(No Model.) 2 Sheets—Sheet 1.

E. HEUER.

REPEATING WATCH.

No. 411,148. Patented Sept. 17, 1889.

Fig. 1.

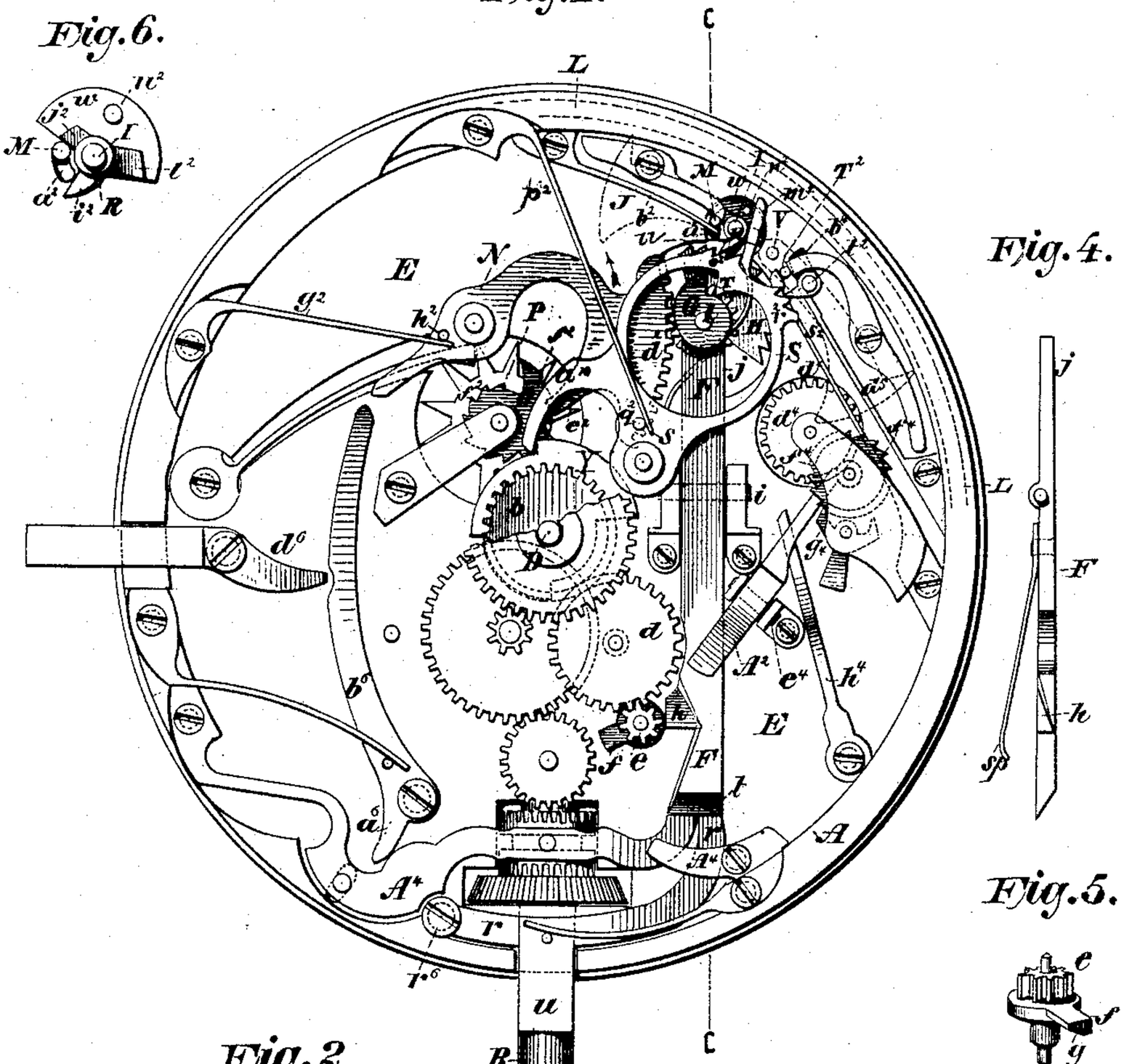


Fig. 6.

Fig. 4.

Fig. 5.

Fig. 2.

