

(No Model.)

A. E. MÜLLER.  
Escapement.

No. 231,839.

Patented Aug. 31, 1880.

Fig. 1.

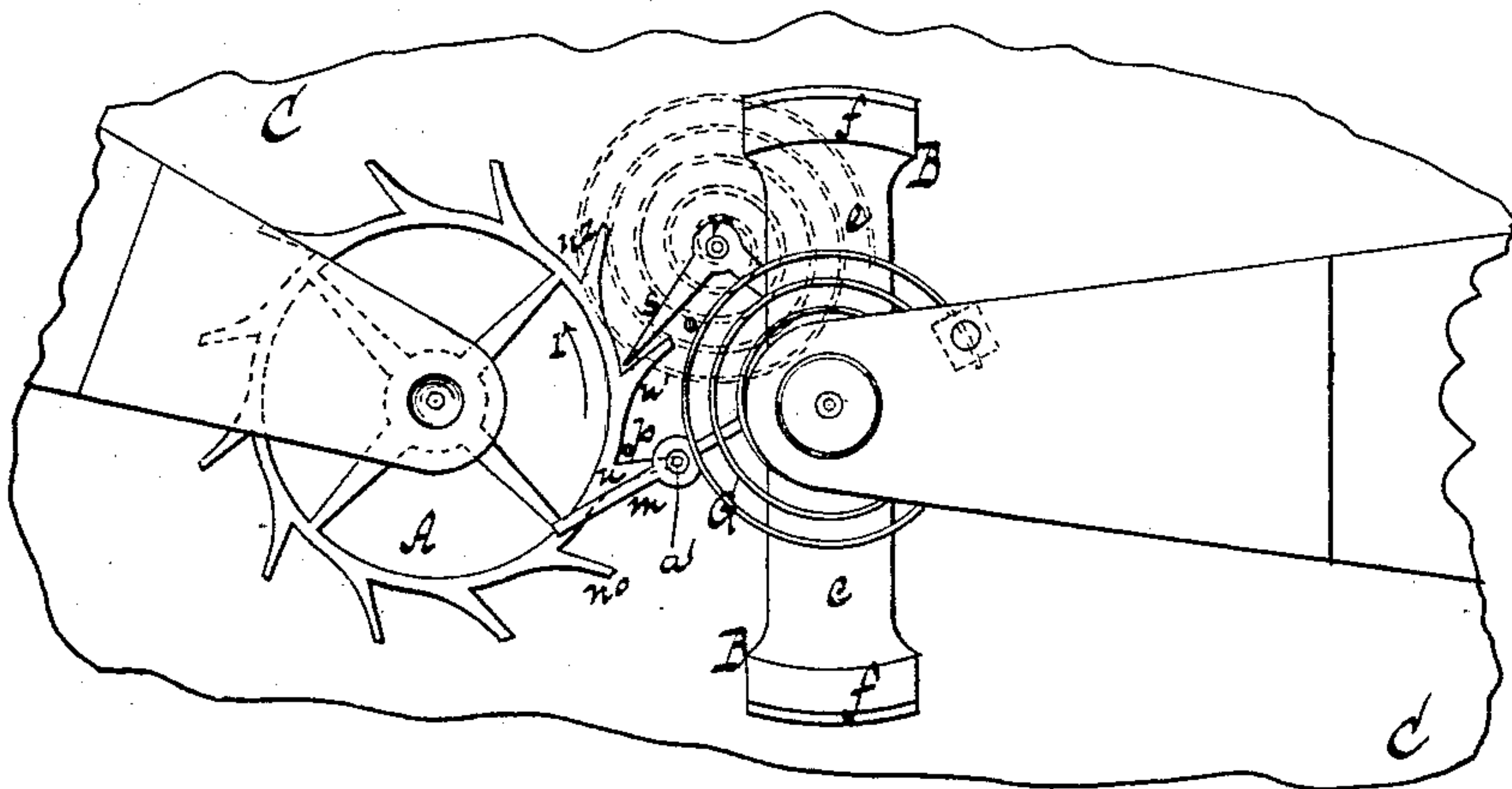


Fig. 3.

