

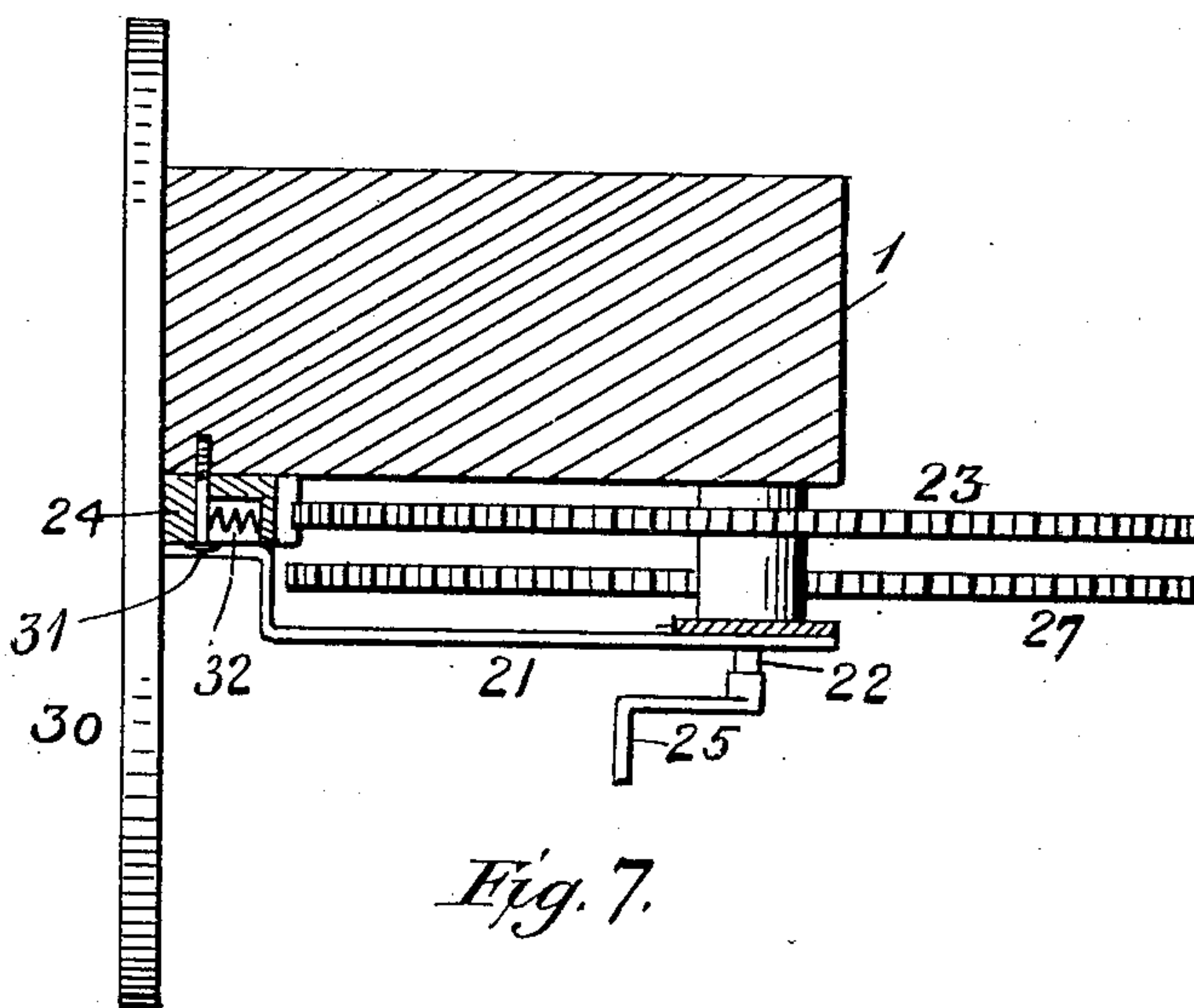
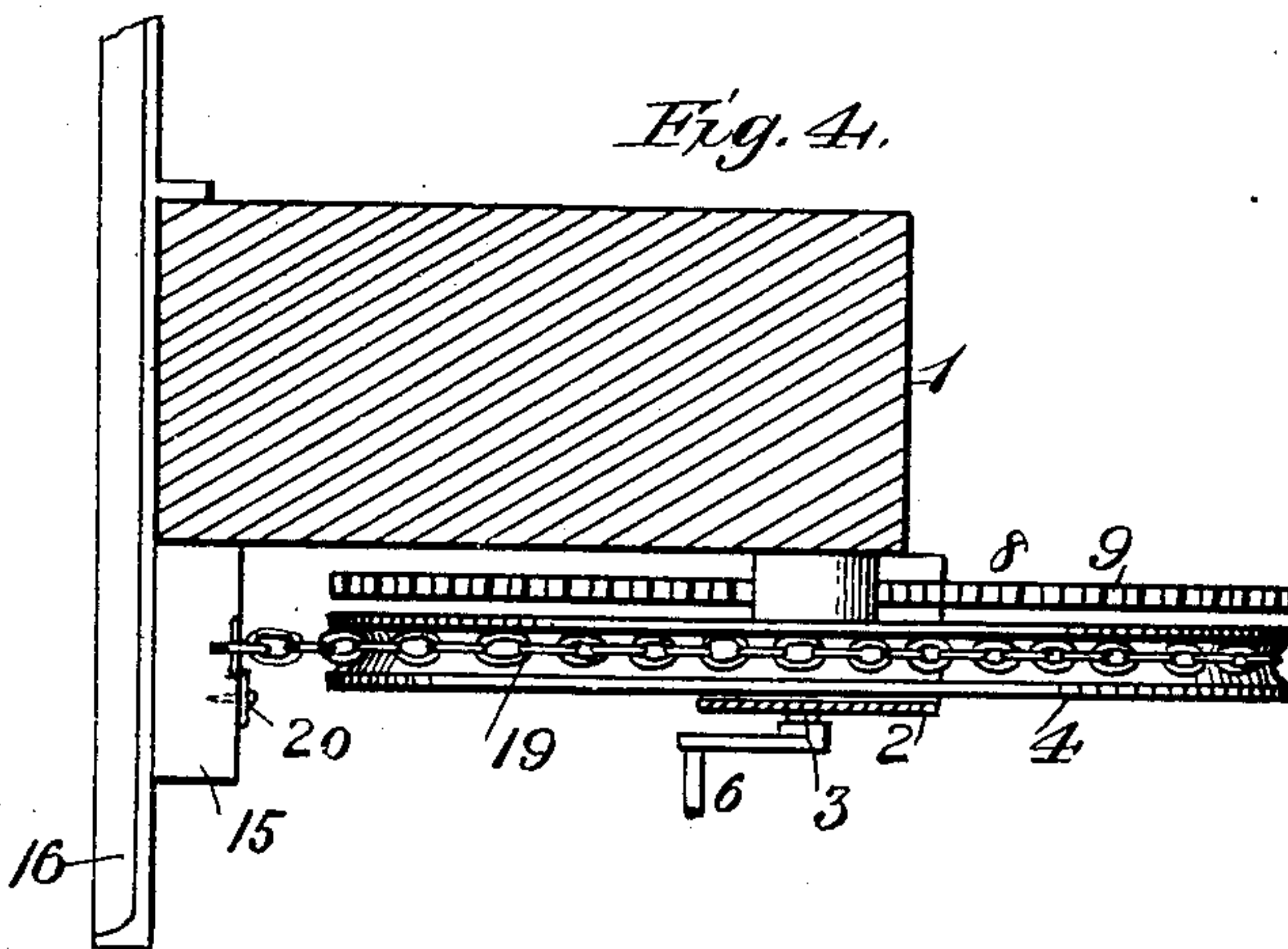
