

Nov. 1, 1938.

E. R. WHEELER ET AL

2,135,374

MECHANICAL CORRECTOR

Filed March 15, 1934

2 Sheets-Sheet 1

FIG. 1

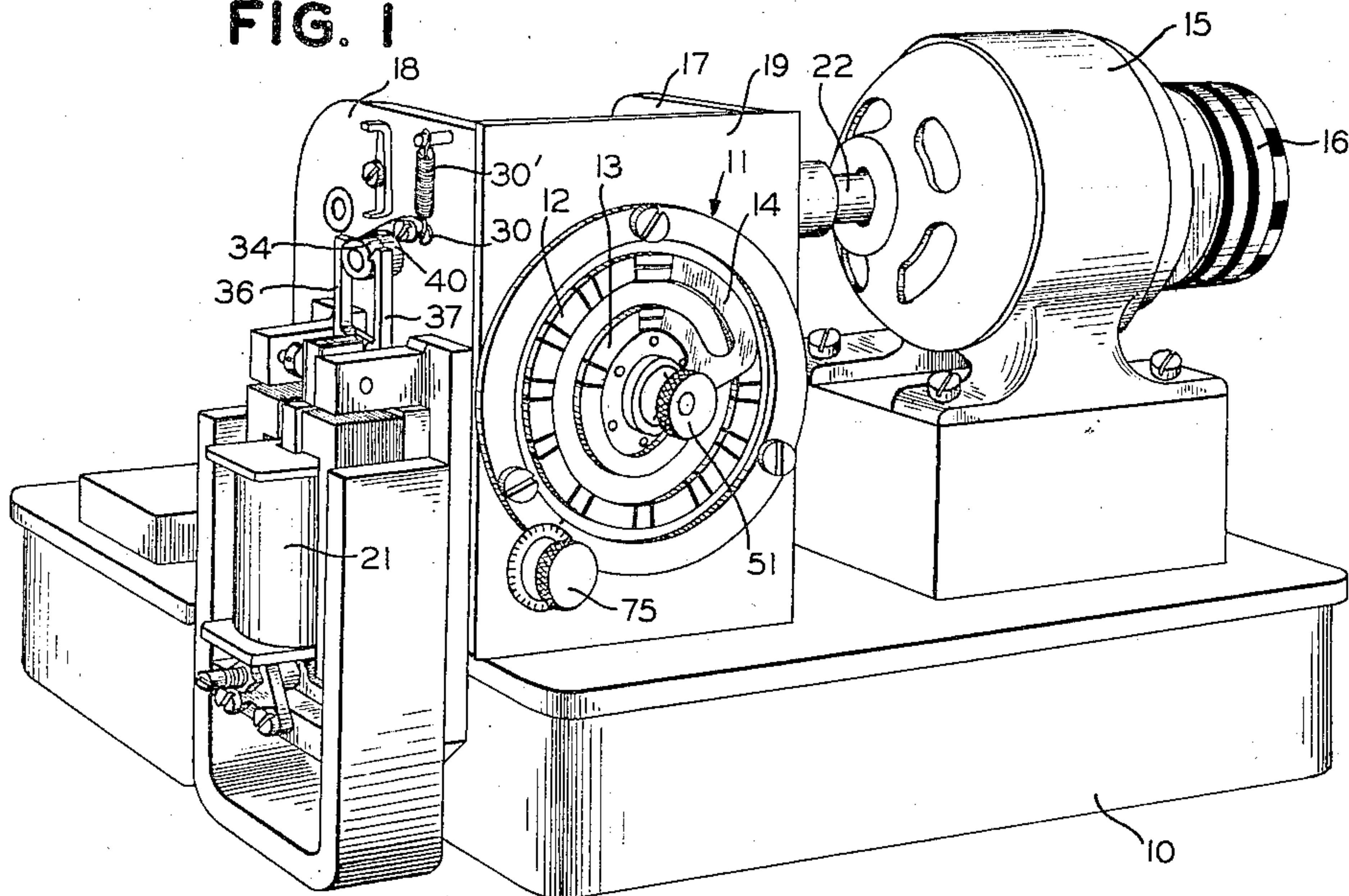


FIG. 4

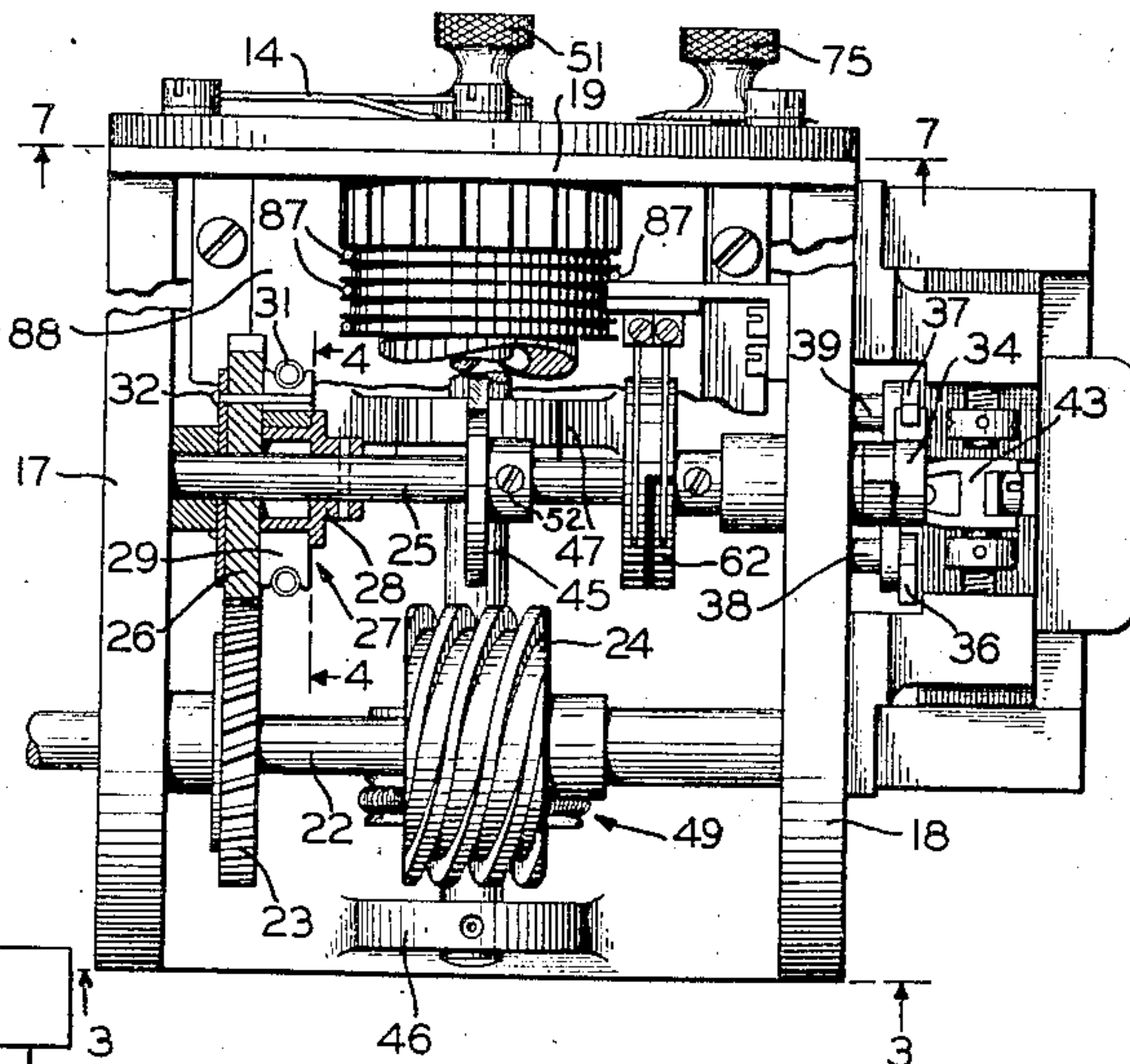
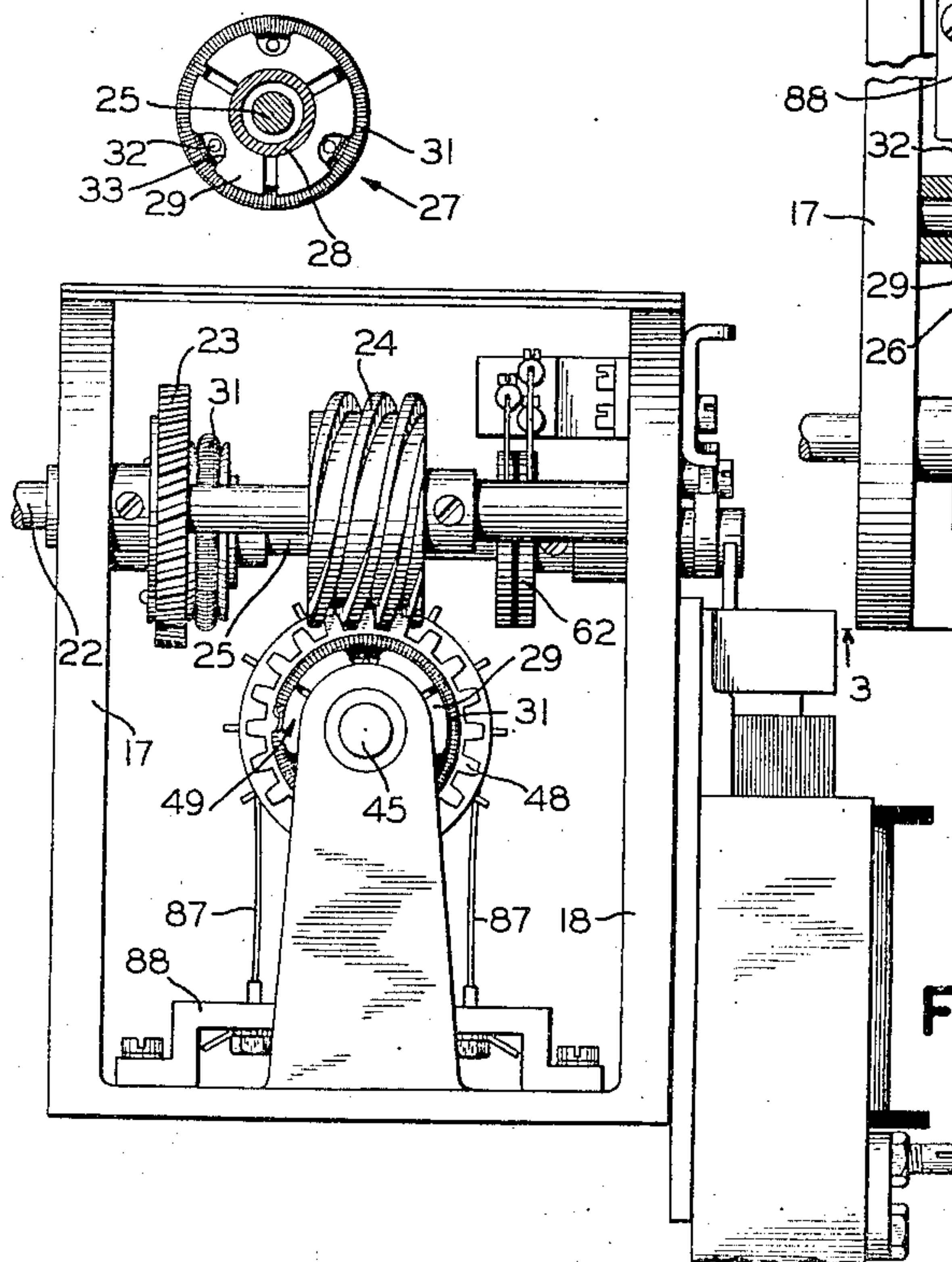


