

No. 816,767.

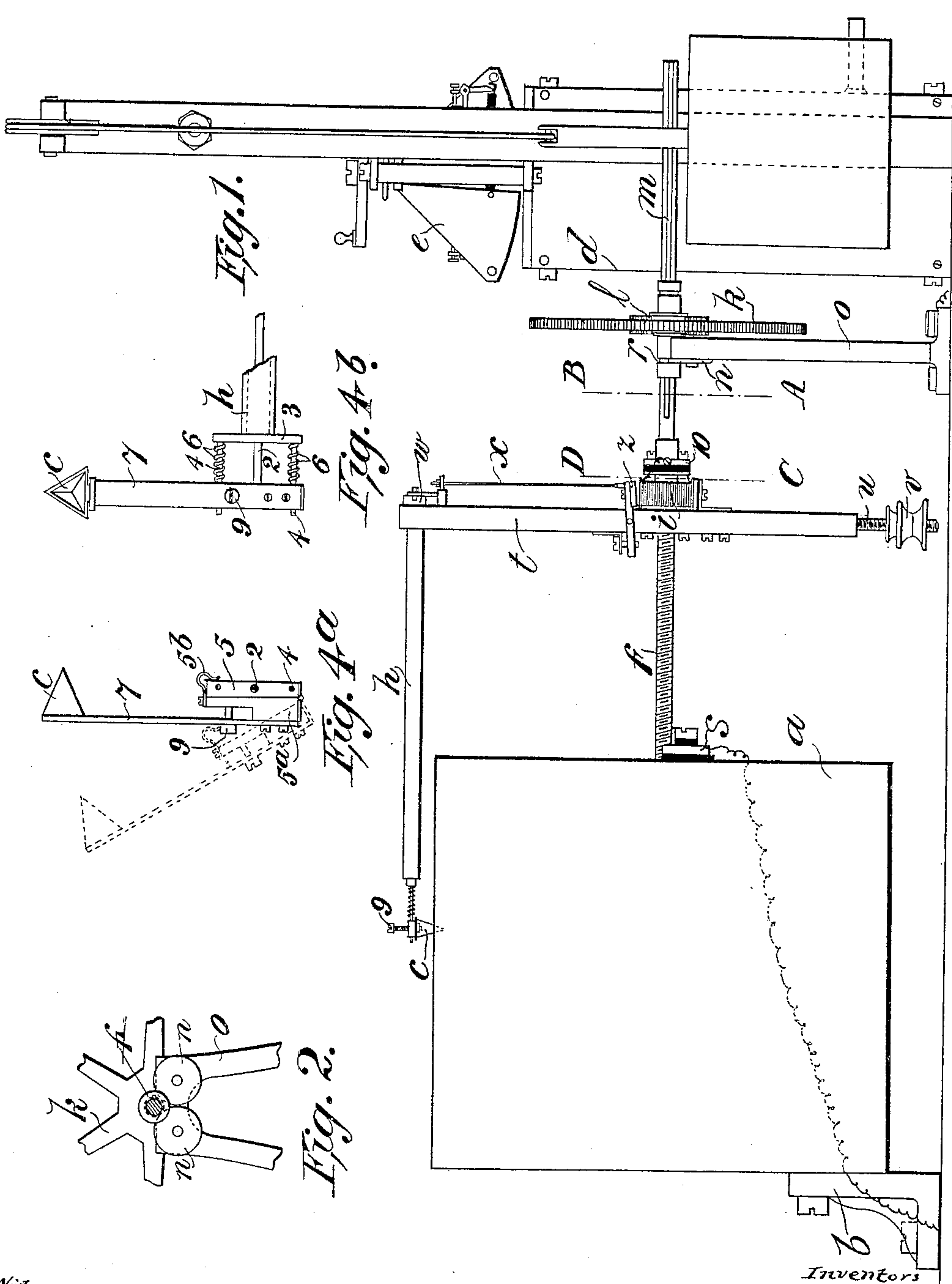
PATENTED APR. 3, 1906.

M. WILDERMANN & R. L. MOND.

CHRONOGRAPH.

APPLICATION FILED NOV. 18, 1903.

3 SHEETS—SHEET 1.



Witnesses

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3 SHEETS—SHEET 2.