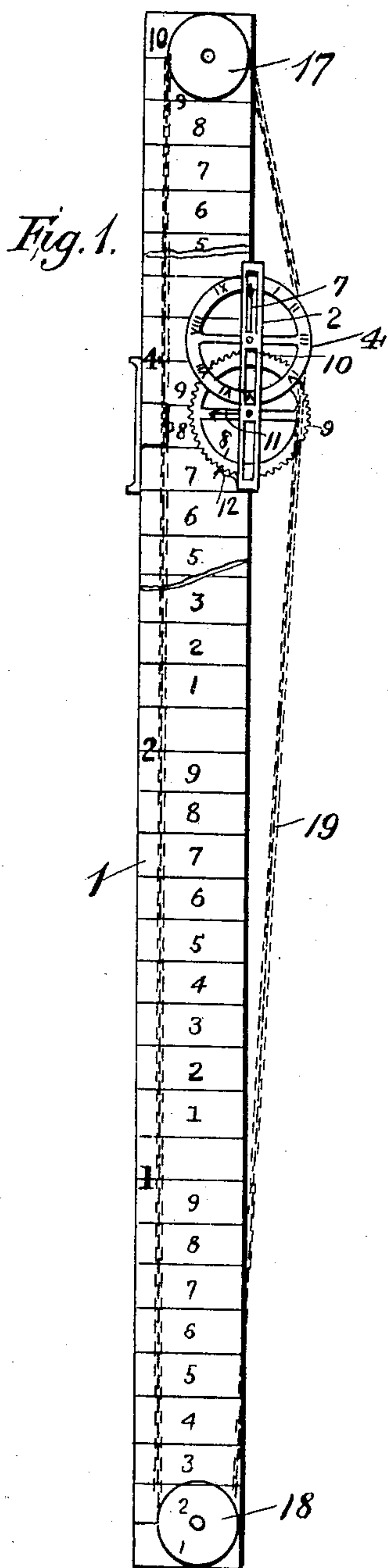
No. 864,485.

