Dec. 22, 1931. S. MAZUR 1,837,462

CLOCK

Filed May 10, 1926 5 Sheets-Sheet 1

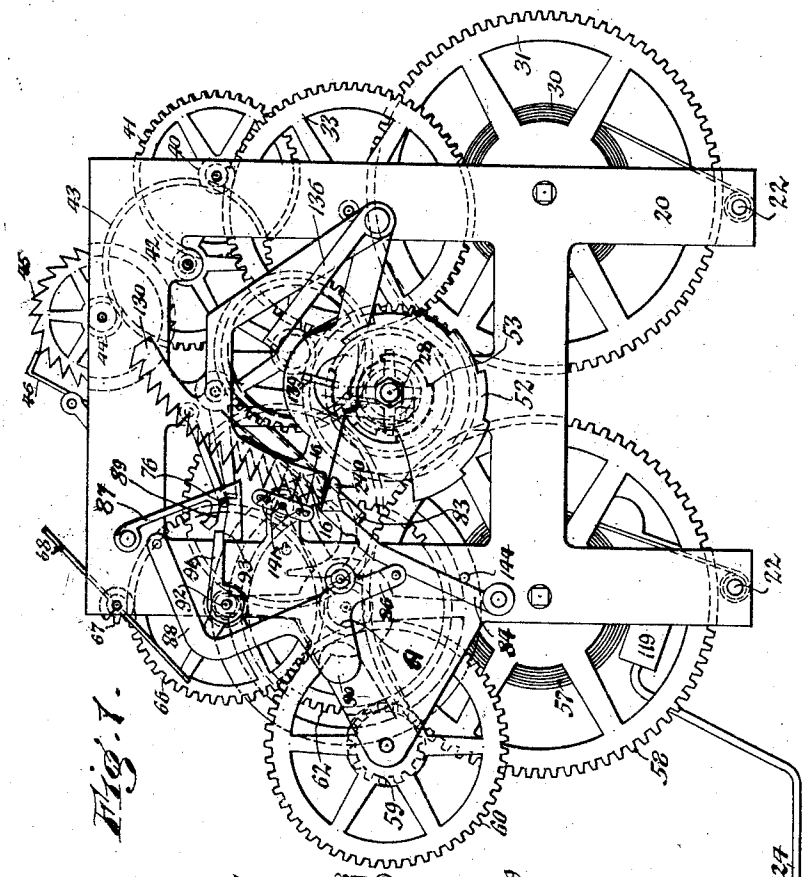


Fig. 1.

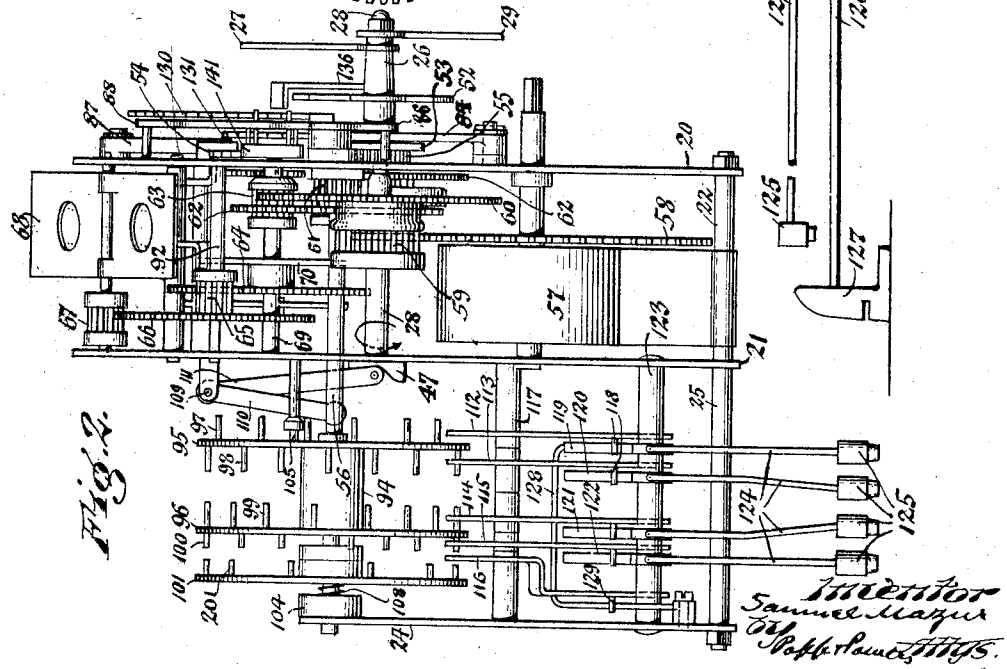


Fig. 2.

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CLOCK

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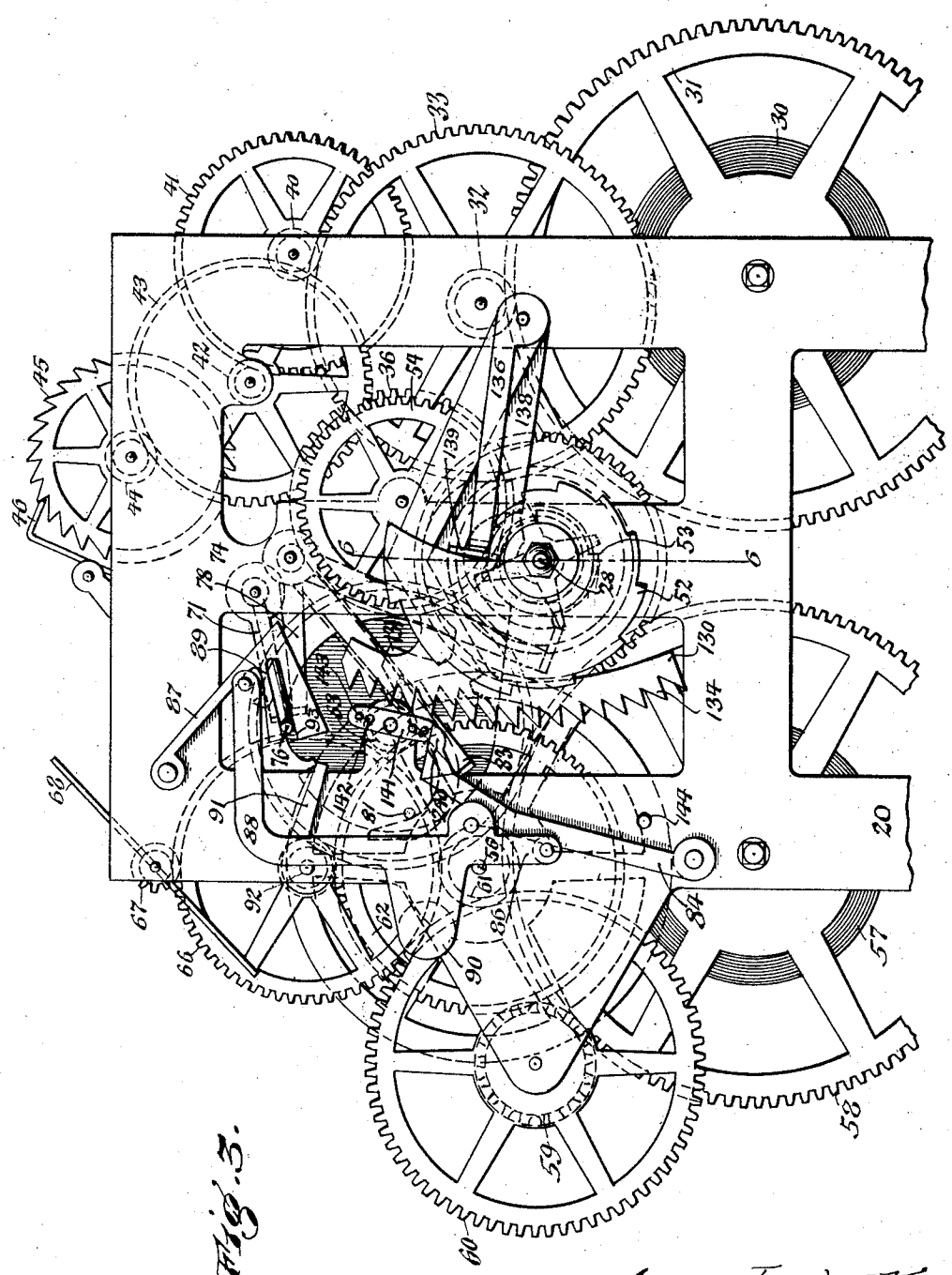


Fig. 3.

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CLOCK

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Fig. 3.