Witnesses
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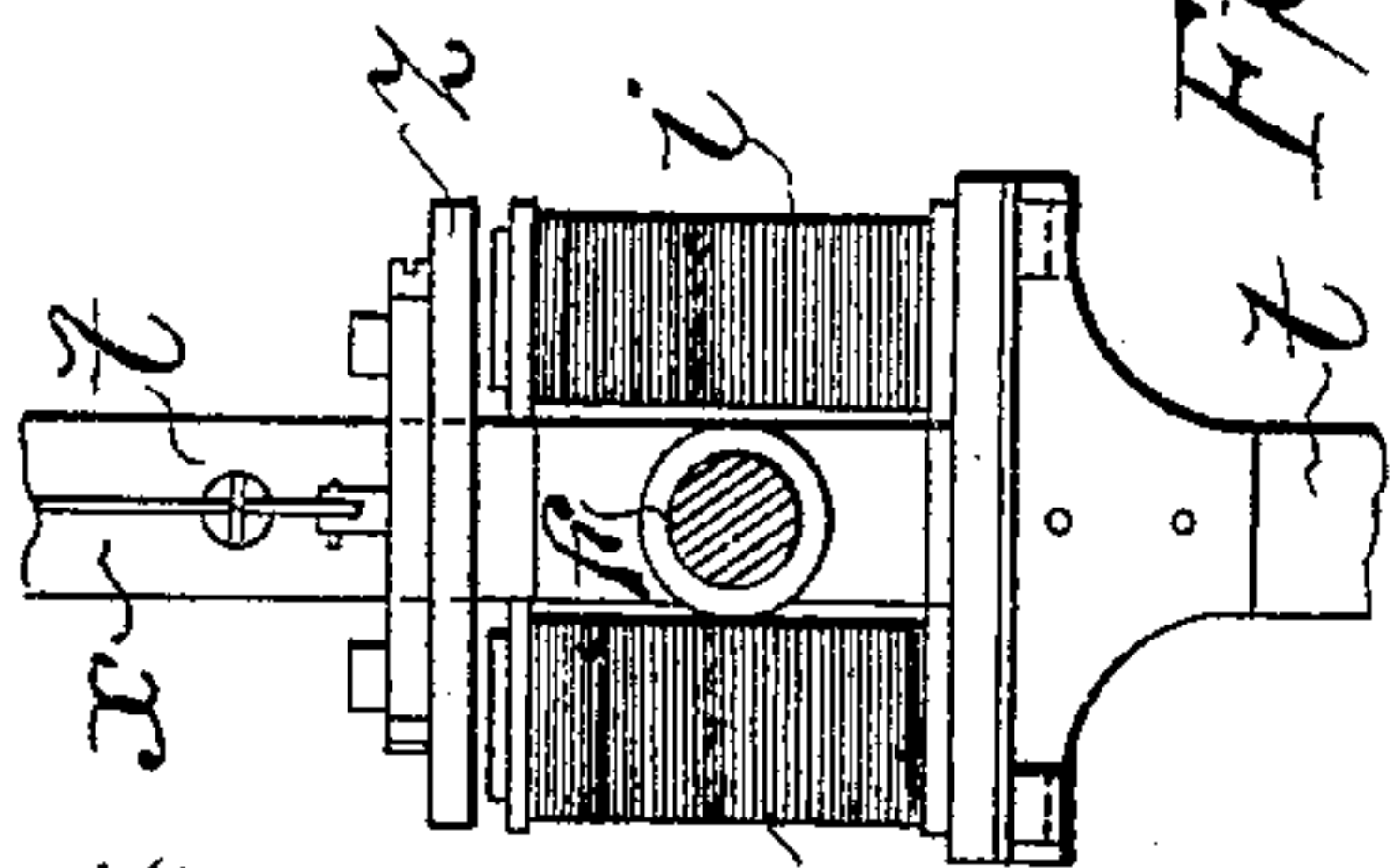


Fig. 3.

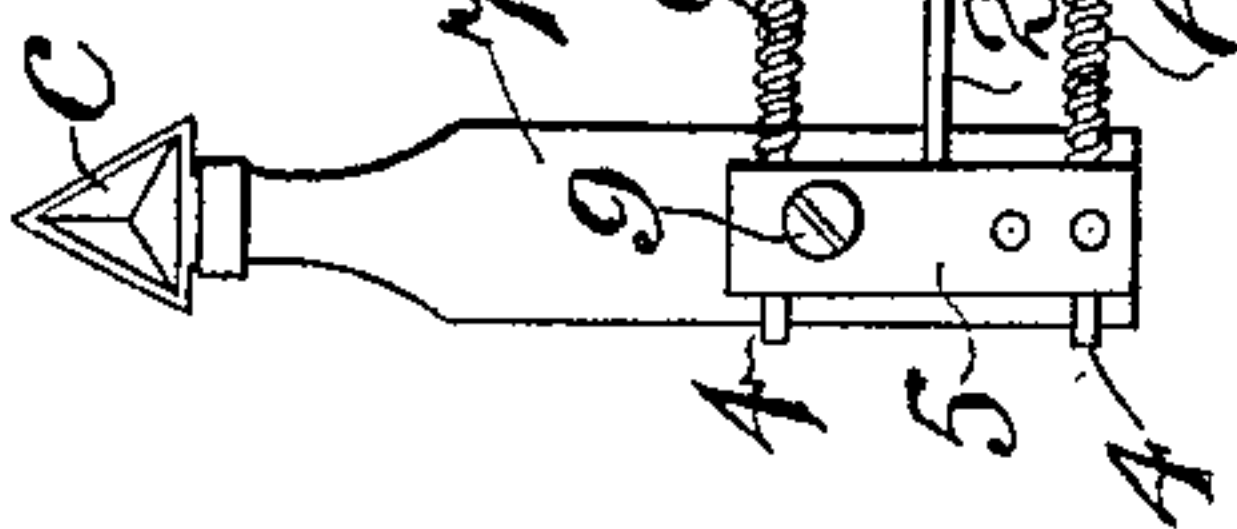


Fig. 4.