PATENTED AUG. 27, 1907.

J. OSS.
SURVEYOR'S LEVELING ROD.

APPLICATION FILED JAN. 14, 1907.

4 SHEETS—SHEET 1.



Witnesses:
F. L. Ourand
L. L. Buckle.

Inventor:
John Oss,
by *Wm. Ragger*
Attorney.

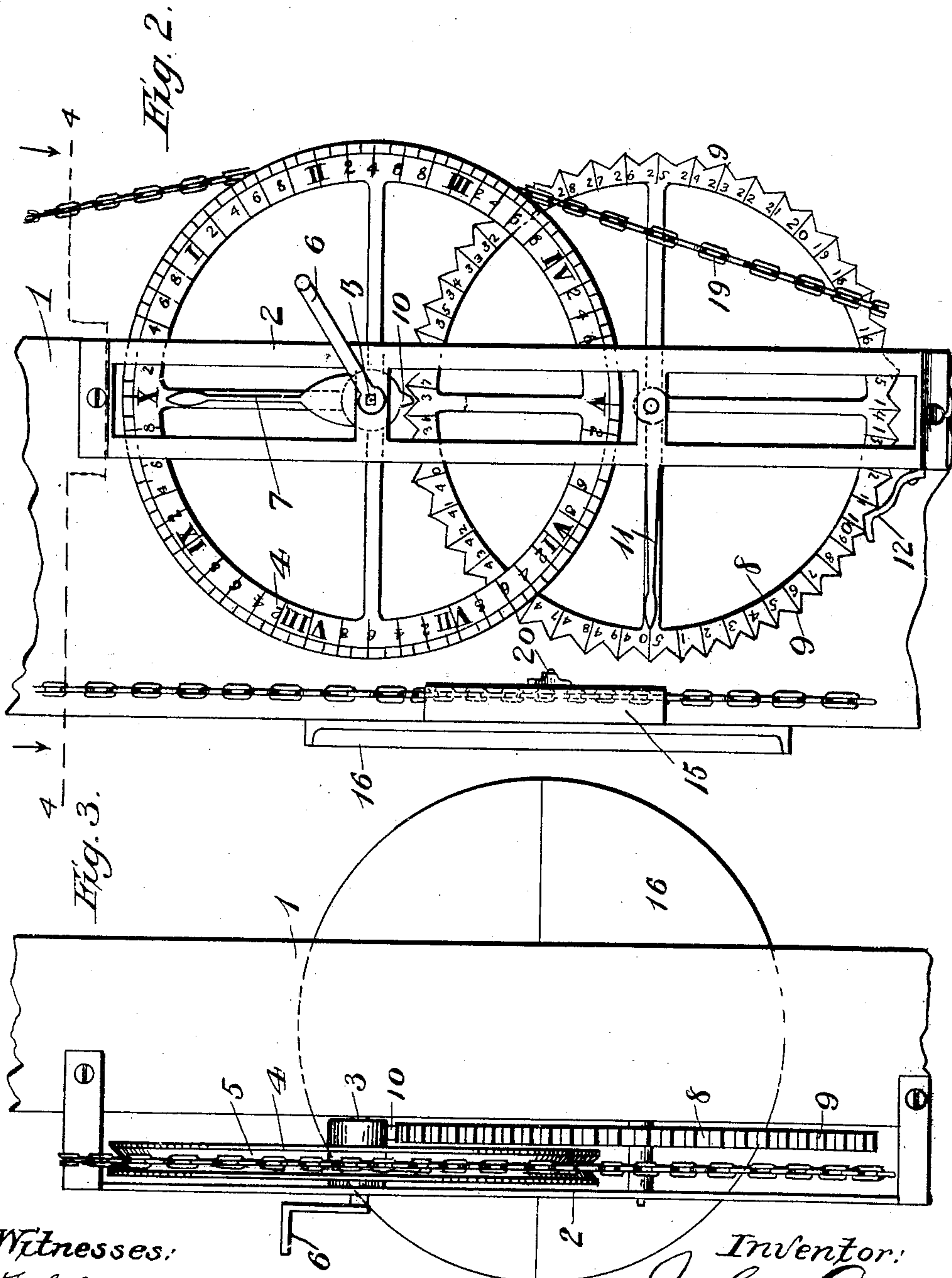
No. 864,485.