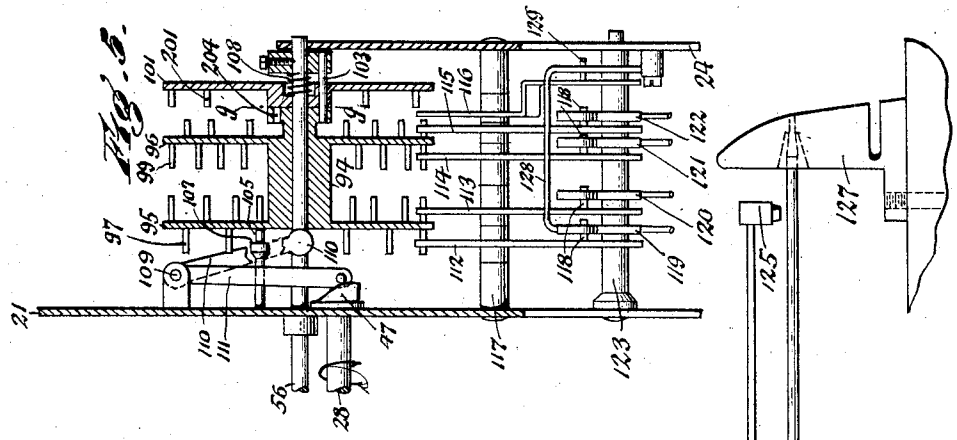
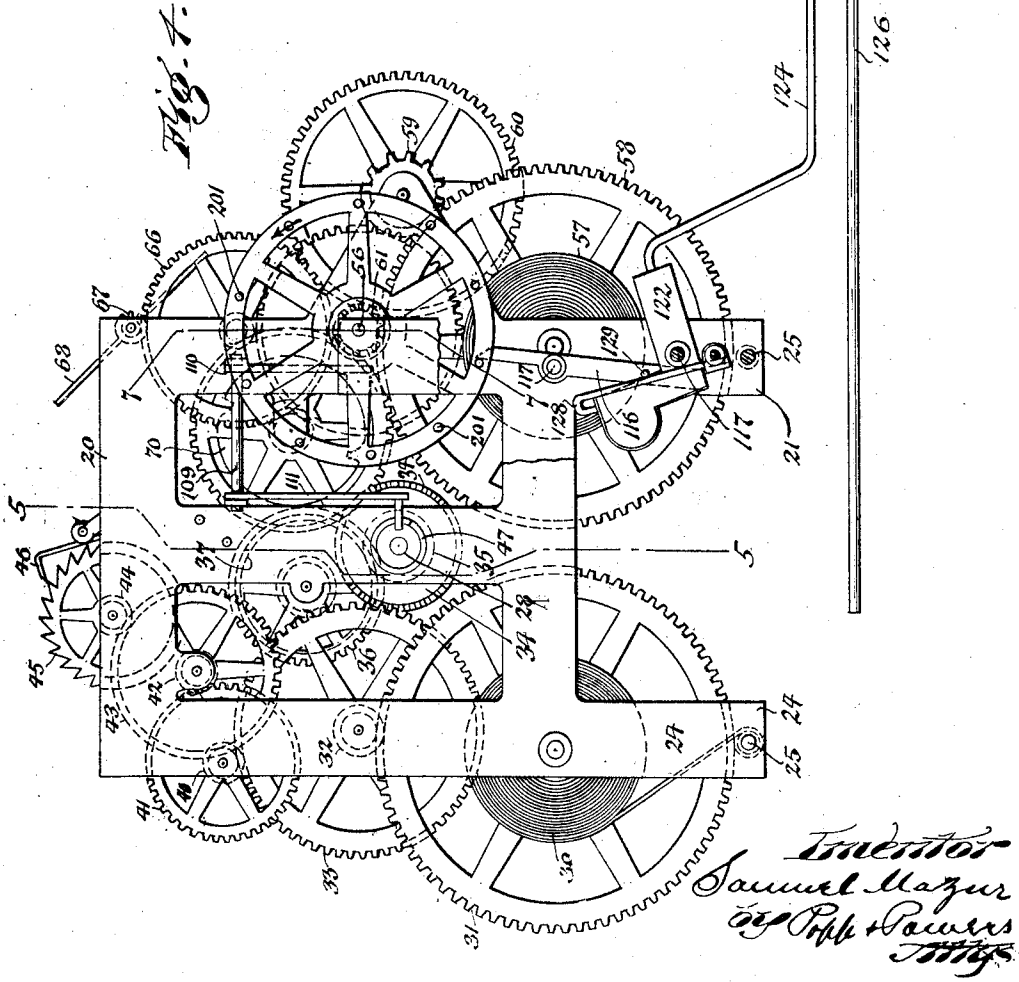


Fig. 4.



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CLOCK

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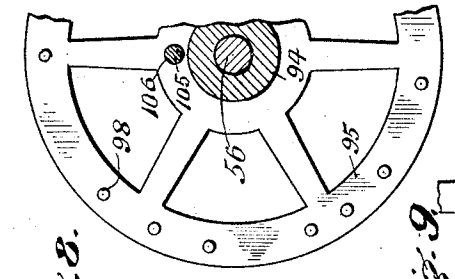


Fig. 8.

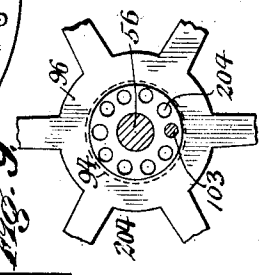


Fig. 9.

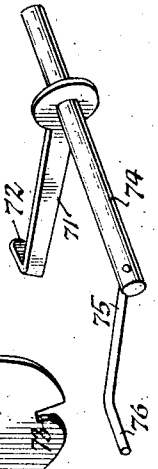


Fig. 12.

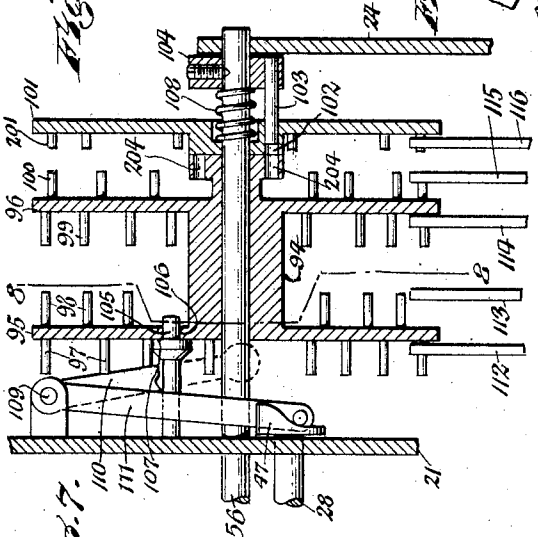


Fig. 7.

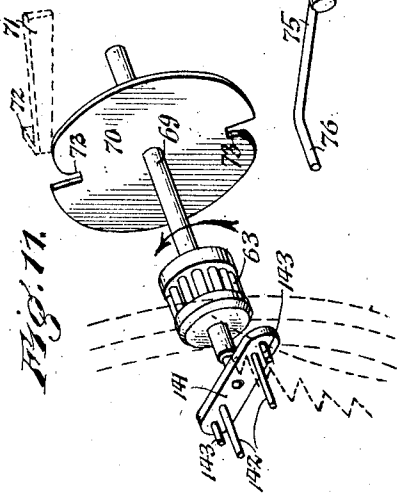


Fig. 11.

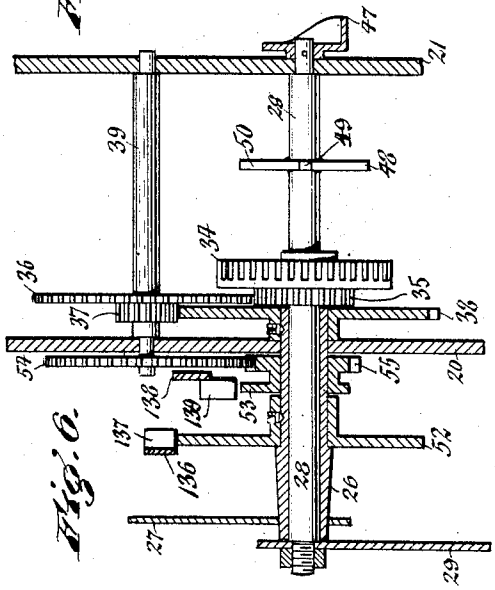


Fig. 6.

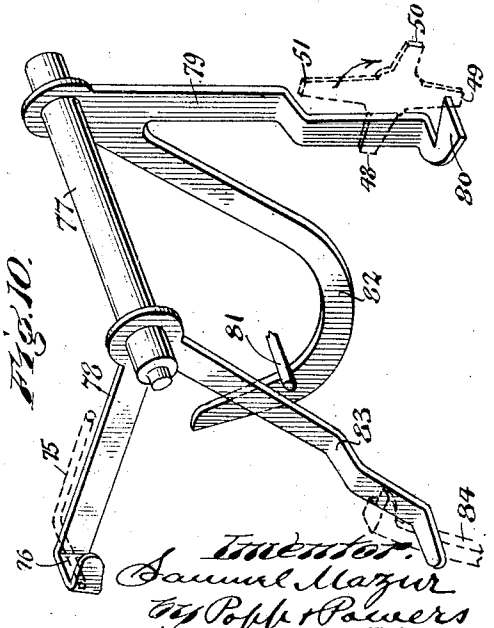


Fig. 10.

