(No Model.) 4 Sheets—Sheet 1.

J. PALLWEBER.

CLOCK.

No. 359,227. Patented Mar. 8, 1887.

Fig. 4.

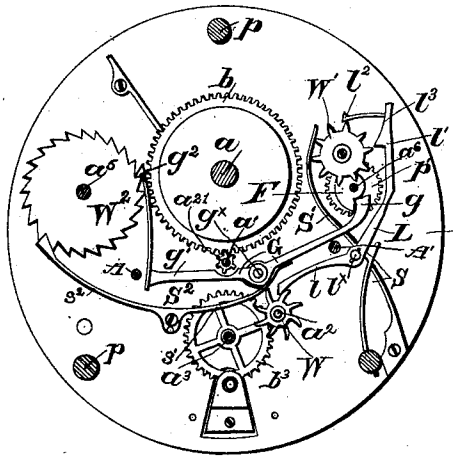


Fig. 3.

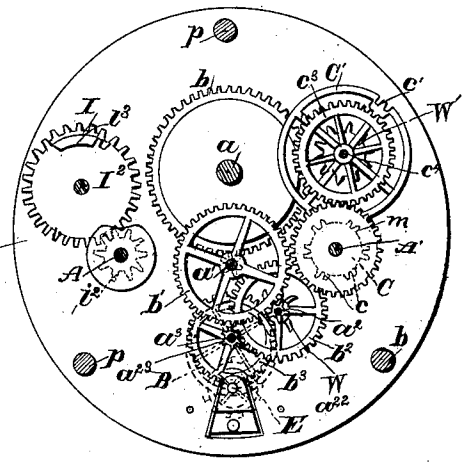


Fig. 1.

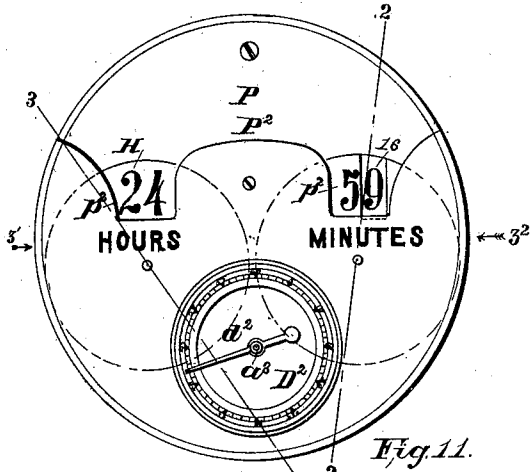


Fig. 2.

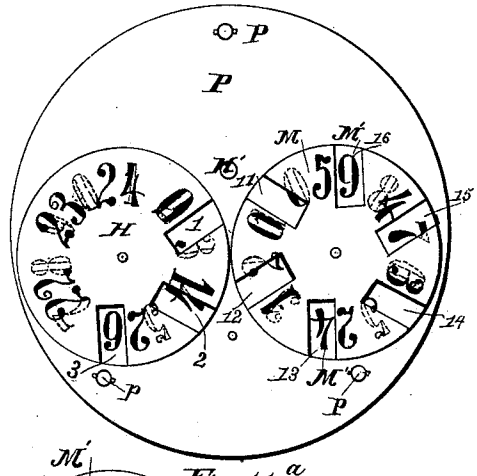


Fig. 11.

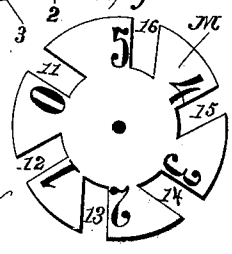
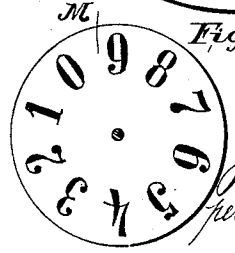


Fig. 11. a



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Fig. 5.

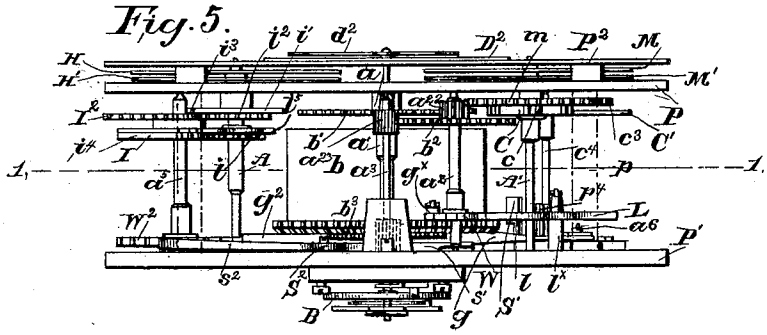


Fig. 6.

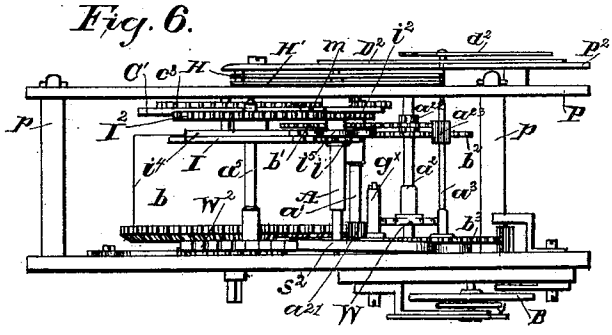


Fig. 7.

