

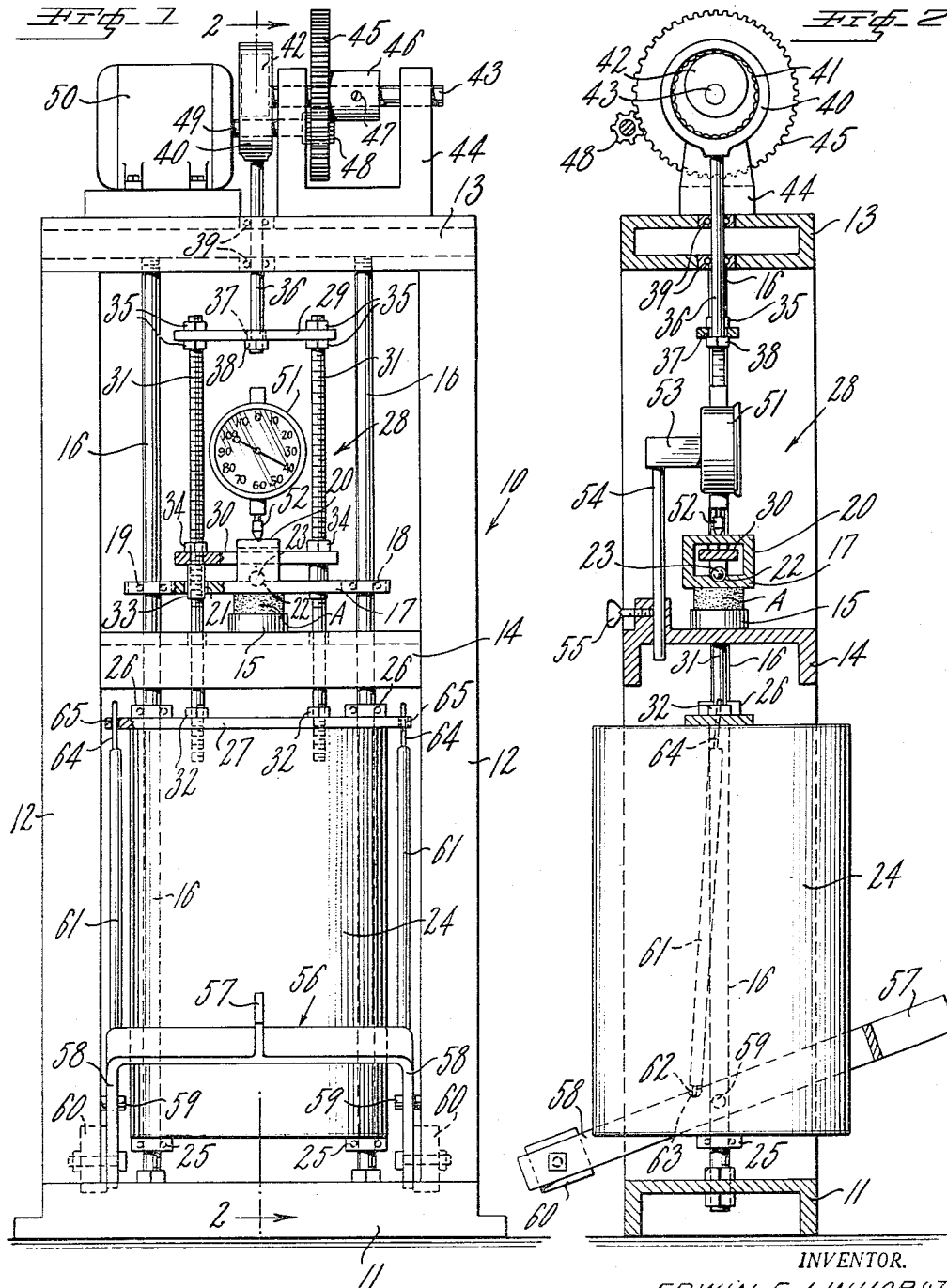
Aug. 28, 1956

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2,760,370

MOTOR-DRIVEN LOAD-DEFLECTION TESTER

Filed May 17, 1954.



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MOTOR-DRIVEN LOAD-DEFLECTION TESTER

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Application May 17, 1954, Serial No. 430,085

10 Claims. (Cl. 73—94)

This invention relates to an improved load-deflection tester for resilient plastic material.

