T. OLSEN.

Hydraulic Testing-Machine.

No. 215,067. Patented May 6, 1879.

Fig. I

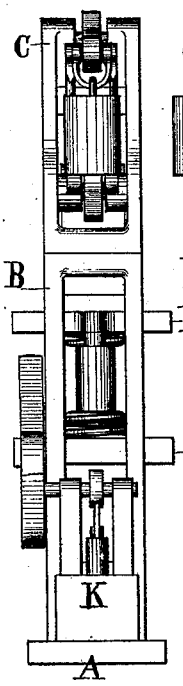


Fig. II

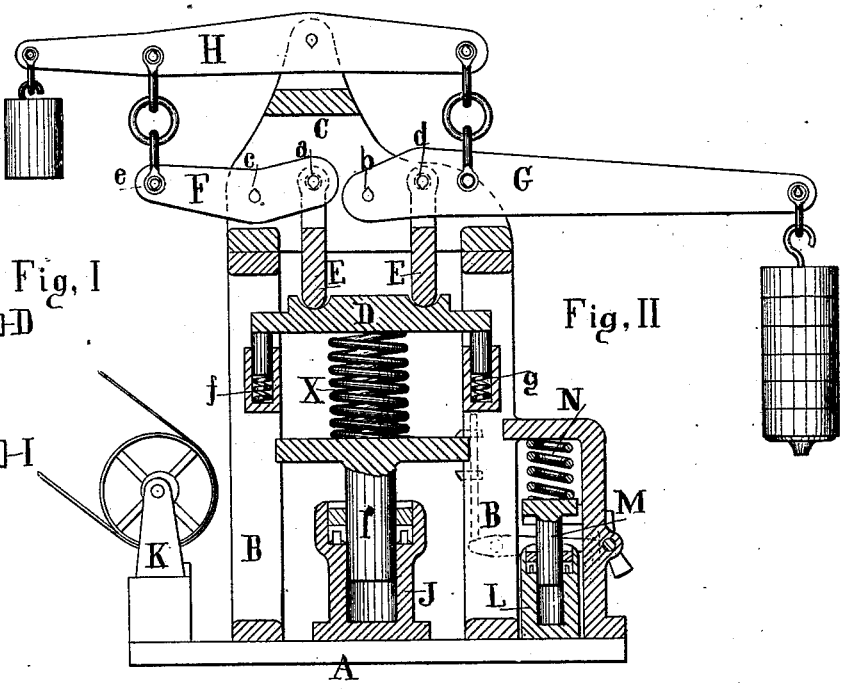


Fig. III

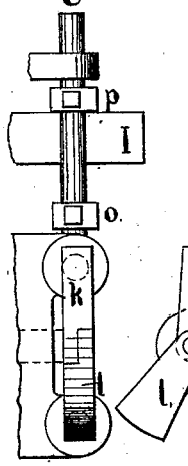


Fig. IIII

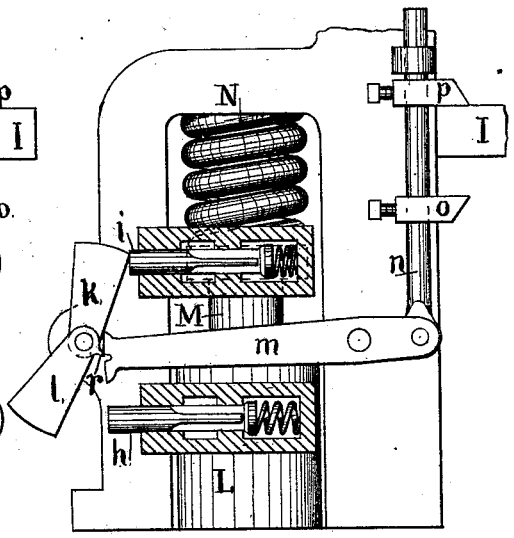
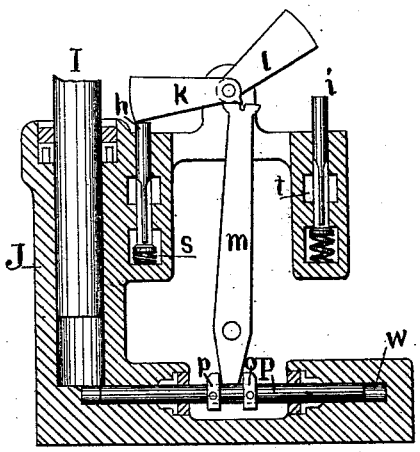


Fig. V



Witnesses.
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Inventor,
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2 Sheets—Sheet 2.