FIG. 2

FIG. 3

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2 Sheets-Sheet 2

FIG. 5

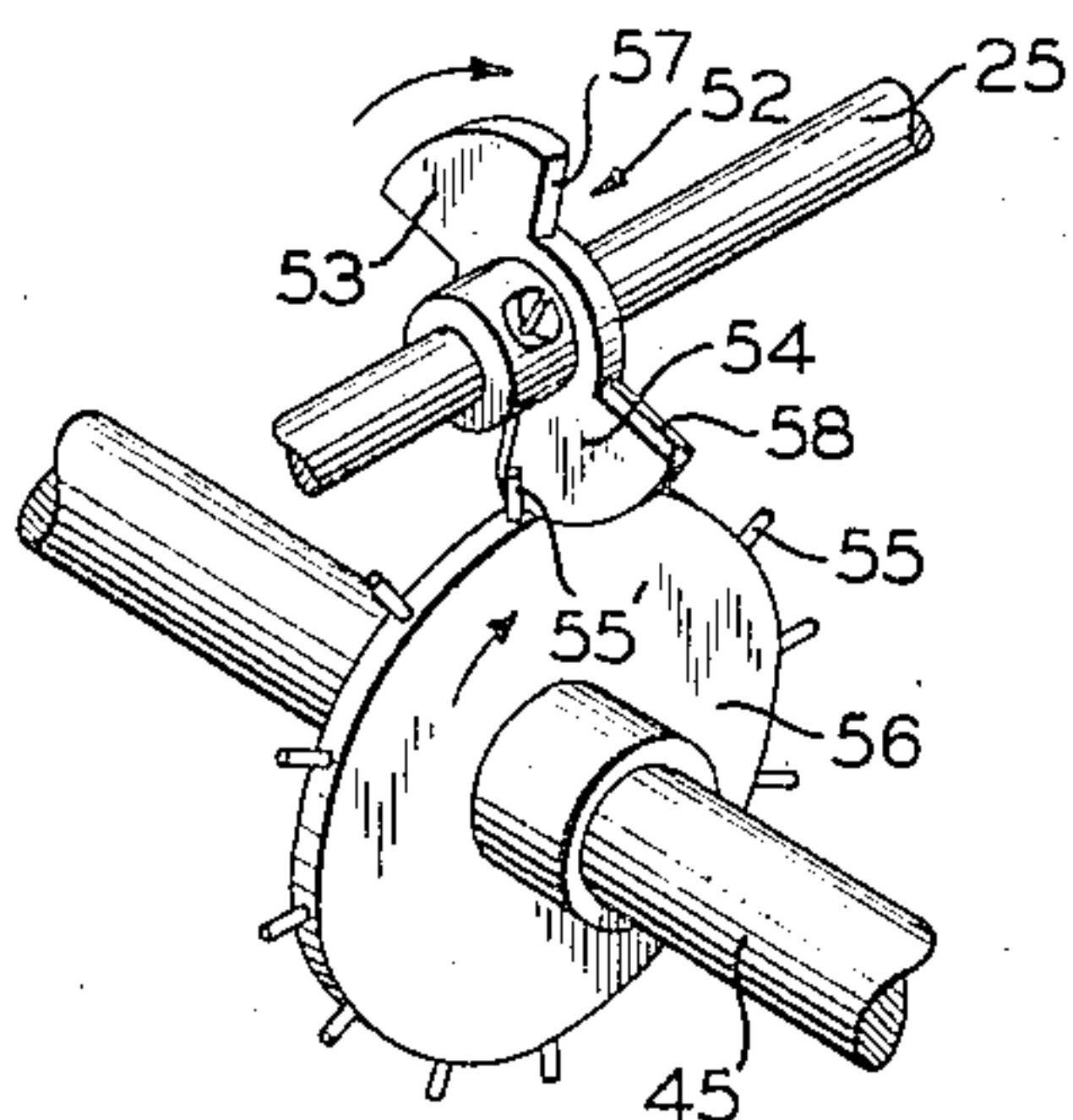


FIG. 6

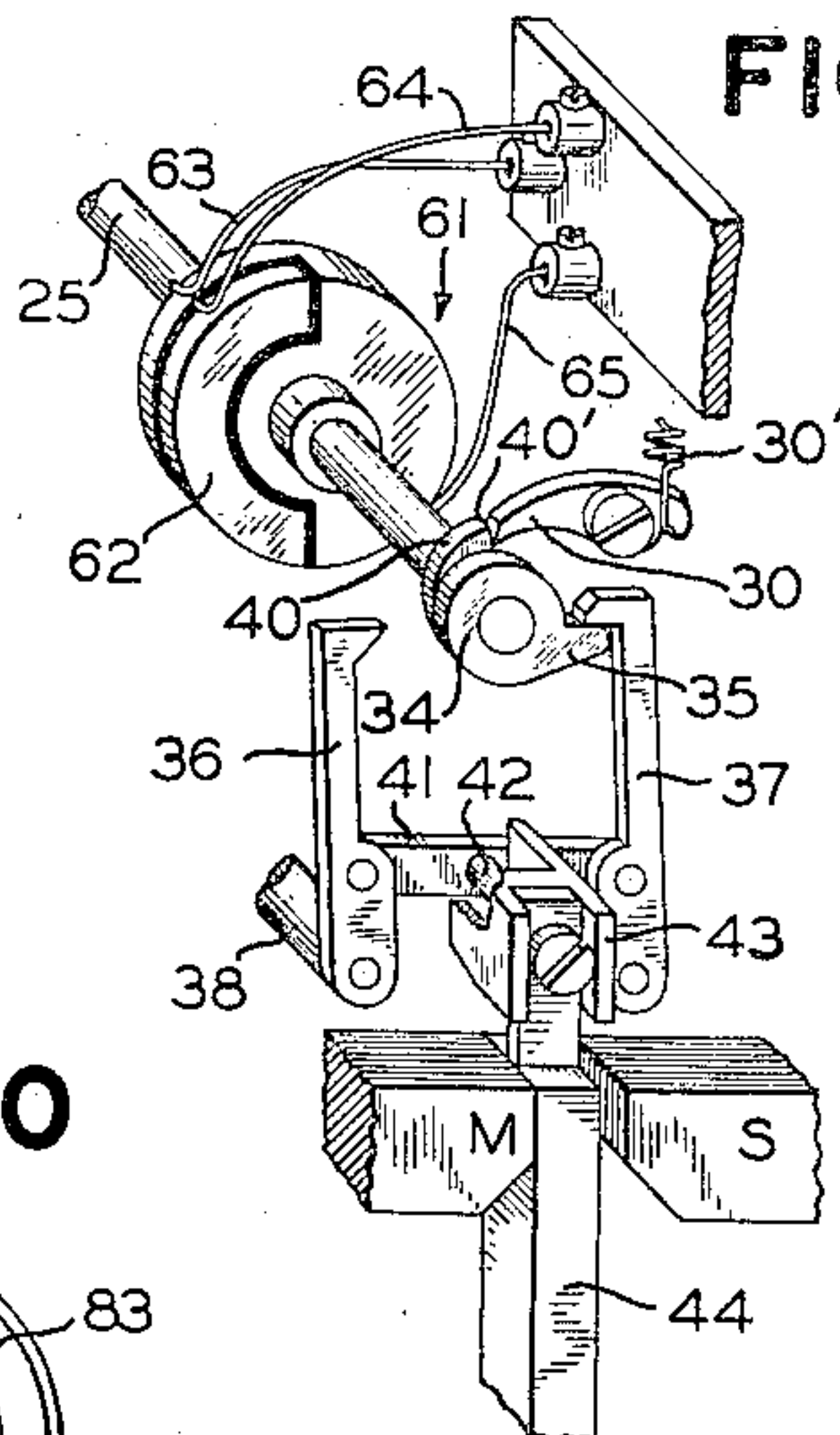


FIG. 10

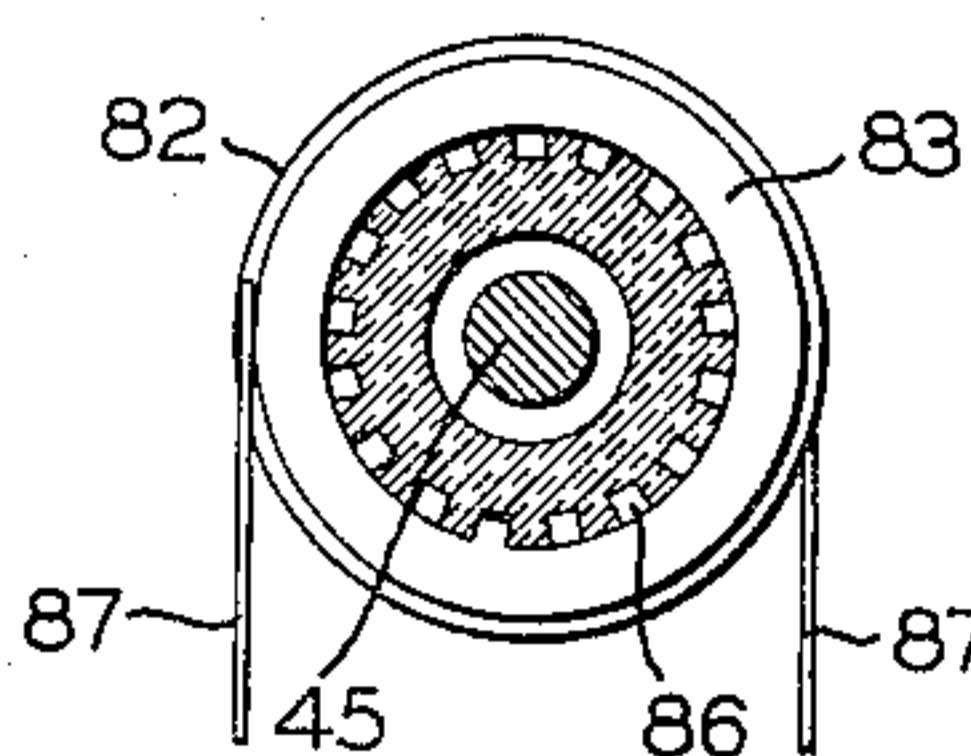


FIG. 7

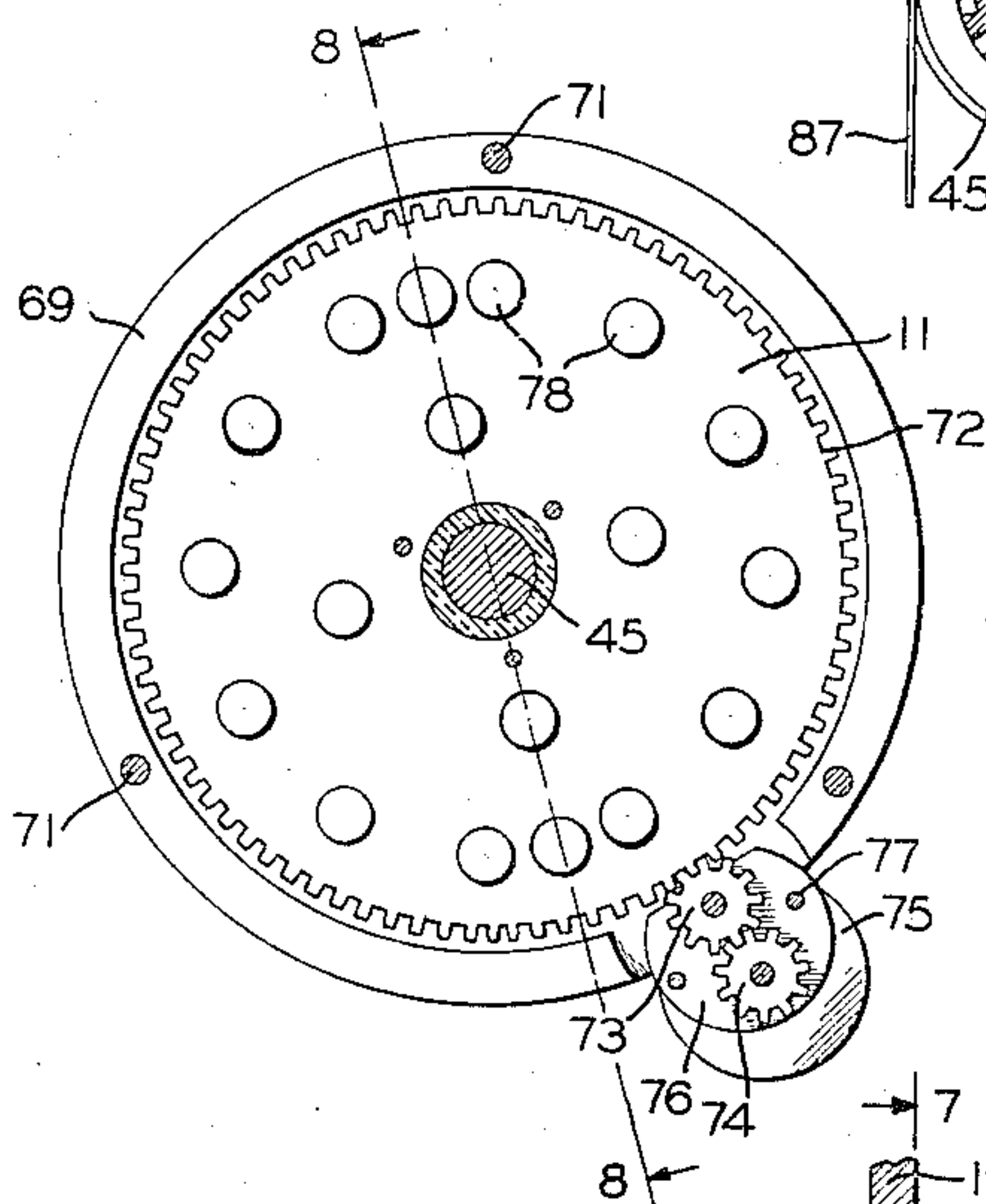


FIG. 9

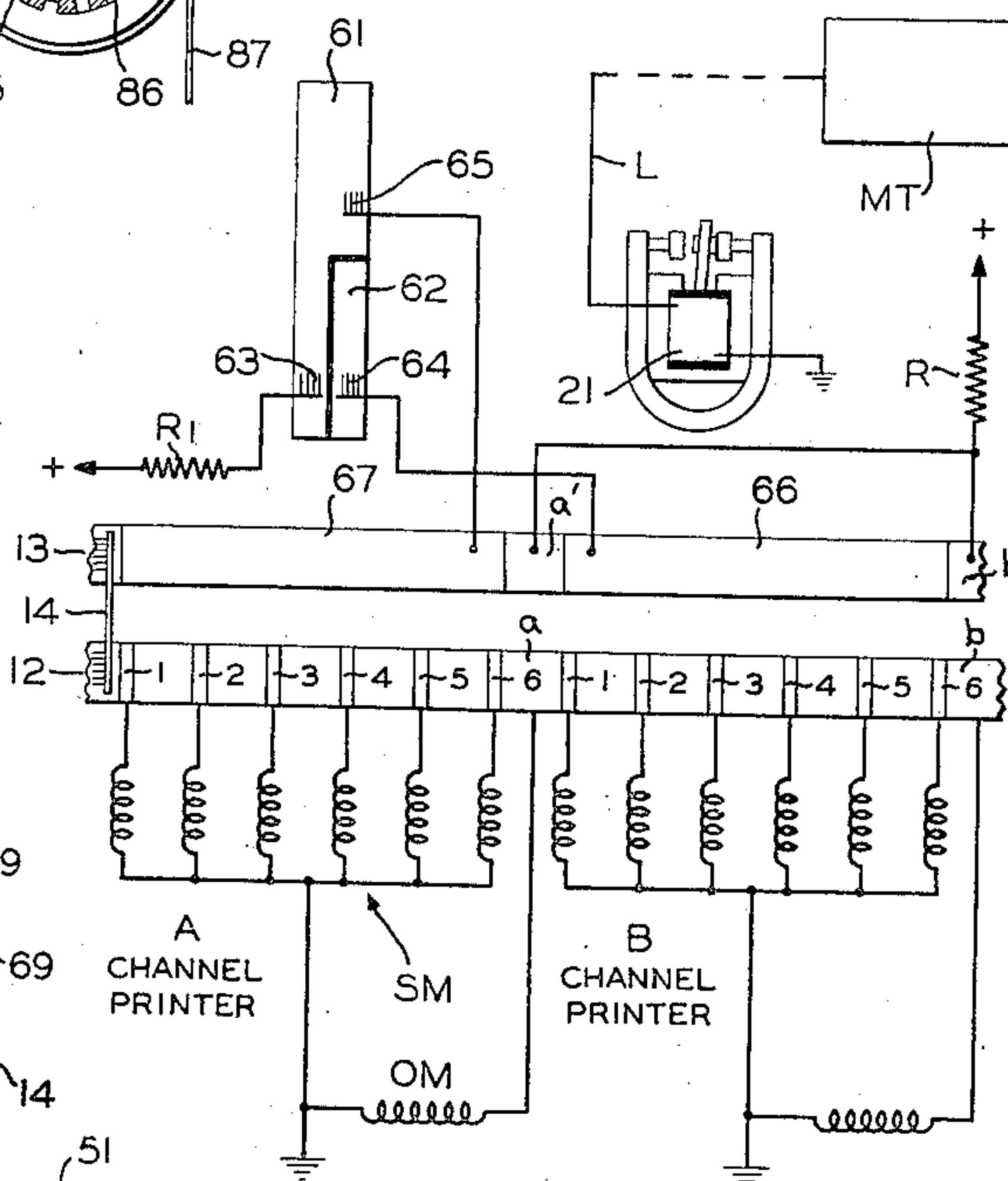
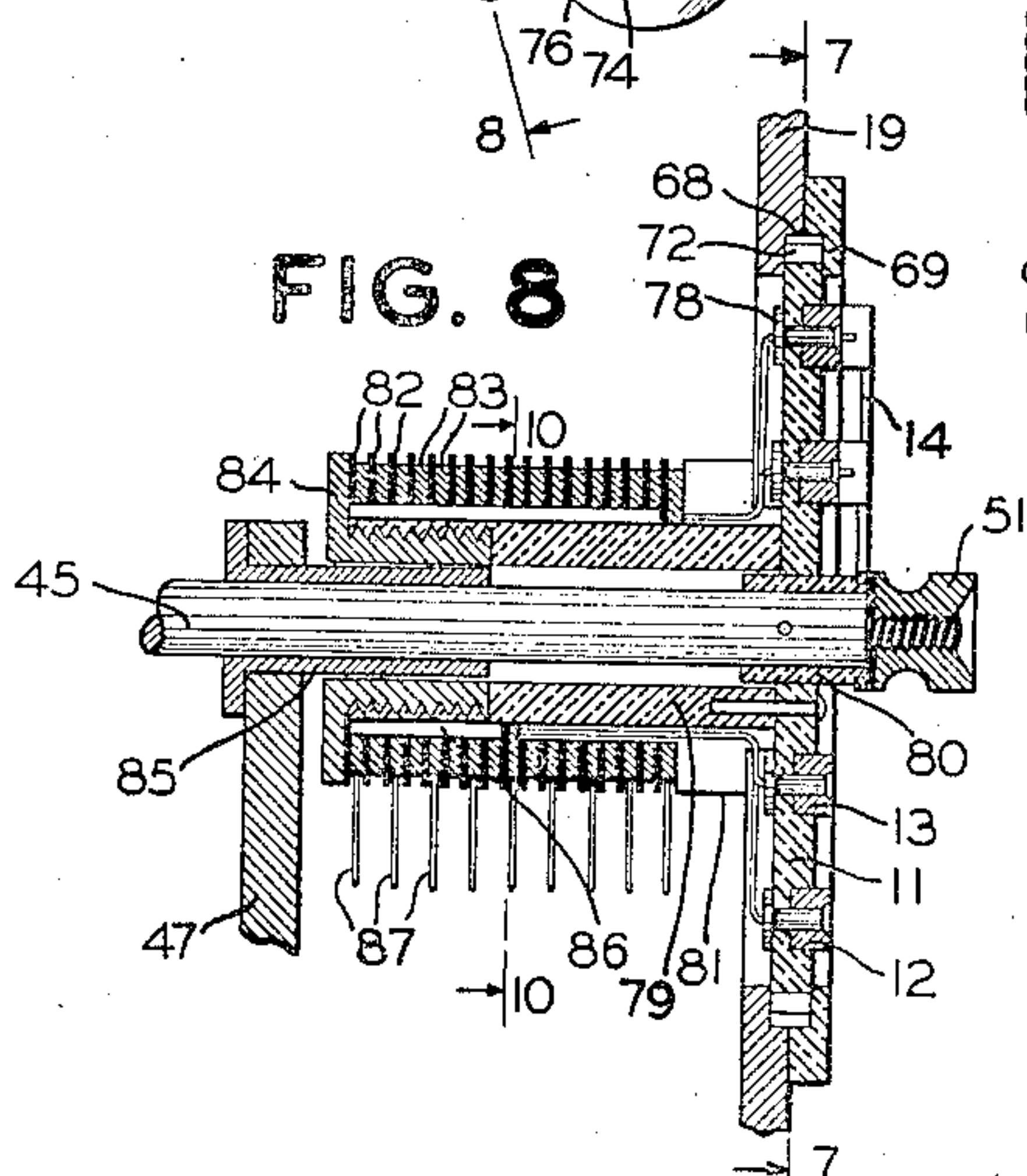


FIG. 8



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2,135,374

MECHANICAL CORRECTOR

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Application March 15, 1934, Serial No. 715,751

56 Claims. (Cl. 178—53)

This invention relates to synchronous apparatus, and more particularly to the maintenance of a rotary mechanism in predetermined phase relation with a source of electrical impulses.

5 The invention is especially applicable to the maintenance of telegraph receiving apparatus in synchronism with received telegraph signals but is not limited to such use. Present day automatic telegraph systems are either of the multiplex or simplex type. The multiplex system involves the use of a receiving distributor, the brushes of which are maintained in synchronism with the electrical impulses through the medium of an electrically operated corrector. The