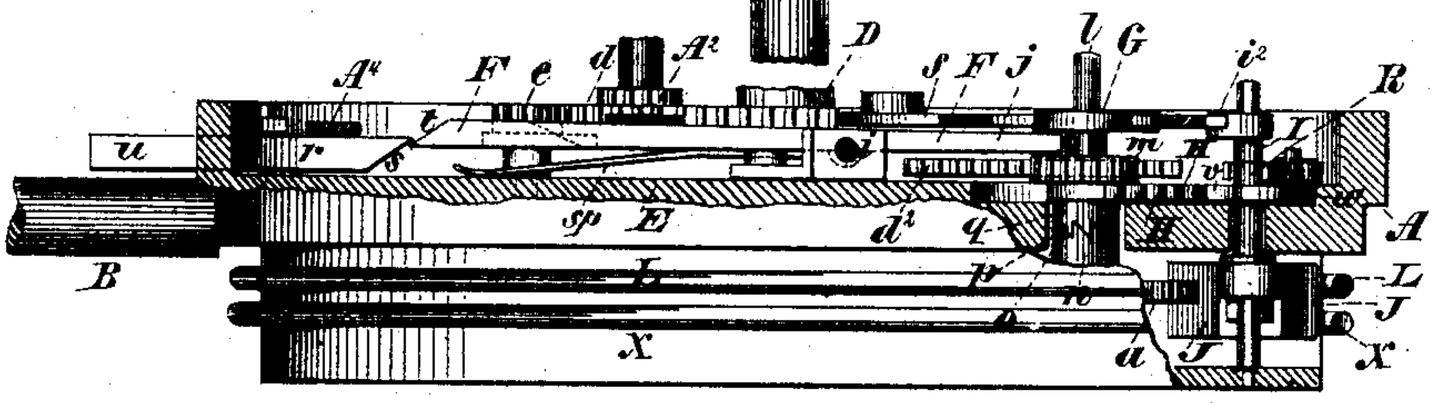
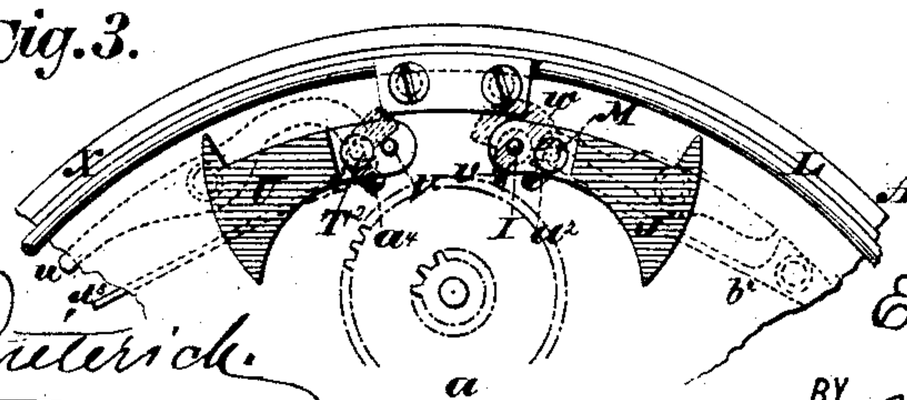


Fig. 3.



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BY Briesen, Steele & Knauth

ATTORNEYS.

(No Model.) 2 Sheets—Sheet 2.

E. HEUER.

REPEATING WATCH.

No. 411,148. Patented Sept. 17, 1889.

Fig. 7.