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CLOCK

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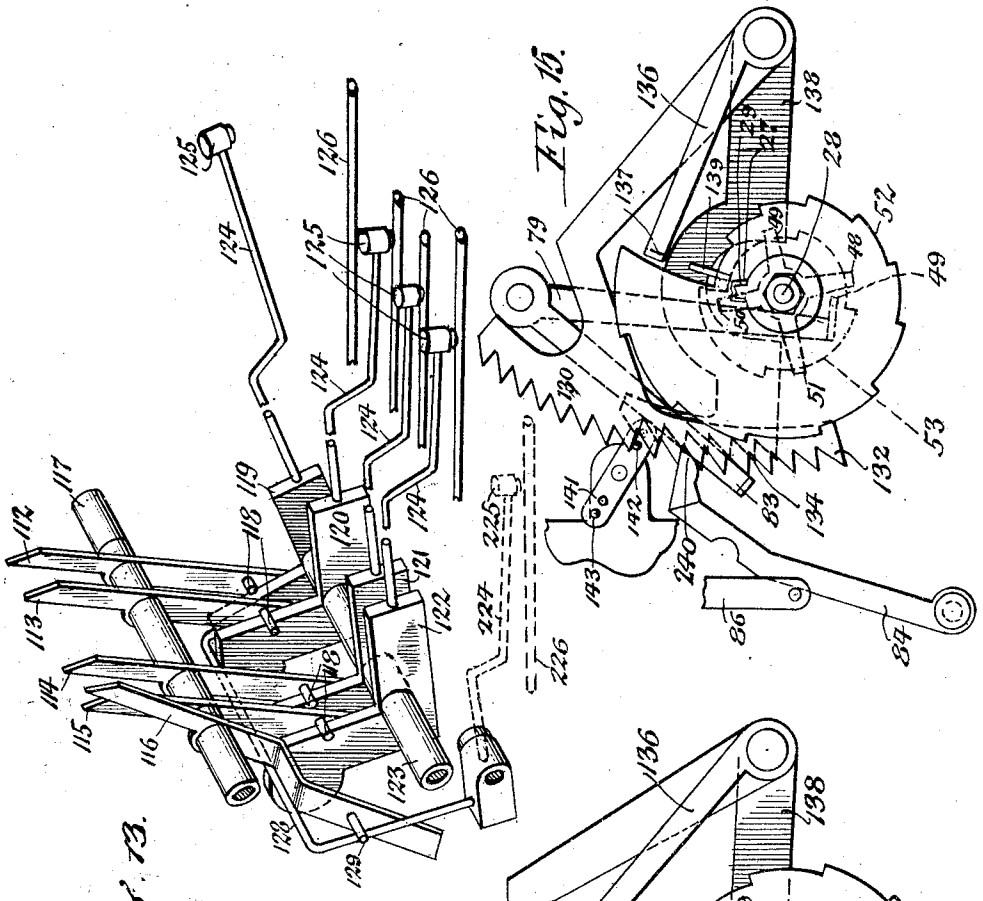


Fig. 13.



Fig. 15.

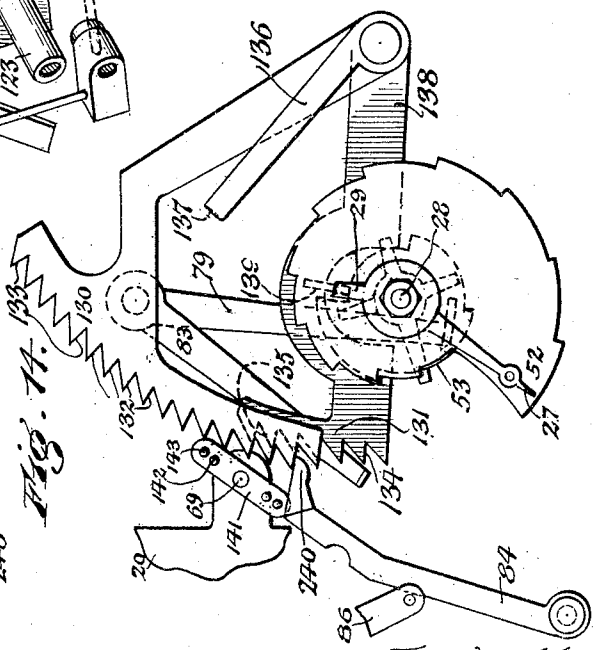


Fig. 14.

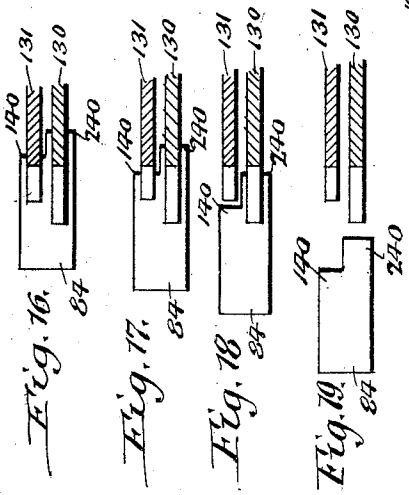


Fig. 16. Fig. 17. Fig. 18. Fig. 19.

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Patented Dec. 22, 1931 1,837,462

# UNITED STATES PATENT OFFICE

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## CLOCK

Application filed May 10, 1926. Serial No. 108,044.

This invention relates to a clock which strikes the hours and also chimes the four quarters of each hour.

Heretofore clocks having this capacity employed three distinct sources of power, usually springs, one of which furnished the power for the time mechanism, another the power for the hour striking mechanism, and still another for operating the chime mechanism every quarter of an hour. Clocks of this type were therefore quite elaborate and expensive which limited their use to persons of ample means.

It is the object of this invention to provide a clock in which the striking mechanism and the chime mechanism are driven from the same prime mover, in this instance a single spring, thereby not only simplifying the construction and rendering the same more compact, but also materially reducing the cost and the liability of derangement and enabling such clocks to come into more general use.

In the accompanying drawings:—

Figure 1 is a front elevation of a clock embodying an approved form of my invention and showing the parts in the position which they occupy when the time mechanism only is in operation.

Figure 2 is a side elevation of the same.

Figure 3 is a front elevation, on an enlarged scale, showing the position of the parts when the clock is about to chime four quarters and strike the twelfth hour, and the hour and minute hands omitted.

Figure 4 is a rear elevation of the clock.

Figure 5 is a fragmentary vertical section taken on line 5—5 Fig. 4, but also showing the strike mechanism cut out and the chime mechanism in its operative position.

Figure 6 is a fragmentary vertical longitudinal section on an enlarged scale, taken on line 6—6 Fig. 3, but showing the parts in the position which they occupy at half past twelve o'clock.

Figure 7 is a fragmentary vertical longitudinal section on an enlarged scale, taken on line 7—7 Fig. 4, and showing the strike mechanism in its operative position and the chime mechanism cut out.

Figure 8 is a fragmentary cross-section taken on line 8—8 Fig. 7.

Fig. 9 is a fragmentary cross-section taken on line 9—9 Fig. 5.

Figure 10 is a perspective view of the mechanism which controls the release of the motive power for driving the chime and striking mechanism and which is commonly known as the "wish bone".

Figure 11 is a similar view of the locking disk forming part of the means for preventing the power from operating the chime and striking mechanism and also the lifter and pinion forming part of the means for operating the chime and striking mechanism.

Figure 12 is a similar view of the locking arm and lifting wire forming parts of the stop mechanism for controlling the operation of the chime and striking mechanism.

Figure 13 is a similar view of part of the mechanism for operating the chime and striking gongs or rods.

Figures 14 and 15 are fragmentary front elevations of the striking and chiming snails and associated parts of the mechanisms which control the operation of the chime and striking mechanism.

Figures 16, 17, 18, 19 are cross sections, on an enlarged scale, taken on line 16—16 Fig. 1, showing different positions of the detent pawls.

Similar characters of reference indicate like parts in the several figures of the drawings.

The main frame of this clock may be of any suitable construction to support the various working parts but in the preferred construction shown in the drawings, the same comprises upright front and rear plates 20, 21 which are connected by horizontal rods or posts 22, and an upright auxiliary plate 24 arranged in rear of plate 21 and connected with the latter by horizontal posts 25. The numeral 26 represents the tubular shaft or socket which carries at its front end the hour hand 27 and which is journaled in a suitable bearing in the front plate in the frame. Turning within this hour shaft 26 and also journaled on the rear plate 21 is a center post or minute shaft 28 which carries at its front

end the minute hand 29 of the clock. Motion for driving the hour and minute shafts 26 and 28 is derived from the main or time spring 30 and is transmitted to these shafts for turning the minute shaft twelve times during one rotation of the hour shaft, the means for this purpose being well known and consisting generally of a winding gear wheel 31 operatively connected with the main or time spring, a gear pinion 32 meshing with the winding gear wheel 31 and connected with a gear wheel 33, a gear 34 secured to the minute shaft 28 and meshing with the gear wheel 33, a gear pinion 35 secured to the minute shaft and meshing with a gear wheel 36, and a gear pinion 37 connected with the gear wheel 36 and meshing with a gear wheel 38 on the hour shaft 26, as shown in Figs. 1, 2, 3, 4 and 6. The gears 36 and 37 are mounted on an intermediate shaft 39 which is journaled in the front and rear plates of the frame, shown in Fig. 6. The rotation of this train of gearing is retarded by the usual retarding mechanism which comprises a gear pinion 40 meshing with the intermediate gear wheel 33 and connected with a gear wheel 41, a gear pinion 42 meshing with the gear wheel 41 and connected with the gear wheel 43, a gear pinion 44 meshing with the gear wheel 43 and connected with an escapement wheel 45, and an oscillating pallet 46 engaging with the escapement wheel, as shown in Figs. 1, 2, 3 and 4.

