(No Model.)

2 Sheets—Sheet 1.

T. C. DRAKE.

ELECTRIC SELECTOR SYSTEM.

No. 605,309. Patented June 7, 1898.

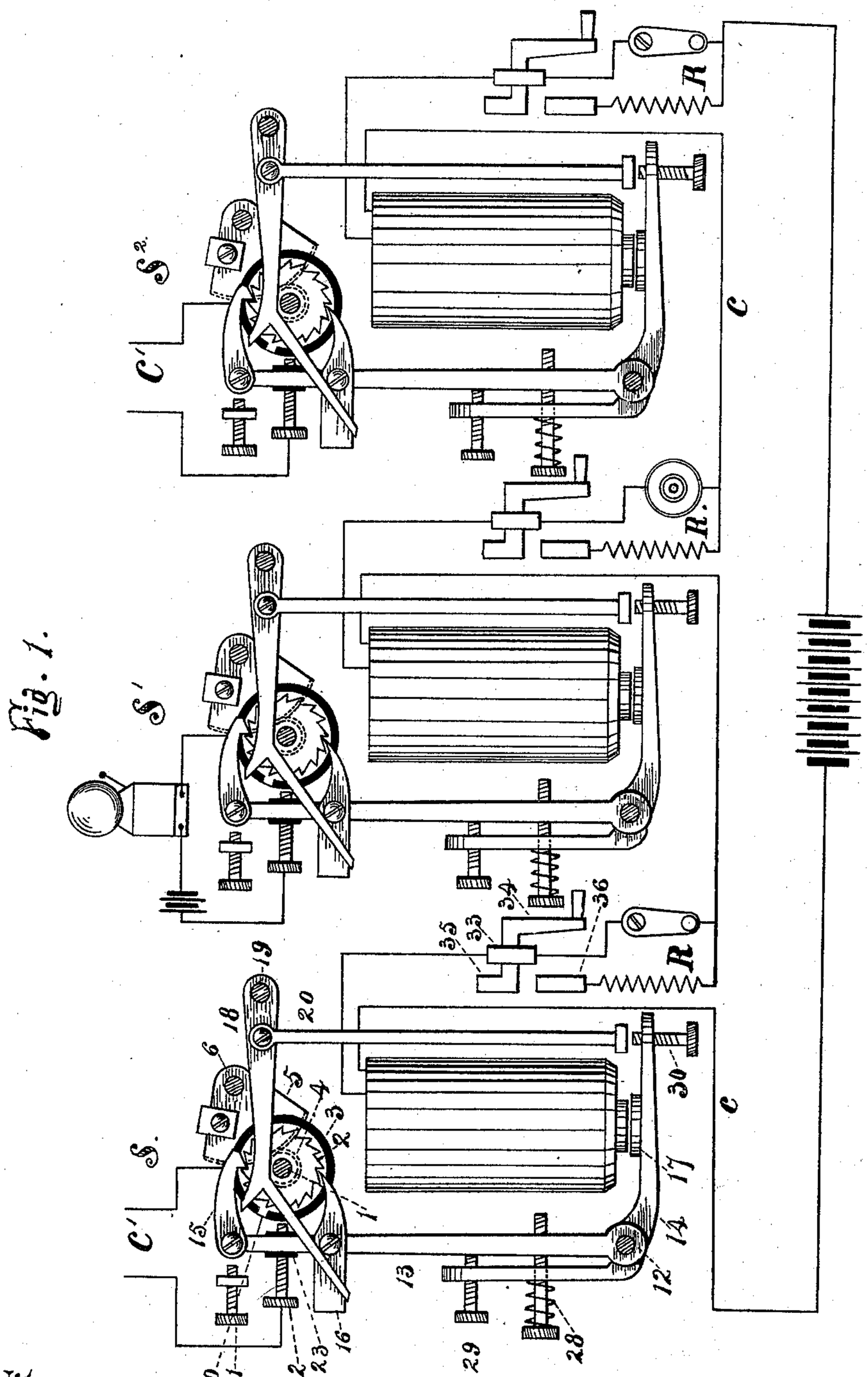

Fig. 1.