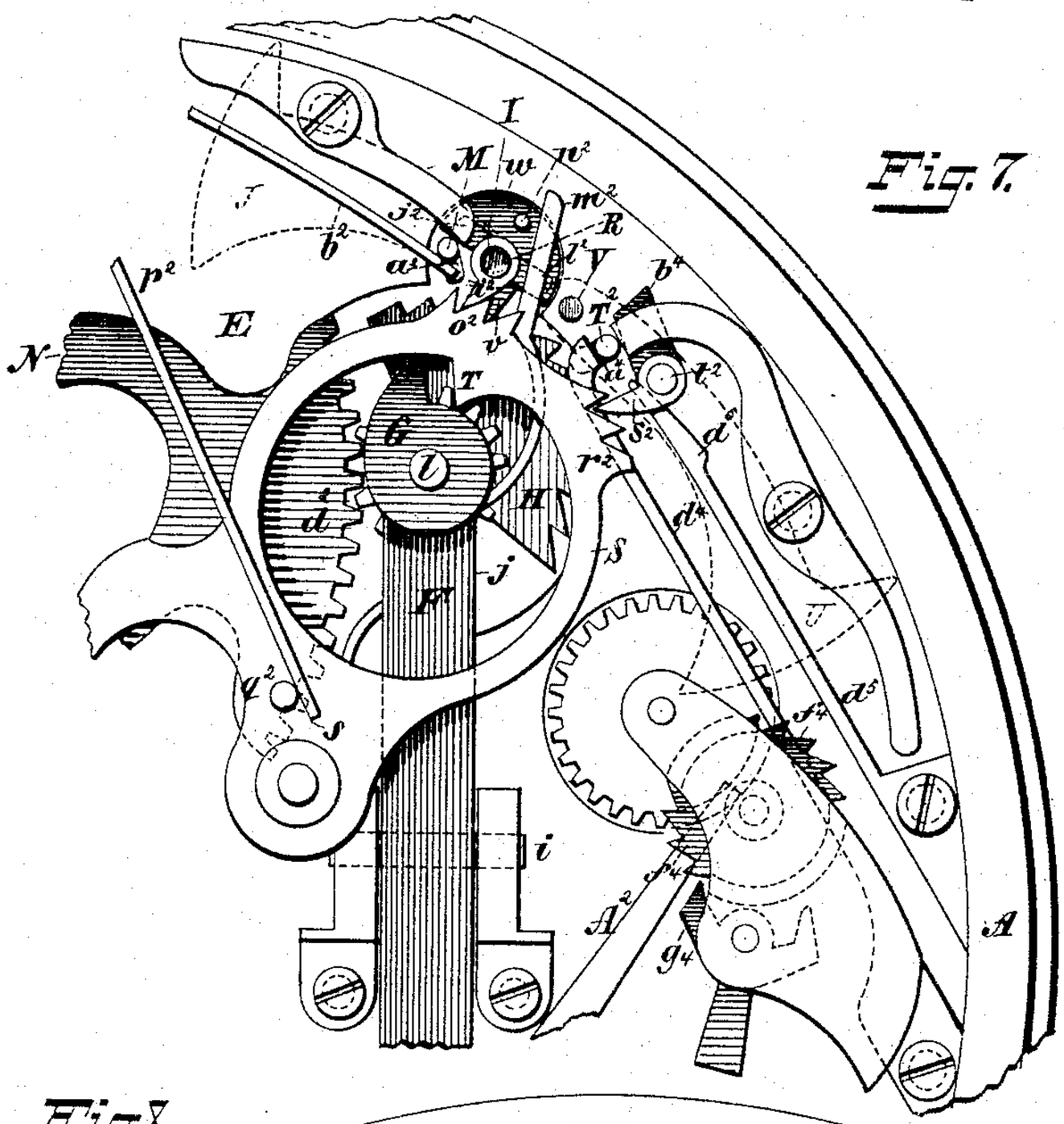


Fig. 8

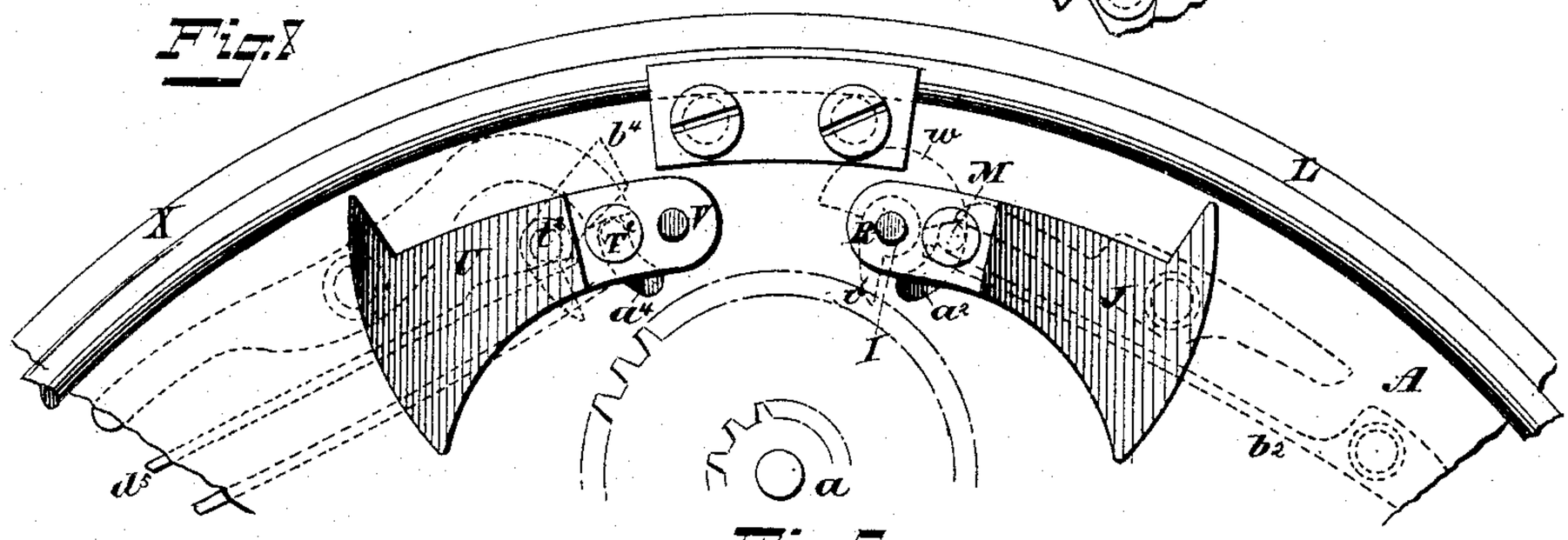
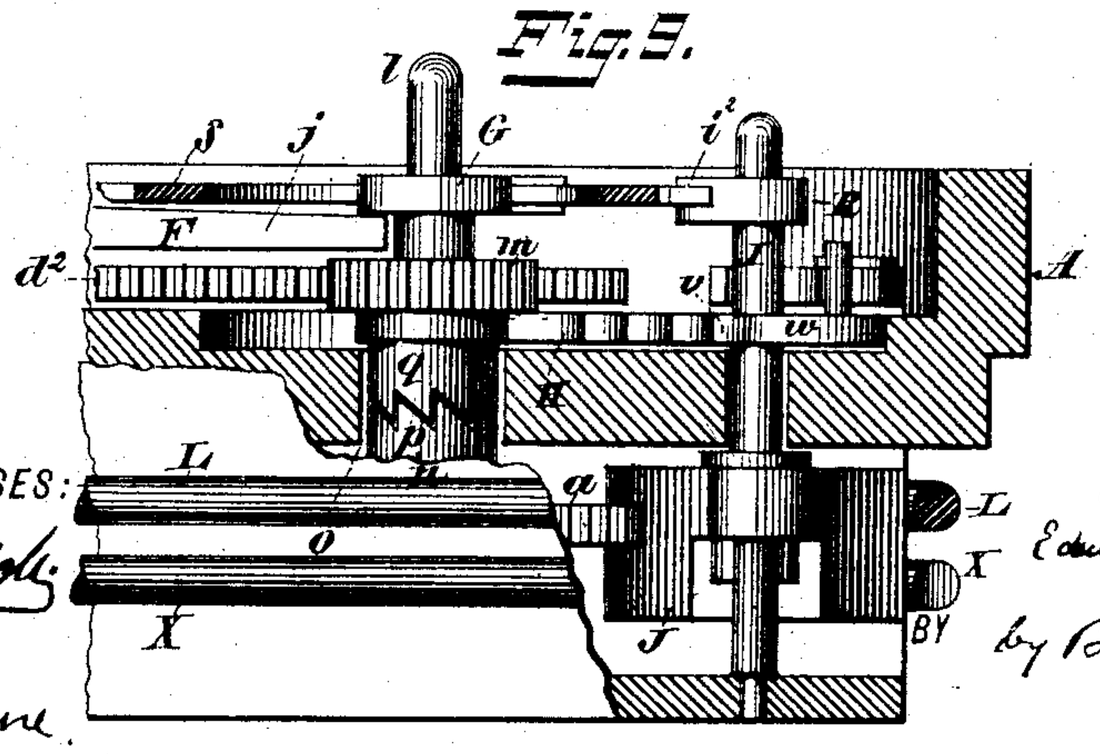


Fig. 9.



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UNITED STATES PATENT OFFICE.

EDOUARD HEUER, OF BIENNE, SWITZERLAND.

REPEATING-WATCH.

SPECIFICATION forming part of Letters Patent No. 411,148, dated September 17, 1889.

Application filed February 6, 1889. Serial No. 298,828. (No model.) Patented in France October 17, 1888, No. 192,640; in England November 14, 1888, No. 16,519, and in Switzerland November 15, 1888, No. 9.

To all whom it may concern:

Be it known that I, EDOUARD HEUER, of Bienne, Switzerland, have invented an Improved Repeating-Watch, (for which I have obtained Letters Patent as follows: France, for fifteen years, No. 192,640, dated October 17, 1888; England, for fourteen years, No. 16,519, dated November 14, 1888, and Switzerland, for fifteen years, No. 9, dated November 15, 1888,) of which the following is a specification.

The object of my invention is to produce a repeating or striking watch which shall be simple in construction; and the invention consists in the details of improvement and the combinations of parts that will be more fully hereinafter set forth.

Reference is to be had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a face view, on an exaggerated scale, of a watch-movement, showing my improvements as applied thereto. Fig. 2 is a cross-section on the line *c c*, Fig. 1. Fig. 3 is a detail reversed face view of a portion of the side of the watch, (opposite to that shown in Fig. 1,) showing the hammers for striking the gong or spring. Fig. 4 is a detail view of the let-off lever. Fig. 5 is a detail perspective view of the pinion for actuating said let-off lever. Fig. 6 is a detail of the hammer-actuating devices. Fig. 7 is a detail plan view, greatly exaggerated, of parts shown in Fig. 1. Fig. 8 is a similar view to Fig. 3, on a greatly-exaggerated scale; and Fig. 9 is a view of part shown in Fig. 2, on a greatly-exaggerated scale.