PATENTED AUG. 27, 1907.

J. OSS.
SURVEYOR'S LEVELING ROD.

APPLICATION FILED JAN. 14, 1907.

4 SHEETS—SHEET 2.



Witnesses:
F. L. Ourand,
L. L. Tucker.

Inventor:
John Oss,
By Wm. K. Koger,
Attorney.

No. 864,485.

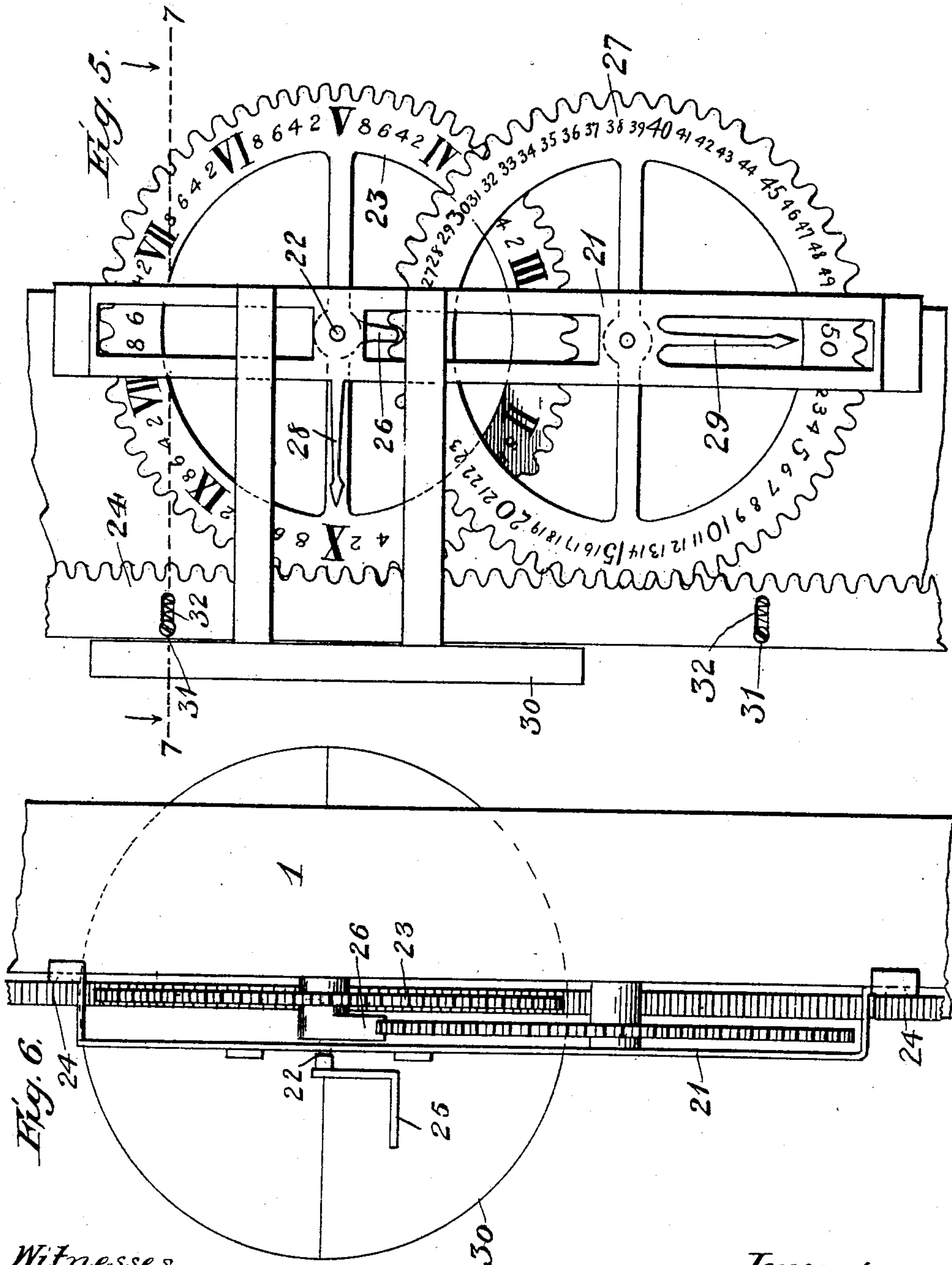
PATENTED AUG. 27, 1907.

J. OSS.

SURVEYOR'S LEVELING ROD.

APPLICATION FILED JAN. 14, 1907.

4 SHEETS—SHEET 3.



Witnesses
F. L. Ourand
L. L. Burkett.

Inventor.
John Oss,
by Wm. Bagger,
Attorney

No. 864,485.

PATENTED AUG. 27, 1907.