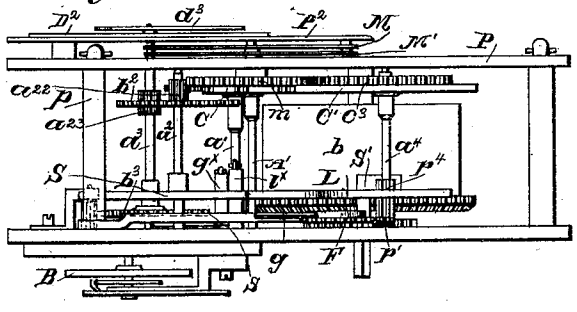


Fig. 12.

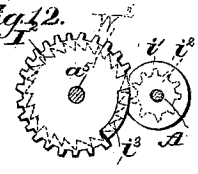
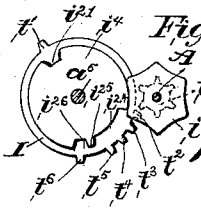


Fig. 13.



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Fig. 8.

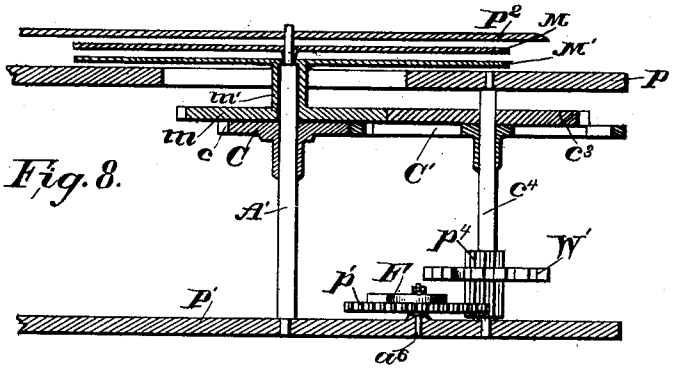


Fig. 9.

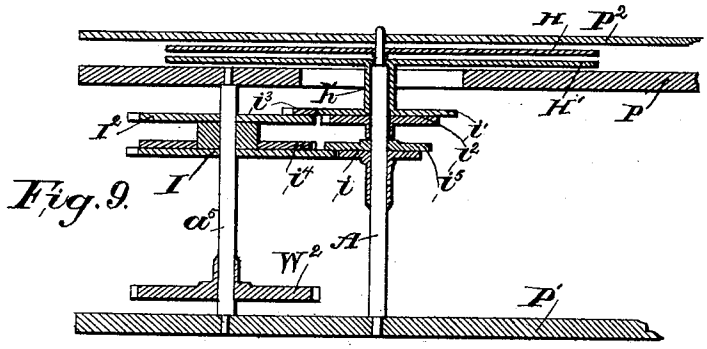


Fig. 1ª.

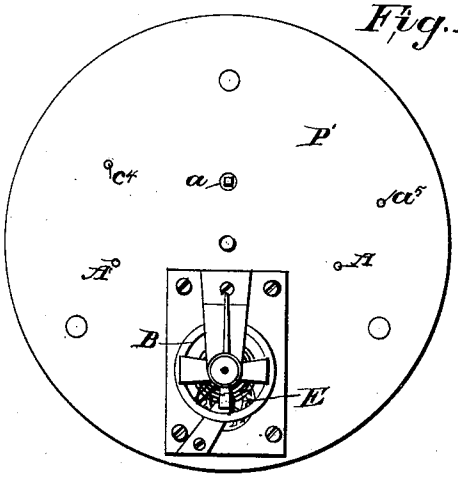


Fig. 10.

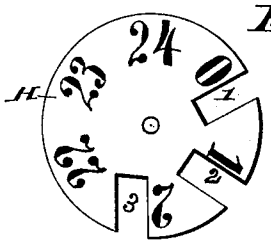
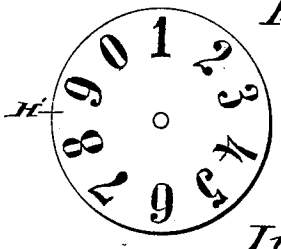


Fig. 10ª.



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CLOCK.

No. 359,227. Patented Mar. 8, 1887.

Fig. 14.

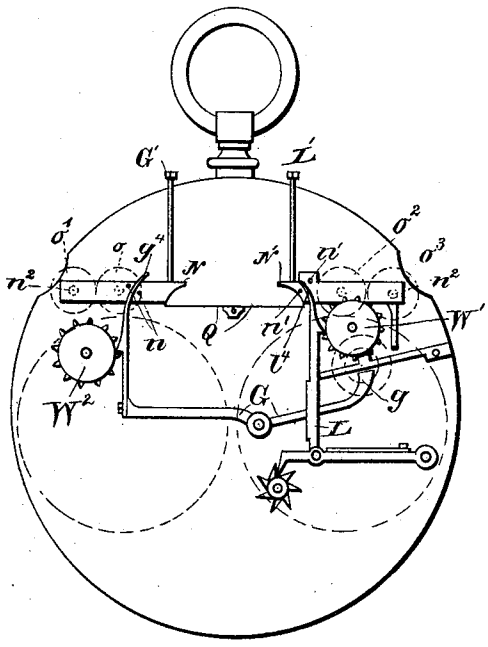


Fig. 15.