Witnesses.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

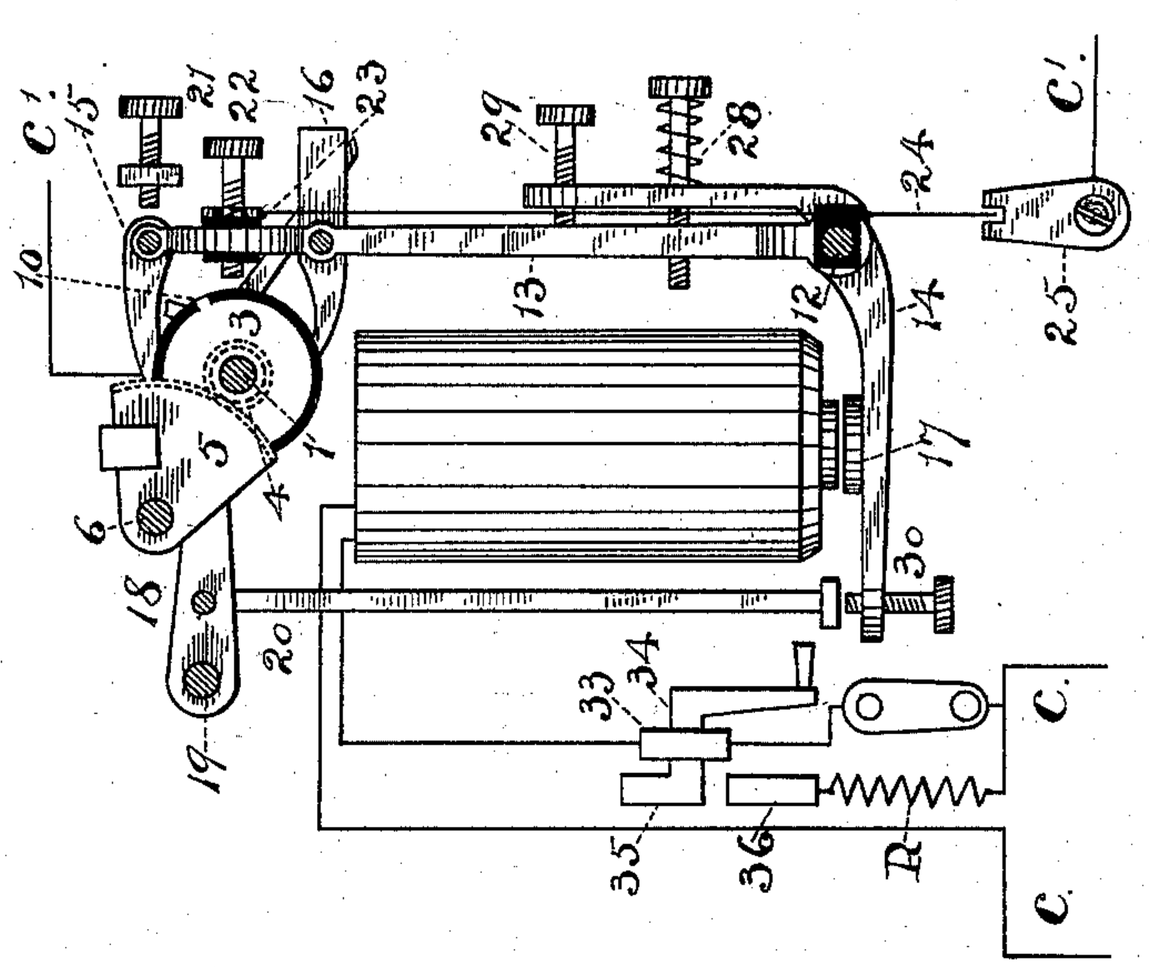


Fig. 3.

