

Jan. 13, 1931.

E. JAUCH

**1,789,044**

# ELECTRICAL STRIKING MECHANISM FOR CLOCKS

Filed Nov. 21, 1929

3 Sheets-Sheet 1

FIG. 1.

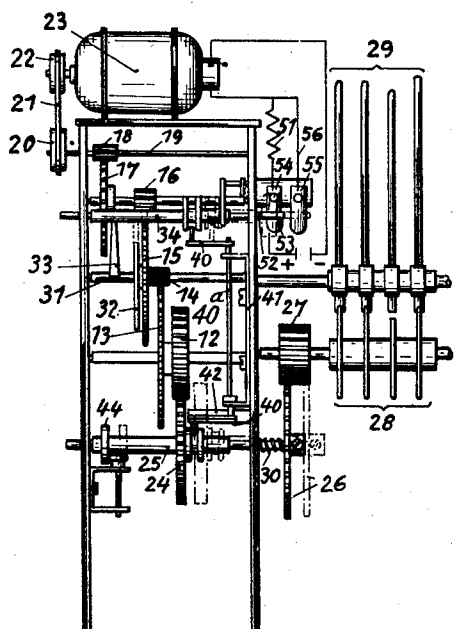


FIG. 2.

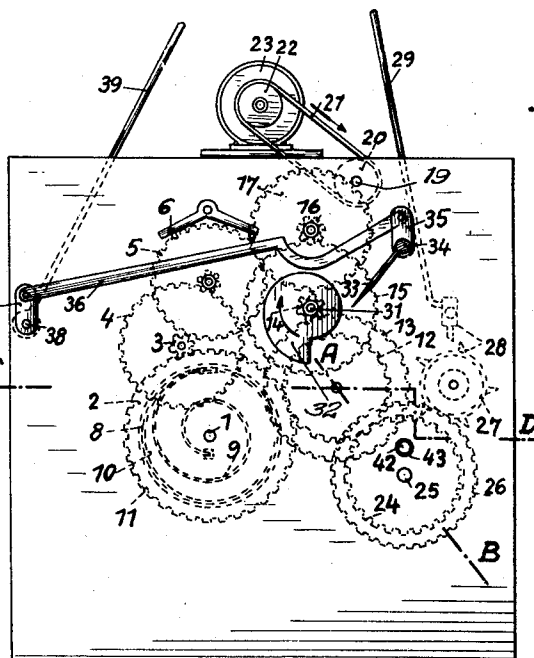
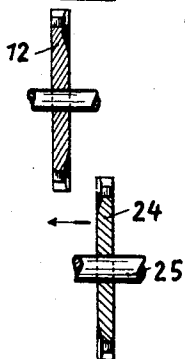


FIG. 4.



AG.5.

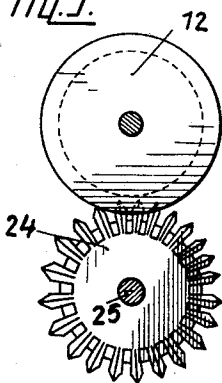
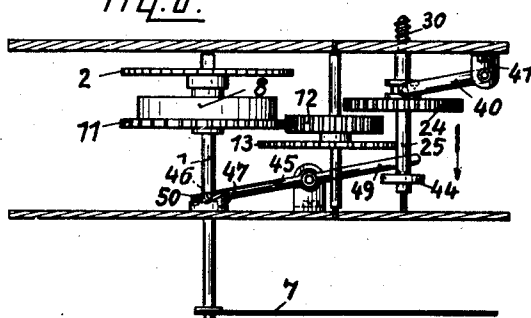


FIG. 6.



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FIG. 3.

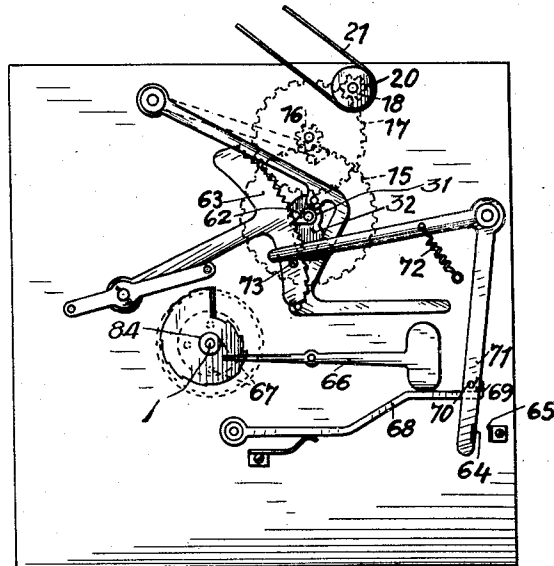


FIG. 7.