10 synchronizing apparatus involves the use of La Cour or phonic motors maintained very closely at the correct synchronous speed by adjustable tuning forks, the brushes being corrected under the control of the incoming signals by stepping the same either forward or backward by definite increments as they creep out of phase with the signals. The signals received on the distributor are distributed to the magnets of a receiving printer, perforator or repeater. The
15 simplex systems are mainly of the start-stop type employing either an electrical or mechanical distributor which is brought to rest at the end of each character and restarted in phase with the succeeding character code combination. This system requires in addition to the character selecting impulses, additional start and stop impulses. With a five unit code these synchronizing impulses consume about 30% of the line time for a five unit selecting code and about 25%
20 of the line time from a six unit selecting code. In the start-stop system no correction is obtained during the reception of the selecting impulses.

Due to the expense of the multiplex synchronizing apparatus and the close supervision and maintenance required thereof this type of synchronizing is not suitable for use in subscribers office and therefore in such locations it has been necessary to resort to the less efficient start-stop type of operation.
45

One of the objects of the present invention is to provide a synchronizing apparatus which in simplicity, dependability and independence from supervision is comparable with the start-stop type of apparatus and in accuracy and efficiency is equal to or exceeds that of the usual types of multiplex synchronizing systems.

Another object is to provide a synchronizing apparatus for telegraph signals which is entirely mechanical in nature and which does not re-

quire separate synchronizing impulses to maintain it in phase with the incoming signals.

Another object is to provide a synchronizing unit which may be employed either in multi-channel systems or in a single channel system.