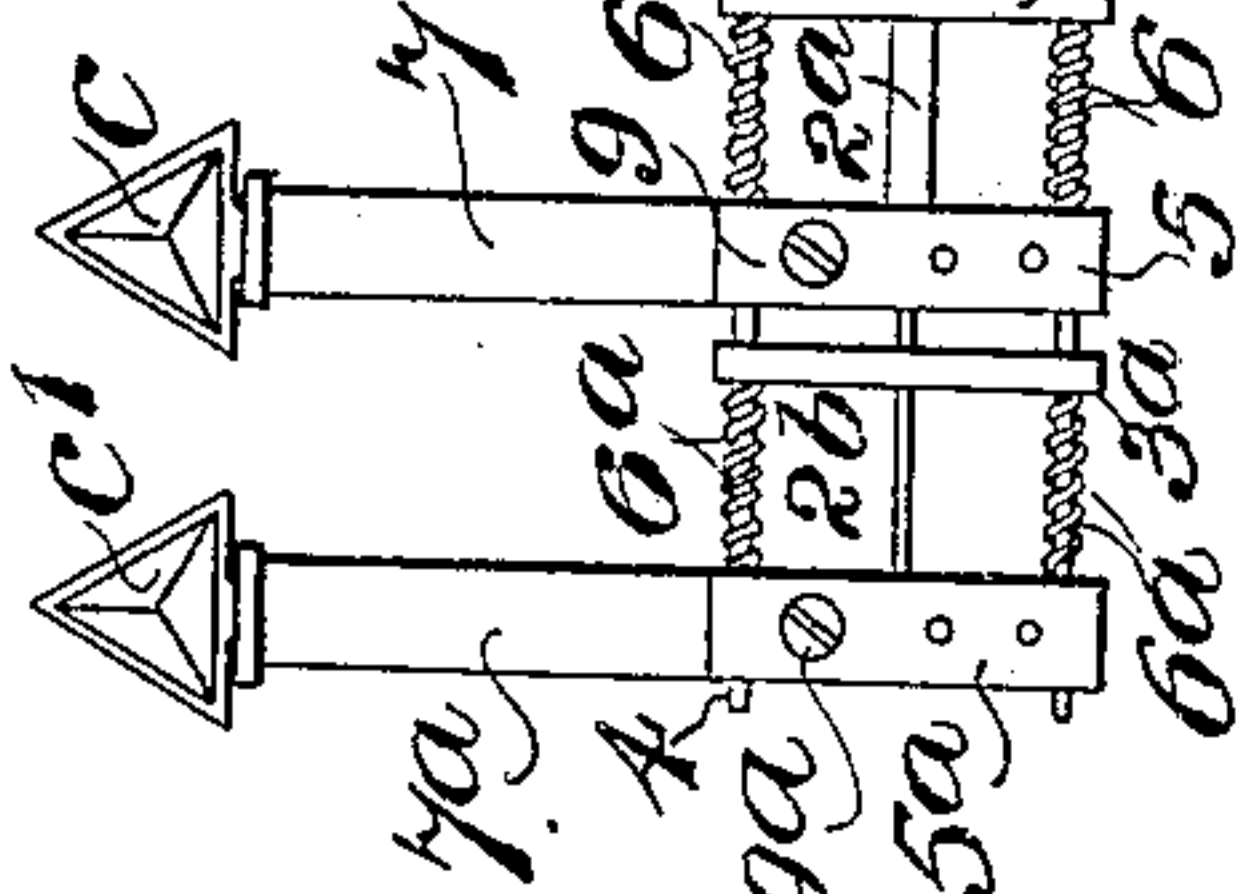


Fig. 5a.

