L. E. FOSTER.

TESTING MACHINE.

APPLICATION FILED JAN. 8, 1916.

1,307,091.

Patented June 17, 1919.

2 SHEETS—SHEET 1.

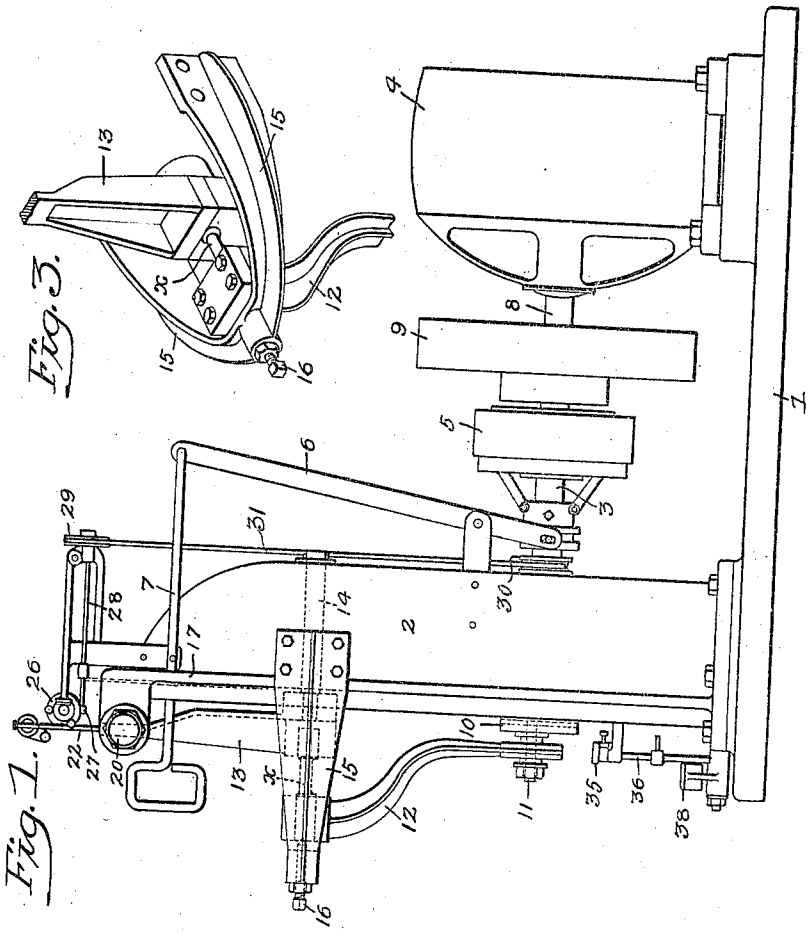


Fig. 1.

Fig. 3.

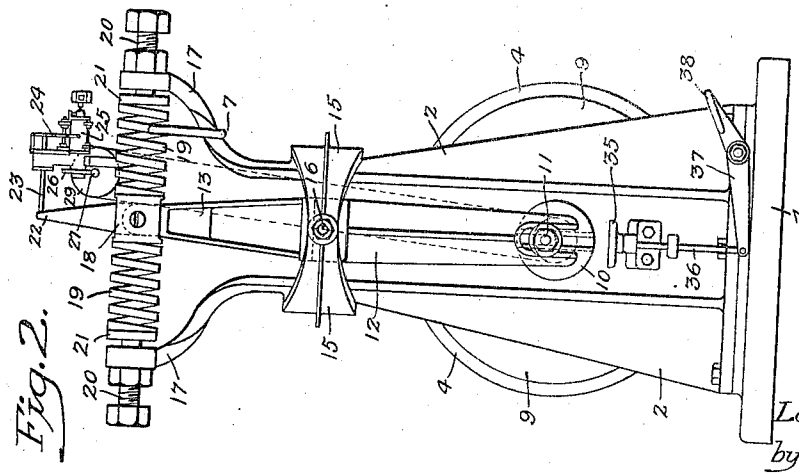


Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 4.