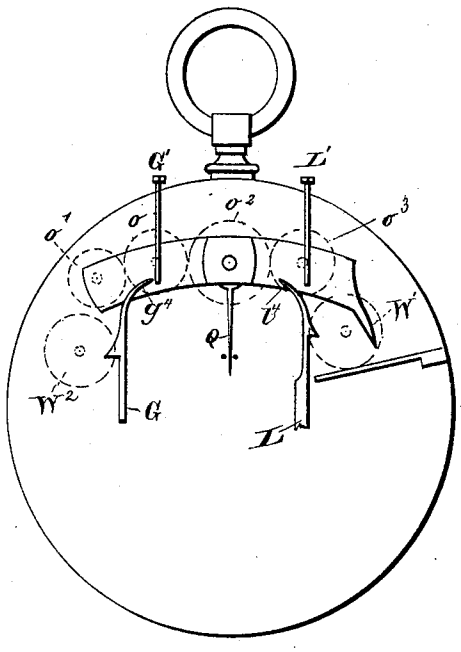


Fig 18.

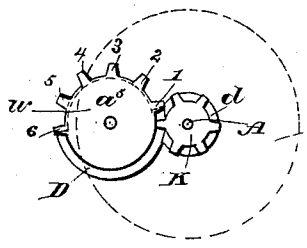


Fig. 16.

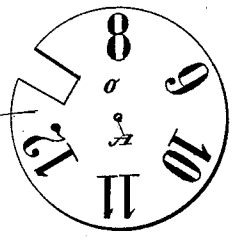


Fig. 19

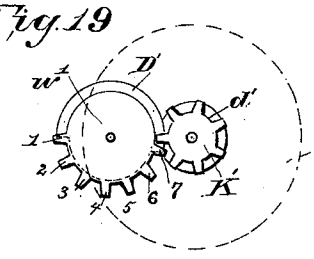
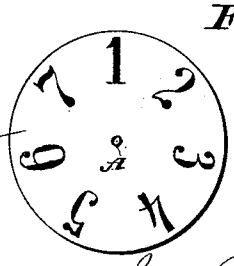


Fig. 17.



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UNITED STATES PATENT OFFICE.

JOSEF PALLWEBER, OF SALZBURG, AUSTRIA-HUNGARY.

CLOCK.

SPECIFICATION forming part of Letters Patent No. 359,227, dated March 8, 1887.

Application filed June 16, 1886. Serial No. 205,369. (No model.) Patented in France November 26, 1885, No. 172,545; in England April 9, 1886, No. 4,978, and in Germany April 12, 1886.

To all whom it may concern:

Be it known that I, JOSEF PALLWEBER, a citizen of Austria, residing at Salzburg, in Austria-Hungary, have invented certain new and useful Improvements in Time-Pieces, (for which I have obtained Letters Patent in France, No. 172,545, dated November 26, 1885; in England, No. 4,978, dated April 9, 1886, and in Germany April 12, 1886,) of which the following is a full, clear, and exact description.

Referring to the drawings, Figures 1 and 1ª show, respectively, by a front and rear face view, a time-piece embodying my invention. Fig. 2 is also a front face view, the face-plate being removed to show the hour and minute dials. Fig. 3 is a like view, the front frame-plates being also removed, showing the main train and a portion of the time mechanism. Fig. 4 is a horizontal section of the time piece, taken on line 1 1 of Fig. 5. Figs. 5, 6, and 7 are elevations of the same, looking, respectively, in the direction of the arrows z z' z^2 of Fig. 1. Figs. 8 and 9 are sections drawn to an enlarged scale and taken, respectively, on lines 2 2 and 3 3 of Fig. 1, looking in a reverse direction to that indicated by arrows z' z^2, the dial-setting mechanism, for the sake of clearness, being omitted from Figs. 3 to 9, inclusive. Figs. 10 and 10ª show by face views the upper and lower hour-dials. Figs. 11 and 11ª are like views of the upper and lower minute-dials, and Figs. 12 and 13 are detached detail views of portions of the hour-dial operating mechanism. Fig. 14 is a face view of the hour and minute dial setting mechanism. Fig. 15 is a like view, showing a slight modification in the setting mechanism as applicable to stem-winder time-pieces. Figs. 16 and 17 are face views of the hour-dials for a time-piece indicating twelve hours only, and Figs. 18 and 19 are detached views of the modified mechanism for operating the said dials.

The invention relates more particularly to that class of time-pieces in which the hours and minutes are indicated by revoluble dials instead of being indicated by hands revoluble around the dial.

The invention, consists in the combination with hour and minute dials arranged in pairs on their arbors, of a time mechanism of novel construction and of mechanism for setting the hour and minute dials respectively, substantially as hereinafter fully described, and as set forth in the claims.

In the annexed drawings I have illustrated my improvements in their application to a watch; but of course it will be understood that the said improvements are also applicable to clocks.