Still another object is to produce a synchronous rotary device responsive to reversals of line impulses and employing a single electro-magnetic control device.

A further object is to provide a multiplex distributor and associated correcting mechanism employing but a single pair of face plate rings.

Still another object is to effect correction of said apparatus independently of the distributor face plate rings.

Another object is to provide means for phasing or orienting the receiving distributor, relative to the signals, over an extended range.

Another object is to produce a synchronizing apparatus which is fast and certain in operation, which applies no appreciable load to the line magnet and which may be employed to control either mechanical or electrical distributors.

Other objects and advantages of the invention will appear from the following detailed description of the invention in connection with the accompanying drawings showing a preferred embodiment thereof, in which:

Figure 1 is a perspective view of a multiplex distributor and correcting mechanism embodying the present invention;

Figure 2 is a top plan view thereof;

Figure 3 is a side elevation, viewed along the line 3—3 of Figure 2;

Figure 4 is a section approximately on the line 4—4 of Figure 2 showing the construction of the friction clutch employed.

Figure 5 is a perspective view of the correcting mechanism;

Figure 6 is a perspective view of the relay escapement and commutator;

Figure 7 is a sectional view on the line 7—7 of Figure 2;

Figure 8 is a vertical sectional view through the distributor face plate and commutator, taken on line 8—8 of Figure 7;

Figure 9 is a wiring diagram showing the operation of a two channel multiplex system; and

Figure 10 is a sectional view on the line 10—10 of Figure 8.

Referring to Figure 1 the synchronizing apparatus is shown applied to a multiplex distributor, the component parts of which are mounted upon a suitable base 10. The distribu-

tor comprises a face plate 11, having a single pair of rings 12 and 13, and cooperating brushes 14. The brushes are driven by an electric motor 15 of conventional design operating from either direct current or alternating current and having in case of a direct current motor a suitable speed regulator 16. The synchronizing apparatus for the distributor brushes 14 is contained within a housing formed of three upright plates 17, 18 and 19. A single line magnet 21 controls both the operation of the synchronizing apparatus and the application of the incoming signals to the distributor segments.

The motor shaft 22 extends through and bears in the plates 17 and 18 and has fixed thereon a spiral gear 23 and a worm wheel 24. An escapement shaft 25, disposed parallel to the shaft 22, is driven from the gear 23 through a gear 26 loose on the shaft, and a friction clutch 27. The friction clutch 27 comprises a hub member or drum 28 pinned to the shaft 25 and having disposed around its periphery a number of arcuate friction shoes 29, three being used at the present instance. The shoes 29 are pressed against the face of the drum by a continuous spiral spring 31 and are secured to the gear 26 to rotate therewith by means of pins 32 extending through the gear and into radial slots 33 in each of the shoes. With the shaft 25 held stationary through the escapement mechanism, to be described, the shoes 29 rotate on the periphery of the drum but upon releasing the escapement mechanism they grip the drum through the action of the spiral spring 31 and cause the shaft 25 to rotate therewith.

The shaft 25 extends outwardly through the plate 18 and on its extended end is provided an escapement wheel 34 having a single stop 35 (Figures 2 and 6) alternately engaged by the escapement pallets 36 and 37. The pallets 36 and 37 are pivoted at their lower ends to posts 38 and 39 (Figures 2 and 6) extending outwardly from the plate 18. The pallets are connected by a cross member 41 pivoted at its opposite ends to each of the pallets. A stud 42 projects outwardly from the cross member 41 and engages in a slot in the rear of an H-shaped block 43 carried by the upper end of the armature 44 of magnet 21.

With the magnet 21 in the line circuit the pallets 36 and 37 will be oscillated in accordance with the received line impulses escaping the shaft 25 for half a revolution on each reversal of the line signals. Except when escaped by the signal reversals the shaft is held in the marking position, as shown in Figure 6, or in the diametrically opposite or spacing position by one or the other of the pallets 36 and 37.

A latch 30 pivoted to the plate 18 is urged in contact with a locking disk 40 by the spring 30'. The latch drops behind a cam projection 40' whenever the escapement stop 35 engages one of the pallets 36 and 37, thereby preventing rebound of the escapement shaft.

Disposed below and transversely of the shafts 22 and 25 is a third shaft 45 mounted in upright brackets 46 and 47. The shaft 45 is driven from the shaft 22 through the worm wheel 24, gear 48, loose on the shaft 45, and a friction clutch 49, similar in construction to the clutch 27. The shaft 45 extends through the front plate 19 of the housing centrally of the face plate 11 and the brushes 14 are adjustably mounted thereon by means of the clamping screw 51. The shaft 45 is driven by the motor 15 at a speed slightly greater than the synchronous speed of the incoming signals and is corrected by each signal re-

versal from the escapement shaft 22 through the following mechanism.

Mounted on the escapement shaft 25 is a disk 52 (Figures 2 and 5) having a pair of diametrically opposite wing members 53, 54. Wing members 53 and 54 extend into the path of a series of radial pins 55 extending outwardly from a disk 56 rigidly mounted upon the brush arm shaft 45 to rotate therewith. An individual pin 55 is provided for each segment of the distributor. With the escapement shaft held in either its marking or spacing position the wing members 53 and 54 are disposed so that the pins 55 may pass freely therebetween permitting the shaft 45 to rotate freely. Whenever a reversal occurs in the signals to escape the shaft 25 for half a revolution, the position of the wings 53 and 54 is reversed relative to the disk 56 during which time one of the wing members passes between a pair of pins 55. If the disk 56 and consequently the brush arm 14 are rotating in phase with the incoming signals one of the pins 55 will rotate past one of the wings 53 or 54 just preceding a reversal. The disk 52 when escaped rotates at a sufficiently fast rate to cause the lower wing member to pass between the uppermost pair of pins 55 before the succeeding pin of the pair rotates into contact therewith. Consequently the succeeding pin does not engage the lower wing member and the speed of the shaft 45 is unretarded. However, if the brush arm shaft 45 has crept forward slightly relative to the signals, which is the usual direction of creep, since the shaft 45 is operated slightly faster than the signals, the lower wing of disk 52 will not have completed its rotation into position following a reversal in time to permit the free passage of the succeeding pin 55' and this pin will engage the lowermost wing member as shown in Figure 5, thereby checking or retarding the rotation of the shaft 45 until the wing member passes from engagement with the pin 55', at which time the pin will pass through the disk 52 and the shaft 45 will continue its rotation. The retardation of the shaft 45 is sufficient to restore it into proper phase relation with the incoming signals.

While we have shown the escapement wheel 34 provided with a single stop 35, it is to be understood that it may have three, five or any other odd number of stops. In the case of a three stop escapement wheel, the shaft 25 would be escaped only one-sixth of a revolution for each reversal and consequently the disk 52 would require six slots and six abutments. If a five stop escapement wheel were used the disk 52 would require ten slots and ten abutments.

It will be noted that a correction, if needed, will be applied for every reversal regardless of whether from marking to spacing or from spacing to marking. Thus for a single character combination, assuming a six unit code, there may be as many as six corrections depending upon the number of reversals occurring in the particular code combination.

It will be noted that both the front and rear faces of each of the wings 53 and 54 are beveled as shown at 57 and 58 respectively. Normally synchronism is maintained at the beveled edge 58 of the correcting disk. As shown in Figure 5 the pins 55' are seen engaging the flat face of the wing member. When this occurs the brush arm shaft is definitely stopped until the beveled edge 58 of the wing member comes opposite the pin, at which time the pin will be permitted to move forward along the inclined face as the latter moves out of the path of the pin. The

disk 56 therefore acquires a predetermined speed at the time it is freed from the wing member 54, thereby reducing slippage which might occur at the friction clutch if the disk 56 were released suddenly from engagement with the wing member 54. The length of the bevel 58 may be equal to the maximum out-of-phase condition obtained under ordinary signalling conditions in which case the brush arm shaft 45 will never be brought to rest but will only be slightly retarded as one of the pins 55 engage the incline plane of the correcting disk. This eliminates the sudden stopping of the brush arm shaft and reduces the noise and shock incident to the operation of the corrector mechanism.

The position shown in Figure 5, with the pins 55' in engagement with the correcting disk 52, adjacent the forward edge of the lower wing member 54, is an extreme out-of-phase condition occurring only when reversals or correcting conditions have not occurred for a considerable period. The first reversal will restore the shaft 45 completely into correct phase relation however, as long as the brush arm shaft has not advanced relative to the disk 52 sufficiently for the pin 55' to pass ahead of the lower wing member, when it is escaped for rotation, instead of engaging the flat face thereof. The purpose of the beveled front edge 57 of the wing members 53, 54 is to prevent the interlocking of the pins 55 with the front face of the wing members, when the pin attempts to pass in front of the advancing edge of the lower wing member, instead of past the rear edge thereof.