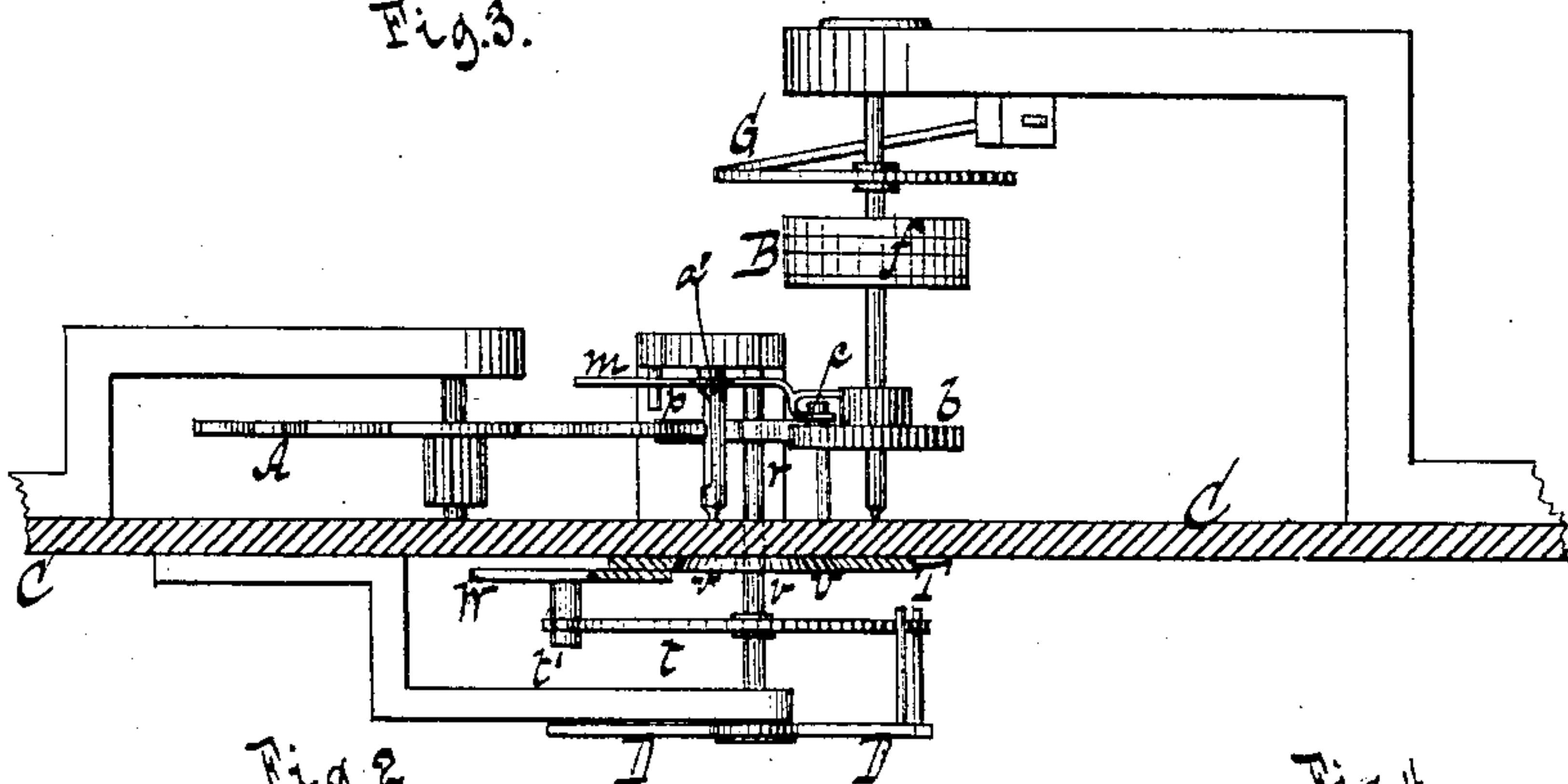
