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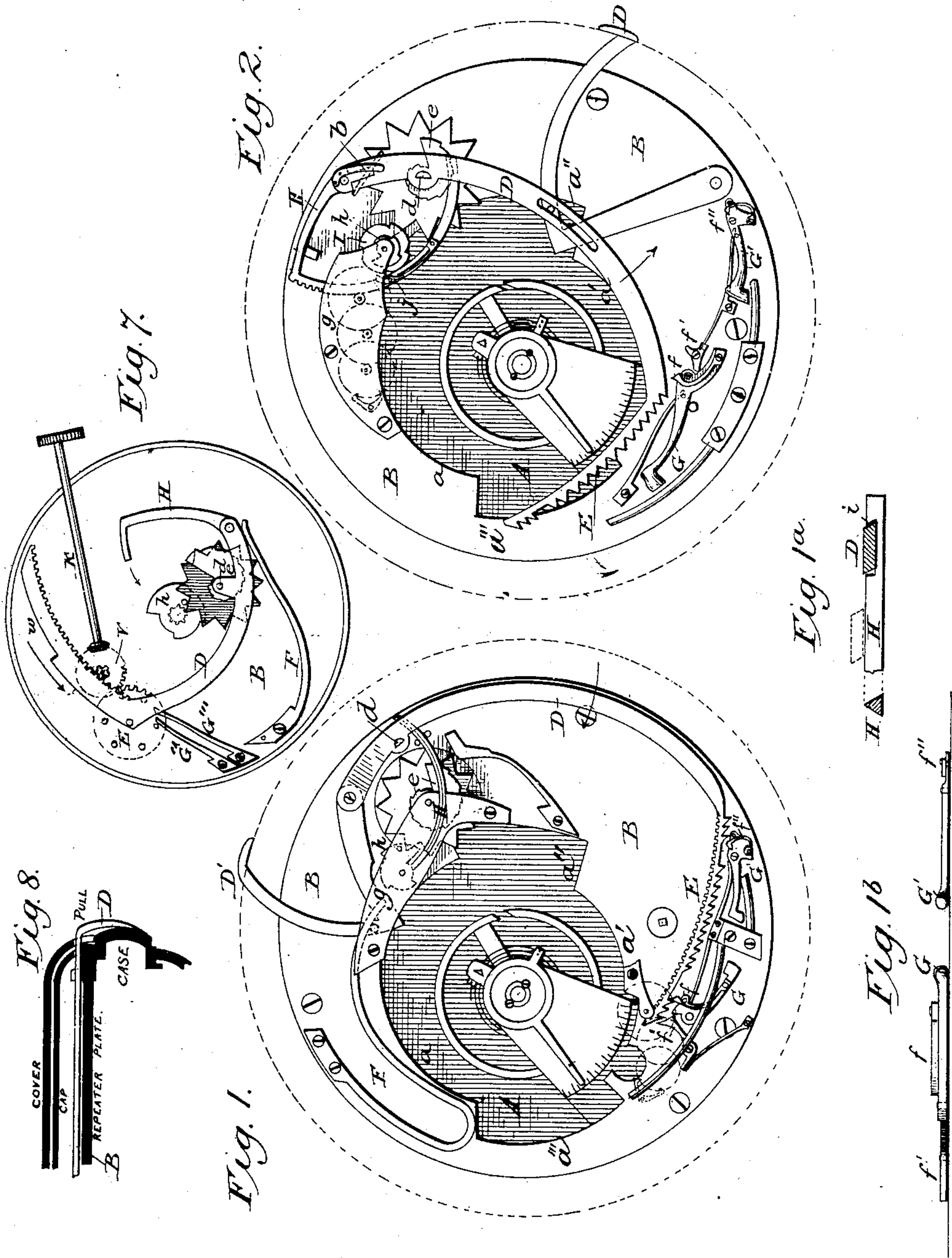
2 Sheets—Sheet 1.

F. TERSTEGEN.

REPEATING ATTACHMENT FOR WATCHES.

No. 311,270.

Patented Jan. 27, 1885.



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Sidney P. Hollingsworth
Lillian V. Kane.

Inventor.

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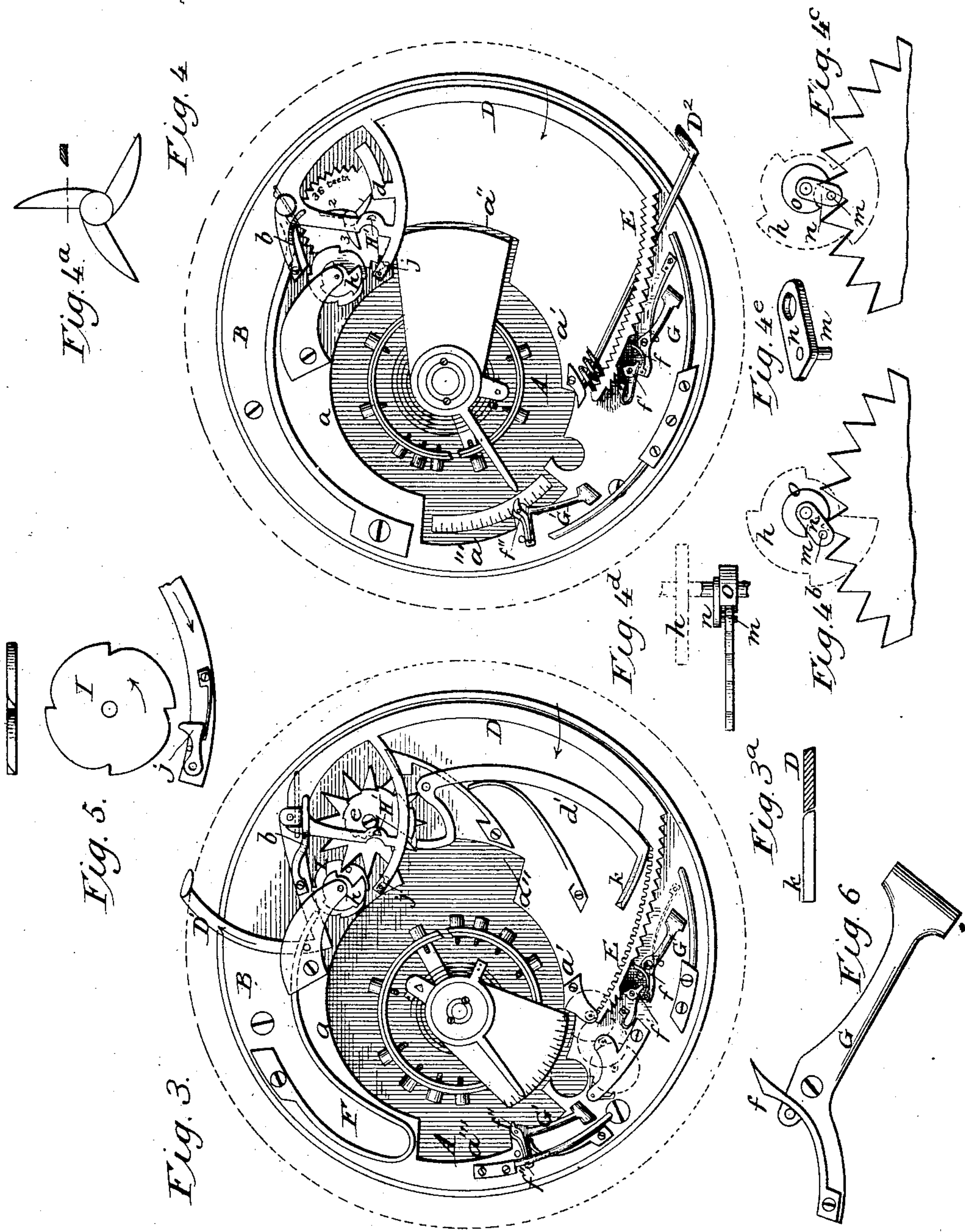
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UNITED STATES PATENT OFFICE.