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Fig. VI

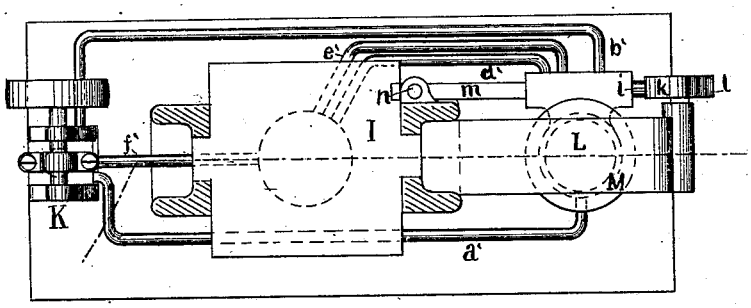
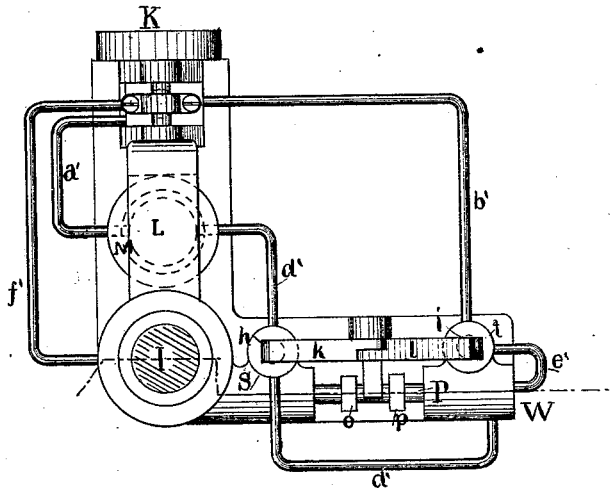


Fig. VII



Witnesses.

J. N. De Haven,

Chas. Robson

Inventor,

Tinius Olsen

UNITED STATES PATENT OFFICE.

TINIUS OLSEN, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN HYDRAULIC TESTING-MACHINES.

Specification forming part of Letters Patent No. **215,067**, dated May 6, 1879; application filed December 13, 1878.

To all whom it may concern:

Be it known that I, TINIUS OLSEN, of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented new and useful Improvements in Hydraulic Testing-Machines for Testing Springs, of which the following is a specification.

Heretofore, in such machines for testing springs the pressure to be weighed has been communicated from and by a single central point of the springs. The block or table between the spring and the pivot of the lever has had to be guided, which occasioned considerable friction, and was likely to deceive the operator as to the quality of the spring being tested.

The object of my invention is to provide a testing-machine with a system of levers, which will take up the pressure from the spring at more than one point, and making the table between the spring and the levers move in the proper manner with the least possible friction.

The object also is to provide means for subjecting the springs, when under pressure in the machine, to a series of shocks, as much as possible similar to such as it will receive in practice, in order to test their quality and suitableness for the purposes they are intended. The object of such tests with shocks is not confined to springs only, but can be applied, when desired, to any kind of material to be tested for tensile, compression, transverse, or torsional strains.

The invention consists of a system of levers in proper connection by rockers with a table against which the spring is pressed.

It also consists in an arrangement of an accumulator, valves, and means for working the same automatically, for causing shocks to be given to the spring or specimen being tested.

It finally consists in the application of an auxiliary piston to the jack for automatically working the valves where the motion of the main plunger of the jack is too small for accomplishing the same.

In the accompanying drawings, in which similar letters of reference indicate like parts in all figures, Figure I is an end elevation. Fig. II is a side elevation, in section; Fig. III an end view, and Fig. IIII a side view, enlarged, partly in section, of arrangement for applying shocks to springs, Fig. V showing, in section, the arrangement of the auxiliary jack-piston for working the shock arrangement for other tests than springs; Fig. VI, plan, partly in section, showing the pipe-connection between the valves, jack, pump, accumulator, and reservoir; Fig. VII, plan, partly in section, showing the pipe-connection between the valves, jack, pump, accumulator, and reservoir when an auxiliary jack-piston is to be used.

On the base-plate A, Figs. I and II, are secured the side frames, B. To the top of frames B is secured the frame C, containing the weighing-levers. On the top of the spring X to be tested is the plate or table D, perfectly free to move up or down. On the top of plate D are the rockers E, through which the strain brought upon the spring X and plate D is transmitted to the fulcrums *a* and *d* of levers F and G. Fulcrums *b* and *c* of levers F and G are pressed up against the bearings in the frame C. The third pivot, *e*, of lever F is connected by clevises and links to one end of the equal lever H, the central pivot of which is supported in the frame C. The other end of lever H is connected by clevises and links to lever G. The end of lever H which is connected to lever F is extended and provided with a weight of sufficient size to counterbalance the weight of lever G. The leverage on each side is made to count the same, so that a strain applied to fulcrum *a* or *d*, or to both, will register the same at the weighted end of lever G.

Under the table D, and in the side frames, B, are springs *f* and *g*, just stiff enough to counterbalance the weight of table D, rockers E, and one end of lever F. The spring or specimen to be tested is placed on the table or cross-head of the plunger I of the hydraulic jack J, which rests on the base-plate A. The cross-head moves freely, vertically, between the side frames, B, the jack being operated by the pump K.