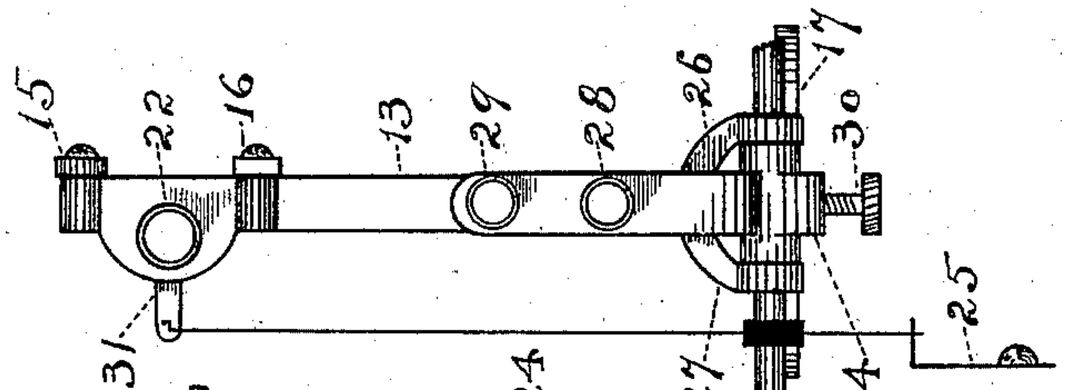


Fig. 4.

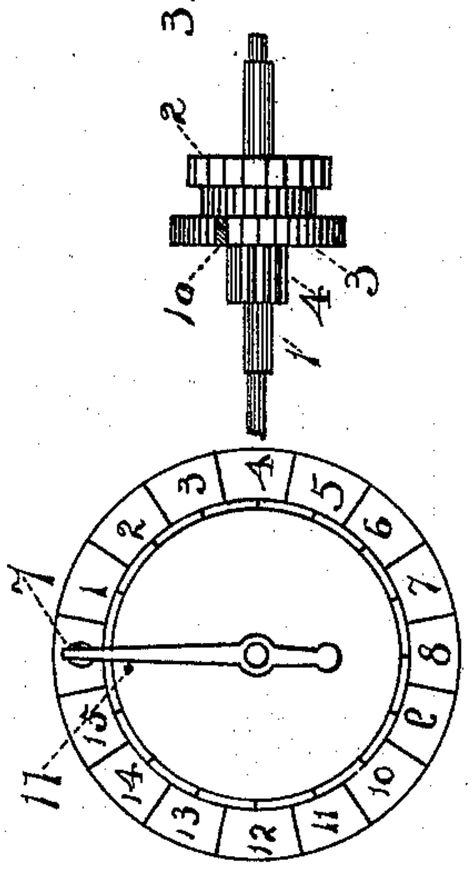
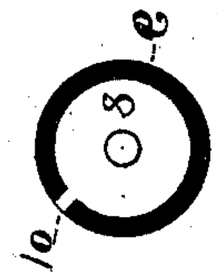


Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS C. DRAKE, OF MALTA, OHIO.

ELECTRIC SELECTOR SYSTEM.

SPECIFICATION forming part of Letters Patent No. 605,309, dated June 7, 1898.

Application filed February 26, 1897. Serial No. 625,230. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. DRAKE, a citizen of the United States, residing at Malta, in the county of Morgan and State of Ohio, have invented a new and useful Improvement in Electric Selector Systems, of which the following is a specification.

My invention relates to a new selector system of electric signaling apparatus intended more particularly for use in connection with telephonic transmission, fire-alarm, district-messenger, and any service requiring individual signaling properties without the intervention of a central office or centrally-located operating or controlling devices.

My invention consists of step-by-step and unison mechanism which is operated and controlled in series. Its operation is such that any particular or desired station or combination of stations in the circuit may be called by any other without interfering with or calling the undesired stations.

This system is especially adapted to and brings about that class of telephone service in which as high as fifty phones may be operated in towns, villages, department-buildings, factories, &c., without the intervention of a central office or any form of central distribution of signaling circuits.

My system is also especially adapted to party-line telephone service by reason of the multiplicity of stations that may be individually signaled from one circuit. This applies to that class of telephony in which series or bridging bells are now extensively used and which ring simultaneously at all stations when any desired station is being called.

In the accompanying drawings and following specification, a description of the mechanism and its operation which forms my invention will be shown and described.

The same letters and numerals of reference indicate the same or corresponding parts throughout the several figures of the drawings.