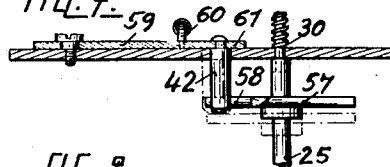
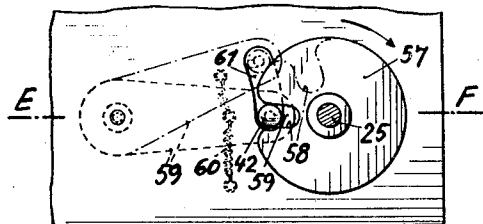


FIG. 8.



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Fig. 9.

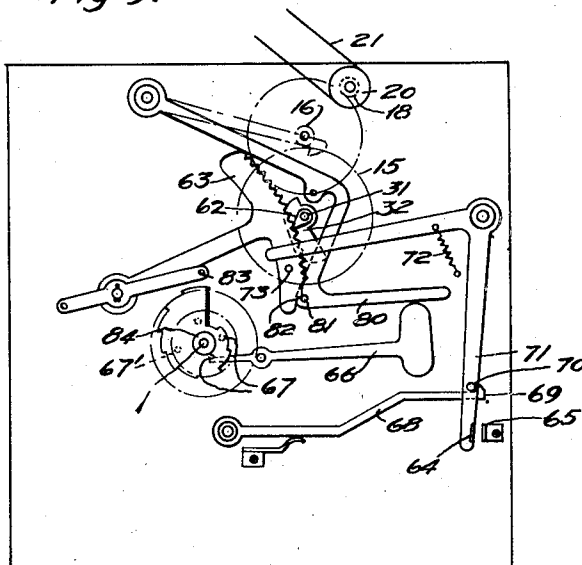
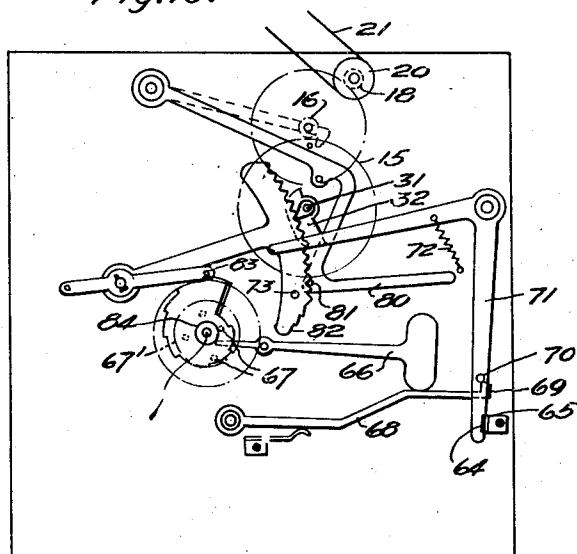


Fig. 10.



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# UNITED STATES PATENT OFFICE

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## ELECTRICAL STRIKING MECHANISM FOR CLOCKS

Application filed November 21, 1929, Serial No. 408,813, and in Germany September 18, 1928.

This invention has as its object an electrically driven clock with striking-train with several hammer striking mechanisms, for instance with bim-bam 4/4 stroke, Westminster chime and the like. The prior art has driven house clocks of this type with the aid of electric motors in the manner that it reduced the high number of revolutions of the motor by means of a reduction device in order to obtain thereby the power for winding the weights or the tension springs of the clock. By means of the slowly running down weights or springs the striking mechanism of the clock was then actuated by the aid of a transmission drive. This double conversion of the work, to be done by the driving motor, not only necessitated a voluminous gearing arrangement, which could cause more or less disturbance due to its noise, but the motor had to be dimensioned stronger from the very beginning in order to equalize again the oftentimes poor mechanical efficiency of wheel transmissions of this type. In a case like this the loss of power could be so great that the use of small weak current motors was made impossible. Hence, there existed from the very beginning a strong limit as to the choice of connection for clocks of this type.