FRED TERSTEGEN, OF ELIZABETH, NEW JERSEY.

REPEATING ATTACHMENT FOR WATCHES.

SPECIFICATION forming part of Letters Patent No. 311,270, dated January 27, 1885.

Application filed August 21, 1882. (Model.)

To all whom it may concern:

Be it known that I, FRED TERSTEGEN, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented new and useful Repeating Attachments and Mechanism for Watches and other Time-Pieces, of which the following is a specification.

My invention relates to the striking mechanism of watches and other time-pieces, and particularly to that class of striking mechanism by which the time is struck and repeated at will at irregular intervals.

Repeating-watches have long been known, and much ingenuity has been expended in their development; but heretofore substantially the same principles of construction and operation have been adhered to by all inventors and makers, and no material advances have been made in the construction and arrangement of the striking mechanism, a part of which has heretofore been placed between the dial and the front plate of the movement, the regulating-wheels of the striking mechanism, spring-barrel, and hammers, between the plates of the movement and other parts around the movement. This disposition of the striking mechanism in and about the time mechanism necessitated an entire reconstruction of the time-movement, and to operate the striking mechanism a separate device—for example, a push-pin or sliding bolt—had to be placed in the case, this necessitating a specially-constructed case to receive the repeating-movement.

From the foregoing it will be understood that previous to my invention the time-movement was specially planned and constructed with a view to the reception of the striking mechanism, as certain parts of the striking mechanism—the regulating-wheels, for example—occupied so much of the space between the plates that the time mechanism was displaced from the position it occupied when no striking mechanism was used.

The watch-movements now made by machinery are no better adapted to the reception of the old form of repeating mechanism than the hand-made watches, and repeating mechanism cannot be applied at all with watches provided with dust-rings, as the bell-wires cannot be placed around the movement when

the dust-ring is used; and no advantage is obtained by placing the repeating mechanism under the dial, as that requires a complete alteration of the time-movement, especially in stem-winders, so that to make a repeater of the modern watch, either machine or hand made, without altering the time mechanism and without weakening the front plate by turning it thin and crowding the delicate parts of the repeating mechanism in the contracted space between the front plate and the dial, I have found that the repeating mechanism or some part or parts thereof must be placed in a part of the watch that has never before been utilized for that purpose—viz: in the space between the back plate or bridges of the movement and the cap or cover of the watch-case. Furthermore, there has not heretofore been produced a compact repeating attachment separate from the time-movement, and applicable to regular-made or ordinary modern watch-movements; neither has there been made a repeating-watch wherein all the repeating mechanism was placed together on one surface of the time-movement where it could be seen and examined as a whole. Besides, the repeating mechanism heretofore made could not be put together on a plate adapted to fit in a watch, so that it could be manufactured and sold as a separate and complete article of itself, applicable to watch-movements. Then the mechanism for actuating the striking devices was difficult to make and adjust, and liable to get out of order, and if the minute-striking mechanism were added it made the repeating watch-movement very complicated and the watch heavy and clumsy.

My repeating attachment is applicable to any modern or regular-made watches, whether hand or machine made, and with or without the dust-ring, and without changing the time mechanism or the size or appearance of the watch as a whole; and the repeating attachment can be made so cheaply that by combining it with a low-priced time-movement a cheaper repeating-watch can be produced than has ever before been possible, and at the same time the operation will be as accurate as the most expensive repeating watch-movement heretofore made.

The following are the objects of my inven-

tion: first, to provide a repeating attachment for watch-movements, whether of American, Swiss, or other foreign manufacture, or key or stem winders, without altering the watch mechanism or the shape or size of the watch; and this part of the invention consists in an attachment having all the pieces forming the repeating mechanism separate from the watch-movement and adapted to be connected therewith; second, to utilize the space between the back of the watch-movement and the case as a receptacle for the repeating mechanism; and this part of the invention consists in placing the striking-racks and other related parts of the striking mechanism on or over the back plate of the time-movement and under the cap or cover of the case; third, to arrange the repeating mechanism so that it can be applied either to the front or back of the watch; and this part of the invention consists in making the repeating mechanism so that its parts connect with each other on the exterior surface of the front or back plate, and with the time mechanism through the said plates; fourth, to provide a repeating mechanism for watches and other time-pieces, that can be seen and examined, and, if required, removed from the watch without taking the time-movement apart; and this part of the invention consists in placing the several parts of the repeating mechanism on the exterior surface of the time-movement; fifth, to provide a repeating attachment that can be manufactured complete for different classes of watches without reference to peculiarities in the construction of the time-movement; and this part of the invention consists in making the several parts of the repeating mechanism and placing and connecting the several parts thereof together in the relation they are to occupy in the watch, so that an operative repeating attachment is produced ready for connection with the time-movement; sixth, to avoid the use of a number of separate devices for actuating the striking devices; and this part of the invention consists in the use of a single striking-rack for striking the several divisions of time; seventh, to adapt the mechanism to be set without the use of a slide or push-pin placed permanently in the case, and thereby permit the repeating mechanism to be placed in any watch-case; and this part of the invention consists in connecting the device by which the repeating mechanism is set, directly with the repeating mechanism through a slot in the case; eighth, to strike the hours, or the hours and quarters, by the direct or positive action of the striking-rack; and it consists in arranging the rack so that it will adjust itself and actuate the striking devices when moved by the operating device; ninth, to dispense with the escapement-spring or spring-pawl; and this consists in applying a device to the quarter-snail staff, which both moves the star-wheel and holds it steady; tenth, to simplify the construction of the snail by which the proper adjustment of the strik-

ing-rack is obtained; and this consists in dispensing with the stepped snail heretofore used and substituting a star-shaped snail; eleventh, to regulate the action of the striking-rack by its movement in different planes in addition to its vibrating movement; and this consists in providing devices for each division of time, which, when they come in contact with the snails, cause the rack to change the plane of its movement and thereby actuate the striking devices the proper number of times; twelfth, to avoid a complicated construction of the minute-striking mechanism; and this consists in regulating the striking of the minutes by the movement of the minute-piece in the direction of the movement of the minute-snail instead of against the snail as heretofore; thirteenth, to provide a snail adapted to regulate the striking of the minutes by raising the striking-rack out of engagement with the striking devices; fourteenth, to provide a device for indicating the minutes, so arranged that when the proper number of minutes have been sounded it throws the striking mechanism out of connection with the hammer.