Figure 1 is a diagrammatic view showing three stations; Fig. 2, a rear view of the station mechanism; Fig. 3, a back elevation of the levers for stepping the ratchet-wheel; Fig. 4, a front view of the face over which moves the hand or pointer. The shaft on which the pointer is secured is shown broken therefrom and lying in a different plane. Fig. 5 is a side elevation of the contact-disk or commutator.

At each station S S′ S″ (shown in Fig. 1) are located similar resistances R. By means of proper switching appurtenances and a make-and-break contact-crank located at each station the resistances at any station may be introduced into or withdrawn from the circuit C containing the electromagnets, and the current for operating the system may be made intermittent by revolving any one of the contact-cranks.

The function of the resistance R is by its introduction into the circuit C to increase the resistance of that circuit, thereby decreasing the strength of current flowing through the circuit.

In practice the resistances at the respective stations S S′ S″ are made equivalents, and the introduction of any one will suffice to give the proper decrease or variation in current strength.

The mechanism, as will be described farther on, is so constructed that by passing a current of given strength intermittently through the electromagnets a step-by-step movement is imparted to the ratchet-wheel and commutator or contact-disk, and by passing a current of greater strength through the electromagnet the mechanism will operate in a somewhat different manner, causing the ratchet-wheel and contact-disk to be returned to former or normal position. Thus in the manner described a series of such mechanisms may be kept in unison and in step by decreasing and restoring the current strength in circuit C. This variation of current strength is preferably and more practically accomplished by means of ohmic resistance, but equivalent means, such as counter electromotive force, may be used.

The mechanism employed in this system is preferably constructed as follows: Mounted on a shaft 1 is a ratchet-wheel 2, containing as many or more teeth than there are instruments in the system, a commutator or contact-disk 3, a pinion-gear 4, meshing with the segment-gear 5, carried on a shaft 6. An indicating hand or pointer 7, secured to the end of shaft 1, moves over a suitable face, Fig. 4, for the purpose of indicating the number of steps given to the ratchet and at the same

time indicates if the system is in use by other stations. A pin 11 serves as a stop for pointer 7.

The commutator or contact-disk, Fig. 5, is constructed as follows: a disk 8, composed of metal, having a rim or band of insulating material 9 around its periphery, a contact-point 10 extending from said disk 8 through said band or rim of insulating material and forming a segment through which the circuit C′ is closed when said segment is rotated diametrically opposite the contact-screw 22, hereinafter described.

The shaft 12 carries two levers 13 and 14, the former being vertical and having bearings on said shaft 12 and the latter being angular and having bearings on the same shaft between the bifurcated end of lever 13. Fig. 3 particularly shows the arrangement of the two levers on shaft 12. The arrangement is such that the angle-lever 14 may move independent of vertical lever 13 when the stress-spring 28 is overcome by reason of the normal current passing through the operating-electromagnet, as will be more fully explained.

The vertical lever 13 carries at its upper end two pawls 15 and 16, by means of which a step-by-step movement is imparted to the ratchet-wheel and contact-disk. The angle-lever 14 carries on its horizontal arm an armature 17, by means of which the energy of electromagnet operates and controls the mechanism. A bifurcated lever 18, mounted on a shaft 19, extends to and under the pawls 15 and 16 for the purpose of disengaging the pawls from the teeth of the ratchet-wheel in order that the ratchet, contact-disk, and pointer may be free to return to zero or normal position through the influence of the weighted segment 5. Pivoted to the bifurcated lever 18 is a lifting-rod 20, through which a certain movement of armature 17 is transmitted to said bifurcated lever, by reason of which the pawls are disengaged and the ratchet made free.

Limiting and adjusting screws 21 and 22 are employed for adjusting the pawls to the ratchet, the former limiting the outward movement of vertical lever 13 and the latter forming a contact for one side of circuit C′ and adjusting the return movement by coming in contact with the periphery of the contact-disk 3. The contact-screw 22 is insulated from the vertical lever 13 by insulating-bushing 23. A spring-wire 24, Fig. 2, has electrical connection with contact-screw 22 by means of a nut having a projection 31. This spring extends from said projection parallel with lever 13 and passes through an insulating-block on shaft 12 to an adjusting arrangement 25. This spring acts as a retractile spring for lever 13 and as an electrical conductor for contact-screw 22 and forms one side of the circuit C′, which is controlled by contact-screw 22 and contact-segment 10. The other side of circuit C′ is by way of disk 8 through the conducting material composing the shaft and journals.