While it is desirable to maintain the speed of the brush arm shaft only slightly faster than the synchronous speed of the signals, the mechanism is not critical in this respect and correct phase relation is maintained at high signalling speeds over a relatively wide variation in the motor speed. Obviously in place of driving the brush arm shaft at a faster rate than the synchronous speed and corrected by retarding the same it may be operated at synchronous speed and correction effected in both directions or it may be operated below synchronous speed and correction effected by stepping the same forward by suitably shaping the correcting disk in relation to the disk 56.

As shown in Figure 9, signals originating at a two channel multiplex transmitter MT and transmitted over a line L are received on the escapement magnet 21 which serves both to control synchronous movement of the brushes 14 over the multiplex ring 12 and to position the commutator 61. The multiplex ring 12 is also arranged for two channel operation, each channel utilizing a six unit code. For convenience these channels are termed the A channel and the B channel. Ring 12 has two groups of segments numbered 1 to 6, the segments of one group being connected to the selecting magnets SM of the A channel printer and the segments 1 to 6 of the other group being connected to the selecting magnets of the B channel printer. Two local segments *a* and *b* disposed between segments numbered 6 and 1, are connected respectively to the operating magnets OM of the A and B channel printers. Ring 13 is provided with two local segments *a'* and *b'* disposed opposite to the segments *a* and *b* and connected through resistance R to a source of battery. Mounted upon the escapement shaft 25 is a commutator 61 comprising a drum of conducting material having on one end thereof at 180° sector 62 insulated

from the remainder of the drum. A brush 63 bears against the continuous conducting periphery of the drum and two brushes 64 and 65 disposed 180° apart are provided for engagement with the insulated sector 62 alternately as the escapement shaft revolves. Brush 64 is connected to the solid portion 66 of ring 13 and brush 65 is connected to the solid portion 67 of ring 13. Brush 63 is connected through resistance R1 to a source of battery.

The operation of the system will best be understood by reference to a particular example. Assume that the magnet 21 is in its marking position as shown in Figure 6, with the escapement arm 37 holding shaft 25 at rest. In this position positive battery is applied through brushes 63 and 65 to segment 67 of the distributor. Assume further that the brush 14 is just approaching segment 1 of the A channel and that the letter character L represented by a code combination of spacing, marking, spacing, marking, spacing, is to be recorded upon the A channel printer. At the first spacing impulse of this combination is received on the magnet 21 the armature 44 moves to its spacing side, moving the pallets 36 and 37 and escaping the shaft 25 for half a revolution, the stop 35 coming to rest against the pallet 36. This rotates the commutator 61 around to bring the insulated segment 62 beneath brush 65 thereby interrupting battery to the segment 67 at the time brush 14 passes over the number 1 segment. Consequently the number 1 selecting magnet is not energized but remains in its spacing condition. The release of the shaft 25 at the same time rotated the correcting disk 52 half a revolution applying a correcting condition to the brush shaft 45 so that the brush 14 crossed the segment 1 in proper phase relation to the incoming signal impulse. The second impulse being marking restores the armature 44 to its left hand or marking side again releasing the escapement shaft 25 which comes to rest against the pallet 37. The commutator 61 is thus moved to bring the insulated segment 62 under brush 64 allowing marking battery to flow through brushes 63 and 65 to segment 67 and thence through brush 14 and segment 2 to the second selecting magnet of the printer to operate the same in a marking direction. At this time the correcting disk 52 is again rotated half a revolution applying a second corrective force to the brush arm shaft 45. The third impulse being spacing again releases the escapement shaft half a revolution causing the commutator 61 to remove battery from ring 67 as the brush 14 crosses the number 3 segment and consequently the number 3 selecting magnet does not operate. A third correcting impulse is applied at this time to the brush arm shaft. The fourth impulse also being spacing the shaft 25 is not released. Consequently battery is maintained off the segment 67 and the number 4 selecting magnet does not operate. Since the correcting disk 52 does not rotate at this time no corrective force is applied by the fourth impulse. The fifth and sixth impulses being marking and spacing respectively, however, each releases the escapement causing the proper battery condition to be applied to the fifth and sixth operating magnets and each applying a corrective force to the distributor brush.

As the brush 14 passes on to the segments of the B channel printer it will be noted that a marking signal will cause the insulated segment 62 to move under brush 64, thereby applying a spacing condi-

tion to the segment 66. This is in accordance with the usual multiplex practice in which the B-channel printer marks on A-channel spacing signals and spaces on A-channel marking signals.

5 A the brushes 14 pass from the sixth segment of the A channel it crosses the local segment *a*, *a'* applying operating battery to the magnet OM to operate the A channel printer. Similarly, as it crosses segments *b* and *b'* the operating magnet
10 of the B channel printer is operated.

It will be noted that in the example given in connection with the A channel printer that five of the six selecting impulses produced a correcting influence on the brush arm shaft. Each
15 correction completely restored the brush into correct phase relation since the disk 56 is definitely retarded until the correcting disk releases the same, this release occurring at the same point relative to each impulse. Since many corrections
20 occur even within a single combination there is little opportunity for any appreciable out of phase condition to occur and the brush is therefore maintained very accurately in the correct phase relation relative to the segments of the dis-
25 tributor.

In order to bring the distributor into phase with the incoming signals, the face plate 11 is arranged to be oriented through a complete revolution. Referring to Figures 7 and 8 it will be
30 noted that the plate 11 is mounted in a circular recess 68 in the front plate and is held in the recess by a shouldered ring 69 by screws 71. The periphery of the face plate 11 is provided with gear teeth 72 meshing with an idler gear 73 which
35 in turn engages a gear 74 to which the orienting knob 75 is secured. The gears 73 and 74 are carried by a plate 76 secured to the plate 11 by screws 77. The plate 11 bears on a sleeve 80 and may be rotated to any angular position by turning the
40 knob 75.

In order to permit contact to be made with the segments of the face plate, each segment is in electrical connection with an individual button 78. The button 78 may be the head of a rivet or eye-
45 let extending through and peened to the segments of the face plate. Rigidly secured to the rear of the face plate to move therewith is a sleeve 79 having a shoulder 81 on which are stacked alternate insulating and conducting rings 82 and 83
50 respectively. A shouldered member 84 threaded into the sleeve 79, clamps the rings 82 and 83 firmly together. The member 84 bears on a sleeve 85 carried by the upright bearing bracket 47. The sleeve 79 and its shouldered portion 81 are
55 provided with radial slots 86 through which conductors extend connecting each segment of the face plate to an individual ring 83 of the commutator. Brushes 87 carried by a bracket 88 (Figure 3) engage the rings and enable the circuit
60 connections shown in Figure 9 to be made.

When the distributor is started up and with signals on the line, the face plate is rotated slowly by turning the knob 75 until the signals are prop-
65 erly received on the A and B channel printers, so that the brushes 14 pass the first segment as the first impulse of the code is being received. The gear ratio between the knob 75 and plate 11 is relatively high so that a fine adjustment of the
70 face plate may be obtained. As shown one turn of the knob 75 advances the face plate the distance of one segment.

If desired a unison mechanism may be provided for starting the distributor brush in the
75 proper phase relation to the signals, as shown in

our copending application, Serial No. 715,750, filed concurrently herewith.

In place of employing the distributor in a multiplex system, it may equally well be used in a simpler system in which the successive char-
acter signals of a message are sent in continuous succession, with the first impulse of one character code combination following immediately after the last impulse of the preceding code combination. In this case all signals would be received upon
10 the same printer. This may be readily accomplished by connecting the corresponding A and B channel segments of ring 12 together and to the receiving magnets of a receiving printer with the brush 54 omitted and brush 65 connected to both
15 solid rings 66 and 67, or if desired a single set of receiving segments might be provided on the face plate with the brushes 14 adjusted to make one revolution for each code combination received. The printer would of course require an overlap
20 mechanism whereby it would be conditioned to receive the number one impulse of a code combination during the operation of the printer following the reception of the last impulse of the preceding combination.
25

An arrangement for operating a printer on continuous transmission and providing the necessary overlap is shown in patent to G. R. Benjamin, granted March 6, 1923, No. 1,447,748 and entitled Method of and apparatus for operating
30 synchronous telegraph systems. This patent also discloses means for providing overlap in the transmitter whereby continuous transmission is possible.

While we have shown an electrical distributor
35 controlled by the connected shaft 45, it is obvious that a mechanical distributor might be equally well operated by this shaft and therefore we do not desire to be limited to any particular form of distributor by the use of the term "dis-
40 tributor" in the appended claims. The distributor may, of course, operate a repeater or reperforator in place of the printers shown.

It will be apparent to those skilled in the art that the invention may be embodied in different
45 forms and therefore we do not desire the foregoing description to be interpreted in a limiting sense but merely as illustrative of one embodiment of the invention. We contemplate all variations coming within the scope of the appended claims.
50

What we claim is:

1. In a synchronous telegraph receiver, a rotary distributor, driving means therefor, a magnet responsive to line current impulses and means controlled by said magnet, upon each reversal of
55 line current impulses for applying a corrective influence to said distributor, if required.