In the accompanying drawings, Figures 1, 2, 3, and 4 represent various arrangements of my repeating attachments applied to the back of watch-movements. Fig. 1^a shows an enlarged sectional view of the striking-rack lever and the quarter-piece. Fig. 1^b represents the hammers and the clicks which engage the striking-rack, showing the relative positions of the different clicks. Fig. 3^a is a sectional detail view of the hour-piece and striking-rack lever used with the repeating attachment shown in Fig. 3. Fig. 4^a represents an enlarged view of the improved hour-snail. Figs. 4^b, 4^c, 4^d, 4^e are views of the improved star-wheel and the pieces which operate the same. Fig. 5 represents detailed views of the improved minute-indicating devices, and Fig. 6 represents my improved hammer for repeaters. Fig. 7 represents an arrangement of the repeating mechanism adapted to be placed either in the front or back of a watch. Fig. 8 is a section of a watch-case showing the position of the pull for operating the repeating mechanism.

Referring to the drawings, A represents the back of a watch-movement, the regulator, bridge, and balance-wheel being exposed, and the case indicated by dotted lines.

B is a plate to which the repeating mechanism is attached. This plate is intended to be placed on the back plate of the movement, whether said plate be what is known as a "whole," "half," or "three-quarter" plate. The plate B is to be provided with screw-holes situated so as to align with the posts in the watch, so that the plate B can be secured by some of the screws that fasten the back plate of the movement. The plate B is also provided with an opening, *a*, to give space for the regulator, bridge, and balance-wheel.

This opening, it will be observed, is so shaped that the parts of the movement which project above the back plate pass or show through the said opening, notwithstanding the different positions that the said parts occupy in different movements. For example, Figs. 1, 2, and 3 represent "Elgin" movements, and Fig. 4 a "Waltham" movement. The plate B is adapted to fit the several movements equally. Thus the said plate, which is designed to carry the repeating mechanism, is also intended to be fastened on the back plate of the movement in such a way that the inside cap or cover of the case will shut down over it, and the bridge or other raised parts of the movement will project through the opening in the plate. The shape of the opening may be varied to suit different movements.

The essential parts of the profile of the opening are marked a' a^2 a^3 . These several openings, by their shape and position with respect to other parts, give place for the regulator-bridge and regulator, which are variously placed in different movements. In some, the regulator lies over the bridge; in others, it projects toward the opposite side of the movement. Thus Figs. 1, 2, and 3 represent the position of the regulator and bridge in "Elgin," "Rockford," and "Hampton" movements, and in these the regulator and bridge project into and show through the opening a^3 . In Fig. 4, which shows the arrangement of the "Waltham" movement, the bridge projects into the opening a^2 and the regulator into a^3 . In "Lancaster" and other three-quarter-plate movements, and Swiss and other modern movements, the cuts or openings a' a^2 a^3 give place for the regulators and bridges, and expose those parts of the movements. The position and shape substantially of these cuts or openings are therefore essential to the plate to adapt it to fit the various modern movements. The snails are placed between the center of the movement and the periphery, on one side, and at about the opposite side the rack is placed, and where the plate is used the snails adjoin the opening a^2 . The quarter-snail not being placed on the center-post, as in repeaters of the ordinary kind, but apart therefrom, and connected with the time-train by additional wheels, as hereinafter described, the "surprise" which forms part of the ordinary repeating mechanism I dispense with. The function of the surprise is this: At the full hour the longest step of the quarter-snail, which latter in all ordinary repeaters is placed on the center-post, is not in line with the quarter-piece, consequently if the repeater were struck on the full hour the quarter-piece would be moved against the step adjoining the longest step, and quarters would be struck, although none were in the hour. To prevent this an additional long step, called the "surprise," is placed loosely on the post, which has a slight independent movement produced

by the teeth of the star-wheel when moved suddenly by the escapement-spring, by which it is moved ahead of the long step of the snail and stops in position to prevent the quarter-piece from moving. In the present invention the quarter-snail being disconnected from the center-post and operated by a train, the surprise is not required, as the quarter-snail is moved sufficiently far every hour to stop the quarter-piece at the proper time.

D represents the lever by which the repeating mechanism is operated. This lever, as represented in Figs. 1, 2, 3, 4, and 7, carries at one end the striking-rack E, and at the opposite end is pivoted to the plate B.

The lever D has two movements—viz., a swinging or vibrating movement on its pivot, and a movement from and toward the plate by which it is caused to move in different planes above the plate B. By the swinging movement, the teeth of the striking-rack are carried in contact with the clicks by which the hammers are actuated, and by the movement from and toward the plate the number of strokes is regulated, and the changes are made by which the time in hours, quarters, and minutes is sounded. The vibratory motion of the lever is produced by a pull, D' , as in Figs. 1, 2, and 3, or by a worm and screw, D'' , as in Fig. 4, or by any other suitable device. The pull projects out of the case, a suitably-shaped opening in the rim and cover being provided for it, and it may be made in one piece with the lever D, as in Fig. 1, or separate, as in Figs. 2 and 3. In order that the lever may move from and toward the plate, it may be formed into a spring near the pivot, as indicated by the shaded lines in Fig. 1, or it may be connected with the pivot by a swivel-joint, as shown in Figs. 2, 3, and 4, a spring, b , being placed over the joint to throw the lever down. The motion of the lever D from and toward the plate is produced by its contact, while swinging on its pivot, with the parts of the repeating mechanism, by which the indications of the several divisions of time are regulated. The said parts are constructed and operate upon the lever in various ways, which will now be described.

Fig. 1: The lever D is provided with a pin, d , which I call the "hour-pin" projecting downward, which acts against the steps of the hour-snail e . This pin is also used in Figs. 2 and 4. The repeating mechanism is arranged in this figure (1) so as to be set when the lever is moved in the direction of its arrow, and to sound the time when it returns to its normal position by the action of the mainspring F.

G G' are the hammers which strike the bells, portions of which are shown in the drawings. f is the hour-click. f' f'' are the quarter-clicks. The clicks f f'' are attached directly to the hammers G G'. Click f' is a separate piece, adapted, when moved back, to engage the short arm of the hammer G, so as to operate it. Click f , as shown in detail in Fig. 1^b,

is placed higher than clicks $f' f''$, the position of the clicks being such that when the lever D is raised, it engages click f , and when it drops it engages the clicks $f' f''$.