This time mechanism has certain elements whereby the same cooperates with the chime and striking mechanism for maintaining these mechanisms normally in synchronism and cause the chime and striking mechanism to operate at the proper time. These means which will now be mentioned but described more fully later on consist of a shifting cam 47 secured to the rear end of the minute shaft so as to turn therewith once per hour; a tappet or star wheel mounted on the minute shaft and having three tappets or short teeth 48, 49, 50, and a long tappet or tooth 51 arranged equidistant around the axis of the minute shaft on the different quarters thereof; a striking snail 52 arranged on the tubular hour shaft and having twelve steps which correspond to twelve hours of the day and are arranged successively nearer to the axis of this shaft beginning with the first hour and ending with the twelfth hour; a chime snail 53 turning about the axis of the hour and minute shaft and preferably journaled on the tubular hour shaft, as shown in Fig. 6; and a gear wheel 54 secured to the front end of the intermediate shaft 39 so as to turn with the gears 36 and 37, and meshing with a gear pinion 55 on the chime snail 53.

The numeral 56 represents a main driving shaft from which motion is transmitted to the striking and chime mechanism of the clock as will hereinafter appear. This shaft is journaled lengthwise and horizontally in bearings in the front, rear and auxiliary plates of the main frame, as shown in Figs. 1, 2, 3, 4 and motion is transmitted by a main spring 57 to this main shaft so that the chime mechanism and the striking mechanism both receive their power from the same spring for operating the chime mechanism at each of the four quarters of every hour and the striking mechanism at each hour of the day. The train of gearing for transmitting motion from the main spring 57 to the main shaft 56 is so organized that a greater number of turns are obtained for operating the striking and chime mechanism than are usually obtained for operating the striking mechanism only, and for this purpose this speed increasing train of gearing preferably comprises a main or winding gear wheel 58 connected with the main spring 57 and meshing with a gear pinion 59, and a gear wheel 60 connected with the pinion 59 and meshing with a gear pinion 61 on the main driving shaft 56, as shown in Figs. 1, 2, 3 and 4. For the purpose of retarding the motion of this train of gears under the action of the main spring 57, a retarding or brake device is provided which preferably consists of a gear wheel 62 connected with the pinion 61 and meshing with a gear pinion 63, a gear wheel 64 connected with the pinion 63 and meshing with a gear pinion 65, a gear wheel 66 connected with the pinion 65 and meshing with a gear pinion 67, and a rotary fly or fan blade 68 connected with the pinion 67 and adapted to produce a resistance when rotating in the air.

The gear pinion 63 and gear wheel 64 are mounted on a lifting shaft 69 which is journaled in the main frame and which forms parts of the mechanism for operating the chimes and the strokes of the clock.

When the chime and striking mechanism are not in operation the main spring 57 is prevented from turning the shaft 69 and the parts geared therewith, this being accomplished in the present case by a locking disk 70 secured to the shaft 69, and a vertically swinging locking arm 71 having a locking finger 72 adapted to engage with one or the other of two notches 73 formed in the periphery of the locking disk 70, as shown by dotted lines in Fig. 11. Upon raising the locking arm 71 the disk 70 is released and the mechanism geared to the shaft 69 is permitted to operate as will presently appear. The lifting of the locking arm 71 is effected by a lifting shaft 74 to which it is connected and which is journaled on the main frame, a lifting arm 75 connected with the lifting shaft and provided with a lifting finger 76, a controlling rock shaft 77 journaled on the main frame and provided with a controlling arm 78 adapted to engage with the underside of the lifting finger 76 and lift the same, and a tappet arm 79 secured at its upper end

to the controlling rock shaft 77 and provided at its lower end with a laterally projecting lug 80 adapted to engage with one or another of the teeth or tappets of the star wheel.

At the end of every quarter hour one of the tappets of the star wheel engages with the lug of the tappet arm and turns the same so as to lift the arms 78, 75, 71 and disengages the latter from the locking disk 70 thereby permitting the spring 57 to turn the shaft 69 and the parts geared therewith. At this time however the shaft 69 is only permitted to turn for a short time to put the mechanism in warning condition preparatory to actually sounding the chimes alone at the first, second and third quarters of the hour, or sounding the chimes four times and following the same with the sounding of the strike at the end of each hour.

This warning control is effected in the usual and well known manner by a warning pin 81 on the gear wheel 66 which is engaged by a warning stop arm 82 on the controlling shaft 77. When therefore, the locking arm 71 is released from the locking disk 70 the warning arm 82 at the same time moves across the path of the warning pin 81 whereby the gearing is only permitted to advance far enough to carry the respective notch 73 of the locking disk out of register from the locking lug 72 of the locking lever. When therefore the respective tooth of the star wheel again clears the tappet arm the latter can swing backwardly for disengaging the warning arm 82 to release the warning pin and permit the train of gearing associated therewith to advance as far as required, because at this time the respective locking notch notch 73 has moved forwardly out of register with the locking lug 72.

Inasmuch as the locking disk at times is obliged to make one or more complete rotations in order to properly sound the chimes and strike the hour, means are provided for preventing the locking arm for re-engaging a notch 73 until after the required number of quarter chimes and hour strikes have been given. This is accomplished by means which operate to hold the locking arm 71 out of operative engagement as long as required and these means, in the present device comprise a trip arm 83 connected with the controlling shaft 77, a detent arm 84 which performs an additional function to be described later on, but for the present purpose is pivoted on the main frame and engaged by the trip arm, an intermediate lever pivoted on the main frame and having a lower arm 86 adapted to be engaged by the detent arm 84, a cam arm 87 pivoted on the main frame and adapted to be engaged by the upper arm 88 of the intermediate lever, and a cam 89 formed in the lower end of said cam arm and adapted to control the engagement of the locking arm 71 with the notches of the locking disk 70. The intermediate lever 86, 88 has a weight 90 which operates to turn the same by gravity in the direction for engaging its lower arm 86 with the detent arm. When therefore the locking arm 71 is raised by the star wheel to release the locking disk the cam 89 holds the locking arm in its inoperative position until the detent arm returns to its normal position, as will be described later on, thereby insuring turning of the locking disk 70 and the parts associated therewith the requisite extent.

When the detent arm 84 returns to its normal position after the chime and stroke operations have been effected, the cam 89 is moved by gravity in the direction for permitting the locking arm 71 to re-engage the locking disk 70 and stop the counting device associated with the chime and striking mechanisms and the sounding operations of the latter.

If desired, an auxiliary stop may be provided for directly arresting the rotation of the fan blades 68, this being accomplished by a stop arm 91 arranged on the shaft 92 which carries the fan gear wheel 66 and a shoulder 93 arranged on the cam arm 87 and movable out of the path of the stop arm 91 to permit the fan to turn when the chiming and striking mechanisms are released for operation and to move into the path and arrest the rotation of said stop arm when the rocking arm 71 is re-engaged with the locking disk and stop the operation of the chiming and striking mechanisms.

Those parts of this invention whereby each quarter hour and each hour is sounded are constructed as follows:—

Slidable lengthwise on the main shaft 56 between the rear frame plate 21 and the auxiliary frame plate 24 is a chime drum which may be variously constructed but which as shown in the drawings, see particularly Figs. 2, 5 and 7, comprises a hub 94 mounted on the shaft 56 so as to be capable of sliding lengthwise and also at times turning therewith and at times held against turning with the same, two disks 95 and 96 carried by said hub, and four annular rows of tappets or pins 97, 98, 99 and 100 carried by said disks, the two rows 97 and 98 being preferably mounted on opposite sides of the front disk and the two rows 99 and 100 being arranged on opposite sides of the rear disk 96.