These disadvantages are of particular importance in the case of clocks with striking trains having more than one hammer mechanism. It is usual in clocks of this type to arrange for each hammer movement a special driving mechanism whose source of power again strongly depends on the size of the clock or the required sound intensity of the quarter and hour strokes.

These disadvantages are eliminated, according to the present invention, in the manner that the driving mechanism of a hammer movement (quarter-hour striking-train) is driven, on the side of its rapidly moving transmission elements (fly movement), by means of an electric motor and is also used alternately for driving a further hammer movement (hour striking-train).

True enough, the prior art knows to drive electric half-hour striking-trains in the manner that an electric motor engages the fly

mechanism of the striking-train. It was, however, impossible up to the present time to utilize this manner of drive also for striking clocks with several hammer movements and to meet thereby a necessary requirement. It has been proven especially suitable, according to the present invention, to regulate the desired rhythm of the strokes according to each hammer movement in the manner that the number of revolutions of the driving motor are correspondingly changed by means of one or several resistances in series-connection with the motor.

In the drawings

Fig. 1 is a side-view of the clock looking from right to left in Fig. 2 with striking-train, the parts for the main train and the cataract being omitted,

Fig. 2 is a front view of the main train and the driving mechanism omitting the front work plate and the cataract,

Fig. 3 is a view of the mechanism of the escapement,

Fig. 4 is a magnified section along line A—B of Fig. 2,

Fig. 5 is a front view of the parts shown in Fig. 4,

Fig. 6 is a section along line C—D of Fig. 2 looking downwardly in Fig. 2,

Fig. 7 is a section along line E—F of Fig. 8 looking downwardly in Fig. 8,

Fig. 8 is a magnified view of the stop for the axle employed for the transmission of the stroke.

Figure 9 is a view similar to Figure 3 showing the releasing mechanism immediately before the release of the mechanism at the beginning of the chime action at the first quarter past one o'clock.

Figure 10 is a similar view before release of the mechanism at the beginning of the hour chimes at one o'clock.

The main train is represented by the minute arbor 1 with hand 7 and with minute wheel 2 which latter drives, over pinion 3 and intermediate wheel 4 the ratchet wheel 5 which acts, in the manner known in the prior art in unison with, for instance, a Graham anchor 6. On the minute arbor 1 is disposed the spring housing 8 with spring

9 in the manner that the spring 9, on the one hand, is connected to arbor 1 and, on the other hand, is coupled by means of a slip spring 10 with the spring housing 8 which latter in turn is rotatably disposed on arbor 1.

The toothed crown 11 of the spring case 8 is engaged by a winding wheel 12. To the latter are connected the following reduction mechanisms: On the same arbor with the winding wheel is mounted a further wheel 13. The latter engages a pinion 14 on whose arbor 31 is disposed the pawl 62 for the escapement rack 63, while the pawl wheel 15, itself, in turn engages an intermediate wheel drive 16. The wheel 17 of this pinion engages the pinion 18 mounted on the driving arbor 19. The latter contains a cord drive pulley 20 which is connected by means of a transmission loop 21 with a cord drive pulley 22 disposed on the armature shaft of the motor 23. The winding wheel 12, as last wheel of the driving mechanism 18, 13 is, besides, engaging a coupling wheel 24 on the arbor 25 of the stroke transmitting wheel 26 which, in the manner known in the prior art via the toothed wheel 27, drives the striking roll 28 for the hammers 29 of the quarter-stroke mechanism. The stroke transmitting arbor 25 is, under the action of a spring 30, movably arranged in axial direction in the manner that the coupling wheel 24 may become disengaged from the winding wheel 12.

To the pawl wheel arbor 31 is attached a striking disk or cam 32 which actuates in the known way a marking lever 33 disposed on an arbor 34. The movement of the marking lever 33 is transmitted by means of a connecting rod arrangement 35, 36, 37 to a hammer arbor 38 of the hour hammers 39. The arbor 34 together with the marking lever 33 are likewise axially movable in the same manner as the stroke transmitting arbor 25.