2. In a synchronous telegraph receiver, a rotary distributor, driving means therefor, a magnet responsive to line current impulses and mechanical means controlled by said magnet in response
60 to character selecting impulses for applying a corrective influence to said distributor.

3. In a synchronous telegraph receiver, a substantially continuously rotatable shaft and means composing a single electro-magnetic device responsive solely to each received character selecting line current impulses for maintaining
65 said shaft in synchronism with said impulses.

4. In a synchronous telegraph receiver, a rotary shaft, said shaft being normally free to rotate in substantial synchronism with received signals, a second shaft controlled by line impulses and normally disengaged means on each of said shafts, adapted to cooperate when an out-of-
75

phase condition occurs, for maintaining said rotary shaft in synchronism with received line current impulses.

5. In a synchronous telegraph apparatus, a rotary shaft, driving means for rotating said shaft in substantial synchronism with received line current impulses, a second shaft normally at rest, means for momentarily rotating said second shaft upon each reversal of line signaling conditions, a baffle member carried by said second shaft, a co-operating baffle member carried by said first shaft, said baffle members being arranged to freely pass each other during the rotation of said shafts, when the first shaft is in phase with the received line current impulses, and to engage each other to retard the movement of the first shaft when the same gains in phase relative to the received line current impulses.

6. In a synchronous telegraph apparatus, a member movable over a predetermined path in approximate synchronism with received line current impulses, and a correcting member movable into marking and spacing positions, in response to received line current impulses and serving during the movement from one position to the other to apply a corrective influence to said member to retain the same in phase with the received impulses.

7. In a synchronous telegraph apparatus, a distributor, a substantially continuously rotating shaft, a correcting mechanism for maintaining said shaft in synchronism with received line current impulses, and a single magnet responsive to line signals for applying said signals to said distributor and for controlling said correcting mechanism.

8. In a synchronous telegraph system, a rotary shaft, a line magnet responsive to received line current impulses, and a solely mechanical correcting mechanism controlled by said line magnet upon operation thereof in response to character selecting impulses for maintaining said shaft in synchronism with said received character selecting impulses.

9. In a synchronous telegraph system, a rotatable shaft, means for driving said shaft in approximate synchronism with received line current impulses, means movable relative to said shaft in response to said line current impulses, and means whereby said last means engages said shaft, only when an out of phase condition thereof occurs, to vary the speed of said shaft without stopping the same, whereby to apply a corrective influence thereto.

10. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, a corrector mechanism, cooperating with said shaft to apply a corrective influence thereto, to restore the same completely into correct phase relation upon each actuation of the corrector, and means responsive to each reversal of line current impulses for effecting the actuation of said corrector.

11. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, a magnet responsive to said line current impulses, and solely mechanical means controlled by said magnet for applying a plurality of corrections to said shaft, if required, during the reception of each character code combination, to retain the same in phase with said signal impulses.

12. In a synchronous telegraph apparatus, a

rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, a magnet responsive to said line current impulses, and solely mechanical means controlled by said magnet for applying a plurality of corrections to said shaft, if required, during each revolution thereof.

13. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, said shaft having a definite angular position corresponding to each impulse of a character code combination and mechanical corrector means for said shaft operable to apply a corrective influence to said shaft in any of said angular positions.

14. In a synchronous distributor, a segmented face plate, a brush movable over said face plate, a local source of potential, a single electro-magnet responsive to line current impulses and mechanical means controlled by said magnet for maintaining said brush in phase with received line current impulses and applying said local source of potential to said segmented face plate in accordance with said received line current impulses.

15. In a synchronous distributor for a telegraph system, a plurality of contacts, one for each impulse of a received character code combination of line current impulses, means for completing said contacts in succession, in synchronism with received line current impulses, a local source of potential, a single electro-magnet responsive to line current impulses, a commutator movable into marking and spacing position, under the control of said magnet, said commutator in one position serving to apply said source of potential to said contacts and in the other position to remove said source of potential from said contacts.

16. In a multiplex distributor, a face plate having a plurality of groups of segments, a brush, means for moving said brush over said segments in synchronism with received line current impulses, a local source of potential, a rotary shaft, contact means controlled thereby, a single electro-magnet responsive to received line current impulses, to control said shaft, in turn to control said control means, said last means being associated with said local source of potential and serving when so controlled to apply said source of potential to one of said groups of segments in response to received line current impulses of one polarity and to apply said source of potential to a different group of segments in response to received line current impulses of the opposite polarity.

17. In a synchronous telegraph system, a printing mechanism, a rotary shaft, power means for driving said shaft in approximate synchronism with received line current impulses, a single electro-magnet responsive to received character selecting impulses, mechanical means controlled by said magnet for maintaining said shaft in phase with said impulses, and means controlled jointly by said magnet and said shaft for selectively operating said printing mechanism.

18. In a multiplex distributor, a face plate having segmented rings, a brush driven in approximate synchronism with received character selecting impulses, means responsive to received character selecting impulses for applying signal conditions to said face plate, and a corrector for said brush, said corrector being controlled by

reversals of received character selecting impulses, independently of said face plate.

19. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in excess of its synchronous speed relative to received line current impulses, a line magnet, and means controlled by said magnet upon each reversal of line current impulses for stopping said shaft, if out of phase with said impulses, and releasing it in proper phase relation to said impulses.

20. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in excess of its synchronous speed relative to received line current impulses, and means controlled solely by selecting line current impulses for stopping and starting said shaft in phase with said received line current impulses.

21. In a synchronous telegraph receiver, a rotary distributor, driving means therefor, a printer controlled through said distributor, and a single electromagnet means responsive to received character selecting line current impulses for controlling the selective action of said distributor on said printer and for maintaining said distributor in synchronism with said impulses.

22. In a synchronous telegraph receiver, a driven rotary shaft, a source of signals of predetermined frequency, means for driving said shaft at a rate in excess of its synchronous speed relative to said signals, an electro-magnet responsive to all of said signals and solely mechanical means controlled by said magnet for restoring said shaft into phase with the received impulses whenever it advances in phase relative thereto.

23. In a synchronous telegraph receiver, a continuously rotating distributor, driving means therefor, a magnet responsive to all line current impulses and means mechanically controlled by said magnet for applying a corrective force to said distributor without stopping the same.

24. In a synchronous telegraph apparatus, a rotary distributor shaft, said shaft being normally free to rotate in substantial synchronism with received line current impulses, a second rotary shaft normally at rest, means for intermittently rotating said second shaft in predetermined phase relation to said received line current impulses and means on said second shaft cooperating with the distributor shaft to maintain the latter shaft in synchronism with said received line current impulses.

25. In a synchronously telegraph apparatus, a rotary shaft, driving means for rotating said shaft in substantial synchronism with received line current impulses, a second shaft normally at rest, means for momentarily rotating said second shaft upon each reversal of line signaling conditions and means carried by said second shaft adapted to engage said first shaft during such momentary rotation, to correct the same into proper phase relation with said line current impulses.

26. In a synchronous telegraph apparatus, a rotary shaft, driving means for rotating said shaft in substantial synchronism with received line current impulses, a second rotary shaft normally at rest, means for momentarily rotating said second shaft upon each reversal of line signaling conditions, a disc carried by each of said shafts, said discs having cooperating projections and being arranged so that upon rotation of said shafts, the projections of one disc move freely between the projectors of the other disc, when said first shaft is in phase with the re-

ceived impulses, and so that the projectors of one disc engage those of the other disc to retard the movement of the first shaft, whenever the latter shaft gains in phase relative to said signal impulses.

27. In a synchronous telegraph apparatus, a rotary shaft, driving means for rotating said shaft in substantial synchronism with received line current impulses, a second rotary shaft, means controlled by line current impulses for determining the angular position of said second shaft, spaced projections on each of said shafts, the projections on one shaft being adapted to engage those on the other in certain relative angular positions of the two shafts corresponding to an out-of-phase relation of the first shaft to the received signals, whereby to restore the first shaft into synchronism with said signal impulses.

28. In a synchronous telegraph apparatus, a rotary shaft, driving means for rotating said shaft in approximate synchronism with received line current impulses, a second rotary shaft, a magnet responsive to said line current impulses, driving means for said second shaft, an escapement mechanism normally retaining the second shaft at rest, said escapement being released by said magnet to permit momentary movement of the second shaft whenever reversals occur in the line signaling conditions, and means controlled by said second shaft during said momentary movement for applying a corrective influence to said first shaft to retain the same in phase with the received line current impulses.

29. In a synchronous telegraph apparatus, a rotary shaft, driving means for rotating said shaft in approximate synchronism with received line current impulses, a correcting member movable into marking and spacing positions in response to received line current impulses, projections on said correcting member, positioned during said movement of the correcting member into the path of said shaft, in certain angular positions thereof, relative to the received signals, whereby to apply a corrective influence to the shaft to restore it into correct phase relation with the signals.