A primary object of the present invention is to provide a motor-driven load-deflection tester which will perform a test with a definite, uniform cycle of operation thereby obtaining reproducible results and eliminating human error inherent in operating hand apparatus.

Another object of the invention is to provide a load-deflection tester so constructed that the resilient plastic sample being tested is constantly placed under a pre-load so that the entire sample is uniformly deformed under each test-load.

A further object of the invention is to provide a load-deflection tester so constructed that the sample will deflect under pressure along and parallel to its central axis to prevent inaccuracies in measurement of deflection caused by canting.

An additional object of the invention is to provide a load-deflection tester having means for removing both the test-load and pre-load from the sample.

The above and other objects and advantages of the present invention will become apparent upon consideration of the following description when read in connection with the accompanying drawing:

Fig. 1 is a front elevational view of a load-deflection tester embodying the features of the present invention; and

Fig. 2 is a sectional view along the lines 2—2 of Fig. 1.

Referring to the drawing, the load-deflection tester comprises a frame 10 having a base 11, vertical sides 12 and a top 13. Intermediate the base 11 and top 13 there is a horizontal support securely mounted in sides 12 of frame 10. The support comprises a bar 14 and a cylindrical platen 15 centrally mounted thereon.

On platen 15 rests cylindrical sample A which is to be tested. This sample may be any resilient plastic material, e. g. natural or synthetic rubber.

Anchored in base 11 and top 13 of frame 10 are vertical guide rods 16 which extend through bar 14 on either side of platen 15. Slidably mounted on guide rods 16 above the bar 14 is a pressure foot 17. Ball bushings 18 and 19 in pressure foot 17 provide nearly frictionless motion of the pressure foot on guide rods 16. Pressure foot 17 has a yoke 20 integral therewith and extending upwardly therefrom. The pressure foot 17 has bores 21 therethrough and a cavity 22 in its top surface. The cavity is in the center of pressure foot 17 and is also directly over the vertical central axis of sample A. A sphere 23 rests in cavity 22. Pressure foot 17 constantly engages and initially compresses sample A to pre-load the same. If there is any unevenness in sample A, the pre-load weight of pressure foot 17 permits the pressure foot and platen 15 to make contact over the entire top and bottom surface areas of sample A. As a result the entire sample will deform uniformly each time a test-load 24 is applied thereto. It will be apparent that any desired amount of weight may be used for the pressure foot and the test load, however, for a cylindrical rubber sample one-half

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inch high and one inch in diameter, a pre-load pressure foot weight of five pounds and a test-load of 100 pounds will prove satisfactory.

Cylindrical test-load 24 is slidably mounted on guide rods 16 below the bar 14. It will be noted that guide rods 16 extend through test-load 24 and that ball bushings 25 and 26 provide practically frictionless movement of test-load 24 on guide rods 16. Bushings 25 are directly attached to the bottom of test-load 24 while bushings 26 are attached to plate 27 which is rigidly secured to test-load 24.

Connected to test-load 24 is a carriage 28 which comprises upper plate 29 and lower plate 30 interconnected by threaded rods 31 freely extending through and movable in a pressure foot 17 and bar 14. The lower ends of rods 31 extend through plate 27 and are threadedly anchored in test-load 24; lock nuts 32 secure plate 27 to test-load 24. On the intermediate portions of rods 31 are threaded collars 33. These collars are freely movable in bores 21 of pressure foot 17. Collars 33 also function as abutments for lower plate 30 which is secured thereon by lock nuts 34. Plate 30 freely extends through yoke 20 of pressure foot 17, and as will be seen, is freely movable therein and is engageable with yoke 20, as well as sphere 23 in pressure foot 17. Upper plate 29 is secured to the upper ends of rods 31 by lock nuts 35.

The eccentric mechanism will now be described. A reciprocable depending rod 36 freely extends through and is movable in a bore 37 in upper plate 29. A nut 38 is threaded on the end of rod 36 below plate 29 and is adapted to lift the plate on the upward stroke of rod 36. Rod 36 extends upwardly through ball bushings 39 in top 13 for reduced friction and rod 36 is integrally connected to annular cam follower 40 having roller bearings 41 mounted around its inner periphery. An eccentric cam 42 mounted on shaft 43 makes rolling contact with bearings 41 for reduced friction between cam 42 and follower 40.