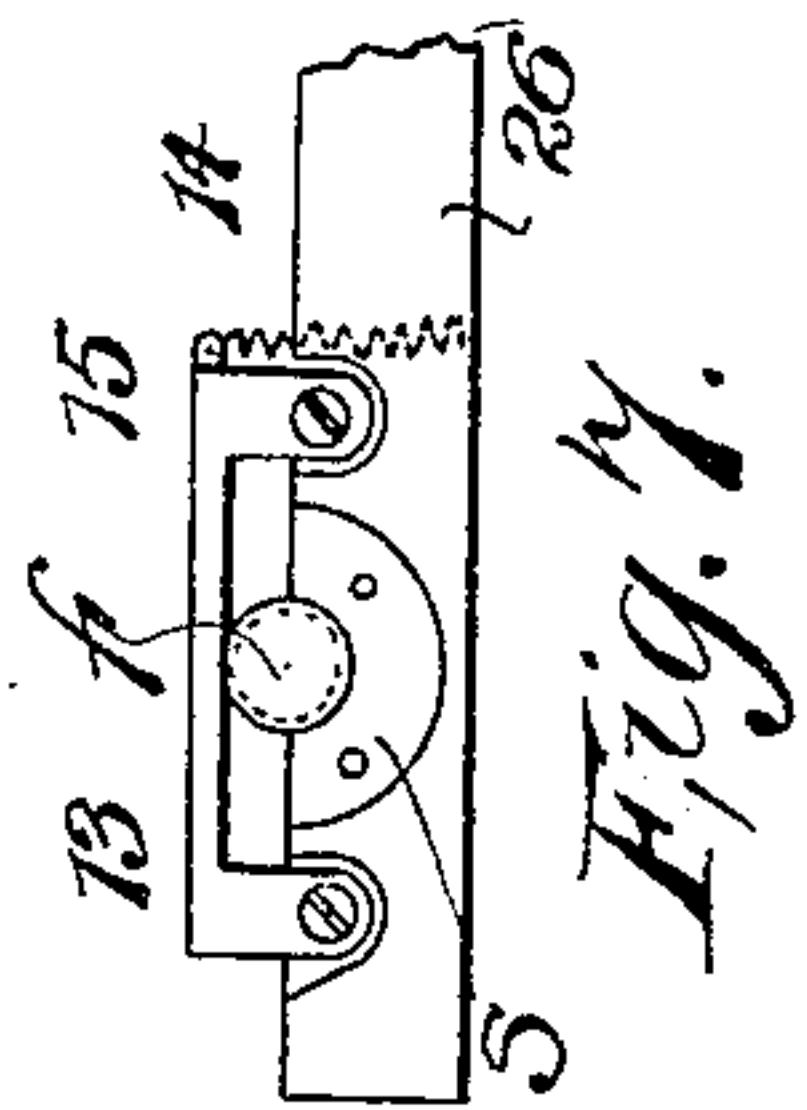


Fig. 1.

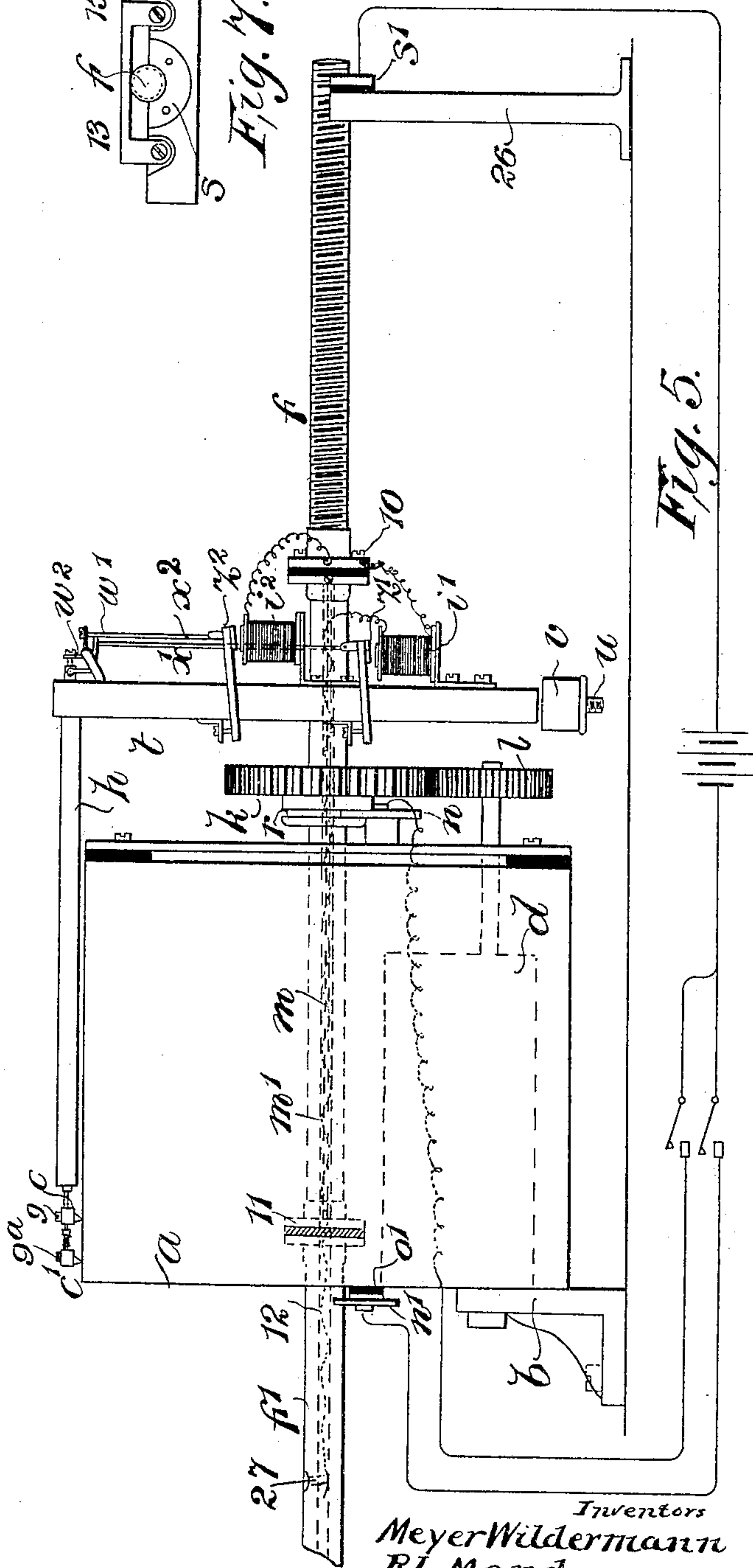


Fig. 5.

