June 5, 1934. E. A. MURPHY ET AL 1,962,028

EXTENSIBLE THREAD TESTING DEVICE

Filed Aug. 8, 1933

Fig. 1.

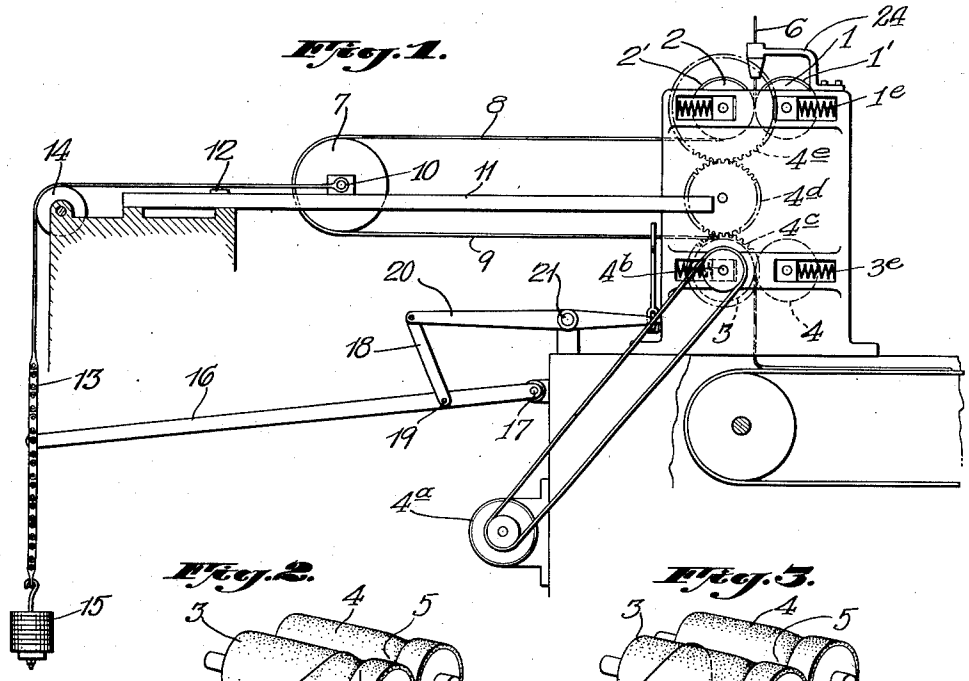



Fig. 2.

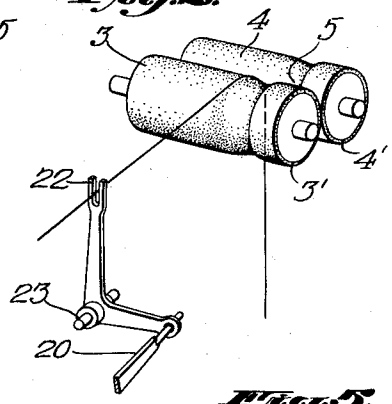



Fig. 3.

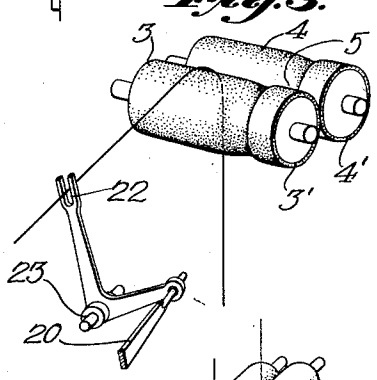



Fig. 4.

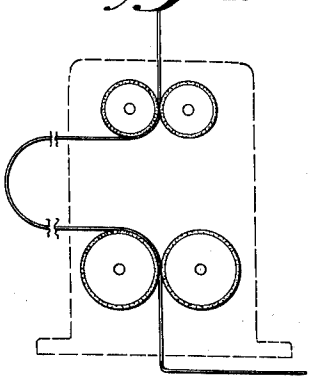


Fig. 5.