The pawls 15 and 16 are arranged on vertical lever 13 in order that both the outward and the return movements of the lever may be utilized in rotating the ratchet-wheel, the pawl 15 pulling the ratchet forward one-half tooth and the lower pawl 16 catching the ratchet at that point, and on the return movement of said lever the lower pawl pushes the ratchet one-half tooth and the top pawl catches the ratchet at that point. In practice this construction is found to possess peculiar advantages to its operation, inasmuch as the inertia of the ratchet, contact-disk, and the pinion-gear and its intermeshing weighted segment 5 causes the operating-levers to be uniform and symmetrical in their oscillation up to the maximum speed to which the mechanism is capable of working and eliminates the "kick" or unsymmetrical oscillations caused by fluctuation in current and self-induction. This arrangement of pawls embodies another advantage, as it lessens the oscillating distance of armature 17 to one-half that required if only one pawl were used to rotate the ratchet a given distance, therefore reducing the air-gap at the poles of the magnets a corresponding amount, and consequently reducing the energy required to operate the mechanism.

Fig. 3, a back elevation of the two levers 13 and 14, is more particularly for showing their preferable construction and arrangement on shaft 12. The arrangement and connection of the retractile spring 24 is also especially shown. The vertical lever is constructed with arms 26 and 27 at its lower end, through which passes the shaft 12, thereby forming journals for said lever. The angle-lever 14 is centrally journaled between the arms 26 and 27 of lever 13, both of said levers being so journaled on shaft 12 as to be free to move thereon. By means of stress-spring 28 and adjusting-screw 29 the vertical arm of angle-lever 14 is so united to vertical lever 13 that they oscillate together under the influence of the intermittent current while giving a step-by-step to the ratchet-wheel. By reason of stress-spring 28 being so adjusted as to overcome the armature pull which tends to separate the vertical arm of angle-lever 14 from the vertical lever 13 the two levers are united in their oscillation as though they were a rigid lever.

In order to put the mechanism in normal condition by returning the pointer to zero or to the pin 11, the greater or normal current is required to pass through the electromagnet thereof. The normal current overcomes the stress of spring 28, thereby separating the vertical arm of angle-lever 14 from the vertical lever 13, which gives an independent or distinct movement to the said angle-lever 14. This independent or distinct movement is for the purpose of disengaging the pawls from

the teeth of the ratchet and operates in the following manner: While the levers oscillate through the influence of electromagnet and armature 17 to step the ratchet-wheel, the bifurcated lever 18 is not influenced or operated thereby; but the higher or normal strength current being made to pass through the electromagnet thereof the stress-spring 28 is thereby overcome, and the independent movement operates to disengage the pawls by reason of adjusting-screw 30 transmitting the independent movement of lever 14 to the lifting-rod 20.

It is obvious that the stress-spring 28 distinguishes and is sensitive to the different strengths of current which are passed through the electromagnets and that to give a step-by-step to the system the normal current in circuit C must be diminished, so as not to overcome the stress of spring 28, and to place the system in normal condition requires the normal current to be restored in circuit C, thus overcoming the stress-springs and disengaging the pawls, allowing the weighted segment 5 to return the revolving parts to zero or normal position.

The commutator or contact-disk 3, containing the segment 10, which is adapted to make contact with contact-screw 22 at a certain point of revolution of shaft 1, is adjustably mounted on said shaft between the ratchet 2 and pinion-gear 4. As the series of mechanisms operate simultaneously in all their functions, it is obvious that the contact-disk at station S may be set to close the circuit C′ at the first step, station S′ at the second step, station S″ at the third step, and so on, as is predetermined by the setting of the disks.