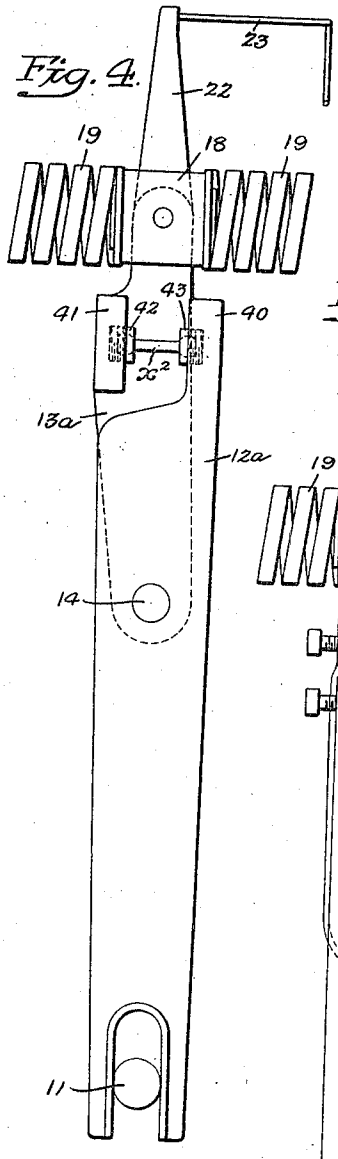


Fig. 5.

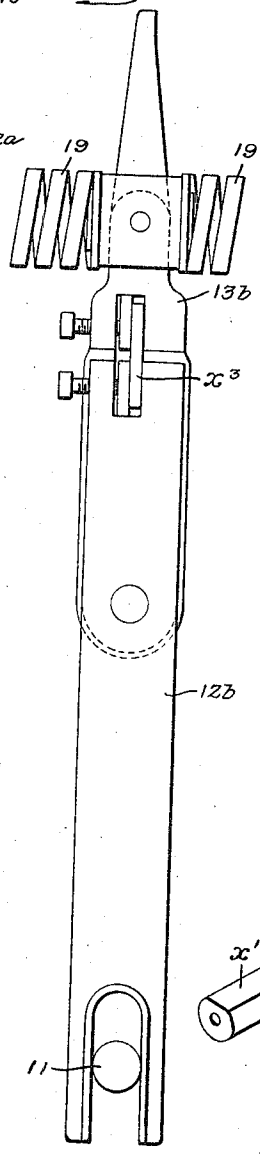


Fig. 7.

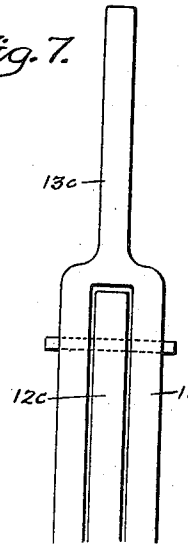


Fig. 6.

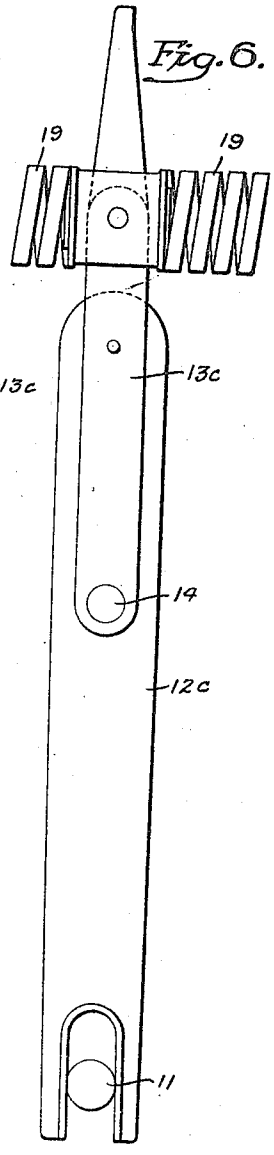
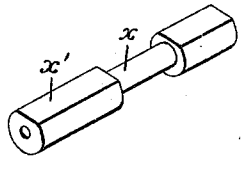


Fig. 8.



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UNITED STATES PATENT OFFICE.

LOUIS E. FOSTER, OF ANNAPOLIS, MARYLAND, ASSIGNOR TO TINIUS OLSEN TESTING MACHINE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TESTING-MACHINE.

1,307,091. Specification of Letters Patent. Patented June 17, 1919.

Application filed January 8, 1916. Serial No. 71,047.

To all whom it may concern:

Be it known that I, LOUIS E. FOSTER, a citizen of the United States, residing in Annapolis, Anne Arundel county, State of Maryland, have invented Testing-Machines, of which the following is a specification.

One object of my invention is to provide a machine whereby a specimen of material to be tested may be subjected to stress applied alternately in opposite directions, with a view to determining its endurance;—the invention broadly contemplating the provision of means whereby such alternate stress may be applied in any of a number of different ways to such specimen.