5 H is the quarter-piece, which in this case is a segment of a circle, preferably V-shaped in cross-section, as shown in Fig. 1^a, and is held in a groove or slot in the cap-plate g , and by a couple of guide-pins, so that it will slide
10 back and forth, and its end can be carried against the steps of the quarter-snail h . In the quarter-piece is a notch, i , where the lever D rests when in its normal position. When the lever is moved by its engagement with
15 the notch, it carries the quarter-piece until it is stopped by the quarter-snail, when the lever D rises out of the notch and slides over the quarter-piece, as shown in Fig. 1^a. The striking-rack on the lever D is provided with
20 a group of twelve teeth to strike the hours, and on each side of this group, but separated from it by blank spaces, a group of three teeth to strike the quarters.

The operation of striking the time is as follows: The lever D being moved forward, it
25 first acts on the quarter-piece and moves it against the quarter-snail. If there are no quarters in the hour, the movement of the quarter-piece is very slight, not being equal
30 to the space necessary to be moved by the lever D to carry the first teeth of the groups of three teeth past the quarter-clicks $f' f''$. When the quarter-piece is stopped, the lever rises out of the notch before the first of the quar-
35 ter-teeth have passed; but if it is in the first quarter of the hour, the quarter-piece moves farther and the lever does not rise out of the notch until its first quarter-teeth have passed the clicks, and so on. The greater the num-
40 ber of quarters the longer the lever stays in the notch, and consequently the greater the number of the quarter-teeth that pass the clicks $f' f''$. The object of this will be understood when it is stated that the quarter-teeth
45 do not engage the clicks $f' f''$ until the lever is allowed to drop down by reaching the notch i as it moves back. Hence the greater the distance the quarter-piece is moved the sooner the lever will drop into the notch and the
50 greater the number of quarter-teeth will engage the clicks $f' f''$. After the quarter-piece is set, the lever, as before stated, rises out of the notch to the top of the quarter-piece, and thereby lifts the striking-rack above the clicks
55 $f' f''$ and in line with the hour-click f , and the pin d is carried toward the hour-snail. There is a short interval at this stage, owing to the space between the quarter-teeth and the group of hour-teeth on the rack, which in-
60 terval, when on the return of the lever the striking of the time is done, serves to separate hours from the quarters. The distance that the lever D can now move depends upon the position of the hour-snail. If it is one
65 o'clock, the long step of the snail being toward the pin d , the lever will be stopped as soon

as the first of its hour-teeth passes the hour-click f . If it is two o'clock, it will be stopped after two of its teeth have passed the click, and so on. The mainspring now moves the
70 lever back, and the teeth that have passed the hour-click engage the same and cause it to strike the hammer against the bell and sound the hour, the number of strokes corresponding to the number of teeth that pass the
75 click. The lever continues to move back over the interval before referred to, and when it reaches the notch drops into the same, thereby carrying the rack below the click f and in line with clicks $f' f''$, and the teeth of the quarter
80 groups which passed the clicks before the lever was raised now drop in front of the clicks $f' f''$ and operate the same to strike the hammers against the bells, there being two strokes for each quarter, sounding alternately. If there
85 were no quarters to be struck, it will be understood that the quarter-piece was not moved, and the lever does not drop into the notch until all its quarter-teeth have passed over the quarter-clicks $f' f''$.
90

Fig. 2: The lever D in this arrangement is returned to its normal position by moving the pull back instead of by a mainspring, though a mainspring may be used if desired.
95 The hour-rack has one group of fourteen teeth and one of three teeth, separated by a blank space. The hours and quarters are struck by the direct or positive movement of the striking rack and lever, and the minutes by the return movement. The hour-pin d projects
100 downward and rests on top of the screw-head of the hour-snail when the lever is in its normal position, and by bearing on top of the snail, as shown, it holds the lever up so that the striking-rack is above the level of all the
105 clicks $f' f' f''$. The quarter-piece H extends from the lever D in position to swing toward the quarter-snail when the lever is moved. The lever D being moved in the direction of its arrow, the lever and rack remain in their
110 highest position as long as the hour-pin remains on the hour-snail. The shortest time it remains in that position is at twelve o'clock, and the longest time at one o'clock. So long as the pin moves on the snail the teeth of the
115 rack pass over the hour-click f , the shortest time being sufficient for two teeth of the larger group to pass, thus leaving twelve teeth in front of the hour-click, while at one o'clock all the teeth would pass except the last one of
120 the group. It is necessary, on account of there being fourteen teeth in the group, that two should pass by the click without engaging it. When the hour-pin drops off the snail, the lever and rack are lowered to the level of
125 the hour-click f , and the rack engaging the same the hours are sounded, the number corresponding to the number of teeth that are before the click f when the rack drops. It can be readily seen that the larger the step of the
130 hour-snail in the line of movement of the hour-pin, the greater the distance the hour-pin must

travel before dropping off the snail, and consequently the greater number of teeth pass the hour-click without engaging it. After the hours are struck the blank space in the rack passes the hour-click, and the quarter-piece H approaches the quarter-snail, and when its end reaches the line of the longest step of the quarter-snail, the first tooth of the group of fourteen, and the first of the group of three, counting from the right, are close to the clicks *ff''*, both of which in this case are used to sound the quarters. If there are no quarters in the hour, the snail stops the quarter-piece and none of the rack-teeth engage the clicks, but if one or more quarters have passed one or more of the two groups of teeth act on the clicks *ff''*, and strike the quarters by sounding two bells alternately for each quarter. The quarters having been sounded, the farther movement of the lever is stopped and its movement is reversed. On this movement the minutes are sounded.

The mechanism for striking the minutes is shown in detail, and on an enlarged scale in Fig. 5, and in connection with the other parts of the repeater in Figs. 3 and 4. It consists of a snail, I, placed on the staff of the quarter-snail, and divided by notches into four equal steps or sections, each of which is designed to pass a certain point in fourteen minutes, the distance from notch to notch representing fifteen minutes. The faces of the notches are chamfered or beveled off to a sharp edge. The other part of the device consists of a spring pawl or click, *j*, pivoted to a limb or extension of the lever D in such a position that when the lever is moved the free end of said pawl is carried against the edge of the snail and bears against the same.

The operation of the device may be described generally as follows: The snail moves in the direction of its arrow, Fig. 5, and the pawl moves in the direction of its arrow to indicate the number of minutes when the lever D is moved to set the repeating mechanism. The pawl is carried the same distance each time; but from the point to which the pawl is carried, the distance to whichever one of the notches may be adjacent to the pawl will depend upon the number of minutes that have passed in the current quarter. If no minutes have passed—that is, if the time is an even quarter of an hour—the pawl will be in contact with the edge or face of the notch. If one or more minutes in the quarter have passed, the pawl will have to travel a less or greater distance before coming in contact with the face of the notch. The effect of the pawl coming in contact with the notch is to limit the number of the teeth on the rack that come in contact with the click which operates the hammer that sounds the minutes. And this limitation is brought about by the action of the inclined face of the notch on the pawl, which action consists in causing the pawl and with it the lever D to rise up and thereby

throw the teeth of the striking-rack out of line with the click which operates the hammer, and thereby stop the said teeth from engaging the said click and the striking of the minutes.