The two arbors 25 and 34 are connected, by means of a double crank or a pair of shifting arms 40, rigidly connected to each other by a transverse spindle 40a which is rotatably disposed in the double bearings 41, in a positive way in such manner that the marking lever 33 of the hour-stroke mechanism is disposed outside the path of the striking disk 32 as long as the coupling wheel 24 is engaged with the wheel 12. On the other hand the marking lever 33 acts in unison with the striking disk 32 when the teeth of the wheels 12 and 24 are not engaged. Due to the positive coupling of the two arbors 25 and 34 the spring 30 acts also upon arbor 34.

As may be seen from Figs. 1 and 2 there is disposed behind the coupling wheel 24 a stop pin 42 parallel to arbor 25. At a corresponding radial distance the wheel body 24 is provided with a bore 43 which, with the

rotation of wheel 24, moves into a position opposite to the stop pin 42. In this position the wheel 24 which, under the action of spring 30, moves constantly against the pin 42, can yield to the spring pressure and move in axial direction whereby the wheel 24 with its bore 43 slides along the stop pin 42. In this released position the quarter-stroke mechanism is just held by the stop pin 42.

Furthermore, the arbor 25 is provided with a collar 44, against which bears the arm 49 of a double lever 45, which has its bearing in the front plate of the mechanism, while the other arm 50 with a pin 46 engages a cam curve or face cam 47 disposed on the minute arbor 1. The rise of the curve 47 is formed in the manner, and is disposed with respect to the minute arbor and the minute hand in the manner, that the lever arm 50, during the time period between the hour stroke and the next following quarter stroke, is moved backwards which causes a movement of the stroke transmission arbor 25 and, thereby, the coupling of the wheel 24 with wheel 12.

On the arbor 1 is a disk 67' carrying quarter pins 67 and in the paths of these pins is one arm of a lever 65 pivoted intermediate its ends as shown in Figures 3, 9 and 10.

The mode of operation of the clock is as follows:

With the release of a quarter-stroke the electric motor 23 is switched in, by means of contact device 64, 65 shown in Figs. 3, 9 and 10. For this purpose the releasing lever 66 is lifted up by one of the pins 67 of the quarter disc so that the rack catch 80 with the pin 81 moves counter-clockwise (Fig. 9). The rack 63 with the pin 73 falls downwards and is caught by the pin 81 in the first step 82, (Fig. 9) at one quarter past the hour, in the second step at half past the hour and in the third step at three quarters past the hour due to the various liftings of the rack catch 80 according to the various distances of the pins 67 from the minute arbor 1. With the releasing of the 4/4-stroke, for instance at one o'clock (Fig. 10,) the falling of the rack 63 is limited by the pin 83 engaging the snail cam 84, whereby the catch pin 81 gears with the toothed sector of the rack like the known releasing mechanism of the mechanical clocks with Westminster chimes.

The releasing lever 66, at the dropping of the lifting pins 67, strikes a locking lever 68 and throws the latter so far downwards that the locking hook 69 releases the pin 70 of the contact lever 71. The latter bears, due to the pressure of a spring 72, with its contact 64 against the fixed contact 65, thereby closing in this manner the electric circuit. The electric motor drives, via the cord drive pulley 20, the driving mechanism 18, 17, 16, 15, 14, 13, 12. The winding wheel 12 causes the

rotation of the spring housing 8 and winds up in this manner the spring 9 of the main train 2, 3, 4, 5, 6 or, in other words, keeps the spring 9 under tension. If the latter is already entirely wound up the slip spring 10 glides with friction, with the further rotation of the spring housing 8, on the inner circumference of the spring housing in order to prevent in this manner an excess tension for the spring 9. In this way the driving power for the main train is renewed with each striking action with the result that its tension varies within relatively narrow limits.

The spring 9, that is its power, may be dimensioned in the manner that it represents for the clock a larger running reserve, i. e. the main train runs for several hours even if the drive by means of the electric motor has been interrupted for some reason or other.