Shaft 43 is rotatably mounted in bearings (not shown) on U-frame 44 which is rigidly attached to top 13 of the frame. A driven gear 45 having a hub 46 is secured on shaft 43 by means of a set screw 47. A pinion 48 which is rigidly secured to a power shaft 49 drives the gear 45. A conventional, constant speed, electric motor 50 rigidly secured to the frame top 13 provides the power for rotating shaft 49.

As will be apparent to one skilled in the art, the rotating eccentric cam 42 causes the follower 41 and depending rod 36 to reciprocate in a vertical direction. The upward stroke of rod 36 is adjusted to lift the carriage 28 sufficiently to remove the test-load 24 from sample A at periodic intervals. The upward movement of lower plate 30 in carriage 28 is thereby controlled so that it will be raised from contact with sphere 23 in pressure foot 17, but will not contact yoke 20. In this manner only the test-load 24, which is attached to carriage 28 and must move upward therewith, is removed from sample A, while the pre-loading pressure foot 17 constantly engages sample A, keeping it under initial deformation. The downward stroke of rod 36 is adjusted so that nut 38 moves a substantial distance below upper plate 29 so that carriage 28 and test-load 24 are free to descend by gravity, thus permitting test-load 24 to dwell on sample A. The actual force-applying member is lower plate 30 of carriage 28 which engages sphere 23 in pressure foot 17. The purpose of employing sphere 23, which as stated above, is located directly over the central axis of sample A, is to insure that the test-load 24 will be applied along that axis so that the entire sample will be deformed uniformly. This construction prevents inaccuracies in measurement of deflection of sample A which

may be caused by canting of the force-applying plate 30 relative to pressure foot 17.

The full cycle wherein the test-load 24 is removed and applied to sample A may be of any period of time. For the present embodiment a period of five seconds has been found to be suitable. The eccentric mechanism is constructed so that the test-load 24 is completely removed from sample A for approximately one second and is likewise permitted to dwell on sample A for the same interval, thereby permitting deflection readings to be taken at each point. The remaining three seconds are taken up by the upward and downward movements of test-load 24. The important feature of the cycle is its uniformity and this is made possible because the cycle is controlled automatically by the eccentric mechanism which is driven by the constant speed motor 50. This construction eliminates human error inherent in operating hand apparatus because there is no variation in the time allowed for recovery of the sample when the test-load is removed therefrom. Moreover, the set (retention of strain following release of stress) in sample A is uniform because the stress applying test-load is repeatedly removed from the sample at uniform intervals and remains completely removed from the sample for uniform periods. As a consequence, accurate deflection readings under pre-load and test-load can be taken thereby obtaining reproducible results for a given total test time and a given number of applications of the test-load.

The device for measuring the deflection of sample A under pre-load and test-load comprises a conventional dial gauge 51 having a plunger 52. Gauge 51 also has an integral projection 53 extending from its rear face and this projection is rigidly attached to a rod 54. A set screw 55 secures rod 54 in a boss on bar 14. Plunger 52 of gauge 51 compressively engages yoke 20 of pressure foot 17 and as the yoke rises or descends the plunger follows it. The pointer of gauge 51 being connected to plunger 52, thereby changes its indications accordingly. If desired, the pointer can be adjusted to give a zero reading when sample A is first placed under the pre-load of the pressure foot 17 and as the test-load 24 is periodically applied and removed the pointer will directly indicate the subsequent deflections under pre-load and test-load.

In order to remove or replace test sample A on platen 15 it is necessary to raise both test-load 24 and pressure foot 17 to provide the necessary clearance. This is accomplished by a release mechanism which will now be described. This mechanism comprises a bifurcated lever 56 having a handle 57 and arms 58. The arms 58 are pivotally mounted on pins 59 in sides 12 of frame 10 and have counter-weights 60 bolted at their ends. A pair of substantially vertical push rods 61 are mounted on arms 58. At their bottom portions, the rods 61 have reduced pointed ends 62 which rest in depressions 63 in arms 58, and at their top portions rods 61 have reduced ends 64 which freely extend through bores 65 in plate 27 which is attached to test-load 24. The reduced ends 64 are long enough so that push rods 61 do not interfere with the periodic reciprocation of plate 27 and test-load 24 relative to sample A during the load-deflection test, and will remain in the bores 65 during the reciprocation of the plate 27. It is apparent that depression of handle 57 causes push rod 61 to pivot upwardly until the shoulders between reduced ends 64 and the central portions of push rods 61 engage the underside of plate 27. Further movement will cause test-load 24 and carriage 28 to rise; plate 30 will eventually contact yoke 20 and thus pressure foot 17 will be raised from sample A at the end of the upward movement of the test-load 24. When sufficient clearance is available, test sample A may be removed from platen 15 and another sample placed thereon.

