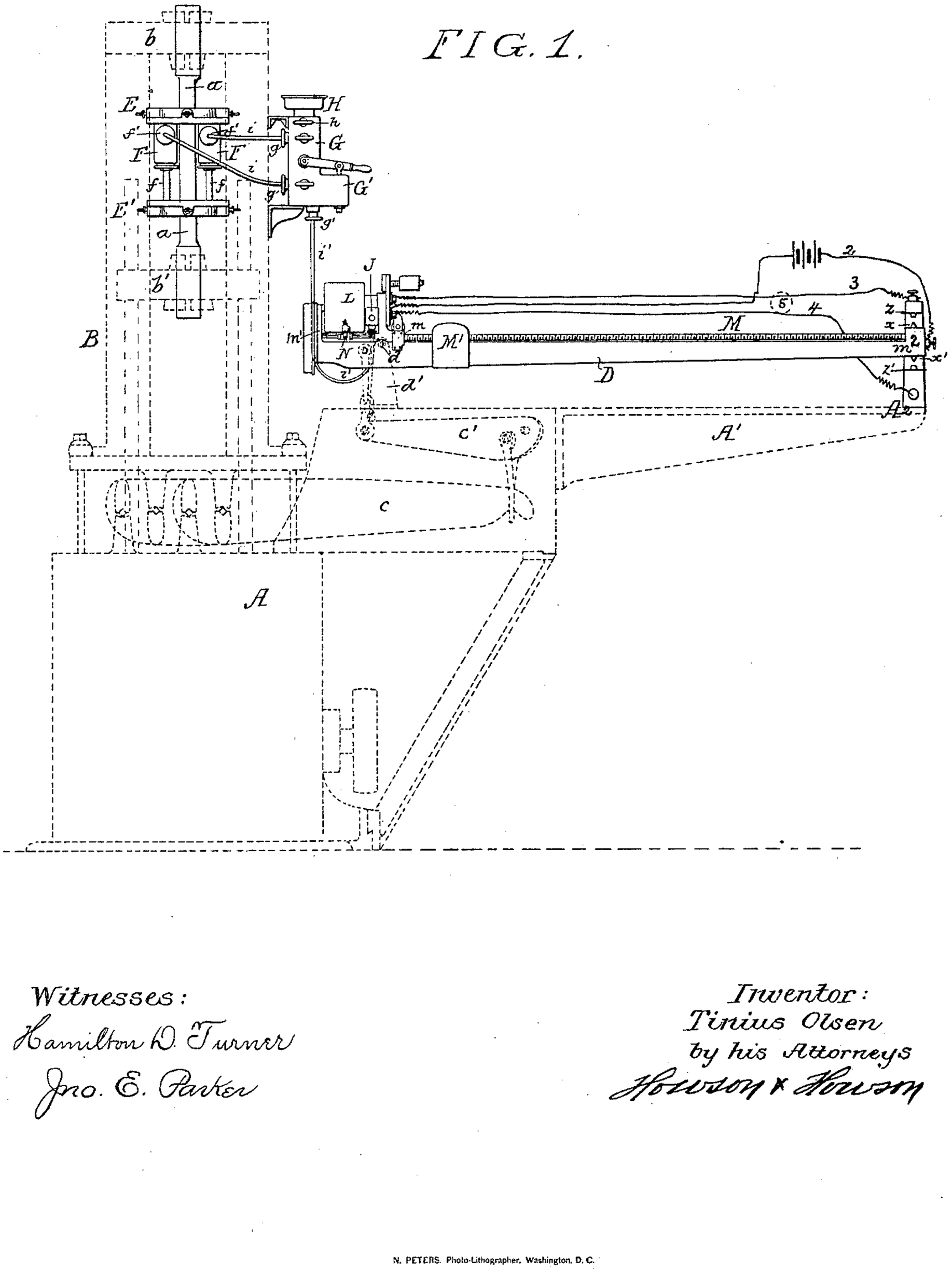
(No Model.) 4 Sheets—Sheet 1.

T. OLSEN.

TESTING AND RECORDING MACHINE.

No. 399,549. Patented Mar. 12, 1889.

FIG. 1.



Witnesses:
Hamilton D. Turner
Jno. E. Parker

Inventor:
Tinius Olsen
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 2.

T. OLSEN.

TESTING AND RECORDING MACHINE.

No. 399,549. Patented Mar. 12, 1889.