In the accompanying drawings, the letter A represents a watch-movement frame, which may be of suitable construction, and B is the winding-stem.

The movement or mechanism for driving the hands and the spring for actuating the repeater parts are not shown in the drawings, as any suitable movement or driving-gear may be used; but I prefer that there be two springs to be wound up at the same time by the winding-stem B, one of said springs being used to actuate the part of the movement for turning the hands and the other of such springs to be used for actuating the mechanism of my repeater improvements.

The spring for actuating the repeater improvements is connected by suitable gearing with a pinion or wheel *a*, (see Fig. 2,) which wheel is suitably journaled in the movement and connected with the repeater mechanism, as hereinafter shown.

D is the minute-hand arbor, that carries a cannon-pinion *b*, which gears with a toothed wheel *d*, suitably journaled on the plate E of the watch-movement. The toothed wheel *d* gears with a pinion *e*, journaled on the plate E, which pinion or the arbor of said pinion carries a projecting lug *f*, that is beveled on its under side at *g*, as shown in Fig. 5. The pinion *e* is adapted to make four revolutions in one hour. The lug *f* or the bevel *g* on said lug is adapted to engage an incline or beveled edge or projection *h* on a lever F, that is hung on the plate E by a pivot *i*, supported in suitable bearings on the plate E. As the pinion *e* rotates and its lug *f* engages the incline *h* on the lever F, the outer end of said lever will be depressed thereby and the other end *j* of said lever raised. The end *j* of the lever F reaches near to the arbor *l* of the pinion or wheel *a*, and said end of said lever is situated between a pinion *m*, secured to a sleeve *q*, hung loosely on the arbor *l*, and a finger or cam G, that is secured to said sleeve. The toothed wheel *a* is secured to the arbor *l*, and is provided with a sleeve *n*, that carries a number of ratchet-teeth *o*. These teeth *o* are adapted to engage similar teeth *p* on the sleeve *q*, so that when the teeth *o p* are in contact the revolution of the pinion or wheel *a* will turn the sleeve *q*, and thereby the pinion *m* and finger or cam G; but when said teeth are disengaged the sleeve *q* and its connected parts are free to be turned independently of the wheel *a*. The teeth *o p* are disengaged by the raising of the end *j* of the lever F, which, coming under the finger or cam G, lifts said cam and its sleeve *q*, so as to unlock the said teeth. The end *j* of said lever is raised when the lug *f* on the pinion *e* engages the incline *h* near the opposite end of the lever F and depresses the latter end of said lever. Normally the outer end of the lever F is raised and the end *j* lowered by a spring *sp*, as shown in Fig. 2. Said lever F may be actuated also by a lever *r*, that is

hung at r^6 on the plate E, and at its opposite end is beveled at *s*, Fig. 2, and adapted to engage a bevel *t* on the outer end of the lever F, whereby as the lever *r* is pressed against the outer end of the lever F said end of said lever F will be depressed. The lever *r* carries a projecting shank *u*, that passes through the frame A, and is adapted to be engaged by the finger of the user for the purpose of actuating the lever F.

H is a toothed sector, that is secured to the sleeve *q*, and is actuated thereby. The sector H preferably has twelve teeth for indicating the hours of the day. The teeth of said sector are adapted to engage a tooth *v*, that is carried by a segment *w*, loosely hung on the arbor I of a hammer J. The hammer J is adapted to strike a gong-spring L, that is coiled around the movement and carried thereby. One edge of the segment *w* is adapted to engage a pin M, that is carried by the hammer J, and that extends parallel to the harbor I of said hammer and passes through a slot a^2 in the plate E, whereby as each tooth of the sector H contacts the tooth *v* of the segment *w* it will cause the edge of said segment to press upon the pin M of the hammer J and move said hammer from the gong-spring L, and as said tooth *v* is released by the onward movement of the toothed sector the parts will be free to move, whereby a spring b^2, that presses upon the pin M, will throw the hammer against the gong-spring L, to sound the same. These movements are given each time a tooth of the sector H engages the tooth *v* of the segment *w*. By this means the hours of the day can be indicated by a stroke of the hammer J. When it is twelve o'clock, the twelve teeth of the sector H will successively engage the tooth *v* and cause it to give twelve strokes to the hammer J; but when any other hour of the day arrives—say, for instance, six or three o'clock—only six or three teeth of the sector H will encounter the tooth *v*, giving but six or three strokes, as the case may be.