The circuit C′ (shown at each station) may be connected to any signaling device that requires the circuit to be closed in order to be put in operation. To illustrate, I show a common electric vibratory bell and an operating-battery connected at station S′. In order to signal this station, it is necessary to give a step-by-step to the ratchet corresponding to the position of the contact-segment 10. Thus if the contact-segment is set three teeth back of the zero or normal point it requires three steps of the ratchet to revolve the contact-segment diametrically opposite the contact-screw. Furthermore, a number of segments may form parts of the periphery of contact-disk 3. By means of this arrangement any combination of stations could be signaled at the same time. To illustrate, suppose at station S the contact-disk was set to close the circuit C′ at the first step, the station S′ at the second step, and the station S″ at the third step. At the fourth step segment-contacts could be arranged in all the disks so as to close the circuit C′ at all stations at the same time, thus signaling all stations at once. At the fifth step segments could be arranged to only close the circuit C′ at stations S and S′, and so on throughout any desired combination of stations by properly adjusting the disks.

The crank-contact arrangement shown at each station is for the purpose of making and breaking the circuit C, thereby pulsating or making the current intermittent by revolving the same. It is preferably constructed as follows: a suitable bearing 33, through which extends the shank of crank-arm 34, on the end of which shank is placed a cam 35. This cam is adapted to make contact with contact-leaf 36 on revolving said crank. Below the crank, at R, is located the resistance in electrical connection with contact-leaf 36 and circuit C, so as to be directly in circuit when the current is pulsated. Around this crank-contact device and resistance is placed a shunt or cut-out, so as to keep the circuit C normally closed and the resistance R normally out of circuit. This shunt or cut-out may be controlled by various means. A push-button is shown in one instance, which is arranged to break said shunt or cut-out circuit by pressing the same. At stations S and S″ is shown common switch-arms and contacts for the same purpose. However, when using this device directly in connection with telephonic apparatus the shunt or cut-out is placed under the control of the switch controlled by the hand-phone or receiver.

The operation of the system is as follows: In operating the system to make a call the shunt or cut-out circuit around the resistance and contact-crank at the station desiring to make the call is opened or broken by the switch or push-button, as the case may be. This operation introduces the resistance at that station directly into circuit C, thereby diminishing the current through the circuit at the time of pulsation by revolving the contact-crank. As hereinbefore explained, the stress-springs at the station mechanisms are not overcome by this diminished current. Therefore at each pulsation a step is given to the ratchet-wheel at every station. It now remains with the operator to give a number of revolutions of the contact-crank corresponding to the number of steps required to put the contact-segment of disk 3 into contact with contact-screw 22 at the particular station or stations being called. At the completion of the call the push is released or the switch closed, as the case may be, thereby closing the shunt or cut-out circuit around the resistance and contact-crank. The resistance being now cut out, the normal current is restored in circuit C, thereby overcoming stress-springs 28, which allows angle-lever 14 to lift bifurcated lever 18, thereby disengaging the pawls from the teeth of the ratchet-wheels throughout the entire system. This operation places the series of mechanisms in unison at the completion of each call by returning the revolving parts to zero or normal position and makes obvious, by reason of the pointers standing at zero or nor-

mal position, that the system is not in active operation and is ready for any one desiring to make a call.

By means of the mechanism and resistance as described the system is under the control of each and every operator without the intervention of any controlling devices. The operators have complete control of the entire system from their individual stations by means of the resistance R to increase the resistance of the circuit C containing a practically constant electromotive force and the mechanism operated, connected, and constructed as herein described. It is rapid and reliable in its action and obviates the necessity of attention to keep the mechanisms in unison throughout the system.

In a former application for Letters Patent, Serial No. 516,354, I have described and claimed the application of the resistance as it is herein described and applied to the operation of step-by-step and unison mechanisms.

The contact-disk or commutator, as herein shown and described, has been described and claimed in a former application for Letters Patent, Serial No. 516,354. This contact-disk overcomes any contingency in contacts for selective step-by-step mechanism. The novelty of this contact-disk or commutator consists in the fact that contact is made and the circuit C′ closed in the mechanism without disturbing the operating-balance of the mechanism. Should a contact arrangement be used that would introduce friction at the point of making contact and that friction was not present in the mechanism at other times, then the mechanism would, when working rapidly, be inclined to "stick" at the point of making contact and would also miss steps at this point, which would throw the series of mechanisms out of unison.