In the rear of the chime drum is arranged a striking disk 101 which is provided on its front side with an annular row of ten striking pins or tappets 201, and which is capable of sliding on the main shaft 56, but is always compelled to turn therewith for which purpose the hub of the striking disk is provided on one side of its center with a longitudinal coupling opening 102 which receives the front end of a coupling pin 103, secured at its rear end to a collar 104 on

the main shaft 56, see Fig. 7. On its front side the striking disk is provided with an annular row of tappets 201. On its rear end the hub of the chime drum is provided with an annular row of coupling openings 204 which are on a pitch line corresponding to the positions of the coupling opening 102 in the striking disk so that the chime drum can be coupled with the main shaft upon moving the chime drum backwardly whenever one of its coupling openings 204 is in line with the pin 103, at which time the latter will enter the respective opening 204 in the chime drum and couple the same with the shaft so that these members turn together, as shown in Fig. 5. In the foremost position of the drum, the same is uncoupled from the main shaft 56, as shown in Fig. 7, and at this time the chime drum is locked against turning by a locking pin 105 projecting rearwardly from the rear frame plate and engaging with a locking opening 106 in the chime drum. When this drum is moved rearwardly it is first disengaged from the locking pin 105 so that it is free and then the same is interlocked with the coupling pin 103 to connect it with the main shaft 56. The forward movement of both the chime drum and the striking disk is limited by engagement of the front side of the drum with a shoulder 107 on the locking pin 105, and this drum and the striking disk are yieldingly held in this foremost position by a spring 108 surrounding the shaft 56 between the rear side of the striking disk and the collar 104. The rearward movement of the chime drum and the striking disk is effected by means of a rock shaft 109 journaled on the rear plate of the main frame, an outer arm 110 engaging with the front side of the drum and an inner arm 111 engaging with the cam 47 on the main driving shaft.

The cam 47 is so constructed and positioned that during the first fifteen minutes of the hour the same shifts the chime drum backwardly into engagement with the coupling pin 103 so as to cause the drum to turn with this shaft. As soon as the drum is turned far enough to carry its locking opening 106 out of register with the locking pin, then the salient part of the cam 47 clears the arm 111, but as the front side of the drum at this time is riding on the rear end of the locking pin 105, the drum and striking disk cannot again move forwardly under the pressure of the spring 108 until the drum has made a complete rotation and the locking opening 106 has again come into register with the pin 105. By this means the chime drum will be locked against rotation after the chiming of the four quarters at the end of each hour and during the striking of the hour. The chime drum is then again released by the cam 47 during the first quarter of the new hour. Inasmuch as the drum can be locked against turning only in one position, any accidental displacement of the drum on the driving shaft will be automatically corrected so that the drum will always start off at the same point and thus insure uniformity in the sounding of the chimes of the four quarters and the strokes of the hours.

The several annular rows of tappets on the chiming drum and striking disk are adapted to engage successively with the upper arms of trip or bell levers 112, 113, 114, 115, 116 respectively, which are mounted to turn about a longitudinal horizontal rod 117. The lower arms of the bell or trip levers 112, 113, 114 and 115 associated with the tappets of the chime drum are provided with pins 118 engaging with the upper arms of elbow shaped hammer levers 119, 120, 121, 122 which are pivoted co-axially on a horizontal longitudinal rod 123, each of which has its lower arm connected by a hammer rod 124 with a hammer head 125 which is adapted to strike a bell rod 126 so as to produce the effect of a chime or gong. Each of the bell rods is mounted at one end on a stand 127 which in turn is supported on the casing of the clock in any desired manner. As the drum rotates, the bell tappets in each of its rows turn the respective trip lever in the direction for raising the companion hammer, and as each bell tappet clears the respective trip lever, the corresponding hammer drops and delivers a blow against the bell rod below the same. The tappets of the several rows on the chime drum are so arranged that bell rods of different tones are struck in the proper sequence to produce the effect of ringing chimes in a manner well known in this art.

In order to avoid increasing the number of bell rods beyond those required for the chimes, one of the chime rods, preferably the foremost one is also utilized as the bell for striking or sounding the hours. This is accomplished by providing a yoke 128 which extends lengthwise of the several trip levers and is adapted to be engaged by a pin 129 on the lower arm of the striking trip lever, and the front end of this yoke being connected with the foremost bell hammer elbow lever, and the rear end of the yoke being pivoted on the auxiliary frame plate, as shown in Figs. 2 and 5.

During the first quarter of each hour the cam 47 pushes the chimes drum backwardly so as to become interlocked and turn with the main shaft 56 without shifting the tappets thereof beyond their respective bell trip levers, but at the same time the chime disk is moved backwardly so that its bell tappets clear the striking bell lever 116. It follows from this that the drum and striking disk will turn in unison but only the chimes levers will be tripped by the chimes tappets and cause their respective bell rods to sound while the tappets of the striking disk will

rotate idly without actuating the bell striking lever.

Immediately after the ringing of the fourth quarter of the chimes rods has been completed by the completion of a rotation of the main shaft, the chimes drum is moved forwardly and locked against further turning but the striking disk continues its rotation and as its bell tappets are now in line with the rearmost bell trip lever 116, the latter is tripped and its motion is transmitted by the yoke 128 to the foremost bell lever 119 so that the bell or gong of the latter is now sounded a number of times corresponding to the hour. After the hour has been thus struck, the rotation of the main shaft 56 ceases until the next quarter hour. At the end of first, second and third quarters of each hour only the chimes are sounded but at the end of each hour the chimes are struck first and this is followed by the striking of the hour.

The mechanism whereby the chiming and striking are effected in this manner is constructed as follows:—

The numerals 130 and 131 represent two counting gear racks which are preferably in the form of segments arranged side by side and axially in line and having teeth of ratchet form. The rack 130 is the main rack and works primarily in connection with the striking mechanism and the rack 131 is the auxiliary rack which works primarily in connection with the chime mechanism. The main rack is comparatively long and has over twelve teeth, preferably sixteen, the lower twelve 132 serving as counting teeth while the teeth 133 above the counting teeth, serve solely as lifting teeth. The auxiliary rack 131 has in excess of four teeth, preferably six in number, the lowermost four 134 of which serve as counting teeth while those teeth 135 arranged above the counting teeth 134 serve as lifting teeth. The teeth of the main rack are comparatively long and those of the auxiliary rack comparatively short. The main gear rack is provided with a snail arm 136 which rocks therewith and is provided with a gage finger 137 adapted to engage one or another of the steps of the main or striking snail 52. The auxiliary gear rack is provided with a snail arm 138, which rocks with the same and is provided with a gage finger 139 adapted to engage with one or another of the steps of the auxiliary snail 53.

At the free or upper end of the detent arm 84 the same is provided with main and auxiliary detent pawls 240, 140 see Figs. 16–19, the latter being short and adapted to engage with the teeth of the auxiliary rack and the former being long and adapted to engage with the teeth of the main rack. These pawls engage successively with the teeth of the main and auxiliary racks respectively from the upper parts to the lower parts of these racks as the same are lifted in accordance with the position of the main and auxiliary snails, and finally engage with the lower ends of these racks and hold the same in their highest or foremost position after a chiming operation has been completed at the end of the first, second and third quarters of each hour, and the chiming and striking operations have been completed at the end of each hour.

Means are provided whereby the gear racks after being released and moved backwardly in accordance with their respective snails, are again raised step by step until the same reach their highest or foremost position. The means for this purpose comprise a lifter which engages with the teeth of the gear racks. This lifter has the form of a rotary gear pinion 141 mounted on the lifting shaft 69 and provided with teeth 142, 143 adapted to engage with the teeth of the main and auxiliary gear racks respectively. As the pitch of the teeth on the main gear rack is relatively of larger diameter than the pitch of the teeth of the auxiliary gear rack, the pitch diameter of the teeth 142 of the lifting pinion engaging with the main gear rack is smaller than the pitch diameter of the teeth 143 of the lifting pinion engaging with the teeth of the auxiliary gear rack, thereby causing the auxiliary gear rack to always move slightly in advance of the main gear rack during each step of the lifting operation, and thereby easing this operation of lifting the gear racks.

As shown in Fig. 1, the detent arm 84 has dropped to its innermost position in which its pawls 240, 140 engage with the lower ends of both the main and auxiliary gear racks 130, 131 respectively, at which time the chiming and striking mechanism is at rest. The detent arm 84 is limited in its movement in this direction by engaging a stop 144 on the main frame.

Assuming that the time mechanism of the clock arrives at the first quarter past an hour, the operation of the chime mechanism will be as follows:—

Upon reaching the first quarter of an hour, the first short tooth or tappet 48 of the star wheel will engage the lug 80 of the tappet arm 79 and turn the trip arms in the direction for releasing the locking arm 71 from the locking disk 70 and moving the auxiliary detent pawl 140 far enough to disengage the same from the lower end of the auxiliary counting gear rack 131 but not far enough to disengage the pawl 240 from the lower end of the main counting gear rack, thereby permitting the auxiliary counting rack to drop until its gage finger 139 engages the highest face of the auxiliary or chime snail and also permitting the main shaft 56 and the lifting pinion 141 to turn. The instant this occurs, the chime drum will be turned far enough to produce four strokes on the bell or chime rods and then be stopped by the stop arm 71 engaging

with the next notch 73 of the locking disk 70. The stop arm 71 is permitted to thus engage this locking disk due to the fact that the lifter 141 during its first half rotation upon being released engages one of its auxiliary lifting teeth or pins 143 with an adjacent tooth of the auxiliary counting rack and raises the latter one space, tooth or step so that the detent pawl 140 can again drop fully back into engagement with the lower end of the auxiliary rack and prevent the latter from falling back when the lifter is disengaged from the auxiliary rack. As the detent arm 84 moves back fully and engages its pawl with the lower end of the auxiliary rack, the detent arm also permits the weight 90 to turn the intermediate levers 86, 88, in the direction for permitting the cam arm 87 to swing back and cause its cam slot 89 to lower the lifting wire 75 and the locking arm 71 to drop its finger 72 into the next notch 73 of the locking disk, thereby arresting the operation of the chime mechanism after the same has sounded the chimes but once. While the lifter is turning and engaging the adjacent tooth of the auxiliary rack for raising the same one step, one of the main pins 142 of the lifter also engages the adjacent tooth of the main rack and lifts the same, but as the main detent pawl 240 only engages the lower end of the main rack at this time—the latter is raised idly and simply drops back into its normal position after the lifter lets go of it. This idle motion is imparted to the main rack during all subsequent operations on the same by the lifter whenever the main rack is in its highest position and the lifter is acting on the auxiliary rack for raising the same.