In the arrangement shown in Fig. 2, when the lever D is moved forward the pawl is carried in contact with the minute-snail, which is constantly moving in a direction opposite to that in which the pawl is carried by the lever. The pawl bears against the edge of the snail, and when the lever moves back it slides against the edge until it reaches the face of the notch, when it is raised up by the inclined edge. When the lever D reaches its farthest forward movement, all of the teeth in the larger group were carried past the click *f'*, which sprung back without operating the hammer; but on the return these teeth engage the said click *f'* and cause it to operate the hammer G to strike the minutes. There being fourteen teeth in the group, fourteen minutes can be struck, but the number will depend upon the distance the pawl *j* will have to travel before reaching the notch, the effect of which is, as before mentioned, to cause the lever to rise up and throw the striking-rack above the click *f'*. If, for example, it is an even quarter of an hour, when the repeating mechanism is set the pawl will be in such a position when the lever D reaches the end of its forward movement that on the reverse the pawl will bear immediately against the face of one of the notches of the minute-snail, and consequently the lever will be raised before any of the rack-teeth will have time to engage the click *f'*. If one minute has passed it will not reach the notch until one tooth has engaged and moved the said click, and so on, the greater the number of minutes up to fourteen over the quarter the farther the pawl has to travel to reach the notch, and the greater the number of teeth that are carried against the click; but if the minutes are over fourteen, another notch is brought into position to engage the pawl as soon as the lever reverses its movement. When the lever is raised by the pawl as described, it clears click *f'* and returns to its normal position. The pawl drops off the snail when the lever nearly reaches its normal position, and rests under the bridge G, whereupon the snail is liberated and turns freely.

Fig. 3: The lever D is moved forward by a pull and back by a mainspring, and the teeth of the striking-rack are arranged the same as in Fig. 2. The hour-piece *d'* is separate from the lever, and is pivoted to the plate B in such a position that it can be moved forward by the lever D, and its short end is carried against the steps of the hour-snail to indicate the hours. The end *k* of the hour-piece that comes in contact with the lever D, has its edge next to the lever beveled off abruptly, and is preferably made V-shaped in cross-section. The striking of the quarters is regulated by a pin, H', placed in a limb of the lever D, project-

ing downward so as to be carried against the steps of the quarter-snail when the lever D is moved. The minute-pawl is arranged to engage the minute-snail, the same as in Fig. 2.

5 The hours are struck on the direct movement of the lever by the teeth of the larger group engaging directly the click f . The limitation of the number of strokes is made by the lever D rising up on the hour-piece d' in the following manner: When the lever is moved forward, it carries the hour-piece before it until it is stopped by the hour-snail, during which time certain of the rack-teeth have operated the click f , the number depending on the distance moved by the hour-piece before coming in contact with the hour-snail. When the lever rises, it throws the rack above the click f and in line with click f'' , which strikes the quarters. As the lever moves on, the group of three teeth approach the click f'' , and one or more of them operate the said click as the quarter-pin H' strikes one or the other of the steps of the quarter-snail, and stops the forward movement of the lever, unless there are no quarters over the hour, when the lever D is stopped before either of the said groups of teeth reaches the click f'' . In the forward movement of the lever to reach the quarter-snail all the teeth in the group of fourteen are carried past the click f' , and on the return the said teeth engage the click and strike the minutes, the number of teeth engaging the click depending on the time the pawl reaches the notch and raises the lever, so that the rack passes over the click f' . After the proper number of minutes have been struck, the lever continues to move backward until it passes over the hour-piece and drops behind the same. In this case the quarters are struck by a single bell, and the hour-click f is placed closer to the plate B than the clicks $f' f''$.

Fig. 4: The lever is operated by a worm and screw, instead of a pull or slide. The striking-rack is provided with the two groups of teeth arranged as in Figs. 2 and 3, and the striking of the hours and quarters takes place on the forward motion of the lever, and the minutes on the reverse motion, in substantially the same manner as described in connection with Fig. 3. The hour-click f is placed nearest to the plate B, and the quarter-click f'' and minute-click f' are placed at about the same level.

In connection with Fig. 4 is shown my improved snail and snail-wheel, with the device for moving the same. The snail-wheel has thirty-six teeth, or any other number that can be evenly divided by twelve. The wheel is moved by a pin, m , on a piece, n , which is placed on the quarter and minute snail shaft, so as to turn with the same, or the pin m can be attached to the quarter-snail directly. In connection with the piece n or its pin m a disk, O, is employed, which has a concave notch cut into it. The object of this arrangement is to hold the wheel steady, the teeth passing

into the notch when the wheel is turned, as shown in Figs. 4^b and 4^c, and when the pin passes around, the edge of the piece O revolves between two of the teeth of the wheel and holds the wheel. The snail shown on an enlarged scale in Fig. 4^a is star shaped, and the points have straight edges turned in the same direction, and it is intended that the top of the points shall be beveled down to the straight edges, so as to form an abrupt incline. The snail and wheel are attached to the same shaft, as shown in Fig. 4, and are turned from right to left by the pin m . The position of the hour-piece d on the lever D is such that when the lever is moved the edge of the hour-piece is carried against the straight edge of the snail, and when it strikes the straight edge the hour-piece is raised by the inclined surface, and thereby raises the lever and with it the striking-rack, which thereupon is disengaged from the hour-click. The regulation of the time when the lever and rack shall be raised, and consequently the number of teeth shall engage the hour-click, depends upon the distance the hour-piece has to traverse before reaching the straight edge of the snail, which is constantly moving to the left, away from the hour-piece. Each point of the snail serves to indicate the time for twelve hours. The position of the snail in Fig. 4 is such that the hour-piece would be carried to point 3 of the snail when the lever was moved before coming in contact with the snail; consequently the teeth of the striking-rack would engage the click during the length of time taken to traverse this distance. When twelve o'clock has passed, the point 1 comes around, so as to be in position to be struck by the hour-piece, and at such a distance that only one tooth of the hour-rack would engage the click; consequently one o'clock would be struck. It will be understood, of course, that the snail-wheel and snail are only moved once at each revolution of the quarter-snail and exactly at the hour; consequently the snail remains in the same position between the hours, and when twelve o'clock is struck the next movement of the wheel brings another point of the snail in position to stop the hour-piece. Thus from one to twelve o'clock each point of the snail is carried farther from the hour-piece at intervals of an hour, and at one o'clock a new point is brought around in the path of the hour-piece. The effect of the hour-piece being carried in contact with the snail is the same as that produced by the lever D passing out of the notch of the quarter-piece in Fig. 1, and the said lever coming in contact with the hour-piece of Fig. 3—viz., it raises the lever and the striking-rack out of engagement with the hour-click the instant the proper hour is struck.