In order that the requisite number of teeth on the sector H will be presented to the tooth *v* for the proper hour of the day, the pinion *m* on the sleeve *q* is geared with a toothed sector d^2, that is carried by a lever N, that is hung on the plate E. The lever N or the sector d^2 carries a projection e^2, that is adapted to engage a snail-cam O, that is hung on the plate E. The snail-cam O has twelve projections or teeth f^2, upon which the projection e^2 is adapted to rest. Each tooth f^2 on the snail-cam O is at a different distance from the pivot of said cam than the next tooth; or, in other words, the circumference of the snail-cam is made of twelve different planes, so that when the projection e^2 rests upon the third plane f^2 the segment d^2 will have turned the pinion *m* sufficiently far to bring three teeth of the sector H in position for actuating the tooth *v* three strokes, thereby indicating three o'clock. This is shown clearly in Fig. 1. The snail-cam O is turned by connection with the arbor D (not shown) the distance of one plane f^2 each hour, so that by the next hour the cam will have turned to bring the plane f^2 (representing four o'clock) in line with the projection e^2, so that said projection may pass slightly nearer to the pivot of the cam O, thereby turning the pinion *m* a certain distance farther, and bringing another tooth (or, say, four teeth of the sector H) into position for actuating the tooth *v* to actuate the hammer J. This turning of the snail-cam is kept up each hour until the plane f^2 nearest the pivot of the cam comes in line with the projection e^2, whereby the segment d^2 has been moved to its fullest extent, thereby bringing the twelve teeth of the sector H in line in position to actuate the tooth *v* twelve times to indicate twelve o'clock. The snail-cam O is rigidly connected with a star-wheel P or the like, that is actuated by a pin or other suitable means carried by the minute-arbor D, so as to move the star-wheel the distance of one tooth or one plane f^2 at each hour. As the sector H is being turned to actuate the tooth *v*, the pinion *m*, turning with the sector, moves the segment d^2 in the direction of the arrow, Fig. 1, and against the tension of a spring g^2, that bears against a pin h^2 on the lever N, as shown. As soon as the end *j* of the lever F is raised to disengage the clutch *o p*, the spring g^2, acting on the lever N, turns said lever in the reverse direction of the arrow, thereby returning the sector H to its normal position through the medium of the segment-rack d^2 and pinion *m*, ready for another forward movement to actuate the finger *v*.

The quarter-hour and half-hour are indicated by the strokes of the hammers as follows: On the arbor *l* of the hammer J, above the segment *w*, is a sleeve R, that has a tooth i^2, similar to the tooth *v*. The sleeve R also has a projection j^2, (see Fig. 6,) that is adapted to engage the pin M of the hammer J to move said pin through its slot a^2 in manner similar to its movement by the segment *w*. The sleeve R also carries a projection l^2, (see Fig. 6,) that is pressed upon by a spring m^2, so as to hold the tooth i^2 in its proper position. The spring m^2 is also adapted to engage a pin n^2 on the segment *w*, so as to hold the edge of said segment in proper position with relation to the pin M. The tooth i^2 is adapted to engage three teeth o^2 on the edge of a ring-shaped lever S, that is suitably hung on the plate E. On the inner edge of the ring-shaped lever S is a projection T, that is adapted to be engaged by the cam or finger G, so as to move the teeth o^2 of the lever S into engagement with the tooth i^2 at the proper moment, so that by turning the sleeve R the projection j^2, Fig. 6, will encounter the pin M and thereby move the hammer J. As the tooth i^2 slips off its corresponding tooth o^2, the hammer J will be released, and thereby be permitted to strike the gong-spring L to sound

an alarm. A spring p^2, by pressing against a pin q^2 on the lever S, moves said lever so as to carry the teeth o^2 away from the tooth i^2 and in position for engaging said teeth. The lever S also carries three teeth r^2, similar to the teeth o^2, which teeth are adapted to engage a tooth s^2, carried by a sleeve t^2, that is hung on the plate E. The sleeve t^2 carries a projection b^4, that is adapted to engage a pin T^2, that projects through a slot a^4 in the plate E, and is carried by a hammer U, similar to the hammer J. The arbor V of the hammer U is journaled in the plate E. A spring d^4 presses against the pin T^2 and holds it in contact with the projection b^4. The hammer U is adapted to engage a gong-spring X, similar to the spring L. A spring d^5, bearing against a shoulder of the sleeve t^2, serves to bring said sleeve back to its normal position after each stroke of the hammer U.