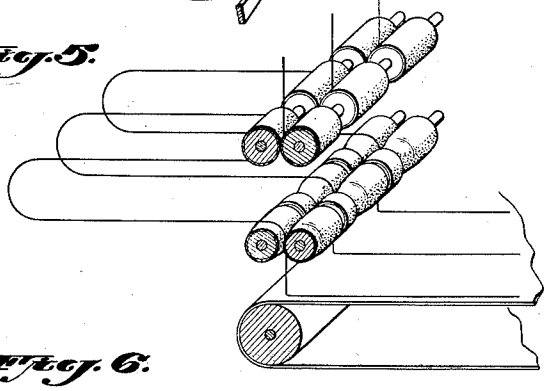
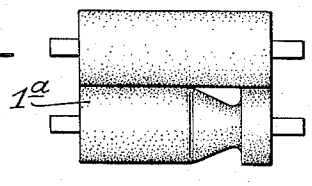


Fig. 6.




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# UNITED STATES PATENT OFFICE

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## EXTENSIBLE THREAD TESTING DEVICE

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7 Claims. (Cl. 73—51)

This invention concerns improvements in apparatus for testing extensible threads particularly those having a high degree of extensibility as, for example, threads of natural or artificial rubber. More particularly the invention relates to testing elastic threads while moving or being drawn.

As compared with tensile tests applied to determine the tensile strength of comparatively inextensible material such as yarn, several additional difficulties are present when tensile tests are made on highly extensible threads, such tests being extremely useful and even indispensible for the purpose of ascertaining or confirming the suitability of the thread to undergo further processes.

Thus for instance where the thread is to be subsequently covered under tension, it is naturally of considerable importance that the thread shall not break during the covering operations.

Merely to stretch the thread between two sets of rollers and hang a weighted pulley in the bight so formed has not always been found sufficient, as it has been found impracticable to maintain the length of thread between the rollers of a constant extension owing to variation in the qualities of the threads which may include variations in extensibility or in thread diameter or variations in the degree of adhesion of the thread to the rollers.

The present invention provides an apparatus devised to maintain automatically a constant extension of the thread or threads under test while they are continuously moving and to apply thereto a breaking load to test the suitability of the thread for further operations, the test load being preferably greater than that to which the thread is likely to be subjected subsequently.

According to this invention, we provide a device for testing the extensibility of threads composed wholly or partly of vulcanized rubber in which the thread is drawn successively through spaced pairs of traction rolls between which it is displaced and stretched by a load, and in which the displacement of the thread under load controls the displacement and stretching by wholly or partly releasing the tractive grip exerted upon the thread by the rolls of a tractive roll pair. Preferably, the tractive grip is diminished or released by deflecting the thread across a surface of gradually diminishing diameter formed between the pair of roll surfaces, the thread is extended between pairs of rolls rotating at different surface speeds, and the surface speed of the traction controlling pair of rolls is greater than that of the pair of rolls spaced therefrom.

In order that the invention may be more easily understood and readily carried into effect, the same will now be described with reference to the accompanying drawing, in which:—

Fig. 1 is a diagrammatic side elevation of the mechanism; Figs. 2 and 3 are part perspective views of the rolls and deflecting arm 22 shown in Fig. 1; Figs. 4, 5 and 6 are, respectively, sectional perspective and plan views of different modifications.

The mechanism consists of a suitable framework supporting two pairs of rollers 1 and 2, and 3 and 4, preferably having resilient surfaces 1', 2', 3' and 4' of rubber or other similar material to give an effective grip, the pairs of rollers being supported substantially one above the other, one or both rollers in each pair being pressed by a spring, such as 1*e* or 3*e*, or other pressure means against its neighbor.

The pairs of rollers will be referred to as the upper and lower pairs respectively.

One of the lower rollers is rotated continuously by hand or other motive power, such as an electric motor 4*a*, transmitted to a shaft 4*b* passing through the roll 3 and connected through reducing gearing 4*c*, 4*d*, 4*e* to one of the upper rolls 2 so that the lower pair 3 and 4 which withdraws the thread, rotates faster than the upper pair 1 and 2 which determines the rate of supply.