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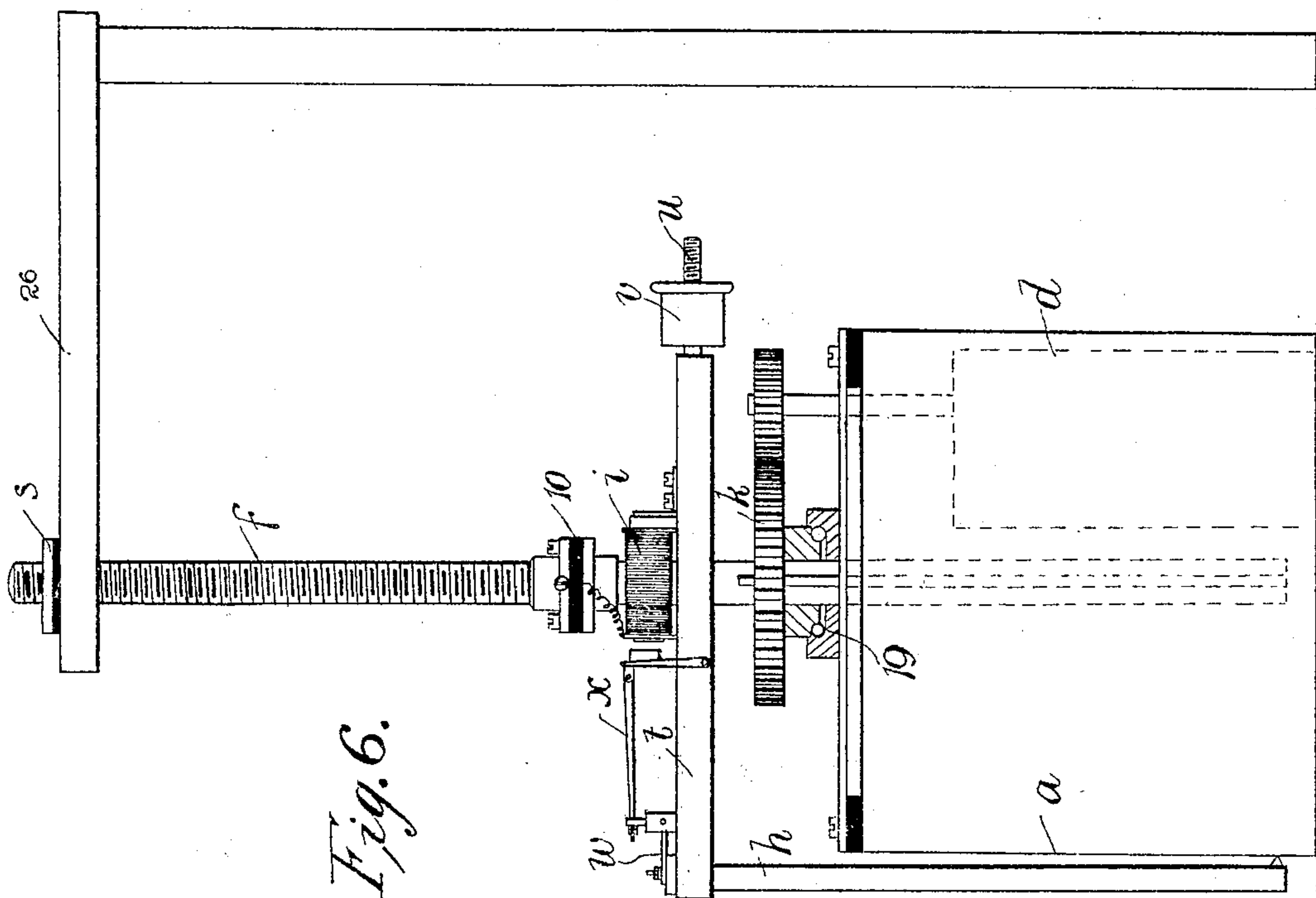
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

MEYER WILDERMANN AND ROBERT LUDWIG MOND, OF LONDON,
ENGLAND.

CHRONOGRAPH.

No. 816,767.

Specification of Letters Patent.

Patented April 3, 1906.

Application filed November 18, 1903. Serial No. 181,736.

To all whom it may concern:

Be it known that we, MEYER WILDERMANN, a subject of the Czar of Russia, residing at 10 Elers road, South Ealing, London, W., and
5 ROBERT LUDWIG MOND, a subject of the King of Great Britain and Ireland, residing at 27 Berkeley Square, London, W., England, have invented certain new and useful Improvements in and Relating to Chronographs, (for
10 which we have made application for Letters Patent in Great Britain, No. 10,373, bearing date May 7, 1903, and in France, No. 326,620, bearing date November 22, 1902,) of which the following is a specification.

15 The invention relates to chronographs, more especially of the type described in our Patent No. 598,042, of January 25, 1898, and has for object the provision of means which shall improve the accuracy and convenience of work-
20 ing of such instruments.

It has been found from experience with the instrument described in the above-mentioned patent that considerable inconvenience is caused by the necessity for screwing back the
25 spindle and parts carried thereby when, for instance, a record has been finished and it is desired to start a new one. Moreover, it is sometimes convenient to be able to readily remove the spindle bodily.

30 The first part of the invention, therefore, comprises means whereby the spindle and parts carried thereby can be readily set in a given position or removed bodily from the instrument.