Fig. 7: In this arrangement of my invention the construction is such that the repeating mechanism can be applied to small and very flat watches, or to either the front or back of a watch, the quarter-snail being arranged to

be placed on the center-post, as shown. Instead of a pull or slide I use a shaft, K, carrying a beveled pinion, which meshes with a toothed wheel, V, on the shaft of which is a pinion meshing with the teeth of the lever D. The lever D carries the quarter-piece H, and on a projecting portion of the lever D is an hour-pin, *d*, projecting downward on the top of the snail in the manner hereinbefore described in connection with Fig. 2. The striking-rack E in this case is a wheel provided with pins forming the teeth, which are of the same length and project upward, any number of which may be used. The wheel gears with toothed wheel V. The shaft of the wheel has a slight vertical movement, so that the said wheel can be raised from and lowered to the plate, whereby the pins may be made to engage one or both of the bell-forks G'' G''', which are so arranged that one stands a little higher than the other. The lever D has an incline at W. By turning the shaft K the lever D is moved in the direction of its arrow, the quarter-piece is turned toward its snail, and the hour-pin commences to move from the center of the snail toward the steps of the hour-snail. Simultaneously the pin-wheel is turned on its axis, and the pins are revolved toward the point of the hour-bell G'' and sound the same. As long as the hour-pin *d* bears on the hour-snail, the pins engage the hour-bell; but when the pin drops off the snail the lever D presses on the shaft of the wheel and throws the wheel down and the pins out of line with the bell G''. The longer the steps of the snail in the line of the movement of the hour-pin the greater the number of the pins carried against the bell; but as soon as the hour-pin drops from the snail the pins no longer engage the bell. After the hour-strokes cease the lever continues to move in the same direction, and when the step at W reaches the shaft of the wheel the lever passes off the end of the shaft, the wheel rises up by the pressure of a suitable spring, and the pins are thrown in contact with both bells G'' G''', and the quarters commence to strike. Each pin engages alternately both bells, thus sounding two bells for each quarter. The pins continue to act on the bells until the quarter-piece comes in contact with the quarter-snail, when the further movement of the lever is prevented, and consequently the turning of the shaft K and the pin-wheel is stopped. A mainspring serves to return the lever to its normal position. It will be observed that in this case the operation of the hour piece or pin is the reverse of the ordinary action of the devices—that is, the striking of the hour commences as soon as the hour-piece commences to move off the snail from its position at the center thereof, and the striking ceases when the hour-piece passes one of the steps of the snail; hence, if it is one o'clock, the shortest step of the snail will be in the line of movement of the hour-piece, and consequently the hour-piece remains on the snail

only long enough for one of the pins of the striking-wheel to engage the bell. If it is two o'clock it stays on the snail long enough to permit two of the pins to engage the bell, and so on.

The improved hammer for repeating-watches is shown in Fig. 6. The hammer G is pivoted to the repeater-plate or to the plate or bridges of the watch-movement, as may be desired, and the spring click or catch *f*, which engages the teeth of the striking-rack, is attached directly to the hammer. When the rack-teeth bear against it in one direction the click bears against a pin and turns the hammer on its pivot; but when the teeth bear against it in the opposite direction the click moves aside without moving the hammer, and it must be understood that each of the clicks *f f' f''* is adapted to operate the hammers only when moved in one direction.

It is evident that the repeating mechanism, described and shown in the several figures of the drawings, can be placed directly on the watch-movement, either at the front or back, and that it is not essential to the operation of the said mechanism that it should be attached to the plate B. The main object of the said plate is to furnish means by which a complete repeating attachment for any kind of a watch-movement can be manufactured independent of the watch-movement, and as a separate article for the trade, complete in all its parts, like the watch-movement itself, and adapted to be fitted into a watch by any skilled workman. By arranging the repeating mechanism on the back of a watch, it can be placed in the watch without taking the movement apart. It can be examined, and, if necessary, removed from the watch without disturbing the movement.

The improved snail, which I have herein described in connection with Fig. 4, and the star-wheel and escapement, can be used in connection with any of the well-known repeating watch-movements.

Instead of the star-shaped snail, such as shown in Fig. 4^a, being made separate, the points against which the hour-piece acts may be made directly on the star-wheel.

In the minute-striking mechanism the minute-piece *j* may be beveled, and the notches of the minute-snail left square, if desired.

It will be understood that in the several arrangements of the repeating watch-movement, (shown in Figs. 1, 2, 3, and 4), the quarter-snail is connected by suitable wheels with the cannon-pinion, which revolves the minute-hand; but the manner of making this connection will be described and shown in an application for patent to be made hereafter. When the minutes are being struck, if there be a part of a minute over the full number, the minute-piece rises and the rack only partially engages the click, which is but slightly moved, and consequently, the hammer not being moved with full force, the bell gives a fainter sound, and

thus indicates that the last stroke is for less than a full minute.

From the foregoing it will be understood that the principle underlying the several constructions of my invention, illustrated by Figs. 1, 2, 3, 4, and 7, is substantially the same. For example, in Figs. 1, 2, 3, and 4, the vibrating rack, which engages the striking mechanism, is arranged to strike successively and at proper intervals the hours, quarters, and minutes, by its movements from and to the plate, whereby it is caused to engage the clicks, which respectively operate the hammers by which the several divisions of time are sounded, the said clicks being arranged, as hereinbefore stated, at different distances from the surface of the said plate. In Fig. 7, which shows a revolving striking-rack, the same principle is used, only in this case the rack does not follow the vibratory movement of the lever, but is rotated on its axis, and its movement from and toward the striking mechanism is produced by the action of the lever and spring. Thus it will be seen that the operation of the striking-rack from and toward the plate is not dependent on any particular construction of the parts by which the several divisions of time are regulated, as I have shown in all figures different devices, which vary the position of the striking-rack from and toward the plate to adjust the right number of strokes and to change the sounds for hours, quarters, or minutes.

My improved striking mechanism further consists in having only one striking-rack, and its actuating pieces constructed and arranged in such a manner that the striking-rack is adjusted thereby, and adapted and arranged to make two movements—viz., one movement to regulate the number of strokes, whereby the exact hour and the number of quarters and minutes in that hour are sounded, and another movement whereby the hours, quarters, and minutes are separately and successively struck and distinguished from each other.