An example of a typical load-deflection test will now be described. Assuming that a previous test has just been completed, the motor 15 may be stopped by a con-

ventional switch (not shown) when the eccentric cam 42 is at the top of its movement, as best shown in Fig. 2 of the drawing. As is evident, lower plate 30 of carriage 28 is spaced above sphere 23 and below yoke 20, therefore test-load 24 is removed from sample A but pre-loading pressure foot 17 continues to initially deform sample A. Handle 57 of lever 56 is then depressed, causing push rods 61 to lift both test-load 24 and pre-load pressure foot 17 off sample A. Dial gauge 51 will not interfere with the upward movement of yoke 20 because plunger 52 can be positioned to recede as yoke 20 rises. Sample A may now be removed and replaced by another sample. Handle 57 is then released and counterweights 60 cause lever 56 to lower push rods 61 thereby permitting pressure foot 17 to pre-load the sample. Even though test-load 24 descends somewhat, lower plate 30 will not contact sphere 23 because cam 42 is still in its uppermost position. Dial gauge 51 is then set for zero reading and motor 50 is turned on. The test-load is then automatically applied and removed in uniform, five second cycles until the desired number of deflection readings under pre-load and test-load are taken.

Although only one embodiment of the invention has been described and a certain mode of operating the same has been referred to, it is to be understood that the invention is not limited thereby but may be practiced within the scope of the appended claims.

Having thus described my invention, what I claim and desired to protect by Letters Patent is:

1. A load-deflection tester for a resilient plastic sample comprising a frame, a support on said frame for said sample, a pressure foot slidably mounted in said frame above said support and engaging said sample to apply a pre-load thereto, a test-load slidably mounted in said frame below said support, a carriage attached to said test-load, said carriage being engageable with and movable relative to said pressure foot, means operating said carriage for reciprocally applying and removing said test-load to and from said sample at uniform intervals, and means mounted on said support and engaging said pressure foot for measuring deflection of said sample under said pre-load and said test-load.

2. A load-deflection tester as in claim 1 wherein a release mechanism is mounted on said frame and engageable with said test-load for removing both said pre-load and said test-load from said sample.

3. A load-deflection tester as in claim 2 wherein said release mechanism comprises a lever pivotally mounted on said frame, push rods mounted on said lever and movable relative to said test-load, said push rods also being engageable with said test-load for removing both said test-load and said pre-load from said sample.

4. A load-deflection tester as in claim 1 wherein said pressure foot has a yoke extending upwardly therefrom, said carriage comprising interconnected plates, one of said plates being movable in and engageable with said yoke.

5. A load-deflection tester as in claim 4 wherein said pressure foot has a cavity in its upper surface adjacent said yoke and centered over said sample, a sphere located in said cavity, said one plate of said carriage being engageable with said sphere.

6. A load-deflection tester as in claim 4 wherein said carriage operating means comprises a motor-driven eccentric mechanism movable relative to and engageable with another of said plates of said carriage.

7. A load-deflection tester as in claim 1 wherein said pressure foot has a yoke extending upwardly therefrom and a cavity in its upper surface adjacent said yoke and centered over said sample, a sphere located in said cavity, said carriage comprising interconnected plates, one of said plates being movable relative to and engageable with both said yoke and said sphere, said carriage operating means comprising a motor-driven eccentric

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mechanism movable relative to and engageable with the other of said plates in said carriage.

8. A load-deflection tester as in claim 7 wherein said eccentric mechanism comprises a depending rod movable relative to said other plate in said carriage for applying said test-load to said sample at uniform intervals by engagement between said one plate and said sphere, said depending rod having means engageable with said other plate for removing said test-load from said sample at uniform intervals by relative movement between said one plate and both said yoke and said sphere.

9. A load-deflection tester as in claim 8 wherein a release mechanism is pivotally mounted on said frame and engageable with said test-load for removing both said pre-load and said test-load from said sample.

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10. A load-deflection tester as in claim 9 wherein said release mechanism comprises a lever pivotally mounted on said frame, push rods mounted on said lever and movable relative to said test-load, said push rods also being engageable with said test-load for removing both said test-load and said pre-load from said sample by engagement between said one plate and said yoke.

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