The contact-segment 10 being circumferential with the periphery of the disk and the contact-screw 22 and the disk 3 being made means of limiting the movement of the vertical lever 13, it is obvious that the contact-screw may make contact with the contact-segment as easy as rest on other portions of the periphery of the disk. This arrangement constitutes a perfectly frictionless means of closing the circuit C′ without detriment to speed and reliability of operation.

Having described my invention and pointed out that which is described and claimed in another application, I desire to claim and secure by Letters Patent as follows:

1. The combination of a series of step-by-step mechanisms and a series of restoring mechanisms at a series of stations respectively, means for moving the series of stepping mechanisms to a predetermined position by an intermittent current, and means for operating the restoring mechanism to return the parts to normal by a current of greater strength than the intermittent current, the stepping and unison mechanisms comprising a magnet, angle-lever and armature, the vertical lever and pawls, the stress-spring to combine the levers, the ratchet-wheel and contact-disk.

2. The combination in a selector system, of a line-circuit connecting a series of step-by-step and restoring mechanisms at a series of stations respectively, an operating-battery located in said circuit, a series of contact-cranks, and a series of switches located at said stations by means of which the said circuit may be opened and closed, and the current pulsated through the mechanisms, means located at each station, by which the normal current in the line-circuit may be diminished when it is desired to step the mechanisms, and restored when it is desired to restore the mechanisms, the step-by-step and restoring mechanisms comprising the ratchet-wheel, levers and pawls, to rotate the contact-disk when pulsating the diminished current, the contact-disk and contact-screw to close the signaling-circuit at a predetermined position of rotation of said series of mechanisms, the bifurcated lever operated by the said normal current to disengage the pawls, and the segment-gear to return the ratchet-wheel and contact-disk to normal position on operating the restoring mechanisms to reset the system.

3. The combination with vertical lever 13, the angle-lever and armature, the contact-screw 22, insulated therefrom, of the retractile spring 24, in electrical connection with said contact-screw, and insulated from said levers to form a conductor for circuit C′, substantially as specified.

4. In a selector system, the combination of the electromagnet and armature, the vertical lever to step the ratchet-wheel, the angle-lever, stress-spring and suitable adjustments, the shaft 1, ratchet-wheel 2, contact-disk 3, pinion-gear 4, the pointer 7, the weighted segment-gear to return the revolving parts to normal position, the bifurcated lever and its lifting-rod to disengage the pawls from the teeth of the ratchet-wheel, the contact-screw 22, and contact-segment of disk 3, to close the circuit C′, substantially as specified..

5. In a selector system the combination at each station of the face-plate and pointer, the ratchet-wheel, pawls and lever to step the contact-disk, the contact-disk and contact-screw to close the circuit C′, the bifurcated lever and lifting-rod operating through the influence of the electromagnet to disengage the pawls, the pinion-gear and segment-gear to return the pointer, ratchet-wheel and contact-disk to normal position, the electromagnet, angle-lever and armature operating under the influence of the diminished current to step the ratchet-wheel, and operating under the influence of the normal current to disengage the pawls from the teeth of the ratchet-wheel, the stress-spring and its adjusting-screw, the resistance to diminish the current, and means of keeping said resistances normally out of circuit, substantially as set forth.

6. In a selector system, the combination of a plurality of devices connected in series with suitable source of current, each of said devices consisting of an electromagnet and armature, a shaft carrying a ratchet-wheel, contact-disk, pointer and pinion-gear, the angle-lever, vertical lever and stress-spring with its adjustments, pawls carried on said vertical lever to step said ratchet, a contact carried by said vertical lever to make contact with said disk, a bifurcated lever to disengage the said pawls from the teeth of said ratchet-wheel, a weighted segment-gear meshing with said pinion-gear to return said ratchet-wheel, contact-disk and pointer to normal position, a resistance located at each of said devices to diminish the current in circuit C, for the purpose specified, and means as described to make the current intermittent through the system.

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