The movement of the lever S is regulated so that the quarter and half hours shall be properly indicated as follows: a^{10} is a projection on the lever S, that comes against a cam or quarter-snail Y, that is carried by the minute-arbor D, as shown in Fig. 1. The cam or quarter-snail Y has its circumference made in four different planes, each of which is at a different distance from the pivot or arbor D. The cam or quarter-snail Y acts with the projection a^{10} and the lever S similarly to the cam O and the projection e^2 on the lever N—that is to say, as the arbor D makes each quarter-revolution a different plane on the cam Y will be presented to the projection a^{10}, thereby moving the lever S and causing one or more teeth o^2 r^2 to be presented to the teeth i^2 s^2, according as the one-quarter, half, and three-quarters are to be struck. Between one and fourteen minutes after every hour—that is, before the first quarter is due—the projection a^{10} on the lever S does not rest on the cam or quarter-snail Y, but on the surprise, which is a similar piece to Y, under the cam Y, and prevents the quarters striking at all. The surprise is actuated every hour by a pin on the star-wheel P. When the projection a^{10} is resting on the surprise and the quarters unable to strike, the teeth i^2 and s^2 and o^2 and r^2 are disengaged.

The position of the parts is such that after the teeth of the sector H have actuated the hammer J to indicate the full hours the cam G will engage the projection T and move the lever S, thereby causing the first tooth r^2 to actuate the tooth s^2 and the first tooth o^2 the tooth i^2, and to make both hammers J and U strike their respective gongs nearly simultaneously, producing a double sound for the first quarter-hour. If the cam G moves farther on, the half-hour will be indicated by the like action of the second tooth o^2 and r^2, and then the three-quarter hour will be indicated by the third tooth o^2 and r^2. After one hour and the fractions thereof have been indicated, and just before the next hour is to be indicated by the hammer J, the snail-cam O will be turned the distance of one tooth, which brings the lower plane f^2 in line with the projection e^2, so that an additional tooth on the sector H may engage the tooth v to indicate the next hour. After the hour has been indicated, the finger or cam G will contact the projection T and move the lever S to indicate the fractions of the hour, as before stated. Any time that it is desired to cause the watch to repeat, the projection u is pressed by the finger, which will depress the end t of the lever F and raise the end j of said lever, thereby disengaging the clutch o p and permitting the spring g^2 to return the sector H and lever F to their original positions, when, on releasing such pressure, the parts will start and indicate the time of day by striking.

In order to stop the movement of the train that actuates the striking mechanism while the clutch o p is disengaged, a lever A^2 is hung at e^4 on the plate E, one end of said lever resting upon the lever F, while the opposite end of said lever comes under the escapement-wheel f^4 of the striking-train. This escapement-wheel f^4 is connected by suitable gearing with the moving train, and it is provided with an anchor g^4, that permits the escapement-wheel to move in proper time. The end of the lever A^2 is kept in contact with the lever F by a spring h^4. The normal position of the lever A^2 is out of engagement with the escapement-wheel f^4; but when the lever F is depressed the end of the lever A^2 in contact therewith is also depressed, while the opposite end of the lever A^2 is forced by the spring h^4 into contact with the escapement-wheel f^4, and thereby said wheel is stopped, and thus the pressure on the pinion or wheel a by the mainspring of the train is counteracted while the clutch o p is disengaged; but when the parts are permitted to regain their normal position—that is, when the clutch comes together again—the lever A^2 releases the escapement-wheel f^4 and permits the train to run to cause the watch to strike. As the pinion e rotates once in every quarter-hour, the lever F will be depressed to disengage the clutch o p once in every quarter-hour, thereby returning the sector H to its normal position four times in every hour.

In order to prevent the striking mechanism from operating while the hands are being set, the hand-setting lever-spring A^4 is adapted to engage a projection a^6 on a lever b^6, that is hung on the plate E, the free end of which lever is adapted to come against the end of the lever N, so as to prevent said lever from moving. The lever b^6 will come against the end of the lever N when the setting-lever A^4 is pressed inward to set the hands, said lever A^4 engaging the projection a^6, thereby moving the lever b^6 and stopping the striking-train while setting the hands. Said striking-train may also be stopped when desired by means of a lever d^6, one end of which lever is adapted to press the lever b^6 into engage-

ment with the lever N, while the opposite end of the lever d^6 projects from the watch-frame or case, and is adapted to be actuated by the finger of the user.

In order to prevent the projection *f* on the pinion *e* engaging or contacting the lever F while the hands are being set, the end of the lever A^4 is adapted to engage the inclined end *t* of the lever F when the lever A^4 is moved to set the hands, and thereby to depress the lever F.

Having now described my invention, what I claim is—

1. The pinion *e*, having a projection *f*, and means, substantially as described, for turning said pinion, combined with the lever F, to be actuated by said pinion, arbor *l*, carrying teeth *o*, pinion or wheel *a*, and means, substantially as described, for actuating the same, and the sleeve *q*, having teeth *p* and toothed sector H, and means, substantially as described, for returning the sector when the teeth *o p* are disengaged, substantially as specified.