In the time-piece illustrated by the drawings the operative devices are supported from two frame plates or disks, P and P', respectively, in which the several arbors have their bearings, while the hour and minute dials are chiefly concealed by a face plate or disk, P^2. This plate or disk may be a full plate or disk provided with suitable slots, through which the numerals on the hour and minute dials may be viewed; or said plate may be a mutilated plate or disk, as shown in Fig. 1, in which case I provide the same with edge-recesses p^2, of such dimensions as to allow two adjacent numerals on either the hour or minute dials to be seen.

The front and back plates, P and P', are secured together, as usual, by means of pillars p, the face-plate P^2 being also secured to the front plate, P, by short pillars, so as to leave sufficient space between them for the free operation of the dials, which are mounted on their respective arbors between said plates P and P^2. The face-plate P^2 is also provided with the seconds-dial D^2, Fig. 1, over which rotates the seconds-hand d^2.

The mechanism, hereinafter to be described, is designed for operating hour-dials capable of indicating twenty-four hours consecutively; but by a slight modification of the hour-train such dials may be made to indicate twelve consecutive hours, as usual, as will hereinafter appear.

In order that my invention may be better understood, I will describe the several parts thereof separately, commencing with the hour and minute dials.

Hour and minute dials.—Referring to Figs. 10 and 10ª, H indicates the upper hour-dial. It is provided with three slots or recesses, 1 2 3, and on the left of said slots the dial bears the numerals 0, 1, and 2, respectively, and between the 0 and slot 3, equidistant from one another, the numerals 24, 23, and 22. H' in-

dicates the lower hour-dial, and bears on its face the numerals 0 to 9, inclusive, arranged equidistant from one another.

Referring to Figs. 11 and 11ª, M indicates the upper minute-dial, which has six slots or recesses, 11, 12, 13, 14, 15, and 16, respectively, which, like the slots in the hour-dial, extend from the periphery toward the axis of the dial, so as to expose to view the numerals on the dial below it. On the left of the slots 11 to 16 the dial M bears the numerals 0 to 5, inclusive, as shown in Fig. 11. The lower minute-dial, M′, like the lower hour-dial, H′, bears on its face the numerals 0 to 9, inclusive, as shown in Fig. 11ª.

The main train.—The main train comprises a spring-barrel, *b*, the toothed rim of which gears with a pinion, a^{21}, Fig. 6, on an arbor, *a′*, which also carries a wheel, *b′*, that gears with a pinion, a^{22}, Figs. 3, 5, and 7, on an arbor, a^2. The latter arbor also carries a wheel, b^2, that gears with a pinion, a^{23}, Figs. 5, 6, and 7, on the seconds-hand arbor a^3, and B, Figs. 3, 5, 6, and 7, is the balance-wheel, and E, Fig. 3, the escapement, which may be of any usual construction.

I would state here that the mechanism for operating the minute and hour dials is controlled solely by the arbor a^2, through the medium of transmitting mechanism.

The minute train and mechanism.—The slotted minute-dial M is rigidly secured to an arbor, A′, and below the said dial is loosely mounted the minute-dial M′, said dial having a sleeve, *m′*, loosely stuck on the arbor, and to said sleeve is rigidly secured or formed a gear-wheel, *m*. Below the gear-wheel *m* the arbor A′ carries a wheel, C, that has six double teeth, *c*, said wheel being rigidly secured to arbor A′. An arbor, c^4, carries a gear-wheel, c^3, that meshes with the gear-wheel *m* on the sleeve *m′* of the minute-dial M′. Said arbor also carries a wheel, C′, that has but a single tooth, *c′*, that actuates the wheel C, as hereinafter described. The arbor c^4 also carries a pinion, p^4, and a wheel, W′, for purposes to be explained. The arbor a^2, which is driven by the main-train wheel *b′*, through the pinion a^{22}, Figs. 3, 5, 6, and 7, carries also a wheel, W, with the teeth of which engages the arm *l* of a spring-actuated pawl-lever, L, fulcrumed at $l^\times$ to the back plate, P′. The arm *l′* of lever L has a stop-pawl, l^3, arranged to engage the teeth of the wheel W′, and at the outer end of said lever is secured a spring push-pawl, l^2, that also engages the teeth of the wheel W′ at proper times.

S′ is a pawl-spring on the opposite side of the wheel W′, which, together with the pawl l^3, locks the said wheel against motion after having been actuated by the push-pawl l^2, the parts forming an escapement.