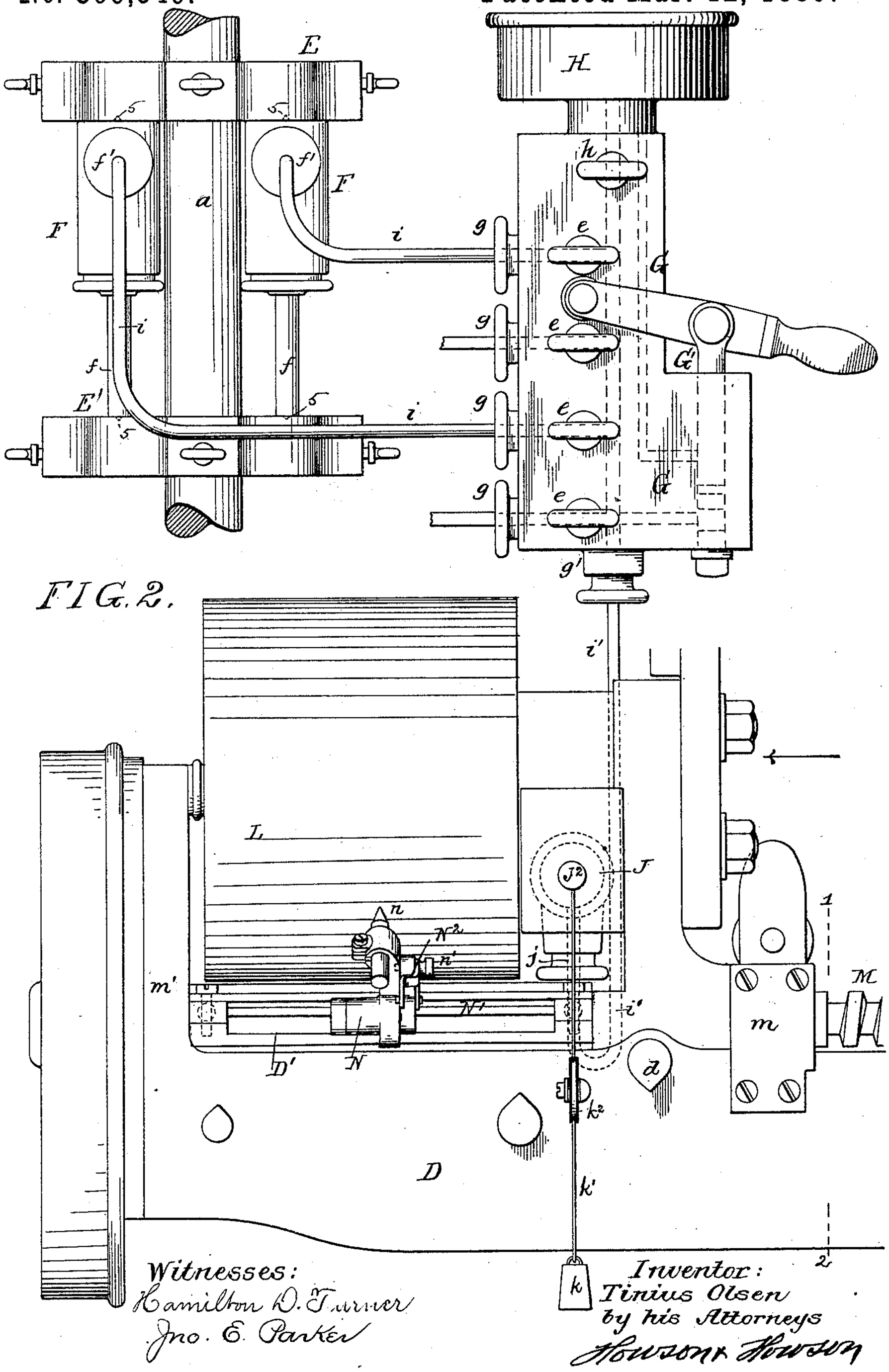


FIG. 2.

Witnesses:
Hamilton D. Turner
Jno. E. Parker

Inventor:
Tinius Olsen
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 3.

T. OLSEN.

TESTING AND RECORDING MACHINE.

No. 399,549. Patented Mar. 12, 1889.

FIG. 7.