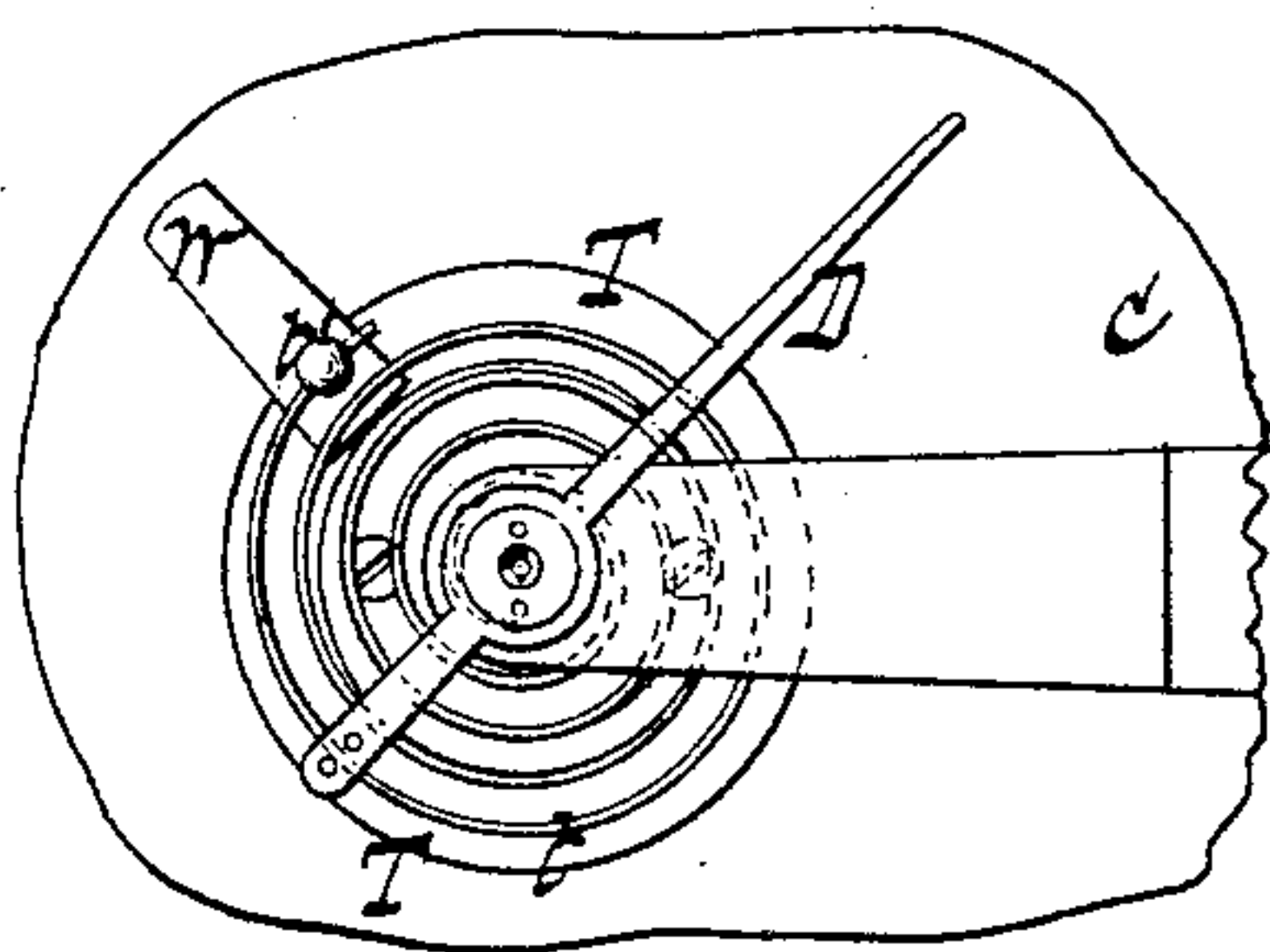