The operation of the described mechanism is as follows: The wheel W has eight teeth, and each eighth of a revolution of said wheel corresponds to one complete revolution of the seconds-arbor, or to sixty seconds. Consequently, as the wheel W revolves, the arm *l* of lever L is gradually lifted by one of the teeth, and as the seconds-arbor completes a revolution the arm *l* drops from a tooth of wheel W into the space between it and the next tooth under the stress of its actuating-spring S, Fig. 4. As the lever-arm *l* is lifted, the arm *l′* of said lever moves away from the wheel W′, the pawl l^3 moving out of engagement with the teeth of wheel W′ at the same time that the push-pawl l^2 moves over a tooth of wheel W, and, owing to its elasticity, drops slightly as soon as it has been moved away from wheel W′ far enough to do so. When both pawls l^2 l^3 have moved clear of the teeth of wheel W′, the lever-arm *l* drops between two teeth of wheel W, the arm *l′* under the stress of spring S is thrown forward toward the wheel W′, the push-pawl l^2 rotating the wheel W′ the space of one tooth, and as said wheel has ten teeth it will make one tenth of a revolution whenever actuated by the pawl l^2. This movement of the wheel W′ is transmitted to the dial M′ through the gear-wheels c^3 and *m*, so that said dial will also make one-tenth of a revolution—that is to say, the dial M′ will be rotated a distance equal to that between two of its numerals. It will thus be seen that at every complete revolution of the seconds-arbor a^3, the minute-dial M′, through the mechanism described, is rotated one numeral-space from left to right without rotating the minute-dial arbor A′, since the dial M′ and wheel *m* are loosely mounted on said arbor A′, as stated. It has been said above that the minute-dial arbor A′ carries also a wheel, C, that has six double teeth, and the arbor c^4 carries a wheel, C′, that has but one tooth, *c′*. The wheel C being rigidly mounted on arbor A′, it follows that at each complete revolution of the arbor c^4 the arbor A′ will make one-sixth of a revolution, or a distance equal to that between two of the slots or recesses in the minute-dial M, which dial, as has been stated, is rigidly connected with its arbor. Let it, for instance, be supposed that the minute-dials M and M′ are in the relative positions shown in Fig. 2, the fifty-ninth minute having just been completed. The minute-dials mechanism will then be in the following relative positions: The arm *l* of lever L will lie between two of the teeth of wheel W, its pawl l^3 in engagement with and its pawl l^2 on top of one of the teeth of wheel W′, while the tooth of wheel C′ will be in position to engage one of the double teeth of wheel C. At the completion of the sixtieth minute, and also the completion of a revolution of the arbor c^4, the dial M′ will make one-tenth of a revolution, which will bring the numeral 0 thereof to the position occupied by the numeral 9. The minute-dial M, on the contrary, will make one-sixth of a revolution, thus bringing the slot 11 over the numeral 0 of the minute-dial M′ and the numeral 0 of minute-dial M beside the 0 of M′, both 0's indicating 60. In practice the space

occupied by the 0 on the dial M is left blank. Thereafter the minute-dial M′ will be moved step by step every minute, the numerals 1, 2, 3, 4, 5, 6, 7, 8, and 9 appearing successively in slot 11 of the minute-dial M. When, however, the tenth minute is completed—that is to say, at the next completion of a revolution of arbor c^4—the dial M′ will carry the 0 again in the place of the 9 in slot 11, while the dial M will make one-sixth of a revolution, bringing the slot 12 in the place of the slot 11 and the numeral 1 by the side of the 0 on the dial M′, thus indicating 10 minutes, and so on successively, the dial M making one-sixth of a revolution to every complete revolution of the dial M′.

The hour train and mechanism.—The hour-train comprises the arbor A, that carries the hour-dials, the arbor a^5, and short arbor a^6, which latter is secured to the back plate, P′, as shown in Figs. 4 and 8. The short arbor a^6 carries a gear-wheel, p', that meshes with the pinion p^4 on arbor c^4, and said arbor a^6 also carries above the gear-wheel a snail or cam, F, on the periphery of which rides the end of one arm, g, of a two armed spring-actuated pawl-lever, G. The lever G is pivoted at $g^\times$ to the back plate, P′, and the other arm, g', of said lever carries a spring-pawl, g^2, that engages the teeth of a ratchet-wheel, W^2, provided with twenty-four teeth and rigidly mounted on arbor a^5.

S^2 is a spring whose arm s^2 has a pawl that also engages the teeth of the ratchet-wheel W^2 and holds the latter against backward rotation, the arm s' of said spring bearing upon the arm g of lever G. The arbor a^5 also carries a mutilated gear-wheel, I, that has six teeth, t' t^2 t^3 t^4 t^5 t^6, arranged as follows: The tooth t' is equidistant from the teeth t^2 and t^6, respectively, and there is a space or hiatus of one tooth between the teeth t^6 and t^5, while the teeth t^5 to t^2 are arranged in proper successive order.

To the mutilated gear-wheel I is secured a disk, t^4, of less diameter than the said wheel I, said disk having a notch or space, i^{21}, opposite the tooth t' of wheel I, a like space, i^{26}, opposite the tooth t^6 of said wheel, a tooth, i^{25}, that if prolonged would intersect the space between the teeth t^6 t^5 of wheel I, and then a space or recess, i^{24}, equal to the space occupied by the four teeth t^2 t^3 t^4 t^5 on wheel I. On arbor a^5, above the wheel I and disk i^4, is secured a second mutilated gear-wheel, I^2, that has twenty teeth and a mutilated or blank portion between the end teeth of the series, said blank portion being of increased thickness by having a segmental strip of metal, i^3, secured thereto, as shown in Figs. 9 and 12, to form a peripheral shoulder in the plane of rotation of a disk, i', secured to sleeve h' of hour-dial H′. The hour dials or disks are mounted on an arbor, A, and in a manner similar to the minute dials or disks—namely, the upper slotted hour-dial, H, is rigidly secured to the arbor A, and the lower dial, H′, has a sleeve, h', and is loosely mounted on arbor A, as more clearly shown in Fig. 9.