35 Our invention also includes the following features: second, a rotatable pen-carrying system capable of perfect balance adjustment; third, improved means for operating and adjusting the pen itself; fourth, means whereby
40 two pens may record on the same drum, and, fifth, a vertical type of the chronograph above mentioned.

Referring to the accompanying drawings, Figure 1 shows a side elevation of a form of
45 chronograph the drum of which is horizontal. Fig. 2 is a detail view taken as a section on the line A B of Fig. 1, showing the arrangement of driving-gear. Fig. 3 is a section to an enlarged scale on the line C D of Fig. 1,
50 showing magnets and parts of the pen-operating mechanism. Fig. 4 is a view showing details of the pen itself, Figs. 4^a and 4^b show-

ing details of a modified form of pen. Fig. 5 shows, partly diagrammatically, a form of the invention in which two pens are used, Fig. 5^a 55 showing details of the double pen itself and parts adjacent thereto. Fig. 6 shows diagrammatically a side elevation of a vertical type of chronograph, while Fig. 7 shows details of the segment nut-bearing of Fig. 6. 60

According to one form of chronograph embodying certain of the features summarized above (see Fig. 1) the drum *a*, on which the record is to be taken, is fixed to a bracket *b*, the recording-pen *c* being adapted, by means 65 to be described in detail hereinafter, to trace out a helical line on the drum. Other mechanism, electrically actuated, serves to give the pen a movement in a direction transverse to this helical line, and thus to record the 70 time of a given occurrence.

The pen-carrying system is driven by clock-work *d*, the speed of which is controlled by means of any suitable fly-governor *e*.

The horizontal spindle *f*, carrying the pen- 75 arm *h* and electromagnets *i*, passes at one end through the boss of a pinion-wheel *k*, driven by the clock through another wheel *l*. A strip *m*, projecting from the spindle, forms a long feather, and a corresponding feather- 80 way in the boss of the pinion renders the spindle capable of axial movement with regard to the pinion *k*, though positively driven by it.

It is found easier for accurate construction 85 to arrange the parts as described than to cut a long feather-way in the spindle and provide a corresponding pin or feather on the boss.

To give different speeds to the pen, change-wheels may be provided to take the place of 90 the wheels *k* and *l*. It is found when such a change is made that the speed is not strictly proportional to the number of teeth in the wheels; but by adjusting the tension of the springs in the fly-governor *e* the exact speed 95 desired can be obtained with great accuracy.

The boss of the pinion *k* rests on friction-wheels *n*, (see Fig. 2,) carried by any convenient fixed portion of the instrument, such as the bracket *o*, longitudinal axial motion of 100 the pinion being prevented by means of an exterior circumferential groove *r* on the boss with which the friction-wheels engage. The screwed portion of the spindle *f* is arranged to

rest in a half-nut cut in the bar *s*, attached to the stationary drum, the weight of the rotating parts being sufficient to insure operative engagement between the screwed spindle and its nut.

By the means described it will be seen that the screwed end of the spindle may be readily lifted out of engagement with the half-nut and replaced in any given position, the manner in which the non-screwed part of the spindle is supported allowing sufficient swiveling motion for this operation to be effected, or, if desired, the spindle and parts carried thereby can be readily removed bodily from the instrument.

It will be seen that the effect of the mechanism just described is to cause the pen by means of the pen-arm *h* and cross-arm *t*, firmly secured to the spindle *f*, to trace out the required helical line on the surface of the drum.

According to feature No. 2 of the invention the arm corresponding with the pen-arm and used for a counterbalance in our Patent No. 598,042, of January 25, 1898, is dispensed with, a screw *u*, together with a nut *v*, forming a balance-weight, being substituted at the end of the cross-arm *t*. This arrangement gives an adjustable and extremely accurate means for securing an exact balance, while it also allows the spindle *f* and attached parts to be removed more readily from their bearings.

Feature No. 3 of the invention consists of improved means for operating and working the pen.

According to one form (see Figs. 1, 3, and 4) a bell-crank *w* is provided at the end of the cross-arm *t*, one of its arms being connected by a wire or rigid link *x* to the armature *z* of the magnets, while the other is connected in a similar manner by means of the wire 2 through an axial hole in the pen-arm *h* to the penholder itself.

The end of the pen-arm *h* carries a small cross-head 3, from which project guides 4, parallel to the pen-arm. A cross-piece 5, to the center of which the operating wire or link 2 is connected, slides on these guides, its motion being controlled by light springs 6, and to it is secured a flexible strip 7, carrying the pen *c*. The pressure with which the pen bears on the drum is regulated by a small screw 9, acting between the flexible strip 7 and the cross-piece 5.

According to a modified form of pen shown in Figs. 4^a and 4^b the flexible strip 7, carrying the pen *c*, is mounted on a block 5^a, hinged to the cross-piece 5, the block 5^a being secured in a working position by means of a spring-clip 5^b or other fastening. The hinged block carrying the pen may thus be drawn back out of action at will. Reference-symbols not directly referred to in Figs. 4^a and 4^b

bear the same significance as in Fig. 4. This arrangement provides a very steady support for the pen, making vibrations impossible, while at the same time the pressure of the pen on the drum can be adjusted to a minimum, so as to secure the greatest possible accuracy of registration.