I do not limit myself to any particular construction of the parts in the repeating mechanism by which the several divisions of time are regulated, and which move the rack from and to the plate. Neither do I restrict myself to the particular construction and shape of the plate B; nor do I limit myself to the exact form of striking mechanism herein shown and described when applied to the back of the movement, as it will be understood from the foregoing that one of the most novel points in my invention consists in placing the repeating mechanism on the surface of the movement, so that my invention consists, broadly, in placing a repeating attachment or mechanism over or outside of the time-movement without reference to the specific devices employed to form the striking mechanism, whereby I utilize the space between the time-movement and the cap or cover of the watch-case as the receptacle for the parts of the repeating mechanism, and thereby obtain the advantage

that the repeating mechanism can be seen and examined without removal from the watch, and can be made stronger. It is evident that if there is sufficient space on the back of the watch-movement for the whole of the repeating mechanism—that is, the bell-wires, hammers, and operating devices, and in some cases an additional plate, as shown in the drawings—that this space, heretofore never employed for this purpose, may serve as the receptacle for the whole or for a part of the mechanism in direct connection with the time-movement.

To avoid making a special case for a repeating-watch, as was heretofore necessary, with a push-pin or thumb-knob projecting out of the case, or, as in stem-winders, with a sliding bolt placed in and around the rim of the case, and intended to be turned around to set the repeating mechanism, I use a device attached to the watch-movement or to the plate B, and projecting out of the case, so that it requires but a very small opening in the case to let the pull or operating device through, which opening can be easily made in any ordinary watch-case by any mechanic acquainted with watch-making, and therefore by using my invention the cases for repeating-watches need not be made specially for the reception of the repeating mechanism, as heretofore.

My invention involves a radical improvement in the manufacture, construction, and principle of operation of repeating mechanism for watches and other time-pieces, whereby the said repeating mechanism can be manufactured at less expense than formerly, and can be applied to any regular-made watch-movement and placed in any modern watch-case, whether manufactured especially for the purpose or not. Furthermore, the said attachments are simple in construction, durable, easily repaired, and serve as an ornament to the back of the watch.

I claim—

1. In repeating attachments for watches and other time-pieces, the method herein described, of changing the strokes to indicate the several divisions of time, which consists in giving an up-and-down movement to the striking-rack to cause it to engage the striking mechanism at different points, substantially as described.

2. The method herein described of changing the strokes to indicate the several divisions of time, which consists in giving an up-and-down movement to the lever to operate the striking-rack, substantially as described.

3. The method herein described of striking the several divisions of time, which consists in the use of one striking-rack having a movement parallel to the watch-movement, and a movement to and from the same, substantially as described.

4. The method herein described of striking the several divisions of time, consisting in striking the hours and quarters by the direct

or positive motion of the striking-rack, and the minutes by the return movement, substantially as described.

5 5. A striking-rack for repeating-watches and other time-pieces, adapted to strike the several divisions of time by changing its movement to different planes above the plate as it engages the striking mechanism, substantially as described.

10 6. A striking-rack for repeating-watches and other time-pieces, having a sidewise movement to engage the striking mechanism, and a movement from and toward the plate to adjust itself to engage the proper striking mechanism to sound the several divisions of hours, quarters, and minutes, substantially as specified.

20 7. A striking-rack adapted to sound the divisions of time, by operating the hammer-clicks, both on its forward and back movements, substantially as described.

25 8. The lever D, arranged to change its position from and toward the plate when its connecting-pieces come in contact with the snails, in combination with a rack having a movement from and toward the plate, substantially as described.

30 9. A striking-rack adjustable from and toward the plate, in combination with the lever, arranged to change its position automatically while striking the time, substantially as specified.

35 10. In combination, with a rack having a movement from and toward the plate, the lever D, having near its attached end a suitable adjusting-spring, and adapted to be changed in its position by the contact of its snail-pieces, with the snails, substantially as specified.

40 11. The pivoted lever D, connected with its axis by a swivel-joint, and provided with a suitable adjusting spring, substantially as specified.

45 12. A striking-rack for repeating-watches and other time-pieces, having a movement to and from the plate, provided with two groups of teeth, one group having three teeth and the other fourteen teeth, for the purpose specified.

50 13. A self-adjusting striking-rack having one group of teeth to strike the hours and minutes successively, substantially as specified.

55 14. A striking-rack having one group of teeth to strike the hours on the forward motion and the minutes by its reverse motion, substantially as described.

60 15. A striking-rack adjustable to and from the plate, in combination with the pivoted lever D, adapted to move automatically to and from the plate and parallel to said plate when operating the striking-rack, substantially as described.

65 16. A striking-rack having a movement to and from the plate, in combination with a slide or pull adapted to be drawn out of the case, and intermediate mechanism to connect the rack with the slide or pull, substantially as specified.

17. In combination with the repeating mechanism of time-pieces, a slide or lever arranged to set the striking-rack and regulate the retraction of the mainspring by being drawn out, substantially as described, and for the purpose set forth. 70

18. A slide or lever adapted to operate the striking-rack back and forth by being drawn out and pushed in the watch-case, so as to act as a starting device to set the repeating mechanism in motion, substantially as set forth. 75

19. A slide or lever arranged to be drawn or pulled out to move the striking-rack and retract the mainspring of the repeating mechanism, substantially as described. 80

20. The combination of a single striking-rack having a motion parallel to the plate of a watch and a motion to and from the same, with striking devices arranged in different planes, so that the said rack engages the said striking devices at proper intervals to separately strike the hours, quarters, and minutes successively, substantially as specified. 85

21. In combination with a striking-rack adapted to engage the striking devices in different planes, a lever for operating the striking-rack having a sidewise motion and a motion from and to the plate, as and for the purpose specified. 90

22. In combination with the striking-rack herein described, having a sidewise motion and a motion to and from the plate, a lever operating the same having the hour-piece connected with it, substantially as specified. 100

23. In combination with the striking-rack having a sidewise motion and a motion to and from the plate, a lever for operating the same having the quarter-piece connected with it, substantially as specified. 105

24. In combination with the hour-rack herein described, a lever for operating the same arranged and constructed to automatically change its position from and to the plate while in motion, and having the minute-piece connected with it, substantially as specified. 110

25. In combination with the hour-rack herein described, a lever for operating the same having the hour, quarter, and minute pieces connected with it, substantially as and for the purpose specified. 115

26. In combination with the lever for operating a single striking-rack arranged to strike the several divisions of time, a quarter-piece adapted to be carried directly to the quarter-snail by the said lever, substantially as specified. 120

27. The lever for operating the striking-rack, in combination with an hour-piece arranged to operate upon the said lever to give it a movement to and from the plate, substantially as described. 125

28. In combination with the lever for operating the striking-rack arranged to move to and from the plate, an hour-piece attached to the lever and adapted to change the position of the said lever when acted upon by the hour-snail, substantially as specified. 130