By a suitable choice of transmission between wheel 12 and spring case 8 it is possible to wind the spring again automatically, after the driving reserve has been used up, within a relatively short time; hence, the spring is wound during a definite period of time to a greater degree than it has run down in the same time period. It is evident that the driving reserve may even be increased by having the spring housing engage the minute arbor not directly but by driving the latter by means of a transmission. There may be also employed, instead of a spring 9, a weight.

Simultaneously with the spring housing 8 the coupling wheel 24 is driven. This drive is transmitted via arbor 25 over the stroke transmission wheel 26 to the striking mechanism 28, 29 of the quarter-hour striking movement. This action is the same in all four quarter-strokes. After the finish of the 4/4-stroke that striking train must be switched to the hour-stroke. This is accomplished, according to the present invention by means of the automatic coupling between wheels 12 and 24. The wheel 24, which moves constantly under the spring pressure 30 against the stop 42, makes one revolution per hour. The bore 43 is disposed, with respect to the mechanism of the hands or the pawl of the escapement, in such manner that it is exactly opposite the stop pin 42 after the end of the 4/4 stroke. This allows the wheel 24 to move out of the way in axial direction under the spring pressure 30 and to become disengaged with the wheel 12. At this moment the quarter-stroke mechanism is idle while the driving mechanism 18, 12 continues to move. Simultaneously with the movement of wheel 24 the marking arbor 34 is axially moved, by means of the double crank 40, so far that the marking lever 33 enters into the path of the striking disk 32.

The marking lever 33 is raised, with each turn of the arbor 34, i. e. with each turn of the pawl 62, by the striking disk 32 and dropped again. This movement is transmitted by the rod arrangement 35, 36, 37 and produces finally the striking motion of the hour hammers 39. As previously mentioned, the escapement does not only take over the mechanical control of the striking mechanism but actuates beside also the contact device since the rack 63 lifts, after each quarter-hour stroke and the last hour-stroke, with a pin 73 the contact lever 71 from the contact 65, thereby stopping the motor.

During the period of time between the hour-stroke and the next following 1/4-stroke the cam curve 47 moves the double lever 45 slowly and gradually in such manner that the arbor 25, against the direction of the pressure of spring 30 is moved forwards, thereby engaging the wheel 24 with the wheel 12. With this the striking mechanism is again set for the coming quarter-stroke, which occurs in the above described way.

In many striking mechanisms it is necessary to drive the different hammer movements with different velocities. For instance the driving mechanism of a Westminster movement must move faster at the hour-stroke than at the quarter-hour strokes. According to the present invention there is connected in such cases a resistance 51 in series with the motor, as long as the quarter striking mechanism is actuated (Fig. 1). The extended end 52 of the arbor 34 connects for this purpose the current tap 53, shown in dot-dash lines, with a contact spring 54 of the resistance 51.

A second contact spring 55 is disposed beside the first one 54 which is connected with a direct line 56 with the motor 23. With the axial movement of the arbor 34 at the time of the change of the driving mechanism from the quarter-stroke to the hour-stroke the arbor end 52 comes in contact with the contact spring 55, thereby connecting the current tap 53 over 55 and 56 with the motor by bypassing the resistance 51. Hence the motor runs faster due to the tension increased by the value of resistance 51. It is a matter of course that the construction of the contacts and the resistance may be of different choice, as well as the arrangement thereof.

For the purpose of accomplishing the coupling of wheel 24 with wheel 12 in any easy manner and free from disturbance it is of advantage to sharpen the teeth of these wheels at the adjacent sides to a wedge-like form, as shown in Figs. 4 and 5. By this means possible displacements of the non-moving wheel 12 relative to the wheel 24, which might be caused by a possible play in the teeth and would hinder a faultless cou-

pling of the two wheels 12 and 24, are again equalized.

When adjusting the clock, for instance when checking by means of repeating the striking mechanism, it may happen that the lever 45 is actuated, by means of turning the hand 7, even during the striking of the hours with the result that the coupling wheel 24 comes within the range of the rotating wheel 12. On the other side, however, the wheel 24, as long as it is not fully in contact with wheel 12, is prevented from rotating by the stop pin 42. Some kind of disturbance must occur in this manner.