More particularly, the invention contemplates a simple, substantial and commercially practical machine for determining the endurance of a test specimen when subjected to torsional stress applied alternately in opposite directions; it being further desired to provide means for graphically recording the performance of the specimen when subjected to an endurance test.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which,

Figure 1 is a side elevation of a testing machine constructed in accordance to my invention;

Fig. 2 is a front elevation of the machine shown in Fig. 1;

Fig. 3 is a perspective view of the specimen-holding jaws and their associated parts;

Figs. 4, 5 and 6 are front elevations of the specimen-engaging members in that form of my invention which is adapted for subjecting test pieces to other than torsional stresses;

Fig. 7 is a side elevation of the structure shown in Fig. 6;

Fig. 8 is a perspective view of a test specimen for use in that form of my machine illustrated in Figs. 1 to 3 inclusive.

In Figs. 1 to 3 of the above drawings, 1 represents a suitable base structure on which is mounted a relatively heavy, rigid frame 2 providing bearings for the support of a shaft 3 driven from a motor 4 through a clutch 5 whose operation may be controlled by a lever 6 and an operating link 7. The armature shaft 8 of the motor is preferably provided with a fly wheel 9.

The main shaft 3 of the machine has a crank disk 10 diametrically slotted for the reception of a crank pin 11, which may be adjusted in said slot to vary its distance from the center line of the shaft, the crank 10 being mounted immediately adjacent the outer face of the frame 2. The crank pin 11 is slidably engaged by the lower forked end of an arm 12 whose upper end is designed to receive and non-rotatably hold one end of a test specimen x, whose second end is similarly held by the lower end of a second arm 13. This latter arm is fixed to an oscillatory spindle 14 suitably supported in bearings carried by the frame 2, and in order to support the upper end of the arm 12 I provide a yoke piece 15 projecting laterally from the frame and having a center spindle or trunnion designed to engage a suitably formed center recess in that end of the test piece which is mounted in the arm 12. The arrangement of parts is such that the trunnion 16, the test piece x, and the spindle 14 are mounted with their axes of rotation coincident.

On the upper end of the frame 2 I provide a pair of oppositely extended arms 17 between each of which and a block 18 on the arm 13 is confined a spring 19; there being bolts 20 respectively threaded in said arms and having retaining heads 21 for directly engaging said springs. Extending upwardly from the block 18 is a bar 22 connected through a link 23 with a stylus-carrying arm 24 forming part of a performance-recording device, which also includes a paper-carrying drum 25 to whose spindle is attached a worm wheel 26 driven through a worm 27, a spindle 28, pulley wheels 29 and 30, and a belt 31 from the shaft 3.

Under conditions of use a specimen x to be tested, preferably having a flat portion x' on each of its cylindrical ends as shown in Fig. 8, is mounted with said ends respectively entering recesses in the adjacent ends of the arms 12 and 13, whose end portions are preferably made with detachable plates formed to engage and clamp the plane faces x' of the test piece so as to prevent its rotation. The center or trunnion 16 is then set

up so as to enter the recess in the center of one end of said test piece, and by means of the link 7, the clutch 5 is so operated as to operatively connect the shafts 3 and 8; the motor 4 having previously been put in operation.

The angle through which the torsional stress is applied to the test specimen depends upon the eccentricity of the crank pin 11, for each time the shaft 3 is rotated the arm 12 is caused to oscillate and apply such stresses to said specimen. The movement of the second arm 13 as a result of this stress is opposed by the springs 19 which are properly calibrated so that, as the motor continues to operate, the test piece is subjected to a predetermined torsion applied alternately in opposite directions until the limit of its endurance is reached, when it breaks.

In order to obtain a record of the behavior of the specimen under test, as well as of the number of times the stress is applied before said specimen fails, a suitable card or sheet of paper is applied to the drum 25, which through the mechanism above described is rotated at a definite rate.

Through the arm 22, link 23, and stylus arm 24, the movement of the upper end of the arm 13 is transmitted to the pencil or other recording device carried by said arm, which bearing upon the paper on the drum 25, describes a zigzag line as said drum is turned and the arm 12 is oscillated. Obviously, the amount of displacement of the stylus from its position of rest is dependent on the resistance of the test piece to the stress applied and the strength of the springs, and the number of applications of such stress is given by the number of convolutions or serrations described on the paper.

When the specimen breaks the arm 12 remains partially supported by the trunnion 16, and in order to conveniently raise it when a second test specimen is to be inserted, I provide a plate 35 connected to the upper end of a rod 36 vertically guided in bearings projecting from the frame 2. The lower end of this rod is pivotally connected to one arm of a lever 37 whose other arm is provided with a treadle 38, the depression of which raises the plate 35 and with it the arm 12 as desired.