J. OSS.

SURVEYOR'S LEVELING ROD.

APPLICATION FILED JAN. 14, 1907.

4 SHEETS—SHEET 4.

Fig. 8.

SURVEYORS REPORT							LEVELING TALLEY			
POINT	REAR SIGHT	FRONT SIGHT	RISE	FALL	REL. RISE	DIS-TANCE	ADD	SUB	REL RISE	REMARKS
A	3.50				0	0			0.00	fixed to read 0.00
1		1.58	1.92		1.92	23	1.92		1.92	
2		1.31	0.27		2.19	38	0.27		2.19	
3		0.50	0.81		3.00	55	0.81		3.00	
3	3.56								3.00	undamp target and move by hand
4		1.44	2.12		5.12	73	2.12		5.12	
5		0.88	0.56		5.68	93	0.56		5.68	
6		0.24	0.64		6.32	113	0.64		6.32	
7		2.65		2.41	3.91	131		2.41	3.91	
7	1.27								3.91	undamp target and move by hand
8		3.59		2.32	1.59	146		2.32	1.59	
9		1.58	2.10		3.60	163	2.01		3.60	
B		1.33	0.25		3.85	180	0.25		3.85	
$858 - 473 = 385$							$858 \div 473 = 3.85$			

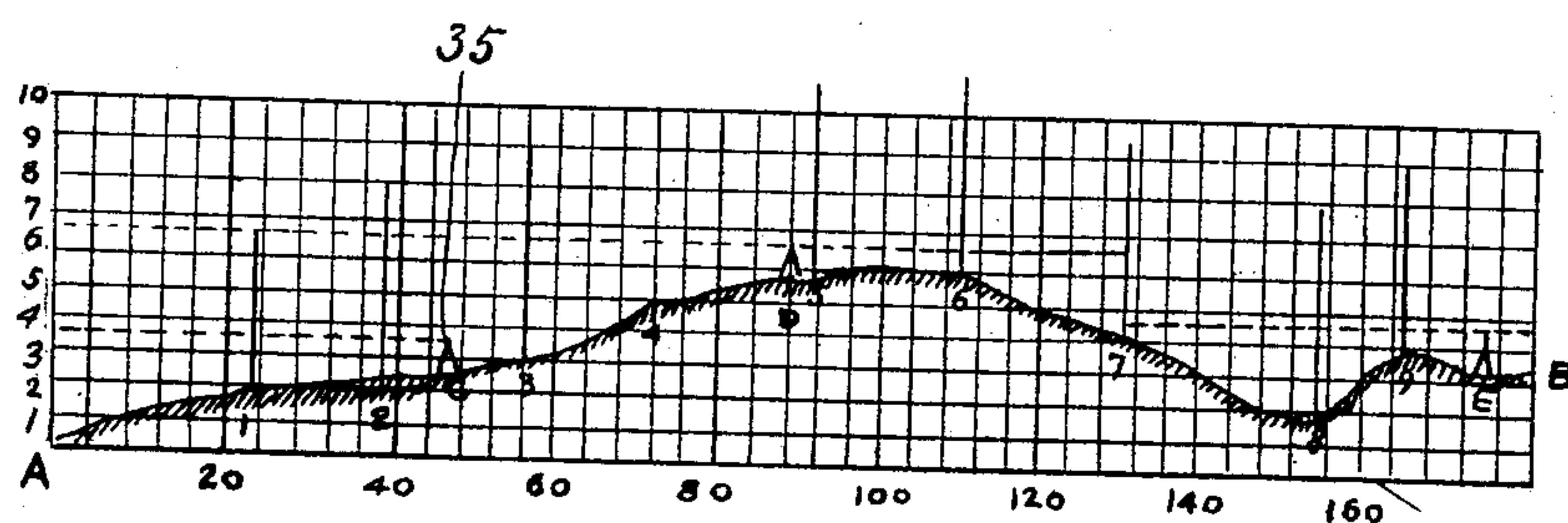


Fig. 9.

Witnesses:
 F. L. Ourand
 S. L. Burkett

Inventor:
 John Oss,
 by *Wm. Ragger*
 Attorney.

UNITED STATES PATENT OFFICE.

JOHN OSS, OF ATLANTA, MINNESOTA.

SURVEYOR'S LEVELING-ROD.

No. 864,485.

Specification of Letters Patent.

Patented Aug. 27, 1907.

Application filed January 14, 1907. Serial No. 352,159.

To all whom it may concern:

Be it known that I, JOHN OSS, a citizen of the United States, residing at Atlanta, in the county of Becker and State of Minnesota, have invented certain new and useful Improvements in Surveyors' Leveling-Rods, of which the following is a specification.