The pen described may be moved automatically (or otherwise) every second for purposes of calibration, the magnets being energized by a small current for this purpose. A larger current may then produce a corresponding large movement when an observation is to be recorded, the same pen being thus used for both calibrating and recording with great practical convenience.

The electrical connections are as follows—namely, by way of the insulated half-nut *s* to the screwed portion of the spindle *f*, whence a connection leads to the magnets and across the insulating-coupling 10 to the plain portion of the spindle. The current then passes through the friction-wheels *n* to the bracket *o* and returns by any convenient path.

According to feature No. 4 of the invention two pens are provided side by side, each independently operated. This arrangement is specially useful when the simultaneous observations of two observers of either the same or correlated phenomena are to be recorded. This part of the invention may be carried into effect according to one form (see Figs. 5 and 5^a) as follows, the duplicate pen being shown applied to a horizontal type of instrument in which for compactness the driving-motor is placed within the drum:

The screwed spindle *f* rests in its insulated half-nut *s'*, supported on any convenient bracket 26, and is coupled, by means of the insulating-coupling 10, to the feathered length *m* of the spindle, operatively engaging in the manner already described with the power-wheel *k*. This power-wheel rests on friction-disks *n*, coacting with a groove *r* on the wheel-boss, the disks being supported by any convenient portion of the drum and the wheel itself being driven by a pinion *l*, receiving its motion from a clockwork-motor *d*, disposed within the drum. The feathered length *m* of the spindle, which has an axial hole *m'* through it, is coupled within the drum, by means of an insulating-coupling 11, to a plain extension *f'*, resting on friction-wheels *n'*, secured to an insulated support *o'*. The cross-arm *t* carries two separate electromagnets *i'* *i''*, each operating its respective pen through mechanism similar to that described above. Thus the pen-arm *h* carries at its end a cross-head 3, from which project guides 4, parallel to the pen-arm, and on these guides a block 5, carrying a pen *c*, is adapted to slide in a manner already explained. The actuating-link 2^a, passing through the rod *h* and attached to the block 5, is, however, in

this case hollow; but it is operatively connected to its magnet i' by way of a bell-crank w' , link x' , and armature z' in a manner similar to that already described with reference to Fig. 1.

Beyond the block 5 a second cross-head 3^a is attached rigidly to the guides 4, and a block 5^a , carrying a second pen c' , is adapted to slide on these guides. This second block is actuated by means of a link 2^b , its other end being operatively connected by way of a bell-crank w^2 , link x^2 , and armature z^2 to a second magnet i^2 . The pen proper, c' , is supported by a spring-blade 7^a , attached to the block 5^a and adapted to be adjusted by a screw 9^a , as before. Springs 6^a serve to return the pen c' after operative movement.

The electrical connections according to one form as applied to the two-pen modification just described are as follows: One electromagnet—for example, i^2 —is connected in series between the screwed portion of the spindle f and the feathered part m , a path for the energizing-current being thus provided by way of the half-nut s' , screwed portion of the spindle f , magnet i^2 , feathered part m of the spindle, and then by way of the friction-wheels n , from which a return-wire completes the circuit. The other electromagnet i' is connected in series between the screwed portion of the spindle f and the plain extension f' by means of an insulated wire 12, passing through the axial hole in the feathered part m and placed in circuit with the part f' by the binding-screw 27. A wire from the insulated support o' , on which the plain extension f' bears, completes the circuit, as shown.

The fifth part of the invention concerns types of instrument (to which certain of the above improvements are applied) in which the axis is arranged vertically. According to one form, as shown in Fig. 6, (the same reference characters being used as before where possible to denote corresponding parts in the horizontal and vertical types of instrument,) the spindle f is driven by a clock d , placed within the drum, the pinion k , which engages with the spindle f , being supported on ball-bearings 19 on the drum. The screwed portion of the spindle engages, as before, with a half-nut s , fixed to any convenient bracket 26, the engagement being insured, for example, by means of a hinged clip 13, (see Fig. 7,) provided with spring 14 and clamping-screw 15. The arrangement of the pen-carrying system is similar to that described above with reference to the horizontal type of instrument, the electrical connections being also substantially the same. This method of supporting the spindle also gives the same advantages as regards resetting the spindle and pen for a fresh observation as were described above with reference to the horizontal type of instrument, the ball-bearing read-

ily allowing the small angular displacement of the spindle necessary to disengage it from the half-nut.

The vertical type of instrument is specially convenient when portability is desired—as, for instance, at race meetings, &c.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In chronographs of the type described, the combination of a stationary drum; a laterally-displaceable screwed pen-carrying spindle axially disposed with regard to said drum; a power-wheel adapted to rotate said spindle while allowing it to move longitudinally; a stationary nut-segment with which said spindle operatively engages together with a bearing for said power-wheel adapted to allow said spindle sufficient lateral movement to be disengaged from said nut-segment in order to adjust the position of said pen-carrying spindle longitudinally.

2. In chronographs of the type described, the combination of a stationary drum, a laterally-displaceable screwed pen-carrying spindle axially disposed with regard to said drum; a power-wheel adapted to rotate said spindle while allowing it to move longitudinally; motor means disposed within said drum for driving said wheel; a stationary nut-segment with which said spindle operatively engages together with a bearing for said power-wheel adapted to allow said spindle sufficient lateral movement to be disengaged from said nut-segment in order to adjust the position of said pen-carrying spindle longitudinally.