As stated above, a disk, i', is secured to sleeve h' of hour-dial H′, said disk having a segmental recess corresponding with the segmental shoulder i^3 on the mutilated gear I^2, and when said parts are in contact the sleeve h', and consequently the hour-dial H′, is held against independent rotation on arbor A.

To the disk i' is rigidly secured a pinion, i^2, that has ten teeth and gears with the wheel I^2 on arbor a^5. Below the pinion i^2 the arbor A carries a hexagonal plate or brake-wheel, i^5, the six faces of which are segments of circles corresponding with the periphery of the disk i^4, said faces acting as friction-brakes to hold the arbor A against rotation. To the brake-wheel i^5 is secured a pinion, i, that has six teeth, and is actuated by the teeth of the mutilated gear-wheel I on arbor a^5.

The operation of this mechanism is as follows: Supposing the time-piece, as shown in Fig. 1, to indicate the twenty-fourth hour—*i. e.*, 24 o'clock—the lower dial, H′, will be in a position with the numeral 1 thereon below the numeral 4 of the numeral 24 on hour-dial H. The relative position of the hour-train will in this case be as follows: The first tooth, t^2, of the series of four consecutive teeth on wheel I will be in engagement with the teeth on pinion i, the segmental recess of disk i' being in contact with the peripheral brake-shoulder i^3 of wheel I^2; hence the arbor A is locked against rotation, while the sleeve h' and dial H′ are free to rotate. Now, let it be understood that at each complete revolution of the arbor c^4 and at each complete revolution of the cam F, controlled by said arbor—that is to say, at the expiration of every sixty minutes or every hour—the lever G is actuated to impart to the ratchet W^2 one twenty-fourth of a revolution, and that the arbor a^5 is thereby rotated from left to right to rotate the arbor A and dial H′ in a reverse direction, or from right to left. The dial H indicates the twenty-fourth hour. Therefore the first step of ratchet W^2 causes the tooth t' on wheel I to impart to the pinion i and hour-dial H one-sixth of a revolution. This will bring the 0 (which in practice may be or is omitted, the space being left blank) and the slot 1 of dial H into the space occupied by the numerals 24. During this partial rotation of dial H the dial H′ remains stationary, being held against rotation by the disk i', which, during the movement of pinion i and dial H, is still in contact with the shoulder i^3 of wheel I^2, but is disengaged therefrom at the completion of the movement of said pinion i and dial H, while the arbor A thereof is locked against rotation by the disk or wheel i^4 coming in contact with one of the faces of the wheel i^5, the hour-dials thus indicating one o'clock. The arbor A will now be held against rotation during the next eight hours—that is, during the eight following suc-

cessive steps made by the ratchet W^2—while the hour-dial H′ will be correspondingly moved step by step until the numeral 9 is shown in the slot one. At the completion of the ninth hour the brake-wheel i^5 will be released from the wheel or disk i^4, and the tooth t' on wheel I will engage the pinion i and impart to the latter and the dial H one-sixth of a revolution, thereby bringing the slot 2 and numeral 1 of said dial H into the place of the slot 1 and blank space or numeral 0, respectively. As the disk i' is now disengaged from the shoulder i^3 on wheel I^2, the dial H′, through wheel I^2 and pinion i^2, will partake of the movement of arbor A referred to, and said dial H′ will make one tenth of a revolution, thereby exposing to view the numeral 0 on said dial below slot 2 in dial H, the dials indicating ten o'clock. The dial H′ will now again be rotated step by step every hour for the next consecutive nine hours, the arbor A being locked against rotation, as before stated, by the brake-wheels i^4 i^5, the numerals 1 to 9, inclusive, being successively exposed to view in slot 2 of dial H. At the completion of the nineteenth hour or nineteen o'clock the brake-wheels i^4 i^5 will be in a position to release the arbor A. The dial H′ in its next step will bring the numeral 0 into the place of the numeral 9, while the tooth t^6 of wheel I, engaging the teeth of pinion i, will impart to arbor A and dial H one-sixth of a revolution, thereby bringing the slot 3 and numeral 2 into the place of the slot 2 and numeral 1, the dials indicating twenty o'clock. At the completion of the latter movement of the dials H H′, the arbor A will again be locked against rotation by the tooth i^{25} of wheel i^4 coming in contact with one of the faces of wheel i^5, and during the next partial rotation of the arbor a^5 the pinion i^2 and dial H′ will make one-sixth of a revolution, to bring the numeral 1 on dial H′ in the place of the 0 below slot 3 of dial H, the dials indicating twenty-one o'clock. At the completion of the twenty-first hour the dial H′ will be locked against rotation by the brake disk or wheel i' coming in contact with the shoulder i^3 on wheel I^2, while the arbor A (being free to rotate the tooth i^{26} of brake-wheel i^4, having found the face on wheel i^5 with which it was previously in contact) will, at the expiration of each of the next four hours, be alone rotated one step by the teeth t^5, t^4, and t^3 on wheel I engaging the pinion i, thus indicating successively twenty-two, twenty-three, and twenty-four o'clock, the dials H H′ being again in their relative positions, as above described, when, at the completion of the twenty-fourth hour, the tooth t^2 on wheel I once more moves the dial H through pinion i, to bring slot 1 in said dial over numeral 1 on dial H′, when the described operation is repeated.