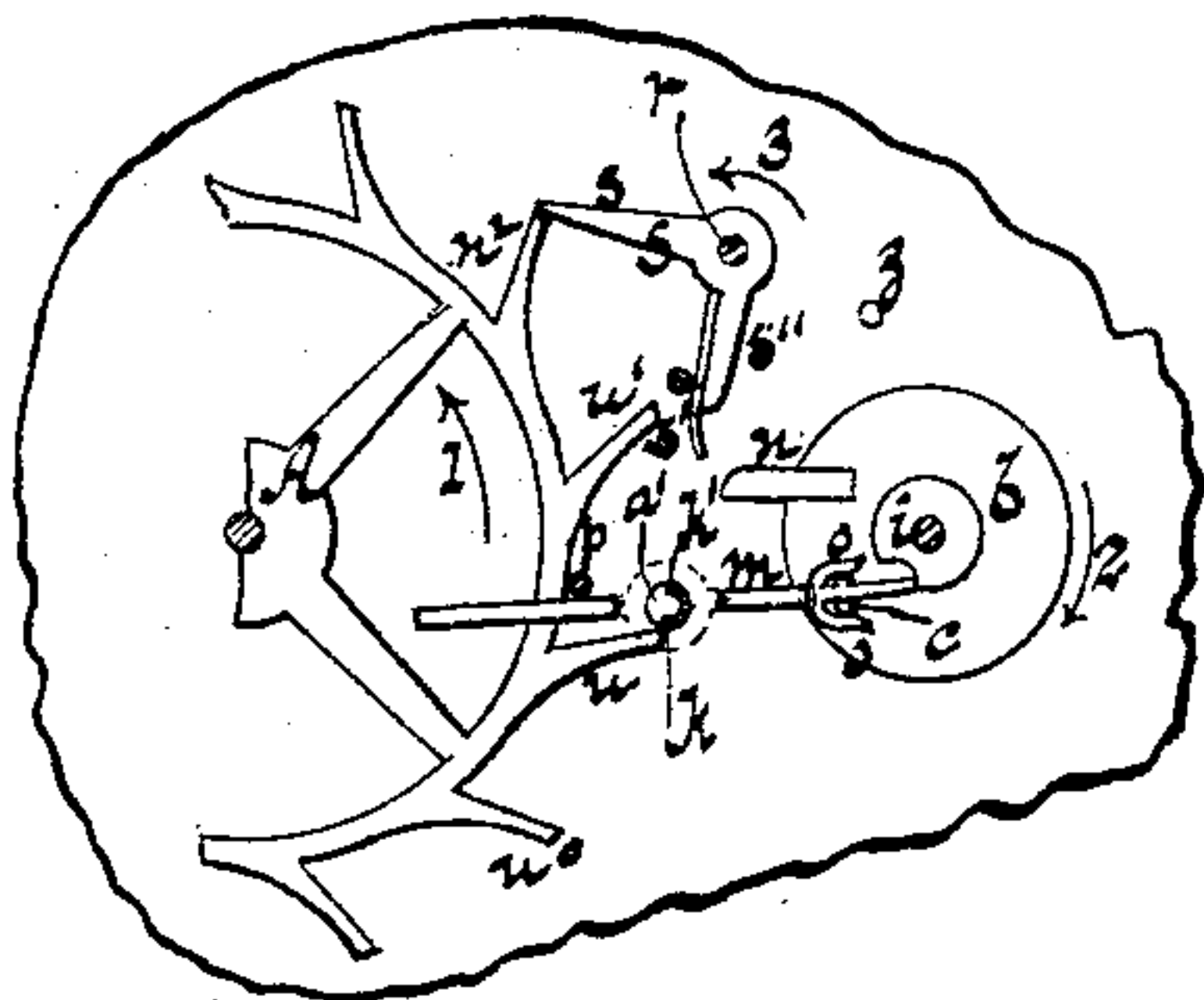