3. In chronographs of the type described the combination of a stationary drum; a laterally-displaceable screwed pen-carrying spindle axially disposed with regard to said drum; a power-wheel adapted to rotate said spindle while allowing it to move longitudinally; a stationary nut-segment with which said spindle operatively engages; a bearing for said power-wheel adapted to allow said spindle sufficient lateral movement to be disengaged from said nut-segment in order to adjust the position of said pen-carrying spindle longitudinally, together with means for preventing longitudinal movement of said power-wheel relatively to said bearing.

4. In chronographs of the type described the combination of a stationary drum; a laterally-displaceable screwed pen-carrying spindle axially disposed with regard to said drum; a power-wheel adapted to rotate said spindle while allowing it to move longitudinally; a stationary nut-segment with which said spindle operatively engages; antifriction elements on which said power-wheel rests adapted to allow said spindle sufficient lateral motion to be disengaged from said nut-segment in order to adjust the position of

said pen-carrying spindle longitudinally, together with means including a groove arranged to prevent longitudinal movement of said power-wheel relatively to said antifriction elements.

5 5. In chronographs of the type described, the combination of a stationary drum; a laterally-displaceable screwed pen-carrying spindle axially disposed with regard to said drum; a power-wheel adapted to rotate said spindle while allowing it to move longitudinally; a stationary nut-segment with which said spindle operatively engages; antifriction-wheels on which said power-wheel rests
10 adapted to allow said spindle sufficient lateral movement to be disengaged from said nut-segment in order to adjust the position of said pen-carrying spindle longitudinally, together with a circumferential groove in a part of said power-wheel coacting with said antifriction-wheels to prevent relative longitudinal movement therebetween.

6. In chronographs of the type described, the combination with a pen-carrying arm
25 actuated by a laterally-displaceable screwed spindle, and means for adjusting the position of said pen-carrying arm longitudinally, of a cross-head fixed to the end of said arm; guides attached to said cross-head, one at each end thereof; a spring-controlled block slidably mounted on said guides; a pen yieldingly and adjustably connected to said block together with means connecting said slidable block to its operative means.

35 7. In chronographs of the type described, the combination with a stationary drum; a rotatable and laterally-displaceable spindle axially disposed with regard to said drum; means for adjusting the position of the pen-carrying spindle longitudinally; a transverse arm carried by said spindle together with a pen-carrying arm carried by said transverse arm; a cross-head fixed to the end of said pen-carrying arm; guides attached to said cross-head, one at each end thereof; a spring-controlled block slidably mounted on said guides; a pen yieldingly and adjustably connected to said block together with means connecting said slidable block to its operative means, said connecting means including a bell-crank disposed at about the junction of said transverse and pen-carrying arm.

8. In chronographs of the type described, the combination of a stationary drum; a
55 screwed spindle axially disposed with regard to said drum; a transverse arm attached to said spindle; and means for adjusting the position of the transverse arm longitudinally; an adjustable balance-weight on one end of said transverse arm; a pen-carrying arm mounted on the other end of said transverse arm; guides attached to said pen-carrying arm, a spring-controlled block slidably mounted on said guides; a pen yieldingly and
65 adjustably connected to said block together

with means for connecting said slidable block to its operative means.

9. In chronographs of the type described, the combination of a pen-carrying arm; guides attached to said arm; a spring-controlled block slidably mounted on said guides; a pen-carrying element hinged to said block; means for securing and adjusting said pen-carrying element on said block, together with means connecting said slidable block to its operating means.

10. In chronographs of the type described, the combination of a stationary drum; a screwed spindle axially disposed with regard to said drum; a transverse arm mounted on said spindle; a pen-arm carried by said transverse arm; a plurality of pens carried by said pen-arm; electromagnetic means for the operation of each of said pens together with means for operatively connecting said pens to their respective electromagnets including coaxial links, one of which is hollow, passing through said pen-arm.

11. In chronographs of the type described, the combination of a stationary drum; a
90 screwed spindle axially disposed with regard to said drum; a pen-arm carried by said spindle; a plurality of pens mounted on said pen-arm; electromagnetic means for the operation of each of said pens together with coaxial links, one of which is hollow, for operatively connecting said electromagnets to said pens.

12. In chronographs of the type described, the combination of a stationary drum; a spindle axially disposed with regard to said drum, said spindle being in three coaxial lengths insulated from each other, one of said lengths being screwed; a stationary nut with which said screwed length engages; two pens carried by said spindle; electromagnetic means for the operation of each of said pens; means for completing the operative circuit of one pen including an end length of said spindle together with means for completing the operative electric circuit of the other pen including the other end length of said spindle and a connection passing longitudinally through the middle length.

13. In chronographs of the type described, the combination of a uniformly-moving motor, a fixed recording-drum, a pen-carrying arm operatively connected to the motor, a transversing laterally-displaceable screw for said pen-carrying arm and means for longitudinally transversing the pen-carrying arm relatively to the fixed drum.

In witness whereof we have hereunto set our hands in presence of two witnesses.

MEYER WILDERMANN.
ROBERT LUDWIG MOND.

Witnesses:

ALBERT E. PARKER,
PERCIVAL M. DAVIES.