30. In a synchronous telegraph system, a substantially continuously rotatable shaft, a line magnet and solely mechanical means directly controlled by said line magnet for maintaining said shaft in synchronism with the received line current impulses.

31. In a synchronous telegraph system, a member movable over a predetermined path in synchronism with received line current impulses, a line magnet and solely mechanical correcting means directly controlled by said line magnet during the reception of solely character selecting impulses, for maintaining said member in synchronism with the received line current impulses.

32. In a synchronous telegraph system, a rotatable shaft, means for driving said shaft in approximate synchronism with received line current impulses, a corrector associated with said shaft, and means fixed to said shaft, said corrector engaging said last means along an inclined surface in different angular positions thereof, whereby said shaft is retarded in speed to apply a corrective influence thereto.

33. In a synchronous telegraph system, a rotatable shaft, means for driving said shaft in approximate synchronism with received line current impulses, correcting means associated with said shaft, independently of said driving means, and means controlled by line current impulses for

engaging said correcting means whenever said shaft gains phase relation to said signals, to retard the speed thereof without stopping the same, whereby to apply a corrective influence thereto.

5 34. In a synchronous telegraph apparatus, a rotatable shaft, means for driving said shaft in approximate synchronism with received line current impulses, correcting means associated with said shaft, signal controlled means movable into the path of said correcting means wherever the shaft gains in phase relation to said impulses, said signal controlled means engaging said correcting means along an inclined face whereby to retard the shaft without stopping the same, the period of engagement of said signal controlled means with said correcting means depending upon the extent of the out-of-phase relation of the shaft, whereby a corrective influence is applied to the shaft in proportion to the extent of said out-of-phase relation.

35. In a synchronous telegraph system, a rotatable shaft, means for driving said shaft in approximate synchronism with received line current impulses, correcting means associated with said shaft, means controlled by character selective impulses and movable into engagement with said correcting means to oppose the movement of said shaft, when an out-of-phase condition thereof occurs, said signal controlled means releasing said shaft for unrestricted movement, in a definite predetermined phase relation to said received line current impulses, whereby the shaft is completely restored to correct phase position upon each correction.

36. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, a corrector mechanism, cooperating with said shaft to apply a corrective influence thereto, to restore the same completely into correct phase relation upon each actuation of the corrector, and means responsive to character code signals for actuating said corrector during the reception of a character selecting combination of line current impulses.

37. In a synchronous distributor for a telegraph system, a segmented face plate, a brush movable over said face plate in synchronism with received line current impulses, a local source of potential, a single electro-magnet responsive to line current impulses, a power driven shaft, a commutator on said shaft, an escapement normally holding said shaft at rest, said escapement being released by said magnet upon each change of line signalling conditions to permit predetermined rotation of said commutator, said commutator being associated with said source of potential and said face plate whereby to apply the former to the latter in accordance with the operations of said magnet.

38. In a synchronous distributor for a telegraph system, a plurality of contacts, one for each impulse of a received character combination of line current impulses, means for completing said contacts in succession, in synchronism with received line current impulses, a power driven shaft, a commutator thereon, means responsive to line current impulses for controlling said shaft, a local source of potential, said commutator being associated with said local source of potential and said contacts whereby to apply the former to the latter in accordance with the received line current impulses.

39. In a synchronous distributor for a telegraph system, a plurality of contacts, one for each impulse of a received character code com-

bination of line current impulses, means for completing said contacts in succession, in synchronism with received line current impulses, a power driven shaft, an electromagnet responsive to line current impulses and controlling the movement of said shaft, contact means controlled by said shaft, a local source of potential, said latter contact means serving to variably apply said local source of potential to said first contacts in accordance with the operation of said magnet.

40. In a multiplex distributor, a plurality of groups of segments, each group having a segment corresponding to each impulse of a character code combination of impulses, a brush driven in approximate synchronism with received line current impulses, a correcting means associated with said shaft and having a correcting element corresponding to each segment of each group, a single electro-magnet responsive to line current impulses, and means controlled by said magnet for applying a correcting force to any one of said correcting elements.

41. In a synchronous telegraph system, a printing mechanism, a local source of power for supplying energy to operate said printing mechanism, a rotary shaft driven in approximate synchronism with received line current impulses, a single electro-magnet responsive to line current impulses, mechanical means controlled by said magnet, in response to selecting impulses for maintaining said shaft in phase with said line current impulses and means controlled jointly by said shaft and said magnet for selectively applying said local source of power to said printing mechanism to operate the same in accordance with said received line current impulses.

42. In a multiplex distributor, a face plate, a brush driven in approximate synchronism with received line current impulses, a plurality of multiplex printers associated with said face plate, an electro-magnetic device responsive to received line current impulses for applying received signalling conditions to said face plate, and a corrector for said distributor for maintaining the same in phase with said drive current impulses, said face plate comprising a single pair of rings and serving to distribute said signals to said printers and to supply local operating impulses thereto.

43. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, a second power driven shaft, normally at rest, an escapement for said second shaft, a line magnet controlling said escapement, cooperating corrector means on said shafts, serving to maintain said first shaft in phase with received line current impulses and means for preventing rebound of said second shaft.

44. In a synchronous telegraph apparatus, a member movable over a predetermined path in synchronism with received line current impulses, an electro-magnet responsive to received line current impulses and solely mechanical means controlled by said magnet upon reversals of line current impulses, for applying a corrective influence to said member to maintain the same in phase with said received impulses.

45. In a synchronous telegraph apparatus, a member movable over a predetermined path in synchronism with received line current impulses, a line magnet and solely mechanical means controlled by said line magnet in response to selecting impulses for stopping said member and re-

starting the same in phase relation to said received line current impulses.

46. In a synchronous telegraph apparatus, a member movable over a predetermined path in synchronism with received line current impulses, means tending to move said member at a rate slightly in excess of said synchronous speed, a line magnet and solely mechanical means controlled by said magnet for stopping said member and restarting it in phase relation to said received line current impulses, at a plurality of points along said predetermined path.

47. In a synchronous telegraph apparatus a member movable over a predetermined path in approximate synchronism with received line impulses and a correcting member movable momentarily in response to each change of received line impulses and serving during the movement to apply a corrective influence to said first member to correct any out-of-phase condition with respect to the received impulses.

48. In a synchronous telegraph receiver, a continuously rotating distributor, driving means therefor, a magnet responsive to all line current impulses and means mechanically controlled by said magnet in a plurality of angular positions of said distributor for applying a corrective force to said distributor without stopping the same.

49. In a synchronous telegraph receiver, a rotatable distributor, driving means therefor, a magnet responsive to all line current impulses and mechanical means controlled by said magnet in any one of a plurality of predetermined angular positions of said distributor for applying a corrective force to said distributor.

50. In a synchronous telegraph apparatus, a rotary distributor shaft, said shaft being normally free to rotate in substantial synchronism with received line current impulses, a second rotary shaft normally at rest, means for intermittently rotating said second shaft in predetermined phase relation to said received line current impulses and means on said second shaft cooperating with said distributor shaft in a plurality of different angular positions thereof to maintain the latter shaft in synchronism with said received line current impulses.

51. In a synchronous telegraph system, a rotatable shaft, means for driving said shaft in approximate synchronism with received line current impulses, a corrector associated with said shaft and means fixed on said shaft in a plurality of different angular positions thereof, said corrector engaging said last means along inclined faces whereby said shaft is retarded in speed to apply a corrective influence thereto.

52. In a synchronous telegraph apparatus, a

member movable over a predetermined path in synchronism with received line current impulses, a line magnet and means controlled by said line magnet in response to selecting impulses for stopping said member and restarting the same in a plurality of different angular positions thereof and in phase relation to said received line current impulses.

53. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, a magnet responsive to all said line current impulses and solely mechanical means controlled by said magnet for applying a correction to said shaft in any one of a plurality of different predetermined angular positions thereof.

54. In a synchronous telegraph apparatus, a rotary shaft, means for driving said shaft in approximate synchronism with received line current impulses, said shaft having a definite angular position corresponding to each impulse of a character code combination and mechanical corrector means for said shaft operable to apply a corrective influence thereto in any one of said angular positions.

55. In a synchronous telegraphic apparatus, a distributor comprising cooperating distributor elements normally free to move relative to each other in a substantial synchronism with received line current impulses, a rotary shaft normally at rest, means for intermittently rotating said shaft in predetermined phase relationship to said received line current impulses and means on such shaft cooperating with said distributor to modify the relative movement of the cooperating distributor elements so as to maintain the same in synchronism with said received line current impulses.

56. In a synchronous telegraph apparatus a distributor comprising cooperating distributor elements normally free to move relative to each other in substantial synchronism with received line current impulses, a toothed disc associated with one of said elements, a rotary shaft normally at rest, means for intermittently rotating such shaft in predetermined phase relationship to received line current impulses and means on said shaft cooperating with said toothed disc to apply a force to its associated distributor element thereby to modify the relative movement of the cooperating distributor elements so as to maintain the same in synchronism with said received line current impulses.

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