This invention relates to surveyors' leveling rods and targets; and it has for its object to provide an automatic computing device which will serve to indicate the various readings of the apparatus and which, being mechanically operated and practically automatic in its operation, will preclude the possibility of mistakes caused by ignorance or carelessness on the part of the operator.

Further objects of the invention are to simplify and improve the construction and operation of this class of devices.

With these and other ends in view, which will readily appear as the nature of the invention is further understood, the same consists in the improved construction and novel arrangement and combination of parts which will be hereinafter fully described and particularly pointed out in the claims.

In the accompanying drawings has been illustrated a simple and preferred form of the invention; it being, however understood that no limitation is necessarily made to the precise structural details therein exhibited, but that changes, alterations and modifications within the scope of the invention may be resorted to when desired.

In the drawings,—Figure 1 is a side elevation of a surveyor's leveling rod constructed in accordance with the principles of the invention. Fig. 2 is a side elevation, enlarged, of that portion of the rod which carries the computing apparatus. Fig. 3 is an edge view of the same. Fig. 4 is a transverse sectional view taken on the plane indicated by the line 4—4 in Fig. 2. Fig. 5 is a side elevation of a portion of a leveling rod, illustrating the modified construction. Fig. 6 is an edge view of the parts shown in Fig. 5. Fig. 7 is a sectional view taken on the plane indicated by the line 7—7 of Fig. 5. Fig. 8 is a view illustrating a surveyor's table to indicate the use of the apparatus. Fig. 9 is a profile drawn from the readings of the table illustrated in Fig. 8.

Corresponding parts in the several figures are denoted by like characters of reference.

The leveling rod proper, which is designated 1, is preferably of rectangular cross-section, and it may be of any desired length; said rod is laid off with a suitable scale which may indicate feet and inches, or decimal divisions of feet, or any other system of measurement that it may be desired to use.

Suitably mounted upon the rod 1, intermediate the ends thereof, is a frame 2 having bearings for a shaft or arbor 3 carrying a measuring wheel 4 which is annularly grooved as shown at 5 and which is of a certain stated

circumference which may be appropriately stated at one foot. Assuming the circumference of this wheel to be one foot, the face of the wheel is laid off with a scale indicating sub-divisions of one foot, either in inches, in decimal measure, or otherwise. The shaft 3 is provided with a crank 6, whereby said shaft and the measuring wheel 4 may be rotated, and a pointer or indicator 7 is fixed upon the frame 2 to cooperate with the scale on the measuring wheel.

Suitably mounted for rotation in the frame 2 is a computing wheel 8, the periphery of which is provided with teeth 9 adapted to be engaged by a single tooth 10 upon the shaft or arbor of the measuring wheel, so that the complete rotation of the latter will cause the computing wheel to be moved the space of a single tooth. The face of the computing wheel is provided with a scale consisting of consecutive numbers from one upward, one number for each tooth, and a hand or pointer 11 fixed upon the frame cooperates with said scale.

The computing wheel 8 may be of any desired size and in practice I have found it convenient to provide it with fifty teeth, although it is obvious that within the scope of the invention it may be provided with any desired number of teeth; however, assuming it to be provided with fifty teeth, and assuming the measuring wheel to be of a circumference of one foot, it is evident that a complete rotation of the computing wheel will indicate fifty feet. A spring pawl 12 of simple construction is attached to the frame 2 in such a manner as to engage the toothed periphery of the computing wheel; said pawl being so constructed that while it will not positively obstruct the rotation of the computing wheel in any direction, it will serve to prevent accidental displacement of the latter.

15 designates a slide, movable longitudinally upon the leveling rod 1 and carrying a target 16. Suitably mounted near the upper and lower ends of the leveling rod are guide wheels or pulleys 17 and 18 supporting an endless flexible element, such as a chain 19, which is also guided over, or in contact with, the periphery of the measuring wheel 4, so that said chain or flexible element will be operated by the rotation of said measuring wheel; it being understood that positive connection, frictional or otherwise, exists between the grooved periphery of the measuring wheel and the chain or flexible element so that, assuming the circumference of the measuring wheel to be one foot, a complete rotation of said wheel will cause a given point of the flexible element to be moved or displaced to the extent of precisely one foot. In order to cause this result to be positively attained, the circumference of the measuring wheel may be provided with sprockets or irregularities to engage the links of the chain; but such construction is obvious and well understood, and it is not deemed necessary to illustrate the same. A clamping or se-

curing member, conventionally indicated at 20, serves to connect the target-carrying slide 15 detachably with the chain.