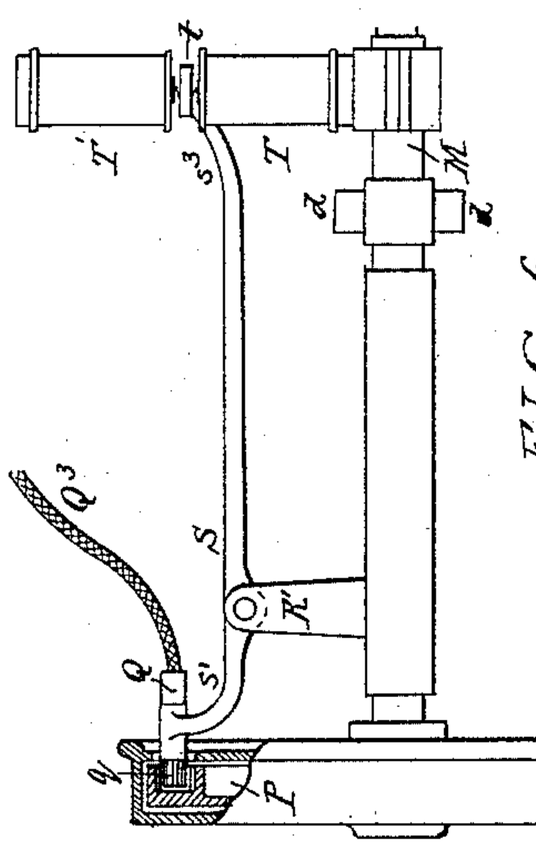


FIG. 6.

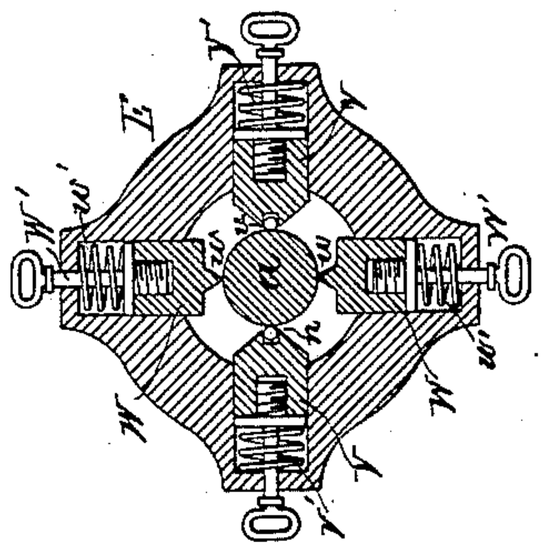
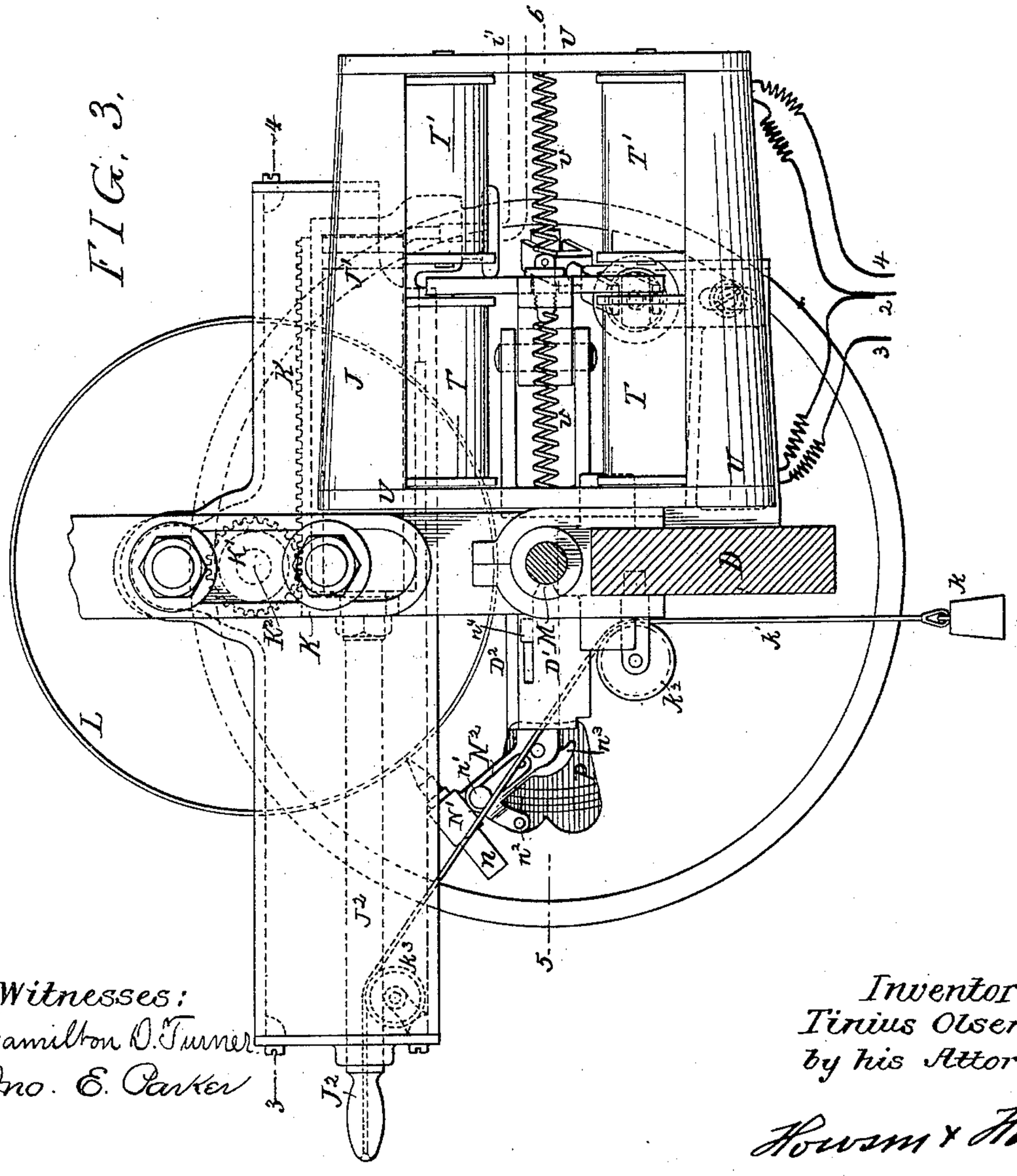