2. The pinion or wheel *a* and means for turning the same, its arbor *l*, and teeth *o*, in combination with the toothed sector H and teeth *p*, connected therewith for engaging the teeth *o*, and with the hammer J, and tooth *v*, connected with said hammer, said tooth being actuated by the toothed sector H, and means, substantially as described, for returning said sector to the actuating position when the teeth *o p* are unlocked, substantially as described.

3. The combination of a driving-train of gearing and a pinion or wheel *a* in said train, a clutch actuated by the same, and a toothed sector connected with said clutch, with a hammer and gong, a pin carried by said hammer, a segment adapted to contact said pin to turn the hammer, and a tooth *v*, connected with said segment to be actuated by the toothed sector, and with mechanism, substantially as described, for returning the toothed sector to the actuating position when the clutch is unlocked, substantially as described.

4. The combination, with a driving-train containing a pinion or wheel *a*, a clutch driven by said wheel, and a pinion *m*, connected with said clutch, of a toothed rack or segment gearing with said pinion and a spring for moving said rack in the reverse direction to its movement by the driving-train when the clutch is unlocked, substantially as described.

5. The combination of the lever F, having the incline *h*, and the pinion *e*, having the projection *f*, to engage said incline, and means, substantially as described, for actuating said pinion with a driving-train having a pinion or wheel *a* and a clutch connected with said wheel, a pinion connected with said clutch, a toothed rack or segment gearing with said pinion, and a spring for moving said rack or segment in the reverse direction to its movement by the driving-train, the projection *f* on the pinion *e* actuating the lever F to unlock the clutch; substantially as described.

6. The pinion or wheel *a* and its driving mechanism, and the clutch *o p*, sleeve *q*, toothed sector H, and finger G, carried by said sleeve, combined with the hammer J, its arbor I, the pin M, carried by the hammer, the segment *w*, having tooth *v*, sleeve R, having tooth i^2 and projection j^2, lever S, having teeth o^2 and projection T, and with mechanism, substantially as described, for returning the sector H and lever S to their actuating position, substantially as described.

7. The pinion or wheel *a* and its driving-train and a clutch connected with said wheel, a segment-rack and a pinion driven by said wheel, a hammer J, and a tooth *v*, connecting said hammer with the sector H, combined with a lever N, having a segment-rack d^2 and a projection e^2, and with a cam O, having a series of unequal projections or planes f^2, adapted to be engaged by said projection e^2, and mechanism, substantially as described, for turning the cam intermittently to present a different plane to the projection e^2, all arranged for operation substantially as described.

8. The pinion or wheel *a* and its driving-gear, a clutch connected with said wheel, a toothed sector, a pinion, and a finger or cam G, connected with said clutch, a hammer J, having a pin M, a segment *w*, having a tooth *v* to engage said sector, a sleeve R, having a tooth i^2, and a projection j^2, combined with the lever S, having teeth o^2 to engage the tooth i^2 and a projection T to be engaged by the finger or cam G, and with the lever N, having segment-rack d^2, engaging the pinion on the clutch, a projection e^2 on said lever, and a cam O, having a series of different planes f^2, means, substantially as described, for turning said cam, and means, substantially as described, for disengaging the clutch and turning the parts in the reverse direction to their movement by the wheel *a*, substantially as specified.

9. The lever F and means, substantially as described, for rocking said lever, combined with a driving mechanism having an escapement-wheel f^4, and with a lever A^2, that rests at one end against the lever F, and that is adapted to contact the escapement-wheel f^4 when said lever F is depressed, and with a spring h^4 for holding the lever A^2 in contact with the lever F, substantially as described.

10. The lever F, having the incline *t*, combined with a hand-setting lever A^4, adapted to engage said incline, and thereby to depress the lever F, substantially as described.

11. The hand-setting lever A^4, combined with a lever b^6, having a projection a^6 to be engaged by the lever A^4, and with the lever N, adapted to be contacted by the lever b^6 to stop the movement of the lever N, substantially as described.

12. The lever b^6 and the lever N, adapted to be engaged by the lever b^6, combined with the

lever d^6, one end of said lever d^6 being adapted to actuate the lever b^6, the opposite end of said lever d^6 passing through the casing of the watch to be engaged by the finger of the operator, substantially as described.

13. The hammer U, journaled in the plate E, and having a pin T^2, that passes through a slot in said plate, the arbor of the hammer having the tooth s^4, and the projection h^4, combined with the lever S, having the teeth r^2 to engage the teeth s^4, and with mechanism, substantially as described, for oscillating the lever S to actuate the hammer U, substantially as described.

The above specification signed by me this 13th day of October, 1888.

EDOUARD HEUER.

Witnesses:
S. COLOWE, Jr.,
D. WEISS.