It will be readily seen from the foregoing construction, that each rotation of the measuring wheel will cause the target-carrying slide to be moved upon the leveling rod a distance which is exactly equal to the circumference of said measuring wheel; also, that the number of rotations, in one direction, of the measuring wheel will be indicated upon the face of the computing wheel by the hand pointing to the scale of the latter. It will furthermore be seen that the target-carrying slide may be detached or unclamped from the chain or flexible element 19, so that the target may be adjusted upon the leveling rod without changing the position of the measuring wheel and the computing wheel.

A somewhat modified construction of the invention has been illustrated in Figs. 5 and 6 of the drawings, the object of said modification being to dispense with the chain or flexible element. Under this modification there is provided a frame 21 longitudinally slidable upon the leveling rod 1 and provided with bearings for a shaft or arbor 22 carrying a measuring wheel 23 which in this instance is provided with a toothed periphery engaging a rack-bar 24, which is mounted longitudinally upon the leveling rod. The measuring wheel 23, which is of a certain stated circumference, is provided on the face thereof with a scale, substantially like that upon the measuring-wheel 4, hereinbefore described, except that it is made to read in the opposite direction. The arbor 22 is provided with an operating handle or crank 25 and with a tooth 26 engaging the toothed periphery of a computing wheel 27 which is supported for rotation in the frame 21, and the face of which is provided with a scale consisting of consecutive numbers, from one upward, one for each tooth, and said scale reading reversely to that of the computing wheel 8, hereinbefore described. Hands or pointers, 28 and 29, are fixed upon the frame 21 to cooperate with the scales of the measuring wheel 23 and the computing wheel 27, respectively. The slide 21, which carries the measuring wheel and the computing wheel, also carries a target 30, and it will be readily seen that said target may be moved to various positions upon the leveling rod by rotating the measuring wheel, the toothed periphery of which engages the rack 24, thus causing the slide to be shifted to various positions.

In order to enable the target 30 to be adjusted upon the leveling rod without changing the position of the measuring wheel 23 and the computing wheel 27, it is necessary that means be provided for temporarily disengaging the rack 24 from the toothed periphery of the measuring wheel; and to this end it is proposed to secure the rack-bar upon the leveling rod by means of headed screws or fastening members 31 engaging slots 32 in the rack-bar; springs, 33, being placed in said slots in such a manner as to hold the rack-bar normally in engagement with the toothed periphery of the measuring wheel 23, and yet in such a manner that the rack-bar may be temporarily disengaged from the measuring wheel by placing it against the tension of the springs. By this simple construction provision is made for adjusting the target 30 upon the leveling rod without shifting the position of the measuring wheel 23 and the computing wheel 27.

The operation and advantages of this invention will be readily understood from the foregoing description, especially when taken in connection with Figs. 8 and 9 of the drawings. The table illustrated in Fig. 8 is ruled with columns or vertical divisions marked as follows: Point, Rear sight, Front sight, Rise, Fall, Rel. rise, Distance, Add, Subtract, Rel. rise, Remarks; said vertical columns being intersected by horizontal lines. Fig. 9 indicates a profile laid out by the use of the apparatus, said profile extending between the points A and B. The theodolite, which is conventionally indicated at 35, having been erected at a convenient point, C, intermediate the points A and B, the operator sights back to the point A, where the leveling rod is temporarily held by the assistant, and the reading, which in the present instance is 3.50 is noted upon the table. The measuring wheel and the computing wheel of the apparatus are now adjusted at zero, and the leveling rod is carried by the assistant to the point 1 intermediate the theodolite at the point A. The assistant now turns the crank of the arbor carrying the measuring wheel until the target is carried into line of sight, and the reading, in the present instance, 1.58, is noted upon the table; deducting 1.58 from 3.50 leaves 1.92, which indicates the actual rise which is noted in the proper columns upon the table; the distance, in feet, between the points A and 1, in the present instance, 23, is also noted upon the table. The operator's assistant now carries the leveling rod to the point 2 intermediate the theodolite at the point 1, and the measuring wheel is again rotated until the target is brought into the line of sight; the reading, in the present instance, being 1.31 which, deducted from 1.58, leaves 0.27 indicating the actual rise which, together with the reading, is properly noted upon the table; in the column marked Rel. rise is noted the rise at the point 1 plus the rise at the point 2; in the present instance 2.19. The leveling rod is now carried to the point 3, which is intermediate the theodolite and the point B; manipulating the measuring wheel to bring the target into the line of sight, in the present instance brings about a reading of 0.50 which, deducted from 1.31, indicates a rise of 0.81, which, added to the previous relative rise, 2.19, makes a total of 3.00, which is noted in the proper place. It is now found necessary to move the theodolite, which is next erected at the point D. The operator now sights back to the leveling rod, which still remains at the point 3, and the reading, which in the present instance is 3.56, is noted upon the table. The target is now disengaged from the mechanism whereby it is operated, which is accomplished by unclamping the target-carrying slide from the endless chain in Figs. 1, 2, 3 and 4, or by disengaging the rack-bar from the measuring wheel, under the construction illustrated in Figs. 5, 6 and 7, and the target is moved manually until it is carried into the line of sight without changing the position of the measuring wheel or the computing wheel; this having been accomplished, the target is once more connected with its operating mechanism. The leveling rod is now successively carried to the points 4, 5, 6 and 7, and the proper readings are made and noted upon the table, as indicated in Fig. 8. It is now again necessary to change the position of the theodolite, and it again becomes necessary to disengage the target from its operating mechanism in order to move it manually into the line of sight, at the point 7.