FIG. 3.



Witnesses:
Hamilton O. Turner
Jno. E. Parker

Inventor:
Tinius Olsen
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 4.

T. OLSEN.

TESTING AND RECORDING MACHINE.

No. 399,549. Patented Mar. 12, 1889.

FIG. 5.

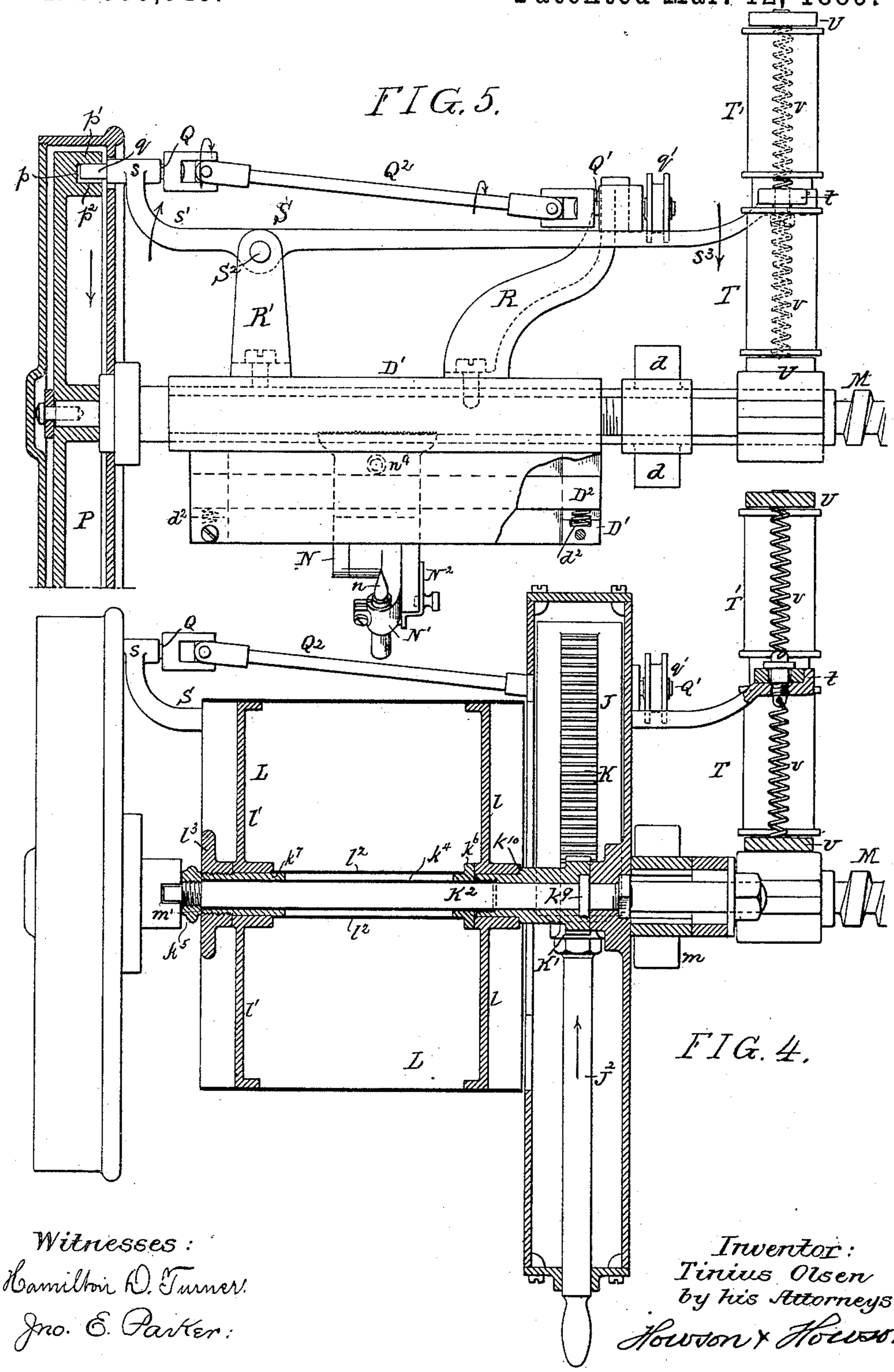


FIG. 4.