At the end of the second quarter hour or half hour the second tappet 49 of the star wheel again releases the locking arm 71 from the locking disk 70 and the detent pawl 140 from the lower end of the auxiliary rack, and permits the latter to drop two steps because the gage finger 139 at this time is arrested by the second highest face of the auxiliary snail. It therefore requires two operations of the teeth or pins 143 of the lifter on the teeth of the auxiliary rack for raising the latter two steps before the same has been again returned to its highest or home position where the auxiliary detent pawl 140 can again drop back fully into engagement with the lower end of the auxiliary gear rack and stop the operation of the train of gearing forming part of the bell mechanism. As the auxiliary rack is raised a step the detent arm is moved outwardly sufficiently by the tooth of the auxiliary rack engaging with the auxiliary pawl 140 but the latter engages underneath each succeeding tooth of the auxiliary rack as the latter is raised step by step, during the turning of the lifter 141 and therefore acts like a detent ratchet to hold the auxiliary rack at the end of every upward step which is gained.

While this gearing is thus in operation for two steps of the auxiliary counting rack, the chime drum is turned two steps and causes the chime or bell rods to sound the first and second quarters or the half of the hour and then come to rest.

In like manner the bell gearing will be released by the third short tappet 50, at the end of the third quarter of the hour and the auxiliary counting rack will be permitted to drop three spaces by engagement of its gage finger 139 with the third highest face of the auxiliary snail, thereby necessitating three lifting steps or operations of the lifter 141 on the auxiliary rack before the latter is again restored to its normal or home position in which the detent pawl 140 again engages fully with its lower end and the operation of the bell mechanism has been arrested. During these three lifting steps on the auxiliary rack, the chime drum turns three steps and causes the chimes to sound thrice denoting the third quarter of the hour and then stops.

At the end of the first hour the long fourth tooth or tappet 51 of the star wheel engages the lug 80 of the tappet arm 79 and turns the trip arms a greater extent than that which is effected by the short teeth 48, 49, 50 thereby releasing the train of bell operating gearing and moving not only the auxiliary detent pawl 140 from underneath the auxiliary counting rack but also moving the main detent pawl 240 from underneath the main counting rack, as shown in Figs. 3 and 19. When this occurs the auxiliary rack drops four spaces until its gage finger 139 engages with the lowest quarter face of the auxiliary snail which is moved into this position by the time mechanism, and the main counting rack drops one step, its downward movement being arrested at this time by engagement of its gage finger 137 with the highest of the twelve faces on the main snail which is turned into this position by the time mechanism.

After the detent pawls 140 and 240 have been thus disengaged from the auxiliary and main racks by the long tooth 51 of the star wheel and this tooth again clears the tappet arm 79 of the "trip arms" during its continued rotation, the detent arm 84 moves forwardly or inwardly but now only engages its main pawl 240 with the teeth of the main rack while the auxiliary pawl 140 is held out of engagement with the teeth of the auxiliary rack, as shown in Fig. 18. As the lifter now turns with the bell mechanism, the first tooth 142 engaging with the teeth of the main rack raises the same one space and then the main detent pawl 240 passes underneath the lower end of this rack and holds it in its highest position. While the lifter is thus operating on the main rack, the same does not operate on the auxiliary rack because the teeth of the

auxiliary rack and the auxiliary pawl 140 are too short to permit of engagement for this purpose, as shown in Fig. 18, and the auxiliary rack therefore remains at rest in its lowermost position while the main rack is being raised by the lifter and held by the main pawl 240. While the main gear rack is being lifted by the lifting pinion or wheel, the latter also operates on the teeth of the auxiliary rack and raises the same but since the auxiliary pawl 140 does not engage the auxiliary rack at this time, this movement of the latter is idle and the same drops back after each lifting operation. The instant however, that the main rack has reached its highest position and the main pawl has moved fully in its innermost position underneath the main rack, then the auxiliary pawl 140 is permitted to engage with the teeth of the auxiliary rack, as shown in Fig. 17. As the lifter now raises the auxiliary rack, the same is caught at the end of each step by the detent pawl 140 and prevented from falling back and after the same has been raised four steps to its highest position, the detent arm moves forwardly into its foremost position in which both the main and auxiliary pawls 240, 140 engage with the lower ends of the main and auxiliary racks. During the one step which the main rack is being raised, the bell mechanism operates to chime the first quarter, during the first upward step of the auxiliary rack the chimes are operated for the second quarter, during the second upward step of the auxiliary rack the chimes are operated for the third quarter, during the third upward step of the auxiliary rack the chimes are operated for the fourth quarter, and during the last or fourth upward step of the auxiliary rack the striking mechanism is operated to strike "one o'clock." For this purpose the timing, chiming and striking mechanisms are so timed that the timing drum remains coupled with the main shaft 56 from a period in advance of the first quarter until the end of the hour so as to chime each of the four quarters and immediately after the fourth chime at the end of the hour has been completed, the opening 106 in the drum registers with the pin 105, thereby causing the drum to be uncoupled from the shaft 56 and discontinue the chimes and then bringing the striking disk into its forward position, whereby the same can strike the hour.

After the clock strikes "one" and some time before reaching quarter after "one", the constantly rotating cam 47 pushes the chime drum and striking disk backward from the position shown in Fig. 7 to a position shown in Fig. 5, whereby the chime drum is coupled with the main shaft 56 but the striking disk is moved out of operative relation to the striking lever 116. The result is that at the end of the first quarter of the hour the chimes will be sounded due to rotation of the chime drum but no hour will be struck.

Immediately after the chime drum has commenced its hourly rotation the locking opening of the drum passes out of register with the locking pin 105 and then the shifting lever 111 drops off from the cam 47 but the drum still remains in its rearmost position because it is held back by the drum riding on the rear end of the pin 105 until the four quarters of the hour have been completed, and then the drum is again pressed forward by the spring 108 to lock the same against turning and bring the striking disk into position for operating the striking lever 116, as shown in Fig. 7. The operation of chiming the first, second and third quarters of each hour are repeated continuously in the manner just described with reference to the chiming, before the striking of "one o'clock."

When the clock reaches two o'clock, the long tappet 51 again turns the detent arm 84 outwardly its full extent so as to permit both the main and auxiliary counting racks to drop, the auxiliary rack dropping four steps as is usual at the end of each hour, but the main rack dropping two steps, inasmuch as the main snail at this time presents its next lower face to the gage finger 137 of the main rack. As the lifter 141 begins to turn, the pins 142 of the same successively engage the teeth of the main rack and lift the same two successive steps to its highest position where it is held by the main detent pawl 240, and then the auxiliary rack is raised four steps to its highest position and held there by the auxiliary detent pawl 140. The two upward steps of the main rack and the first two upward or return steps of the auxiliary rack are used for counting the four quarter chime actions, and the last two upward steps of the auxiliary rack are used for counting the two strokes representing "two o'clock."

As the time reaches three o'clock the auxiliary rack drops four steps and the main rack drops three steps, and subsequently the main rack is first lifted three steps to its home position and then the auxiliary rack is lifted to its home position. During this lifting operation, the three upward steps of the main rack and the first upward step of the auxiliary rack are utilized for operating the four quarters of the chimes, and the remaining three upward steps of the auxiliary rack are utilized for operating the striking mechanism three times.

Upon arriving at four o'clock the auxiliary rack drops four steps and the main rack also drops four steps. The lifting mechanism now first lifts the main rack four steps and then lifts the auxiliary rack four steps. The four return steps in this instance are utilized to count the four actions of the chime mechanism for the several quarters, and the four return steps of the auxiliary rack are

utilized to count the four actions of the mechanism which strikes four o'clock.

At the end of the fifth hour the auxiliary rack drops four steps on to the lowest face of the snail and the main rack drops five steps on to the fifth face of the main snail. As the main and auxiliary racks are successively raised step by step thereafter, the first four upward or return steps of the main rack are utilized for counting the four chiming actions corresponding to the four quarters of the hour, and the fifth or last upward step of the main rack and the four upward or return steps of the auxiliary rack are utilized to count the five striking actions corresponding to "five o'clock."