It is obvious that whenever the contour of the profile indicates a fall instead of a rise, the reading will be deducted from instead of added to the previous figures indicating the relative rise, as will be readily understood by reference to Figs. 8 and 9 of the drawings.

This improved device, as will be seen from the foregoing description taken in connection with the drawings hereto annexed is extremely simple in construction and it may be manufactured and placed upon the market at a very moderate expense. It may be readily and successfully used by parties who are not technically educated and specially skilled in the use of surveying apparatus, and by the use thereof land may be surveyed, ditches laid out, and other work of a like nature be successfully performed without necessity of employing skilled labor. Mistakes caused by ignorance or inadvertence will also be avoided, since the target may be brought into the line of sight at a much greater distance than the voice will carry, and by the use of the improved apparatus it is unnecessary for the operator to shout instructions to the rodman or assistant.

It is desired to be particularly understood that while, in the foregoing, the preferred construction or constructions of the improved apparatus have been described, numerous changes and modifications may be made in the detailed construction without departing from the spirit of the invention; I therefore do not limit myself to the precise construction herein set forth, but reserve the right to any changes which come properly and fairly within the scope of the invention.

While an operating handle or crank, 25, has been shown in Figs. 5, 6, and 7 of the drawings, it is obvious that under the construction illustrated in said figures, the said crank cannot be used for effecting adjustment of the parts when the frame 21 is to be moved beyond the reach of the operator, as is sometimes the case; leveling rods of a length of fifteen or twenty feet, or more, being occasionally employed; it may, therefore, at times, be desired to dispense with the crank, and to provide an endless chain for effecting adjustment of the frame, substantially as shown in Figs. 1 to 4, inclusive.

It is also evident that the scale upon the leveling rod may be dispensed with, when desired, as rise and fall, or variations in the profile may be read off on the computing apparatus.

What is claimed is:—

1. A leveling rod, a target movable upon the same, a measuring wheel, and connecting means between the measuring wheel and the target, whereby the latter is moved by the rotation of the wheel. 50
2. A leveling rod, a target movable thereon, a measuring wheel, connecting means between the measuring wheel and the target, whereby the latter is moved by the rotation of the wheel, and a computing wheel operable by the rotation of the measuring wheel. 55
3. A leveling rod, a target movable thereon, a measuring wheel supported for rotation, connecting means between the measuring wheel and the target whereby the latter is moved by the rotation of the wheel, and computing mechanism to indicate the number of rotations of the measuring wheel. 60
4. A leveling rod, a target-carrying slide movable upon the rod, a measuring wheel supported for rotation, and a suitably guided endless flexible member engaging the measuring wheel and connected detachably with the target-carrying slide. 65
5. A leveling rod, a target-carrying slide movable thereon, a measuring wheel supported for rotation, guide wheels supported for rotation upon the rod, an endless flexible member supported by the guide wheels and guided over and in positive engagement with the measuring wheel, and means for detachably connecting the target-carrying slide with the endless flexible member. 70
6. A leveling rod, a target-carrying slide movable thereon, a frame secured upon the rod, a measuring wheel supported for rotation in said frame and having a scale upon the face thereof, a hand or pointer fixed upon the frame and cooperating with said scale, a suitably supported and guided endless flexible element engaging the measuring wheel and actuated thereby, means for detachably connecting the target-carrying slide with the endless flexible element, and computing means for indicating the number of rotations of the measuring wheel. 75
7. A leveling rod, a target-carrying slide movable thereon, a frame secured upon the rod, an arbor in said frame, a measuring wheel a crank and a single tooth fixed upon said arbor, a peripherally toothed computing wheel supported for rotation in the frame and engaging the single tooth upon the arbor of the measuring wheel, hands fixed upon the frame and cooperating with the measuring wheel and with the computing wheel, a suitably supported and guided endless flexible element positively engaging the measuring wheel and actuated thereby, and means for detachably connecting the target-carrying slide with the endless flexible element. 80

In testimony whereof I affix my signature, in presence of two witnesses.

JOHN OSS.

Witnesses:

J. O. FERAGEN,
M. J. SOLUM.