Witnesses:
Hamilton O. Turner.
Jno. E. Parker.

Inventor:
Tinius Olsen
by his Attorneys
Howson & Howson

UNITED STATES PATENT OFFICE.

TINIUS OLSEN, OF PHILADELPHIA, PENNSYLVANIA.

TESTING AND RECORDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 399,549, dated March 12, 1889.

Application filed June 28, 1888. Serial No. 278,443. (No model.)

To all whom it may concern:

Be it known that I, TINIUS OLSEN, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Testing-Machines, of which the following is a specification.

My invention relates to certain improvements in the testing-machine for which Letters Patent were granted to me on the 1st day of June, 1880, No. 228,214.

One object of my invention is to record the amount of tension or compression of the specimen through the medium of the fluid contained in a series of cylinders, a further object of the invention being to move the poise on the beam by means of power outside the machine, regulated by electricity, and a still further object is to so fasten the collars on the specimen that they will accommodate themselves to the decreasing or increasing diameter of the specimen as pressure is applied.

In the accompanying drawings, Figure 1 is a diagram view showing a testing-machine in dotted lines, with my improvements in full lines. Fig. 2 is also a diagram view, drawn to an enlarged scale, showing the bar to be tested, the valve-chest, and a side view of the recording device on the scale-beam. Fig. 3 is a section on the line 1 2, Fig. 2, looking in the direction of the arrow. Fig. 4 is a plan view on the line 3 4, Fig. 3. Fig. 5 is a section on the line 5 6, Fig. 3. Fig. 6 is a view of one of the bearing-collars situated on the specimen, and Fig. 7 is a view of a modification of part of the device.

Referring to Fig. 1, A is the base of the testing-machine, and B the uprights. *b* is the cross-head to which the upper portion of the specimen *a* is secured, and *b'* is the movable cross-head secured to or acted upon by screws. The lower portion of the specimen *a* is secured to this cross-head. *c c'* are the scale-levers, and D is the scale-beam, its pivots *d* resting in the standards *d'*.

The details of construction of the testing-machine are fully set forth in the patent above referred to, and need not be further described.

Referring to Figs. 1, 2, 3, and 4, secured to the specimen *a* to be tested are two collars, E E', of a peculiar construction, described hereinafter. Situated between these two collars are two or more cylinders, F, and pistons and piston-rods *f*. Attached to any convenient portion of the machine is the valve-chest G, having openings *g g'*, and situated above this chest is a reservoir, H, having a valve, *h*, communicating with the valve-chamber G. A pump, G', for applying pressure to the liquid, is situated at one side of the chest, as described hereinafter. The openings *g* communicate with openings *f'* in the cylinders F through tubes *i*, and it will be understood in the outset that one or two cylinders may be used, two being shown in Fig. 2 of the drawings, or three or four, or, in fact, any number of cylinders may be used, and for this reason I have thought it best to illustrate the two extra openings in the valve-chest. The opening *g'*, in the present instance situated at the base of the valve-chest, is common to all the openings *g*; but I provide valves *e* between each of the openings *g* and the opening *g'*, so that either one or other of the openings may be cut off or turned on at will by simply operating the valve, as clearly shown by dotted lines in Fig. 2. Mounted on the scale-beam D is a cylinder, J, having an inlet-opening, *j*, and this inlet-opening communicates with the opening *g'* through the medium of a flexible tube, *i'*, as shown in Figs. 1 and 2. This cylinder J is provided with a piston, J', and piston-rod J^2. A weight, *k*, is connected to one end of the piston-rod J^2 by a rope, cord, or chain, *k'*, passing over pulleys k^2 k^3. Secured to the piston-rod J^2 is a rack, K, (shown more clearly in Figs. 3 and 4,) which meshes with a pinion, K', loose on a spindle, K^2, on which is also the card-carrier in the form of a drum, L, provided with the usual record-paper. In some instances a band may be used, passing over a pulley on the spindle K^2, and having its ends secured to the piston-rod, this band being the equivalent of the rack and pinion.