At the completion of each additional hour the main counting rack drops one step further and therefore has to be lifted a correspondingly increased number of steps in order to return the same to its home position by means of the lifter, but the auxiliary rack at the end of each hour always drops four steps representing the four chiming operations at the four quarters of the hour. As the main rack progressively increases the extent of its drop and therefore also increases the extent of its return movement in the same measure, the first four lifting steps of the main rack are always taken out to operate the four quarters of the chime mechanism and the remaining lifting steps of the main rack are added to the four lifting steps of the auxiliary rack to complete the counts required for striking a particular hour. In other words, when the time is four o'clock or more, then the four counts taken off from the advancing end of the main rack for operating the chiming mechanism are always added by the auxiliary rack to the trailing end of the main rack so that the combined count equals the four chime operations and the strokes of the particular hour. It is only when the time of the hour is below four o'clock that the four chiming steps are counted, partly on the main rack and partly on the auxiliary rack, as previously described. At all other hours the chiming is always counted wholly on the main rack and the striking is counted partly on the main rack and then finished on the auxiliary rack.

In Fig. 1 the main and auxiliary racks are both raised to their highest position, the main snail stands in a position in which the same presents its ninth space to the main gage finger 137 and therefore would cause the striking mechanism to announce "nine o'clock," and the auxiliary snail is in the position for arresting the auxiliary gage finger so that the chimes will play the first quarter.

Figure 3 shows the main rack dropped to the twelve o'clock striking position on the main snail, and the auxiliary rack dropped to the first quarter chiming position on the auxiliary snail.

The parts are shown in Fig. 14 in the position in which the auxiliary rack has been dropped to the four quarter chiming position on the lowest face of the auxiliary snail, and the main rack has been dropped to the seven o'clock striking position on the main snail, but has already been raised six steps, four of which were used for the four chime quarters, and two for striking, leaving one more on the main rack and four on the auxiliary rack for striking seven o'clock.

In Fig. 15 the parts are shown in the position in which the auxiliary rack has been dropped to the four quarter chiming position on the auxiliary snail, and the main snail is shown in a position in which it has previously permitted the main rack to drop to the twelve o'clock striking position, but the lifter has already lifted the main rack five steps, of which four were utilized to count the four quarter actions of the chiming mechanism and the fifth served to count the first stroke of twelve o'clock, leaving the remaining seven steps on the main rack and the four steps on the auxiliary rack to complete the remaining eleven counts for twelve o'clock.

From the foregoing description in connection with the accompanying drawings it will now be apparent that this invention provides a four quarter chiming and hourly striking clock in which the same motor, such as a spring or the like, serves to operate both the chiming mechanism and the striking mechanism.

By this means the cost of a clock which chimes the four quarters of each hour and strikes each hour, is materially reduced. Moreover the cost of manufacturing the clock and the expense of repairing the same is lessened. Furthermore this clock is more compact and as the same requires winding of but two springs instead of three, the same can be taken care of more easily. If desired a separate striking bell rod 226 may be employed which is struck by a separate bell hammer, having a hammer head 225 and a rod 224 connecting the same with the pivoted yoke 128 which is operated by the bell lever 116 of the striking mechanism as shown by dotted lines in Fig. 13, but in such modified construction—the longitudinal bar of the yoke 128 is not connected with the foremost chiming bell lever 119.

Although the construction herein shown is a practical embodiment of my invention it is to be understood that the same may be varied in the details of its construction, and the arrangement of its parts without departing from the essential features of the invention and it is therefore assumed that obvious modifications are comprehended in the appended claims.

I claim as my invention:

1. A clock comprising a time mechanism, a main driving shaft, a chiming mechanism in-

cluding a tappet drum slidably mounted on said shaft, a striking mechanism including a tappet disk slidably mounted on said shaft, a driving motor operatively connected with said driving shaft, a stop device which controls the motion of said shaft and which is operated by said time mechanism, means which operate in synchronism with the time mechanism for moving said drum and disk lengthwise on said shaft and render either said drum or said disk operative or inoperative, and means whereby in one position said drum and disk are both coupled with said shaft and in another position said drum is uncoupled from said shaft and held against turning.

2. A clock comprising a time mechanism, a main driving shaft, a motor for turning said shaft, a stop mechanism for said shaft controlled by said time mechanism, a chiming mechanism having a tappet drum mounted on said shaft so as to slide lengthwise thereon, a striking mechanism having a tappet disk slidable lengthwise on said shaft, means for moving said drum and disk on said shaft in one direction which are actuated by said timing mechanism, spring means for moving said drum and disk lengthwise on said shaft in the opposite direction, means for coupling said drum and disk in one position on said shaft and uncoupling the same in another position on the same, and means for holding drum against turning when uncoupled from said disk.

3. A clock comprising a time mechanism, a main driving shaft, a motor for turning said shaft, a stop mechanism for said shaft controlled by said time mechanism, a chiming mechanism having a tappet drum mounted on said shaft so as to slide lengthwise thereon, a striking mechanism having a tappet disk slidable lengthwise on said shaft, means for moving said drum and disk on said shaft in one direction which are actuated by said timing mechanism comprising a cam rotating with said timing mechanism, and a pair of connected lock arms engaging respectively with said cam and said tappet drum; spring means for moving said drum and disk lengthwise on said shaft in the opposite direction; means for coupling said drum and disk in one position on said shaft and uncoupling the same in another position on the same; and means for holding drum against turning when uncoupled from said disk.

4. A clock comprising a time mechanism, a main driving shaft, a motor for turning said shaft, a stop mechanism for said shaft controlled by said time mechanism, a chiming mechanism having a tappet drum mounted on said shaft so as to slide lengthwise thereon, a striking mechanism having a tappet disk slidable lengthwise on said shaft, means for moving said drum and disk on said shaft in one direction which are actuated by said timing mechanism, spring means for moving said drum and disk lengthwise on said shaft in the opposite direction, means for coupling said drum and disk in one position on said shaft and uncoupling the same in another position on the same, comprising a coupling pin mounted parallel with said main shaft and turning therewith, and said disk having its hub provided with a single opening which receives said coupling pin and said drum having its hub provided with an annular row of openings and one of which is adapted to receive said coupling pin; and means for holding drum against turning when uncoupled from said disk.

5. A clock comprising a time mechanism, a main driving shaft, a motor for turning said shaft, a stop mechanism for said shaft controlled by said time mechanism, a chiming mechanism having a tappet drum mounted on said shaft so as to slide lengthwise thereon, a striking mechanism having a tappet disk slidable lengthwise on said shaft, means for moving said drum and disk on said shaft in one direction which are actuated by said timing mechanism, spring means for moving said drum and disk lengthwise on said shaft in the opposite direction, means for coupling said drum and disk in one position on said shaft and uncoupling the same in another position on the same, and means for holding drum against turning when uncoupled from said disk comprising a stationary locking pin adapted to engage with the side of the drum in one position of the latter, and said drum being provided with an opening adapted to receive said locking pin in another position of the drum.

6. A clock comprising a time mechanism, a main driving shaft, a chiming mechanism having a tappet drum movable lengthwise on said shaft, a striking mechanism having a tappet disk movable lengthwise on said shaft and bell levers which correspond respectively to said tappet drum and disk, said drum remaining in operative relation to its companion bell levers in all positions of said drum lengthwise of said shaft, and said disk being adapted in one position lengthwise of the shaft to clear the companion bell lever and in another position lengthwise of the shaft to permit of operatively engaging the companion bell lever.

7. A clock comprising a time mechanism, a main driving shaft, a chiming mechanism having a tappet drum movable lengthwise on said shaft, a striking mechanism having a tappet disk movable lengthwise on said shaft, bell levers which correspond respectively to said tappet drum and disk, said drum remaining in operative relation to its companion bell levers in all positions of said drum lengthwise of said shaft, and said disk being adapted in one position lengthwise of the shaft to clear the companion bell lever

and in another position lengthwise of the shaft to permit of operatively engaging the companion bell lever, bell hammers adapted to be actuated by the bell levers associated with said drum, and means for causing the bell lever of the striking disk to operate one of the bell levers associated with the chiming drum.

8. A clock comprising a time mechanism, a main driving shaft, a chiming mechanism having a tappet drum movable lengthwise on said shaft, a striking mechanism having a tappet disk movable lengthwise on said shaft, bell levers which correspond respectively to said tappet drum and disk, said drum remaining in operative relation to its companion bell levers in all positions of said drum lengthwise of said shaft, and said disk being adapted in one position lengthwise of the shaft to clear the companion bell lever and in another position lengthwise of the shaft to permit of operatively engaging the companion bell lever, bell hammers adapted to be actuated by the bell levers associated with said drum, and means for causing the bell lever of the striking disk to operate one of the bell levers associated with the chiming drum comprising a yoke adapted to be engaged by the striking bell lever at one end of the row of levers and connecting with the bell hammer at the other end of said row and extending past the intermediate levers of said row.