This danger is met, as shown in Figs. 7 and 8, in the manner that the stop pin 42 is disposed in flexible manner. There is fixed, besides on the stroke transmission arbor 25, a stop disk 57 with a cut 58 which corresponds to the bore 43 according to Fig. 2. This stop pin 42 is fixed on a swinging lever 59 which has its bearings on the backside of the backplate of the mechanism, which lever is acted upon by a tension spring 60. The stop pin 42 extends through a slot 61 of the backplate, which is formed in such manner that its lower end controls the rest position of the stop pin 42 while the upper end is placed so high that the pin 42 may swing out sufficiently far to move over the circumference of disk 57 (dash-dotted position according to Fig. 8).

This device operates in the following manner: In the coupled state during the quarter-strokes the disk 57 moves, due to the spring pressure 30, against the stop pin 42. After the finish of the 4/4 stroke the cut 58 is located opposite the stop pin 42 so that the disk 57 together with arbor 25 and wheel 24 may move axially, thereby stopping the quarter-stroke mechanism (Fig. 7). Now, when, as mentioned before, at the setting of the clock, the wheel 24, by the turning of the minute hand, should be coupled again, already during the striking of the hour, the wheel 24 and, therefore, arbor 25 may follow the rotation of wheel 12 without causing damage of any kind. In this case the disk 57 moves into the position according to Fig. 7 and carries the pin 42 with it until the latter emerges from the cut 58 and can, with the further rotation of disk 57, bear against the circumference of the latter. When in the meantime the rotation of the minute hand continues, also arbor 25 and with it disk 57 are more and more moved axially until the wheel 24 is finally coupled. At the same time the disk 57 has moved outside the range of pin 42 and the stop pin 42, due to the action of spring 60, resumes its original position according to Fig. 8.

Having thus described my invention what I claim is:

1. In an electrically driven clock, having multiple hammer strike movements, the

combination of a train of gears for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and an electric motor for actuating said train of gears, said train of gears including a striking cam for actuating a part on one of said movements, said cam being secured to one of the arbors of said train of gears.

2. In an electrically driven clock, having multiple hammer strike movements, operating at different velocities, the combination of a train of gears for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements, an electric motor, for actuating said train of gears, and a means for changing the velocity of said motor at the moment of changing the operative connection of said train of gears from one of said hammer movements to the other one.

3. In an electrically driven clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and an electric motor, for actuating said train of gears, said changing means including a toothed gear on one of said movements, in engagement with a toothed gear, forming an element of said train of gears, when the latter is driving said movement, one of said gears being axially movable with relation to the other one, a means for axially shifting one of said gears, thereby disengaging the same from the other gear at the moment of changing the operative connection of said train of gears from one of said movements to the other one, thereby operatively disconnecting said train of gears therefrom, and a stop, for engaging the shifted gear at said moment, thereby retaining the said shifted gear with the arbor thereof in position.

4. In an electrically driven clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and an electric motor, for actuating said train of gears, said changing means including a toothed gear on one of said movements, in engagement with a toothed gear, forming an element of said train of gears, when the latter is driving said movement, one of said gears being axially movable with relation to the other one,

a means for axially shifting one of said gears, thereby disengaging the same from the other gear at the moment of changing the operative connection of said train of gears from one of said movements to the other one, thereby operatively disconnecting said train of gears therefrom, a stop, for engaging a part on the arbor of the shifted gear at said moment, thereby retaining the said shifted gear with the arbor thereof in position, and a resilient means for thereupon permitting the manual rotation of said arbor in one direction, said means thereupon to return said pin to its original position, to engage said part when said arbor is brought to the position of the engagement of said part thereon by said pin.

5. In an electrically driven clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and an electric motor for actuating said train of gears, said changing means including an axially shiftable arbor on said train of gears, a striking cam in said train of gears, for actuating a part on one of said movements when said arbor is in one of its predetermined positions and a means for automatically shifting said arbor axially thereof, thereby periodically removing said cam from the plane of coaction with said part.

6. In an electrically driven clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and an electric motor, for actuating said train of gears, said changing means including a pair of axially shiftable arbors in said train of gears, a revolvably mounted member in said train of gears periodically to actuate a corresponding member on one of said movements, a revolvably mounted part on one of said arbors, periodically to actuate a corresponding part on another of said movements, a pair of shifting arms, rigidly connected to each other at their inner ends and jointly pivotally mounted to be turned in unison, the outer end of each of said arms being slidably-pivotally connected to one of said arbors, and a means for periodically and automatically turning said arms around their joint pivot, thereby simultaneously shifting said arbors axially thereof and thereby alternately bringing said corresponding members and said corresponding parts into coaction with each other.