Before proceeding further with the description of the apparatus I will describe the operation of this portion of the machine, which causes the card-carrier to revolve as the tensional strain or compression increases. If, for instance, the specimen *a* is to be tested as to its tensional strength, the two collars E E' are clamped to the specimen, and the cylin-

ders F are placed between the two collars, and points 5 on the ends of the cylinders and on the arms of the pistons, resting in recesses in the faces of the collars, keep the cylinders in a vertical position. Oil, water, or other fluid is pumped into the cylinder J from the reservoir H by the pump G′, through the side passage shown by dotted lines in Fig. 2, direct to the tube *i′*, connecting with the cylinder J. When sufficient fluid has been forced into the cylinder J to move the piston to its extreme limit, the valves *e e* of the tube *i i*, communicating with the cylinders F F, are turned so as to form communication between the cylinder J and the cylinders F F, the pistons in the cylinders F F being at their extreme inward limit. Power is then applied to the testing-machine, causing the head *b′* to travel away from the head *b*. The specimen *a* is consequently stretched by the strain, and as the two collars E E′ are separated the liquid from the cylinder J, owing to the pressure of the weight *k* through the medium of the piston J′ in said cylinder, causes the liquid to force the piston in the cylinder F outward, and consequently enough pressure is exerted to keep the cylinder and piston-rods always in contact with the two collars. As soon as any portion of the fluid in the cylinder J finds its way to the cylinder F, the piston-rod J^2 is moved in the direction of the arrow, and with it the rack K, and it, engaging with the pinion on the drum-spindle K^2, causes the drum to turn a certain distance, depending upon the separation of the two collars E E′.

The drum L is so secured to the pinion K′ that when the record-paper is to be placed upon or removed from the drum the drum is thrown out of gear with the pinion, and can then be turned without turning the pinion. This is accomplished by loosely mounting the pinion K′ on the fixed spindle K^2 and securing to the hub of the pinion a tube, k^4. This tube k^4 extends to near the end of the spindle K^2, as shown, and a nut, k^5, bears against the end of the tube k^4 and presses the pinion K′ against a shoulder, k^9, on the fixed spindle K^2. It will be understood, however, that the spindle is stationary and the pinion and tube revolve when the pinion is moved by the rack K. Mounted loosely on the tube k^4 are two collars, k^6 and k^7, the collar k^6 bearing against the hub of the spider *l* of the drum L, the hub in turn bearing against a shoulder, k^{10}, on the hub of the pinion K′. A tube, l^2, is situated between the spider *l′* and the collar k^6, and back of the spider *l′* is a nut, l^3, which is adapted to a thread on the collar k^7. By moving this nut one way or the other the drum is either clamped or released from the pinion, as the nut forces the hub of the spider *l* against the shoulder on the hub of the pinion K′ through the medium of the spider *l′*, tube l^2, and collar k^6.

When the amount of compression is to be tested, the fluid is pumped into the cylinders F F, instead of the cylinder J, as above, and the operation is then reversed. Situated in the present instance above the scale-beam D is a screw, M, mounted in bearings *m m′* m^2 on the beam. Said screw M passes through a balance-weight, M′, as shown in Fig. 1, which slides upon the beam D. The beam D is graduated. The thread of the screw between the bearings *m m′* is very fine, while the thread of the screw between the bearing *m* and the bearing m^2 at the outer end of the beam is comparatively coarse, so that while the balance-weight is acted upon by the coarse portion of the screw the pencil-carrier N is acted upon by the fine portion of the screw.

The pencil-carrier N is mounted in suitable guideways, D′, its inner end being threaded, as shown in Fig. 5, and bearing against the fine portion of the screw M, and it carries at its outer end a pivoted arm, N′, to which is attached the pencil *n*, which is arranged radially in respect to the drum L, so that when the drum is rotated and the pencil moved longitudinally the desired line will be marked upon the paper on the drum. The arm N′ is adjustable toward and from the drum, and is secured in either position by a spring-plate, N^2, having two pins, *n′* n^2, adapted to enter an opening in the side of the arm. The arm N′ is provided with a finger, n^3, which, when the arm N′ is moved downward, will press against the edge of the guideway D′, and will consequently force the carrier out of gear with the screw M, the pin n^2 locking the arm N′ and the carrier in this position.

In the guideway D′ is a bar, D^2, supported at each end by springs d^2, Fig. 5, a roller, n^4, on the carrier N, traveling on the bar D^2, and the bar and spring keeping the teeth of the carrier always in gear with the screw, except when forced out by the finger n^3 on the arm N′, the springs thus giving an even pressure at all times upon the carrier.

The screw, by mechanism described hereinafter, can be revolved either to the right or to the left, or can remain stationary, depending altogether upon the power exerted upon the specimen *a*, as it will be remembered that the screw registers the amount of power exerted when tension or compression is applied to the specimen.

