

In certain circumstances it is sufficient to employ besides the centrifugal clutch at the receiver station only one of the two supplementary magnet systems. The centrifugal clutch alone may, for instance, transmit a somewhat lower speed so that the full speed is normally obtained by the additional exciter current impulses of the magnet clutch. On the other hand a brake magnet alone may be employed besides the centrifugal clutch, the centrifugal clutch then transmitting a speed slightly in excess which is braked down correspondingly by the magnet. In both cases it is advisable to provide a plurality of contacts which are all located in front or behind the picture seam position and to dispatch a corresponding number of synchronizing impulses one immediately after the other, so that the clutch or brake magnet receives a plurality of correction impulses in close succession in the case of strong differences in speed.

A particularly suitable construction of a centrifugal clutch supplemented in its action by adjustable electromagnets is illustrated in the Figs. 5 to 8.

Referring to Figs. 5 to 6, *a* is the driving shaft. Upon its free end is mounted a clutch or friction disk *b*. On the circumference of this disk act a plurality of clutch or friction jaws or shoes *c* pivoted upon pins *d*. These pins *d* are fixed within a flanged casing *e* mounted upon the shaft *f* of the apparatus to be driven. The friction jaws *c* are controlled by springs *g* journaled in the flange or rim of the casing and their tension is adapted to be regulated by means of screws *h*.

Upon the shaft *f* of the driven apparatus there is also mounted an electromagnet *i* of pot shape, the winding *j* of which is either through a rheostat connected with a separate source of current or directly traversed by the working current of the driven apparatus or, if desired, by a branch current of the apparatus. The armature of the magnet *i* is designed as disk *k* axially movable along the shaft *f*. This disk acts in the design illustrated upon a plurality of bell-crank levers *m* pivoted upon pins *l* in the casing *e*. These levers act with their axially extending arms upon the jaws or shoes *c* in the same direction as the springs *g*.

Owing to the centrifugal motion of the friction jaws *c* the armature disk *k* is moved away from the magnet by the lever *m*, as long as the magnet is not energized. When the magnet is, on the other hand, energized the levers *m* exert an additional force upon the jaws. If, for instance, the driven apparatus is suddenly strongly loaded the magnet will quickly attract the armature disk, operate the bell-crank levers and thereby exert a strong additional pressure upon the friction jaws so that practically no slip occurs between the parts of the clutch in frictional contact. When smaller current fluctuations occur the action of the springs is assisted in a correspondingly less forcible manner. Resilient means should preferably be provided between the armature disk and the magnet which offer a certain resistance to the tractive force of the magnet.

In order to increase the speed of the driven apparatus during service, a certain permanent current may be sent through the energizing winding of the electromagnet. The parts operated by the magnet may also act upon the abutments of the springs instead of directly upon the friction jaws. In such a case the adjusting screws for the springs would not be screwed into the casing but be provided upon the parts actuated by the magnet.

In the embodiment illustrated in the Figs. 7 and 8 the action of the electromagnet *i* is simplified in so far as its armature *k* is directly connected with the coupling disk *b* of the motor shaft *a* by pins *n*. When the disk *k* is attracted by the magnet, a coupling frictional action is set up upon the edge surfaces *o* covered with a non-magnetic material whereby apart from the coupling jaws *c* operated by the centrifugal force an additional frictional connection is produced between the two co-operating shafts.

I desire to have it distinctly understood that I do not intend to limit myself to the exact details shown or described, but that I intend to include as part of my invention all such obvious changes and modifications of parts as would suggest themselves to persons skilled in the art and as would fall within the scope of the claims.

I claim as my invention:—

1. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force and a magnetic clutch adapted to be energized by said synchronizing current impulse when the speed of the transmitter differs from that of the receiver.

2. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combi-

nation, at the receiver station a centrifugal clutch adapted to transmit the main driving force and a clutch magnet and a brake magnet adapted to be energized by said synchronizing current impulse when the speed of the transmitter differs from that of the receiver.

3. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force and a clutch magnet and a brake magnet adapted to be energized by said synchronizing current impulse, both said magnets being adapted to be excited to the same extent when the speed of the transmitter and receiver coincide and to a different extent when said speeds deviate so that the regulation is proportional to the deviation.

4. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force and a clutch magnet and a brake magnet adapted to be pre-magnetized by adjustable permanent currents and their strength to be regulated by said synchronizing current impulses for the purpose of enabling a very accurate adjustment of the speed of the receiver.

5. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force and a clutch magnet and a brake magnet adapted to be pre-magnetized by adjustable permanent currents and their strength to be regulated by said synchronizing current impulses to the same extent when the speed of the transmitter and receiver coincide and to a different extent when said speeds deviate for the purpose of enabling a very accurate adjustment of the speed of the receiver.

6. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force, a clutch magnet and a brake magnet, a line relay controlled by the synchronizing current impulse, a local circuit adapted to be completed by said relay and to vary the action of said clutch and brake magnets and a simultaneously energized magnet for instantly breaking said circuit.

7. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force, a clutch magnet and a brake magnet, a line relay controlled by the synchronizing current impulse, a local circuit adapted to be completed by said clutch and brake magnets and a simultaneously energized magnet for instantly breaking said circuit, two brush contacts at the receiver station, one in front and one behind the synchronizing point and one connected with the clutch magnet and the other with the brake magnet.

8. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force, a clutch magnet and a brake magnet, a line relay controlled by the synchronizing current impulse, a local circuit adapted to be completed by said clutch and brake magnets and a simultaneously energized magnet for instantly breaking said circuit, two brush contacts at the receiver station, one in front and one behind the synchronizing point and one connected with the clutch magnet and the other with the brake magnet, said brush contacts being located so closely together, that the synchronizing current impulse operates across both in succession.

9. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force, a clutch magnet and a brake magnet, a line relay controlled by the synchronizing current impulse, a local circuit adapted to

be completed by said relay and to vary the action of said clutch and brake magnets and a simultaneously energized magnet for instantly breaking said circuit, and two condensers connected in said local circuit one or both of which are adapted to be charged by the said synchronizing current impulse and the discharge current of which passes to the clutch or the brake magnet.

10. In a device for synchronizing individually driven parts at a transmitter and a receiver station by synchronizing current impulses dispatched from the transmitter station across the connecting line between said stations, more particularly for the telegraphic transmission of pictures, in combination, at the receiver station a centrifugal clutch adapted to transmit the main driving force, a clutch magnet and a brake magnet, a line relay controlled by the synchronizing current impulse, a local circuit adapted to be completed by said relay and to vary the action of said clutch and brake magnets and a simultaneously energized magnet for instantly breaking said circuit, brush contacts located near the synchronizing point only, and a single supplementary magnet adapted to effect the speed correction in one sense only under the action of the synchronizing current impulses.

11. In a device for synchronizing individualy driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft, pivoted jaws connected with said driven shaft and adapted to grip said clutch, mechanical means adapted to force said jaws against said disk, an electromagnet mounted on said driven shaft and adapted to assist said mechanical coupling means, and means for varying the action of said electromagnet.

12. In a device for synchronizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft, pivoted jaws connected with said driven shaft and adapted to grip said clutch disk, mechanical means adapted to force said jaws against said disk, an electromagnet mounted on said driven shaft, an additional friction clutch adapted to be controlled by said electromagnet, and means for varying the action of said electromagnet.

13. In a device for synchorizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft, pivoted jaws connected with said driven shaft and adapted to grip said clutch disk, mechanical means adapted to force said jaws against said disk, an electromagnet mounted on said driven shaft, an armature for said electromagnet, a system of levers operated by said armature and adapted to act upon said jaws, and means for varying the action of said electromagnet.

14. In a device for synchronizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft, pivoted jaws connected with said driven shaft and adapted to grip said clutch disk, mechanical means adapted to force said jaws against said disk, a pot-shaped electromagnet mounted on the driven shaft co-axially with said mechanical clutch and adapted to assist it, and means for varying the excitation of said electromagnet.

15. In a device for synchronizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft, pivoted jaws connected with said driven shaft and adapted to grip said clutch disk, mechanical means adapted to force said jaws against said disk, an electromagnet mounted on said driven shaft and adapted to assist said mechanical coupling means, and means for passing the service current of the driven part through said electromagnet.

16. In a device for synchronizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft, pivoted jaws connected with said driven shaft and adapted to grip said clutch disk, mechanical means adapted to force said jaws against said disk, an electromagnet mounted on said driven shaft and adapted to assist said mechanical coupling means, and means for passing a branch current of the service current of the driven part through said electromagnet.

17. In a device for synchronizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft substantially in alignment with said driving shaft, a flanged casing mounted upon the end of said driven shaft, a plurality of pivoted jaws upon the outer face of said casing and adapted to contact with said disk on the driving shaft, springs for controlling said jaws, means for adjusting the tension of said springs, a pot-shaped electromagnet mounted on said driven shaft, slip-rings upon said electromagnet for energizing it, a disk-shaped armature for said electromagnet movable on said driven shaft, a plurality of bell-crank levers pivoted on said casing, one arm of which is adapted to contact with said jaws and the other to be operated by said armature disk.

18. In a device for synchronizing individually driven parts at a transmitter and a receiver station by means of synchronizing current impulses dispatched from the transmitter station across the connecting line of said stations, in combination, at the receiver station, a motor, a shaft driven by said motor, a clutch disk on said driving shaft, a driven shaft substantially in alignment with said driving shaft, a flanged casing mounted upon the end of said driven shaft, a plurality of pivoted jaws upon the outer face of said casing and adapted to contact with said disk on the driving shaft, springs for controlling said jaws, means for adjusting the tension of said springs, a pot-shaped electromagnet mounted on said driven shaft, slip-rings upon said electromagnet for energizing it, a disk-shaped armature for said electromagnet movable on said driven shaft and connected with said armature disk on the driving shaft, and a friction face on said electromagnet with which said armature disk is adapted to come in contact.

In testimony whereof I affix my signature.

HORST RASSOW.