Fig. 2.

Fig. 4.



Witnesses:

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# UNITED STATES PATENT OFFICE.

AUGUST E. MÜLLER, OF VIENNA, AUSTRIA.

## ESCAPEMENT.

SPECIFICATION forming part of Letters Patent No. 231,839, dated August 31, 1880.

Application filed March 10, 1880. (No model.) Patented in Belgium December 17, 1879.

*To all whom it may concern:*

Be it known that I, AUGUST ERNST MÜLLER, a resident of Vienna, in Austria, in the Province of Lower Austria, and a citizen of Germany, have invented certain new and useful Improvements in Time-Keepers called "Normal Chronometer-Motions;" and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an escapement for chronometer-movements; and it consists in a non-expansive balance consisting of weights or rim-segments supported on the ends of wooden arms, said arms being rendered impervious to atmospheric influences and changes of temperature by being dried and saturated with varnish or equivalent material.

It also consists in the combination, with the non-expansive balance supporting the end weights or rim-segments upon its wooden varnish-coated arms, of a spring having one end fixed to the shaft of the arbor on which the balance is mounted and its other end connected with the frame supporting the time mechanism, the impulse mechanism, and a spring for imparting motion to the balance, and a lever swinging on a pivot and actuated by said balance, the said pivot also carrying the detent mechanism, substantially as set forth.

Figure 1 is a plan view of the parts of a chronometer or time-piece containing my invention. Fig. 2 is a detached view of the same, partly in section. Fig. 3 is a side view of the same. Fig. 4 is an inverted plan view, showing the impulse-spring and its regulators. Similar letters indicate corresponding parts.

In the example shown in the drawings the letter A designates the scape-wheel, which is urged by the motor to revolve in the direction of the arrow-head 1.

B B is the balance. This balance consists of arms *ee*, of some non-expansive material—as, by preference, wood, boxwood being the most suitable. These wooden arms are rendered impervious to atmospheric influences and changes of temperature in the following manner: The

roughly-finished wooden arms are laid upon wire-nettings suspended in a box or suitable apartment. The temperature in this box is kept by a spirit-lamp or other suitable means, at a temperature of from 160° to 180° Reaumur, as indicated by a thermometer which is to be connected therewith. After being exposed to this temperature about twelve hours and dried, the wooden arms, while still hot, are immersed in copal-varnish, whereby the pores of the wood, after a few hours, become saturated with the same. These arms are then freed from the varnish adhering to the surface, and again introduced into the drying apparatus, and exposed for about twenty-four hours to a heat of from 60° to 100° Reaumur. These arms may now be exposed to considerable variations in temperature without their length being altered thereby, nor are they sensible to hygroscopical influences. To these arms *ee* are fastened the rim-segments *ff*, of brass or any other heavy metal or substance. In chronometers these segments *ff* will be provided with mean-time screws for regulating the moment of inertia of the balance.

In ordinary time-pieces the hair-spring G of the balance may be varied in length, as is now done in watches, whereby the angular velocity of the balance can be varied.

To the arbor of the balance is attached the main pallet *b*, carrying the lifting-pallet *c*, both oscillating with the balance. When swinging in the direction of the arrow-head 2 the lifting-pallet *c* passes in between the two prongs *oo* of the forked end of the detent-lever *m*, carrying it along. The center prong of the lever *m* is raised, allowing the lifting-pallet *c* to pass underneath. This center prong engages a notch, *i*, in a raised portion of the main pallet *b*. The lever *m* is thus caused to swing about its pivot *a'*, and its inner end to pass away from the stop-pin *p*, rising from one of the frame-plates of the mechanism. The detent consists in this case of a sector, *kk'*, of ruby or steel, connected with the lever *m*. As the inner end of this lever *m* is caused to swing away from the pin *p*, the tooth *u* of the scape-wheel is freed from the end *k* of the detent, and the wheel springs forward until the tooth *u* abuts against the inner side of the end *k'* of the detent. By this movement of the scape-wheel A the arm *s* of



the impulse mechanism is freed from its contact with the tooth  $u^2$ , and the action of its spring  $t$  swings the impulse mechanism in the direction of the arrow 3.