It will be obvious that instead of employing hour-dials indicating twenty-four hours, dials indicating twelve hours may be employed without departing from the nature of my invention, by proportioning the number of teeth of the operating mechanism accordingly, as shown in Figs. 16, 17, 18, and 19. In this arrangement the hour-dial H is also rigidly secured to the arbor A, while the dial H′ is loose thereon and has rigidly connected to its sleeve a pinion, K′, on a brake or locking-disk, d'. The arbor A also carries a pinion, K, and a brake-disk, d, rigidly secured thereto. The arbor a^5 in this arrangement carries two mutilated gear-wheels, w' and w, that mesh, respectively, with the pinions K′ and K. The gear-wheel w' and pinion K′ have each seven teeth, and the gear-wheel w and pinion K have each six teeth, while the number of teeth—namely, twenty-four—on ratchet-wheel W^2 on arbor a^5 may remain the same as above described.

The operation of this hour mechanism may be briefly described as follows, the direction of rotation of the arbors being the same as hereinabove stated: Referring to Figs. 16 to 19, let it be supposed that the hour-dial H indicates twelve o'clock. The dial H′ will then be in a position with the numeral 1, below the 12 of dial H, and the relative position of the gearing will be the following: The tooth 6 of gear-wheel w will be in engagement with the teeth of pinion K, while the pinion K′ of dial H′ will be held against rotation by the mutilated portion of the gear-wheel w' lying in contact with disk d'. At the next step of the ratchet-wheel W^2 the tooth 6 of gear-wheel w will impart to the pinion K and dial H one-sixth of a revolution, thereby bringing the single slot in dial H over the numeral 1 on dial H′, indicating one o'clock, said dial H′ bearing the numerals 1 to 7, inclusive, while the dial H bears the numerals 8 to 12, inclusive. In this movement of the wheel w and pinion K the tooth 1 of wheel w' is brought into engagement with the teeth of pinion K′, which latter is now free to rotate, the pinion K being, on the contrary, locked against rotation, and will remain so locked for the following six hours, at the expiration of each of which the dial H′ will be moved a numeral-space by the teeth 1, 2, 3, 4, 5, and 6, showing the numerals 2 3 4 5 6 7 successively in the slot of dial H. At the next movement of arbor a^5 both dials, H and H′, will move around one numeral-step simultaneously, the dial H being operated through pinion K′ by the tooth 7 on wheel w', while the dial H will be moved through pinion K by tooth 1 of wheel w, thus bringing the numeral 8 on dial H over numeral 1 on dial H′. The latter dial will now be held against rotation for the succeeding five hours, and at the expiration of the first, second, third, and fourth succeeding hours the dial H will be moved through pinion K by teeth 2, 3, 4, and 5 on wheel w a numeral-space around, bringing the numerals 9, 10, 11, and 12 in view, the dials being then in their relative position above described. At the expiration of the last hour of the five above referred to

the dial H will be moved to bring the slot thereof over the numeral 1 of dial H′, when the latter again commences to move, as above set forth.

By means of the arrangement of twin dials, as described, I am enabled to give the numerals thereon a greater space, and consequently make these numerals larger, so that they may be better seen than would be the case if but one dial were employed.

In Figs. 14 and 15 I have shown the mechanism for setting the hour and minute dials. In the former figure the winding of the time-piece is effected in the ordinary manner by means of a key, while Fig. 15 shows the setting mechanism in its application to an ordinary stem-winder, the winding mechanism of which I have deemed unnecessary to show, since it has no co-operation or relation with the setting mechanism, except in rotating the pinion *o*, and through the latter and the pinions *o′ o²* the setting-pinions *o o³*, as hereinafter stated.

L′ and G′ are push-bars, which, when depressed or pushed inwardly, throw the levers L and G, respectively, out of engagement with their respective ratchet-wheels W′ and W², and when the setting devices are employed the said levers are slightly modified, as shown in Fig. 14, each being provided with an extension, *l⁴ g⁴*, that lie between pins *n n* and *n′ n′*, projecting from levers N and N′, respectively, to which the push-bars L′ G′ are connected.

The levers are fulcrumed at *n² n²*, and each carries two pinions, *o o′* and *o² o³*, respectively, so that when, for instance, the push-bar G′ is pushed inwardly the lever or fulcrum bar N will also be moved inwardly and throw the lever G out of engagement with its ratchet W² through the medium of the pins *n n*, thus throwing the hour-dials H H′ out of gear with the going train. At the same time the pinion *o′* will be brought into engagement with the ratchet W², which may then be rotated by the pinion *o′* by hand, said pinion being accessible through the case of the watch for this purpose. The minute-dials are set in the same manner through the medium of the pinion *o³*, the pinion *o²* actuating the ratchet-wheel W′. When the dials are set a suitable spring, Q, carries the fulcrum-bars back into their normal positions.