7. In an electrically driven clock, having multiple hammer strike movements, the com-

bination of a train of gears, for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and an electric motor, for actuating said train of gears, said changing means including a pair of axially shiftable arbors on said train of gears, a revolvably mounted member in said train of gears periodically to actuate a corresponding member on one of said movements, a revolvably mounted part on one of said arbors, periodically to actuate a corresponding part on another of said movements, a pair of shifting arms, rigidly connected to each other at their inner ends and jointly pivotally mounted to be turned in unison, the outer end of each of said arms being slidably-pivotally connected to one of said arbors, a means for axially shifting one of said arbors in one direction, connected thereto, thereby causing said arms to shift said other arbor axially in one direction, and a face cam actuated by said gears for periodically axially shifting said first mentioned arbor, thereby causing said arms simultaneously to shift said other arbor axially in the opposite direction, thereby alternately bringing said corresponding members and said corresponding parts into coaction with each other.

8. In a clock, having multiple hammer strike movements, the combination of a train of gears for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and a means for actuating said train of gears, said train of gears including a striking cam for actuating a part on one of said movements, said cam being secured to one of the arbors of said train of gears.

9. In a clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and a means for actuating said train of gears, said changing means including a toothed gear on one of said movements, in engagement with a toothed gear, forming an element of said train of gears, when the latter is driving said movement, one of said gears being axially movable with relation to the other one, a means for axially shifting one of said gears, thereby disengaging the same from the other gear at the moment of changing the operative connection of said train of gears from one of said movements to the other one, thereby operatively disconnecting said train of gears therefrom, and a stop, for engaging the shifted gear at said moment, thereby

retaining the said shifted gear with the arbor thereof in position.

10. In a clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements  
5 at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and a means  
10 for actuating said train of gears, said changing means including a toothed gear on one of said movements, in engagement with a toothed gear, forming an element of said train of gears, when the latter is driving said  
15 movement, one of said gears being axially movable with relation to the other one, a means for axially shifting one of said gears, thereby disengaging the same from the other gear at the moment of changing the opera-  
20 tive connection of said train of gears from one of said movements to the other one, thereby operatively disconnecting said train of gears therefrom, a stop, a part on the arbor of the shifted gear for engagement by  
25 the stop at said moment, thereby retaining the said shifted gear with the arbor thereof in position, and a resilient means for thereupon permitting the manual rotation of said arbor in one direction, said resilient means  
30 being arranged to return said pin to its original position, to engage said part when said arbor is brought to the position of the engagement of said part thereon by said pin.

11. In a clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements  
35 at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and a means for  
40 actuating said train of gears, said train of gears including an axially shiftable arbor in said train of gears, a striking cam in said train of gears, for actuating a part on one  
45 of said movements when said arbor is in one of its predetermined positions and a means for automatically shifting said arbor axially thereof, thereby periodically removing said cam from the plane of coaction with said  
50 part.

12. In a clock, having multiple hammer strike movements, the combination of a train of gears, for driving one of said movements  
55 at any one time, a means for alternately changing the operative connection of said train of gears from one of said movements to another of said movements and a means for actuating said train of gears, said changing  
60 means including a pair of axially shiftable arbors on said train of gears, a revolvably mounted member in said train of gears periodically to actuate a corresponding member on one of said movements, a revolvably  
65 cally to actuate a corresponding part on an-

other of said movements, a pair of shifting arms, rigidly connected to each other at their inner ends and jointly pivotally mounted to be turned in unison, the outer end of each of said arms being slidably-pivotally connected to one of said arbors, and a means for periodically and automatically turning said arms around their joint pivot, thereby simultaneously shifting said arbors axially thereof and thereby alternately bringing said corresponding members and said corresponding parts into coaction with each other.

Signed at Schwenningen-on-the-Neckar, Germany, this 9th day of September, A. D. 1929.

ERHARD JAUCH