5 The motions of the balance and the impulse mechanism are so timed that when the impulse mechanism swings in the direction of the arrow 3 the arm  $s'$  of the same strikes against the pallet or stud  $n$  on the main pallet  $b$ , giving the balance B B a push in the direction of  
10 the arrow 2. The arm  $s'$  consists of a thin elastic piece of metal or steel. The action of the spring  $t$  swings the impulse mechanism in the direction of arrow 3 until the arm  $s''$  abuts against the stop-pin  $z$ , rising from a frame-plate. The arbor  $r$  of the impulse mechanism turns in the frame of the machine. The balance B now moves back in the direction opposed to the arrow 2, under the influence of its  
20 spring G. The inner end of the arm  $m$  is thus carried back to its original position against the stop-pin  $p$ . The tooth  $u$  of the scape-wheel is thus freed from its contact with the end  $k'$  of the detent, and the wheel springs forward until  
25 the tooth  $u^c$  abuts against the end  $k$  of the detent. The impulse mechanism is thereby carried back to its original position by the tooth  $u'$  engaging the arm  $s$ , and the action of the several parts is repeated, as before.

30 In place of a detent of the form shown in Fig. 2, an anchor may be substituted, the action of whose pallets on the teeth of the scape-wheel A will be analogous to the action of the detent  $k k'$ .

35 As is well known, when the time-piece is exposed to a rise of temperature the hair-spring G of the balance is lengthened, its action on the balance B B weakened. Consequently the angular velocity of the balance is diminished  
40 and the mechanism goes too slow. The reverse takes place on a fall of temperature, and too great rapidity is the result. But the action of the temperature on the spring  $t$  is precisely the same as its effect on the spring G. Consequently, on a rise of temperature, when the  
45 spring  $t$  is lengthened the impulses of the arm  $s'$  on the pallet  $n$  are weakened, and the number of oscillations of the balance B remains uniform for equal periods of time. On a fall of  
50 temperature the impulses are stronger and the resistance of the spring G is greater. Thus it will be seen that by the arrangement of the two springs G  $t$ , with appropriate mechanism, any change in one spring, by reason of changes

of temperature or other atmospheric influences, 55 is exactly compensated by the change from the same causes in the other spring, whereby great accuracy of the mechanism is obtained.

In order to tighten the spring  $t$  a disk, T T, is provided, which is held in place by the slant- 60 ing edge of a circular plate,  $v v$ , screwed or otherwise fastened to the base-plate C C. About this plate  $v v$  the disk T T can be turned by the nose W. The plate T carries a stud,  $t'$ , to which one end of the spring  $t$  is fastened, so  
65 that by turning the plate T in the proper direction the spring  $t$  is subjected to greater or less tension. A regulating-hand, D, working on the ordinary principle, is further provided for adjusting the action of the spring  $t$ . 70

The edges of the teeth of the scape-wheel are cut wedge-shaped, as shown, and the end of the arm  $s$ , as also the faces of the detent  $k k'$ , are so formed that the only resistance to be overcome is the slight friction of these parts  
75 against each other, so that as little force as possible is expended, contributing largely to the durability of the instrument.

What I claim as new, and desire to secure by Letters Patent, is— 80

1. In an escapement for chronometer-movements, a non-expansive balance consisting of weights or rim-segments  $f$ , supported on wooden arms  $e$ , said arms being rendered impervious to atmospheric influences and changes of tem- 85 perature by being dried and saturated with varnish or equivalent material, substantially as set forth.

2. The combination, with the non-expansive balance B, supporting the weights or rim-segments  $f$  upon its wooden varnish-coated arms  $e$ , of the spring G, having one end fixed to the shaft of the arbor on which the balance is mounted and its other end connected with the frame supporting the time mechanism, the im- 90 pulse mechanism, and spring F, for imparting motion to the balance, and the lever  $m$ , swinging on a pivot,  $a'$ , and actuated by said balance, said pivot  $a'$  also carrying the detent mechanism, substantially as described. 95 100

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

AUG. ERNST MÜLLER.

Witnesses:

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ROBERT B. JENTZSCH.