On the inner end of the screw-shaft is a wheel, P, having a groove, *p*, in one face near the periphery. This groove has two bearing-faces, *p′* p^2, and in the groove rests a small roller, *q*, on a shaft, Q, connected to a shaft, Q′, through the medium of a universal coupling-shaft, Q^2. The shaft Q′ is mounted in a bearing, R, on the beam, and is provided with a belt-wheel, *q′*, preferably on the same line as the pivot *d* of the scale-beam, so that when the driving-belt is applied to this belt-wheel *q′* the power exerted on the driving-belt will not affect in any degree the scale-beam.

The shaft Q is mounted in a bearing, *s*, on one arm, *s′*, of a lever, S, pivoted at s^2 to a bracket, R′, secured to the guideway D′ on the beam. The long arm s^3 of this lever has

at its outer end an armature, *t*, situated between two pairs of magnets, T T′, secured to the beam by a frame, U, in any suitable manner.

I prefer to secure springs *v v* to each side of the armature and at their opposite ends to the frame U. These springs tend to keep the armature always in a central position in respect to the magnets T T′, so that the roller *q*, when in its normal position, will always be centrally situated in the groove P, free from contact with either of the faces *p p′*. When the armature is in the central position, the screw will not be revolved, and the poise and pencil will consequently remain stationary.

In the present instance at the outer end of the scale-beam, as shown in Fig. 1, are contact-points *x x′*, and on a bracket, A′, is a yoke, A², on which are contact-points *z z′*. A wire, 2, is connected to the contacts *x x′* on the beam D and passes to the battery, and through the battery to each of the magnets T T′, while a wire, 3, connects with the contact-point *z* to the pair of magnets T, and a wire, 4, connects the contact-point *z′* with the pair of magnets T′.

It will be seen that when sufficient power is exerted to move the beam so that the points *x* and *z* come in contact the magnet T attracts the armature *t*, and consequently the arm *s*³ of the lever S is moved in the direction of its arrow in Fig. 5 and the arm *s′* moved in the direction of its arrow, and consequently the roller will bear against the surface *p′* of the wheel P and move the poise forward on the beam, at the same time moving the pencil-holder forward; but as soon as the poise balances or overbalances the weight the beam will drop and the contact will be broken; consequently the poise will remain stationary, as will also the pencil-holder; but if tension on the specimen relaxes connection will be made between the two contact-points *x′* and *z′*, thus causing the magnet T′ to attract the armature and move the lever S in a direction the reverse of that indicated by the arrows and cause the roller *q* to press against the surface *p*² of the wheel P and reverse the movement of the pencil and poise. Thus it will be seen that the poise is automatically moved on the beam and always balances the load. A switch may be inserted at the point 5 to throw one or both of the magnets out of action.

As before remarked, the collars E E on the specimen accommodate themselves to the differing diameter of the specimen as strain is applied. The collars are constructed as follows: In the present instance, (referring to Fig. 6,) the collar is provided with four pockets, though it will be understood that any number of pockets may be employed. Two of these pockets have blocks V V, on one end of which are anti-friction rollers *u u*. These blocks V V are backed by suitable springs, V′, in order to keep the rollers in contact at all times with the specimen. The other two pockets have blocks W, provided with steel points *w*, which are forced into the specimen. Into an orifice in the block W is tapped the screw-stem of a spindle, W′, and beneath a head on this spindle and the casing is a spring, *w′*, which tends to press the pin *w* against the specimen. The pressure of the springs may be varied by turning the spindle W′, which is provided with a suitable handle for that purpose. Thus it will be seen that as the diameter of the specimen decreases or increases the points *w* will always accommodate themselves to the specimen.

In some instances I dispense with the driving-shaft Q′ and connecting-rod Q², and attach directly to the shaft Q a flexible shaft, Q³, as shown in Fig, 7, driven from a shaft independent of the machine, and this shaft may also be connected by means of universal-jointed connections, instead of by the flexible shaft, as shown in Fig. 5. The roller *q* in some instances, as shown in Fig. 7, may be provided with teeth, forming a pinion, engaging with teeth on either the surface *p′* or the surface *p*³ of the wheel P.

I have described the mechanism for traversing the poise in connection with a testing-machine; but it will be understood that this portion of my invention may be used on any scales now in common use, and is not necessarily limited to testing-machines.

The specimen-cylinders F F need not necessarily be situated between the two collars E E′. For instance, they may in some instances be situated between the cross-heads *b b′*, or, in fact, attached to the specimen in any suitable manner for indicating the amount of tension or compression of the specimen.