In the arrangement of mechanism shown in Fig. 15, the setting of the dials is effected through the medium of the winding-stem, instead of being effected by hand, as shown in Fig. 14, after either of the levers L G have been thrown out of gear with their respective ratchets W′ W².

Having now particularly described and ascertained my said invention, what I claim, and desire to secure by Letters Patent, is—

1. In a time-piece, the combination, of two minute-dials mounted one above the other on the same arbor and arranged to rotate independently of each other, one of said dials bearing the unit numerals and the other the tens, the latter dial having slots through which the units are exposed to view, with a main train, an escapement comprising the pinions W and W′, and the spring-actuated pawl-lever L, controlled from pinion W and controlling the pinion W′, a transmitting-gear to transmit the movements of the pinion W′ to the units minute-dial, and transmitting-gear controlled by the escapement for rotating the tens minute-dial at each complete revolution of the ratchet W′, substantially as described, for the purpose specified.

2. In a time-piece, the combination of two minute-dials mounted one above the other on the same arbor and arranged to rotate independently of each other, one of said dials bearing the unit numerals and the other the tens, the latter dial having slots through which the units are exposed to view, with a main train, an escapement comprising the pinions W and W′, and the spring-actuated pawl-lever L, controlled from pinion W and controlling the pinion W′, a transmitting-gear to transmit the movements of the pinion W′ to the units minute-dial, and transmitting-gear consisting of the wheel C′ on the arbor of the pinion W′ and a pinion, C, on the arbor of the minute-dials, substantially as described, for the purpose specified.

3. In a time-piece, the combination of two superposed hour-dials, one of which bears the hour-unit numerals and the other two tens numerals and the numerals 22 23 24, the latter dial being slotted to expose the numerals on the unit-dial, with a main train and an hour-train operating the hour-dials to indicate the hours from 1 to 24 successively, substantially as described.

4. In a time-piece, the combination of two hour-dials mounted on the same arbor, one of which dials bears the hour-unit numerals and the other the numerals 1 2 of the tens, and the numerals 22, 23, and 24, the latter dial being slotted to expose the numerals on the unit-dials, with a main train and an hour-train operating the hour-dials to indicate the hours from 1 to 24 successively, substantially as described.

5. In a time-piece, the combination of two hour-dials mounted on the same arbor and arranged to rotate independently of each other, one of said dials bearing the hour-units and the other the numerals 1 2 of the tens and the numerals 22, 23, and 24, the latter dial being slotted to expose the units on the unit-dials, with a main train and an hour-train operating the hour-dials to indicate the hours from 1 to 24 successively, substantially as described.

6. In a time-piece, the combination of two superposed minute-dials, each bearing numerals, one of said dials being slotted to expose the numerals on the other, and two superposed hour-dials each bearing numerals, one of said dials being also slotted to expose the numerals on the other, with a main train, a

minute-train controlled thereby to operate the minute-dials, and an hour-train controlled by the minute-train to operate the hour-dials, substantially as described.

7. In a time-piece, the combination of two superposed hour-dials, one bearing a portion of the hour-unit numerals and the other bearing the tens numerals and the remaining portion of the series, the latter dial being slotted to expose the numerals on the dial below, with a main train and an hour-train operating the hour-dials to indicate the full series of hours successively, substantially as described.

8. The combination of the arbor a^5, the ratchet-wheel W^2, and the mutilated gear I^2 on said arbor, and a pawl for imparting to the ratchet a step-by-step rotation of the arbor A, the hour-dial H', loosely mounted thereon, the pinion i^2, and brake-disk i', rigidly connected with the hour-dial H', substantially as described, for the purpose specified.

9. The combination of the arbor a^5, the ratchet-wheel W^2, the mutilated gear-wheel i^4 and brake-disk i^5 on said arbor, and a pawl for imparting to the ratchet a step-by-step rotation of the arbor A, hour-dial H, brake-disk i^5, and pinion i, substantially as described, for the purpose specified.

10. The combination, with a main train, the arbor a^2, its pinion W, and the spring-actuated pawl-lever L, having push-pawl l^2, of the arbor c^4, the wheels W' and C' thereon, the arbor A', the minute-dial H', loose on arbor A', and the gear-wheel m, rigidly connected with the hour-dial H', substantially as and for the purpose specified.

11. The combination, with a main train, the arbor a^2, its pinion W, and the spring-actuated pawl-lever L, having push-pawl l^2, of the arbor c^4, the wheels W' and C' thereon, the arbor A', its pinion C, and the hour-dial H, rigidly connected with said arbor A', substantially as and for the purpose specified.

12. In a time-piece, the combination, with two minute-dials on one arbor and two hour-dials on another arbor, a main train, a minute-train for operating the minute-dials, a pawl-lever controlled by the main train and operating the minute-train, an hour-train for operating the hour-dials, and a pawl-lever for operating the hour-train, of setting devices comprising a lever for throwing either of the operating-pawls on the minute and hour trains out of operation and gearing for operating said trains independently of each other and of the main train, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand this 16th day of March, 1886.

JOSEF PALLWEBER.

Witnesses:
EUGEN BENEDIEL,
JOSUM WEIMER.