29. The snail herein described, having three points or sections equidistant from each other and constructed and arranged to raise the hour-piece and with it the lever and rack when the hour-piece is moved against it, substantially as and for the purpose specified.
30. In combination with the star-shaped snail, an hour-piece adapted to be carried against the snail when moved in the direction of the motion of the snail, substantially as and for the purpose specified.
31. The star-shaped snail, in combination with the hour-piece so constructed that when the hour-piece is carried against the snail it rises up and carries the lever with it, thereby raising the striking-rack out of engagement with the striking devices, substantially as specified.
32. In combination with the striking rack and lever and the hour-piece connected therewith, a snail adapted to throw the said rack out of engagement with the striking devices when the hour-piece is moved against it, substantially as specified.
33. A snail for repeating-watches, adapted to regulate the number of strokes of the striking mechanism by moving the striking-rack out of engagement with the striking devices, substantially as specified.
34. In combination with the hour-snail, a star-wheel, and a suitable device attached to the quarter-snail shaft to move by its revolution the said star-wheel one tooth forward and hold it steady, substantially as shown and described.
35. In repeating mechanism for watches and other time-pieces, the pin *m* and notched disk or piece *O*, connected with the quarter-snail, in combination with the star-wheel and hour-snail, substantially as and for the purpose specified.
36. In combination with the striking-rack and its lever, a quarter-piece adapted to throw the striking-rack out of engagement with the striking devices, substantially as specified.
37. The method of regulating the striking of the minutes, which consists in moving the minute-piece in the direction of the revolution of the minute-snail and against a notch in the said snail to adjust the rack for the right number of strokes, substantially as specified.
38. The method of limiting the movement of the striking-rack when striking the minutes, which consists in moving the minute-piece in the direction of the revolution of the minute-snail, and carrying the said minute-piece against the face of a notch in the snail, by which movement the minute-piece is raised and thereby throws the striking-rack out of connection with the striking devices, as specified.
39. The minute-piece *j*, composed of a spring-pawl attached to one arm of the striking-rack lever, in combination with the minute-snail and striking-rack, substantially for the purpose specified.
40. A minute-snail for repeating-watches and other time-pieces, consisting of a disk provided with four equal sections divided by notches, in combination with a quarter-snail shaft and minute-piece, substantially as described.
41. The combination of the minute-snail *I*, divided into four equal sections by notches, and minute-piece *j*, with the striking-rack and connecting-lever, substantially as specified.
42. In combination with the minute-snail and minute-piece, a striking-rack in one piece adapted to change its position from and to the plate automatically while moving sidewise against the striking mechanism, substantially as specified.
43. As a new article of manufacture, a plate, *B*, adapted to receive the various parts of a repeating attachment and to be connected with a watch-movement, substantially as shown and described.
44. A plate, *B*, carrying a repeating mechanism, and adapted to be connected with and detached from a watch-movement, in combination with a watch-movement, substantially as described.
45. A plate, *B*, provided with an opening, *a*, and adapted to receive the several parts of a repeating attachment, in combination with a watch-movement, substantially as described and shown.
46. As a new article of manufacture, a repeating attachment for watches and other time-pieces, made separate from the watch-movement, and adapted to be attached to the same, substantially as described.
47. A repeating attachment for watches made separate from the watch-movement, in combination with the plate *B*, adapted to be connected with the watch-movement, substantially as described.
48. A plate, *B*, of suitable shape, adapted to be connected with a watch-movement, in combination with a repeating mechanism made separate from the watch-movement, substantially as specified.
49. A repeating mechanism for watches and other time-pieces, so constructed that it may be attached to or detached from the movement as a whole without disarranging its parts, substantially as herein described.
50. A repeating mechanism for watches, placed on the back of a watch-movement, in combination with a watch-movement, substantially as herein shown and described.
51. A repeating mechanism constructed on the back of a watch-movement, so that it can be seen and examined, and, if necessary, removed without taking the movement apart, substantially as described and shown.
52. A pull or slide for operating the repeating mechanism of a watch by being drawn or pulled out of the watch, in combination with a watch-case provided with openings in the rim and covers of the watch-case, substantially as and for the purpose described.
53. The bell wires or forks for a repeating

attachment for watches, arranged above or over the back of a watch-movement, substantially as and for the purpose described.

54. The clicks or pawls for operating the striking-hammers, fixed on different planes above the plate, in combination with a striking-rack having a sidewise motion and a motion from and to the plate, substantially as specified.

55. A hammer for repeating attachment for watches and other time-pieces, having the pawl and actuating-spring made in one piece, and attached directly to the hammer, substantially as described.

56. The combination, with the repeating mechanism, of a pull or slide, adapted to be drawn out through an opening in the watch-case, and provided with a finger-piece movable from and toward the edge of the case, substantially as and for the purpose described.

57. The operating device for repeating mechanism arranged on the back of a watch-movement, in combination with the striking mechanism, substantially as described.

58. The hour-snail for repeating mechanism, arranged above or over the back of the watch-movement, in combination with the watch-movement, substantially as described.

59. A striking-rack for repeating mechanism, arranged on the back of a watch-movement, in combination with the striking devices, substantially as described.

60. A striking-rack arranged over or above the back of a watch-movement, in combination with a snail, and the devices for connecting the snail with the time-train, substantially as described.

61. A striking-rack for repeating mechanism for watches, movable between the back of a watch-movement and the cap or cover of the watch-case, substantially as described.

62. The quarter-snail for repeating mechanism, placed above or over the back of a watch-movement, in combination with the time-train, and devices for connecting the same, substantially as described.

63. The quarter and minute snails for repeating mechanism, arranged above or over the back of a watch-movement, in combination with the quarter and minute pieces for adjusting the actuating mechanism for the striking devices, substantially as described.

64. The quarter and minute snails for repeating mechanism, arranged above or over the

back of a watch-movement, in combination with the time-train, and devices for connecting the same, substantially as described.

65. A minute-snail revolving above or over the back of a watch-movement, in combination with the minute-piece arranged above or over the back of the watch-movement, and the striking-rack, substantially as described.

66. The regulating-wheels or gearing for the repeating mechanism, arranged above or over the back of a watch-movement, in combination with the repeating mechanism, substantially as described.

67. In a watch-movement, a back plate having on its outer side the striking-rack of a repeating mechanism, and devices for connecting the same with the time-train, substantially as described.

68. A back plate for a watch-movement, adapted to expose the balance-wheel and bridge, and having on its outer side the striking-rack of a repeating mechanism, and devices for connecting the same with the time-train, substantially as described.

69. A repeater-plate having irregular openings a , and cuts a' a'' , substantially as described and shown.

70. A repeater-plate, B, having an irregular opening a , and the cut a'' , substantially as described and shown.

71. A quarter-snail for repeating mechanism, arranged above or over the back plate of a watch-movement, and provided with a device for setting the hour-snail, in combination with the time-train, substantially as specified.

72. The snails for repeating mechanism, placed on the plate B, between the center of the watch-movement and its periphery and adjoining the cut a'' of the plate, substantially as described and shown.

73. In a watch-movement, a snail or snails for repeating mechanism, placed above or over the back plate on one side between the center of the movement and the periphery, in combination with a striking-rack placed on the opposite side of the movement between the center and the periphery, substantially as described and shown.

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Witnesses:

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