The arrangement for subjecting the specimen to shocks is shown in Fig. II, Fig. III, end view, and Fig. IIII, side view of the same. The cylinder L, with the plunger M, is an accumulator, the loading of which is accomplished by the spring N, the accumulator standing in proper connection with the pump K, from which it is supplied with fluid through pipe *a'*, Fig. VI. The valve *i*, Fig. IIII, opens or shuts the passage for the fluid from the jack to the reservoir. Valve *i* is opened by the lever or striker *k*. Striker *k* is operated by le-

ver *m*, and has for this purpose a tooth, *r*, which fits into a notch in the end of lever *m*. To the other end of lever *m* is, by a hinged joint, connected the rod *n*, which carries the stops *o* and *p*. The lever *m* similarly operates the striker *l*, which in turn operates the valve *h*.

The cross-head of plunger I of the jack, or some other parts directly in connection with the same, being placed between the stops *o* and *p*, a limited motion therefore of the plunger up or down will, through the shifting device rod *n*, lever *m*, and strikers *k* and *l*, alternately open the valves *i* and *h*, the shutting of same being done by the fluid, and in addition a small spring on the head of the valves. Fig. IIII represents the cross-head I at its highest point, having operated the shifting device, and placed the valve *i* open. A reverse motion of the cross-head will reverse the position of the shifting device and force the valve *h* open. Valve *i* when open will establish a communication, through pipes *b'* and *e'*, Fig. VI, between the jack and the reservoir, and valve *h* when open will establish communication, through pipe *d'*, Fig. VI, between the jack and accumulator.

From the position shown in Fig. IIII with the valve *i* open, the plunger and cross-head I will rapidly descend, caused by the pressure on the spring to be tested being released on the top of the cross-head and plunger. The downward motion will continue until stop *o* is reached, and carrying the same with it until the device has operated the valve *h*. The jack then will stand in communication with the accumulator, in which always is to be kept up an over-pressure—that is, the pressure in the accumulator always to be much greater than what is at any time wanted in the jack, the amount of same to be regulated by the operator of the machine, either by the speed of the supplying-pump or a valve made for the purpose. It is also, in a measure, regulated by the opening allowed between the two stops *o* and *p*, the pitch of the shocks imparted being proportionate to the difference of pressure in the jack and accumulator, the moving parts of the jack to be for shock arrangement made as light and small as possible consistent with necessary strength, preferably of steel, in order not to check the effect of the shock on the specimen.

When, in testing specimens for tensile or crushing strength, they rarely have sufficient elasticity—that is to say, the elongation or compression of the specimens produced by the difference of pressure and corresponding strain in the applications of the shocks is not sufficient to give the required motion to the plunger for it directly to operate the valves *i* and *h*, and an auxiliary piston, P, Fig. V and Fig. VII, is introduced, J being the jack and I the main plunger of testing-machine. The auxiliary piston or plunger P has smaller diameter than the main plunger. The proportion will vary to suit the case.

One end of the cylinder in which piston P works is in direct communication with the jack. The other end, at W, is, by pipes *e'* and *d'*, Fig. VII, connected to the valve-chambers *t* and S, Fig. V, the valves of which are worked by the strikers *k* and *l*, levers *m*, stop *o* and *p*, the latter on piston P, the cylinder for which is cut away in the center, for the purpose of attaching the stops *o* and *p*.

The valves *i* and *h*, as above described, will alternately, as operated, subject the end of the auxiliary piston to the pressure of the accumulator, and then entirely release the same from all pressure by letting the fluid flow into the reservoir, and affecting the main piston in the same manner, the motion being only less.

The operation of the machine is as follows: For testing springs, the specimen is placed on the cross-head or table of plunger I of jack J. The plunger is made to ascend by pumping the fluid into the jack J, and the spring will be pressed up against the plate D, the pressure communicated through the system of levers to the end of the lever G, where the strain is counterbalanced by weights, and at the same time indicating the amount of pressure exerted on the springs. By moving the end of the lever G up and down under stationary pressure, the practical operator will ascertain the quality of the spring.

If, now, it be desired to subject the spring to a series of shocks, the fluid is forced into the jack J from the pump K, directly through the pipe *f'*, until the plunger ascends to the maximum load to which the spring can be subjected, at which point the direct flow from the pump is cut off by the operator, the pump is placed in connection with the accumulator, and the stops *o* and *p* are placed in such position on bar *n* that the maximum and minimum pressure to which the spring will be subjected will be attained in the two positions in which the cross-head of the plunger I will operate the two valves *h* and *i*. The apparatus is set to work by opening one of the valves by the corresponding striker or pawl, and stopping the same either by stopping the pump or by a suitable valve shutting off the flow to the accumulator.

What I claim, and on which I desire Letters Patent, is—

1. The rockers E, levers F, G, and H, in combination, as and for the purpose herein set forth.

2. The cylinder L, plunger M, spring N, valves *h* and *i*, strikers *k* and *l*, lever *m*, bar *n*, stops *o* and *p*, in combination with pump K of a hydraulic testing-machine, as and for the purpose herein specified.

3. The auxiliary piston P, in combination with jack J of a hydraulic testing-machine, as and for the purpose herein set forth.

TINIUS OLSEN.

Witnesses:
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CHAS. ROBSON.