9. A clock comprising a main snail, an auxiliary snail, a main counting gear rack adapted to engage different faces of said main snail, an auxiliary counting gear rack adapted to engage different faces of said auxiliary snail, detent means adapted to engage said racks, a lifter adapted to raise said gear racks, a motor for operating said lifter, a stop device for controlling the transmission of motion from said motor to said lifter, a time mechanism operatively associated with said snails, stop device and said detent, and chiming and striking means which are responsive to the actions of said auxiliary and main gear racks.

10. A clock comprising a main snail, an auxiliary snail pivoted co-axially with said main snail, a main counting gear rack adapted to engage with said main snail, an auxiliary counting gear rack adapted to engage said auxiliary snail, a detent device adapted to engage said racks, a lifter adapted to raise said racks, a motor operatively connected with said lifter, a stop device for controlling said lifter, a time mechanism operatively associated with said snails, stop device and detent device and chiming and striking means which are responsive to the actions of said auxiliary and main gear racks.

11. A clock comprising a main snail, an auxiliary snail pivoted co-axially with said main snail, a main counting gear rack adapted to engage with said main snail, an auxiliary counting gear rack adapted to engage said auxiliary snail and having its teeth arranged along side the teeth of the main gear rack, a single detent device adapted to engage both of said racks, a lifter adapted to engage both of said racks, a motor operatively connected with said lifter, a stop device for controlling said lifter, a time mechanism operatively associated with said snails, stop device and detent device, and chiming and striking means which are responsive to the actions of said auxiliary and main gear racks.

12. A clock comprising a main snail, an auxiliary snail pivoted co-axially with said main snail, a main counting gear rack adapted to engage with said main snail, an auxiliary counting gear rack adapted to engage said auxiliary snail, and having teeth which are shorter than the teeth of said main gear rack, a detent device having a long pawl adapted to engage the teeth of the main gear rack and a short pawl adapted to engage the teeth of the auxiliary rack, a lifter adapted to engage both of said racks, a motor operatively connected with said lifter, a stop device for controlling said lifter, a time mechanism operatively associated with said snails, stop device and detent device, and chiming and striking means which are responsive to the actions of said auxiliary and main racks.

13. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a time mechanism operatively associated with said snails, detent device and stop device, and chiming and striking means responsive to the actions of said racks.

14. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack, adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a time mechanism operatively associated with said snails, detent device and stop device, chiming means, striking means, and means for causing the chiming means to be operated by the early actions of the main counting rack and the striking means to be operated by the later actions of the main counting rack.

15. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack,

adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a time mechanism operatively associated with said snails, detent device and stop device, chiming means, striking means and means for causing the chiming means to be operated by the early actions of the main counting rack and the striking means to be operated by the later actions of the main counting rack and all of the actions of the auxiliary counting rack.

16. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a star wheel having short and long teeth adapted to engage and trip said stop device and cause said lifter to operate, a time mechanism operatively associated with said snails, detent device and star wheel, and chiming and striking means responsive to the actions of said racks.

17. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a time mechanism operatively associated with said snails, detent device and stop device, chiming means adapted to be actuated every quarter of an hour in response to actions of said auxiliary rack, and striking means adapted to be actuated every hour in response to successive actions of said main and auxiliary racks.

18. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a time mechanism operatively associated with said snails, detent device and stop device, chiming means adapted to be actuated every quarter of an hour in response to actions of said auxiliary rack, and striking means adapted to be actuated every hour in response to successive actions of said main and auxiliary racks, said detent device being disengaged from said auxiliary gear rack while the lifter is operating on the main rack and engaged with said auxiliary rack after the main rack has completed its return movement.

19. A clock comprising a main snail, an auxiliary snail, said snails being pivoted co-axially, a main segmental counting gear rack adapted to engage said main snail, an auxiliary segmental counting gear rack adapted to engage said auxiliary rack, said gear racks being pivoted co-axially, a detent device for said racks, a lifter for said racks, a time mechanism operatively associated with said snails, detent device and stop device, chiming means adapted to be actuated every quarter of an hour in response to actions of said auxiliary rack, and striking means adapted to be actuated every hour in response to successive actions of said main and auxiliary racks, said detent device being disengaged from said auxiliary gear rack while the lifter is operating on the main rack and engaged with said auxiliary rack after the main rack has completed its return movement, and said chiming means being coupled with said motor while the auxiliary snail is in action and said chiming means and striking means being coupled successively with said motor when said main and auxiliary rack come successively into operation.

20. A clock comprising two counting gear racks, a lifter for raising said racks, and a detent for successively holding said racks in position after every forward step of the same, under the action of said lifter.

21. A clock comprising a main rack, an auxiliary rack, an hour striking mechanism, a four quarter chimes sounding mechanism, and controlling means which are responsive to the positions of said main and auxiliary racks and whereby the steps for operating the first, second and third quarters of the chimes mechanism are controlled by the auxiliary rack, and at the end of each hour the first step of the chimes mechanism is controlled by the main rack and the final step of the striking mechanism is controlled by the auxiliary rack.

22. A clock comprising a main rack, an auxiliary rack, an hour striking mechanism, a four quarter chimes sounding mechanism, and controlling means which are responsive to the positions of said main and auxiliary racks and whereby the steps for operating the first, second and third quarters of the chimes mechanism are controlled by the auxiliary rack, and at the end of each hour the first step of the chimes mechanism is controlled by the main rack and the final step of the striking mechanism is controlled by the auxiliary rack, and the balance of the quarter chimes steps are, at times, controlled wholly by the main rack, and at other times partly by the main rack and partly by the auxiliary rack.

23. A clock comprising a main rack, an auxiliary rack, an hour striking mechanism, a four quarter chimes sounding mechanism, and means for controlling said striking mechanism and chimes mechanism which are responsive to the positions of said racks whereby the steps for operating the chimes

mechanism for the first, second and third quarters preceding each hour are controlled solely by the auxiliary rack; and the first chime steps at the end of the first, second and third hours are controlled by the main rack and the remaining chimes steps and the hour steps are controlled by the auxiliary rack; and whereby in operating the chimes and striking mechanisms at the end of the fourth hour all of the chimes steps are controlled by the main rack and all of the striking steps are controlled by the auxiliary rack; and in operating the chimes and striking mechanisms at the end of the remaining hours the chimes steps are first controlled by the main rack, then part of the striking steps are controlled by the main rack and the last four of the striking steps are controlled by the auxiliary rack.

24. A clock comprising a main rack, an auxiliary rack, an hour striking mechanism, a four quarters chimes sounding mechanism, and controlling means responsive to the positions of said main and auxiliary racks for operating said four quarter chimes sounding mechanism and hour striking mechanism, said controlling means being constructed to operate the chimes sounding mechanism for the first, second and third quarters of each hour in accordance with the auxiliary rack, and to operate the hour striking mechanism for some of the hours solely in accordance with the auxiliary rack and for other hours partly in accordance with the main rack and partly in accordance with the auxiliary rack.

25. A clock comprising a main rack, an auxiliary rack, an hour striking mechanism, a four quarters chimes sounding mechanism, controlling means responsive to the positions of said main and auxiliary racks for operating said four quarter chimes sounding mechanism and hour striking mechanism, said controlling means being constructed to operate the chimes sounding mechanism for the first, second and third quarters of each hour in accordance with the auxiliary rack, and to operate the hour striking mechanism for some of the hours solely in accordance with the auxiliary rack and for other hours partly in accordance with the main rack and partly in accordance with the auxiliary rack, a driving mechanism, and automatic means for coupling said four quarter chimes sounding mechanism with said driving mechanism after the operation of the striking mechanism, and for uncoupling said four quarter chimes sounding mechanism from said driving mechanism and coupling said hour striking mechanism with said driving mechanism after operation of the fourth quarter of said chimes sounding mechanism.

26. A clock comprising a main rack, an auxiliary rack, an hour striking mechanism, a four quarter chimes sounding mechanism means for controlling said striking mechanism and chimes mechanism which are responsive to the positions of said racks whereby the steps for operating the chimes mechanism for the first, second and third quarters preceding each hour are controlled solely by the auxiliary rack, and the first chime steps at the end of the first, second and third hours are controlled by the main track and the remaining chimes steps and the hour steps are controlled by the auxiliary rack and whereby in operating the chimes and striking mechanisms at the end of the fourth hour all of the chimes steps are controlled by the main rack and all of the striking steps are controlled by the auxiliary rack, and in operating the chimes and striking mechanisms at the end of the remaining hours the chimes steps are first controlled by the main rack, then part of the striking steps are controlled by the main rack and the last four of the striking steps are controlled by the auxiliary rack, a driving mechanism, and automatic means for coupling said four quarter chimes sounding mechanism with said driving mechanism after the operation of the striking mechanism, and for uncoupling said four quarter chimes sounding mechanism from said driving mechanism and coupling said hour striking mechanism with said driving mechanism after operation of the fourth quarter of said chimes sounding mechanism.

In testimony whereof I hereby affix my signature.

SAMUEL MAZUR.