Alternatively, it is evident that the diameter of the rolls may be arranged to obtain this effect, as shown in Fig. 4 and that in a further modification a plurality of such rolls may be arranged in line so that a number of threads may be tested at the same time as shown in Fig. 5.

The diameter of one or both of the lower pair of rolls is reduced so as to provide a curvilinear, conical or other surface, preferably diminishing gradually in diameter at first and then more rapidly to provide what may be termed a circumferential groove by which the grip of the roller on the thread may temporarily be diminished to varying degrees of varying tractive grip or may be completely released.

Thus in Figs. 2 and 3, the periphery of each of the lower rolls has been reduced with a gradual taper until at 5 the thread can slip, freely between the rolls at the widest part of the grip.

Alternatively, however, as shown in Fig. 6, the taper surface may be formed on one roll 1*a* only, the reduction in diameter in this case in-

creasing somewhat more rapidly to terminate as before in a portion of minimum diameter.

The thread 6 which is to be tested is passed vertically between the nip of the upper pair of rolls 1 and 2 and is then carried out horizontally around the periphery of a floating pulley 7 and back between the nip of the lower pair of rolls 3 and 4, the diameter of the groove in the pulley 7 being substantially the same as the distance between the lowest and highest surfaces respectively of the rolls 2 and 3 over which the thread is led.

The two legs of the loop 8 and 9 which pass round the pulley are thus maintained parallel and the stress imparted to the thread by the load and tractive effort is divided equally between them.

The floating pulley around which the thread passes is mounted on an axle 10, the ends of which are slidingly supported on a pair of guides 11, such that friction is reduced as far as possible, and at the ends of the guides constituting the sliding support for the axle passing through the pulley, stops 12 may be provided on the side of the pulley remote from the rolls to limit the movement of the pulley when the thread fractures.

The pulley 7 is attached by a flexible connection 13 which passes over a guiding pulley 14 to a pendant weight 15 or other force exerting device of an adjustable nature, the weight, if this be employed, being preferably of laminated form detachably secured to a link or links connected to the pulley so that the test load can easily be adjusted.

To the weight is connected a lever, or system of levers, by which the portion of the thread forming one of the legs of the bight, for instance the lower leg, may be deflected across the line of contact of the lower pair of rolls and thus vary the tractive force exerted thereon by diminishing the tractive grip by means of the grooves described above.

To deflect the thread, a light lever or rod is attached by one end to the weight or to the link carrying the weight and is pivoted at the outer end to the supporting framework at 17 thus affording varying degrees of angular displacement about the pivot 17 according to the point selected in the lever 16 for the attachment of further links.

To the lever 16, which moves with the weight 15, an intermediate link 18 is pivoted at a point 19 near the pivot 17 chosen so as to give an adequate range of movement. The free end of the intermediate link 18 which is inclined at an angle to the link 16 and substantially in the same plane is pivoted to a lever 20 which rocks about a support 21 near the far end, the levers and link being disposed in zig-zag formation. The opposite end of the rocking lever 20 acts upon one arm of a bell crank lever 22 fulcrumed at 23, the other arm of which guides the thread and moves through an arc transversely across the path of, the lower leg 9 of the parallel loop adjacent the lower rolls 3 and 4.

In Fig. 3 we show a pair of rolls in which each roll has complementary tapering portions which register with one another.

The thread 9 is shown gripped between the rolls with full tractive drive as would be the case when the pulley 7 has been carried to the outer end of its guide path.

In Fig. 2, we show a pair of rolls in which the thread is shown approaching release from tractive effort at the maximum gap 5 which is the path to which the thread will be deflected by the deflector 22 when the extension has become too small and the pulley has been carried towards the rolls.

The action of the deflecting arm or fork is set forth in the following description of the operation of the machine.

To perform the test, a suitable weight is attached to the weight carrier or hook, the thread is guided between the upper rolls around the pulley and between the engaging surfaces of the lower rolls and the motor driving the rolls is then set going.

If the thread is of uniform texture and tensile strength, the floating pulley will settle to a position from which it will make no appreciable forward or backward movement in either direction and in consequence no movement of the weight will take place or of the deflector which is actuated by the linkage attached thereto.