I claim as my invention—

1. The combination, in a testing-machine, of the specimen-carriers, the tension of compression mechanism, the specimen cylinder and piston, the card-carrier cylinder and piston, and a communication between the two cylinders, whereby displacement in one cylinder causes corresponding displacement in the other cylinder, substantially as described.

2. The combination, in a testing-machine, of the specimen-carriers, the tension or compression mechanism, the specimen cylinder and piston, the card-carrier cylinder and piston, and a communication between the two cylinders, with a valve-chest, communicating-tubes between the chest and the specimen-cylinder and between the chest and the card-carrier cylinder, and valves in said chest, so that the passages between the two cylinders may be regulated, substantially as and for the purpose set forth.

3. The combination of the specimen cylinder and piston and the drum cylinder and piston with a valve-chest, G, valves therein, a reservoir, H, a pump, and communications from the valve-chest to both the specimen-cylinder and piston-cylinder, substantially as and for the purpose described.

4. The combination, in a testing-machine,

of the collars E E′, cylinders F, and their pistons and rods confined between said collars, a cylinder, J, and its piston, and a recording-drum connected to said piston in such a manner as to be revolved as the piston in the cylinder J is moved, substantially as described.

5. The combination of the collar E, the pointed blocks W, adapted to engage with the specimen, and a spring in the rear of the blocks to keep said blocks always in contact with said specimen, substantially as and for the purpose set forth.

6. The combination of the collar E, the pointed blocks W W, and springs at the rear of said blocks, with blocks V V, carrying friction-rollers, and springs in the rear of these blocks, so that the rollers will at all times bear against the specimen to be tested, substantially as described.

7. The combination of the collar E and the pointed blocks W with a spindle, W′, having a threaded portion adapted to a threaded opening in the block W, and a spring adapted to force the spindle and the block against the specimen to be tested, substantially as set forth.

8. The combination, in a testing-machine, of the scale-beam and its balancing-pivot with a poise and operating mechanism therefor and a driving-pulley for said mechanism, said pulley being mounted on the pivot-line of the beam, so that the power exerted on the driving-belt will not affect the balancing of the beam, substantially as set forth.

9. The combination, in a testing-machine, of the scale-beam and its balancing-pivot with a poise-operating screw, a driving-pulley, and mechanism connecting the pulley to the screw, said pulley being mounted on the pivot-line of the beam, so that the power exerted on the driving-belt will not affect the balancing of the beam, substantially as described.

10. The combination, in a scale-beam, of the screw, the wheel P, magnets, an armature situated between said magnets, and the lever S, having at one end the said armature and at the opposite end carrying the shaft Q, and mechanism for driving said shaft, substantially as and for the purpose set forth.

11. The combination, in a scale-beam, of the screw-shaft, a wheel, P, an annular recess, p, therein, having two bearing-faces, p' p^2, a driving-roller, q, and a lever carrying the same, and devices by which said roller is thrown against either the faces p' p^2 or suspended between the two, substantially as and for the purpose described.

12. The combination, in a scale-beam, of its screw-shaft, the wheel P, having an annular recess therein, driving-roller q, its shaft Q, mounted on the lever S, an armature at one end of said lever, magnets I I′, and a shaft, Q′, connected to said shaft Q with a belt-wheel, q', substantially as described.

13. The combination, in a scale-beam, of the screw, its driving-wheel, the pivoted lever S, carrying at one end the driving-shaft Q, an armature at its opposite end, magnets on each side of said armature, with springs v v, tending to keep said armature in a central position, and a driving-roller on said shaft Q, central between the two surfaces of the recess in the wheel P, substantially as described.

14. The combination, in a testing-machine, of the specimen cylinder and piston, the recording-drum L and its cylinder and piston, and connections between said cylinders with a scale-beam, and lever mechanism connected thereto and to the specimen, a screw-shaft carrying a pencil-holder, and reversible driving mechanism for actuating said pencil-holder, magnets controlling said driving mechanism, and contacts on said scale-beam and on the frame, so that as the scale-beam swings it will make and break the circuit through said magnets, the whole acting in conjunction with the drum and its cylinders to form a chart giving the tensile or compression strength and the amount of expansion or contraction, substantially as set forth.

15. The combination, in a recording-drum, of the screw M, and a pencil-carrier mounted in bearings and having teeth engaging with said screw, with a lever mounted on said pencil-carrier and having a finger, n^3, on the movement of which the pencil-carrier is thrown out of gear with the screw, substantially as specified.

16. The combination of the drum-shaft K, a driving pinion or pulley, K′, with a drum, L, carrying the record-paper, and a nut, l^3, adapted to bind the drum to or release it from the driving mechanism, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

TINIUS OLSEN.

Witnesses:
WILLIAM D. CONNER,
HENRY HOWSON.