As shown in Fig. 4, with but relatively slight change, the two arms may be modified so that the machine can be utilized to apply alternate tension and compression to a test specimen, and in such case the lower arm 12^a would have an upward extension 40 parallel with but spaced apart from a lateral extension 41 of the arm 13^a, at some distance above the oscillatory support provided by the spindle 14, which serves also as a pivot for the arm 12^a. Any suitable means, such as clamps 42 and 43, may be applied to the parts 40 and 41 of the arms in order to support a test specimen x^2 horizontally between them, and as before the springs 19 are placed to operate on opposite sides of the block 18 on the upper end of the arm 13^a.

When the shaft 3 of the machine is turned, the crank pin 11 oscillates the arm 12^a on its pivot 14, thus alternately compressing and applying tension to the test piece whose movement is resisted by the arm 13^a under the action of the springs 9. As before, suitable recording mechanism may be connected to an extension 22 of the arm 13^a to give a graphic illustration of the number of times the stress is applied and of the behavior of the specimen before it fails under such stress.

Again in the case shown in Fig. 5, the crank-actuated arm may be given the form illustrated at 12^b and the second arm may be made as shown at 13^b so as to overhang the upper end of said first arm. Said overhanging part and the upper end of the arm 12^b are recessed to receive a test piece x^3 and are provided with means for clamping this in a substantially vertical position, so that when the machine is operated it is subjected to a combined shearing and bending stress which is applied alternately in opposite directions.

In that form of my invention shown in Figs. 6 and 7, the crank actuated arm 12^c and the spring controlled arm 13^c are as before provided with a common pivot 14, although the latter arm is preferably forked so as to extend on opposite sides of the former. At a point adjacent the upper end of the arm 12^c, it, as well as the branches of the arm 12^c, are provided with a transverse hole for the reception of a test piece, which when said arm 12^c is oscillated on its pivot, is subjected to a shearing stress alternately in opposite directions; it being noted that such stress is applied when this latter arm is in close proximity to the branches of the arm 13^c, while if said branches are widely separated, the stress becomes that of bending rather than shear.

I claim:—

1. The combination in a testing machine of a supporting frame having a yoke; a shaft mounted in the frame; an arm on the shaft; resilient means for resisting oscillation of said arm; a trunnion carried by the yoke in position to engage one end of a test piece whose second end is connected to said arm; a second arm formed to engage the test piece adjacent its point of engagement with the trunnion; and means for oscillating said second arm about the axis of oscillation of said first arm.

2. The combination in a testing machine of two oppositely extending arms mounted to be connected by a test piece and supported in positions to oscillate about an axis coincident with the longitudinal axis of said test

piece; a source of power for oscillating one of said arms to apply a stress alternately in opposite directions to the test piece; and resilient means for opposing movement of the second arm.

3. The combination in a testing machine of two oppositely extending arms mounted to be connected by a test piece and supported in positions to oscillate about an axis coincident with the longitudinal axis of said test piece; a source of power for oscillating one of said arms to apply a stress alternately in opposite directions to the test piece; resilient means for opposing movement of the second arm; with a device for recording the number and amplitude of the oscillations of the second arm.

4. The combination in a testing machine of a supporting frame; a power actuated shaft mounted therein; a crank on said shaft; an arm connected to be oscillated by said crank; and a yieldingly mounted arm placed to cause torsional stress in a test piece connected between it and the first arm.

5. The combination in a testing machine of a supporting frame; a shaft journaled therein; a crank on said shaft; an oscillatory arm pivoted to the frame; and a second arm having a slotted portion in engagement with the crank and formed to engage a test piece supported by the first arm.

6. The combination in a testing machine of a supporting frame; an oscillatory structure; and a trunnion on the frame formed to engage a test piece; means for resisting oscillation of said structure; and an oscillatory member also formed to engage the test piece for applying thereto a stress alternately acting in opposite directions.

7. The combination in a testing machine of a supporting frame; a shaft journaled therein having a crank; an oscillatory structure and a trunnion also supported by said frame; means for clamping a test piece to said structure with one end in engagement with the trunnion; with an arm having means for clamping it to the test piece and operatively engaging the crank.

8. The combination in a testing machine of a supporting frame having a yoke; an oscillatory arm mounted on the frame; a trunnion carried by the yoke in line with the axis of oscillation of said arm; means for clamping a test piece to said arm with one end in engagement with the trunnion; two oppositely disposed springs for resisting movement of the arm; a second arm having means for clamping it to the test piece adjacent the trunnion; and means for oscillating the second arm.

9. The combination in a testing machine of a frame having two arms; a power shaft having a crank; a member oscillated by said crank and provided with means for gripping a test specimen; an oscillatory member also having specimen gripping means and extending in a plane containing the first member and the power shaft; with springs mounted between said arms and operative to oppose movement of the latter member.

LOUIS E. FOSTER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."