If now a weak portion of the thread moves into the test bight, if the thread does not break, it will give way and so the floating pulley 7 will retreat from the rolls upon its slides and the weight will fall, the extension being increased beyond the required amount.

But the unduly extended loop or bight of thread is reduced to normal as the weight falls because as the weight falls, the rocking link and deflecting or traverse arms cause the thread to be gripped between the contacting surface of the lower pair of rolls, and since the surface speed of these rolls is greater than the upper pair, the length of thread is reduced, causing the weight to rise to a point at which the deflector arm now actuated by the upward movement of the weight releases the grip partly or wholly for a period sufficient to check further upward movement of the weight, and therefore also checking further decreases in the length of the test loop by allowing the upper rolls to feed in thread until the amplitude of the loop is restored which is indicated by the oscillation of the floating pulley diminishing until it remains stationary in equilibrium.

In the event of the thread breaking or being momentarily deflected into the position between the lower rolls where the grip is released, the stops prevent the sliding pulley from receding too far from the rolls.

In order to preserve the continuity of the test, the system is arranged so that the floating pulley does not remain in contact with this stop longer than the time taken for a point on the thread to travel between the pairs of rolls for if this period were exceeded, it will be evident that as long as the pulley is against the stops, the testing load is carried by the stops and not by the portion of the thread under test.

If a break occurs, the pulley recedes to and remains against the stops under the pull exerted by the weight and the incoming free end of thread passing through the upper rollers may be caused by a guide 24 placed above the upper pair of rolls to pass through the lower pair of rolls at 5 that is in the position where no tractive effort is exerted. That is, the guide 24 is placed in such a position axially of the rolls that thread dropping directly downwardly passes first between the part of rolls 1 and 2 directly above the groove 5 thence falls into the groove 5.

The floating pulley is then moved forward to the rolls, the thread re-engaged therewith and the floating pulley allowed to move back

towards the stops under the action of the weight and as the pulley recedes from the rolls, the thread engages the deflecting arm thus restarting the operation of the system.

Having now particularly described our invention, we claim:—

1. An apparatus for continuously testing a moving thread which comprises a pair of traction rolls, the surfaces of said rolls being arranged to diverge progressively in a longitudinal direction from contact, means for passing thread to and between said rolls, means for displacing said thread to a variable distance under constant load in passing to said rolls and means controlled by said displacement means to shift said thread longitudinally of said rolls thereby to vary the tractive grip of said rolls on said threads.

2. An apparatus for continuously testing the extensibility of moving threads which comprises two pairs of rolls, means to rotate the rolls of one pair at a different speed from the rolls of the other pair, means to displace said thread in passing from one pair of rolls to the other to a variable displacement under constant load, the surfaces of one pair of said rolls being arranged to diverge longitudinally from contact and means actuated by the movement of said uniform loading means to shift said thread longitudinally of said last-mentioned pair of rolls.

3. The apparatus of claim 2, in which the second pair of rolls has the diverging surfaces and the higher speed.

4. An apparatus for continuously testing the extensibility of a moving thread which comprises two spaced pairs of traction rolls between which said thread may be drawn successively, the surfaces of said rolls of one pair being arranged to provide a tractive effect on said thread progressively decerasing longitudinally of said rolls, thread displacing means comprising a pulley movable transversely from a position between said pairs of rolls, a weight secured to said pulley to move it from said rolls, a thread shifting member movable longitudinally of said roll pair of decreasing tractive effect through which thread passes to said pair of said rolls and a linkage between said weight and said shifting member to shift said member with the movement of said weight.

5. An apparatus for continuously testing the extensibility of a moving thread which comprises two spaced pairs of traction rolls between which said thread may be drawn successively, the surfaces of said rolls of the second pair being arranged to provide a tractive effect on said thread progressively decreasing longitudinally of said rolls, thread displacing means comprising a pulley movable transversely from a position between said pairs of rolls, a weight secured to said pulley to move it from said rolls, a thread shifting member movable longitudinally of said roll pair of decreasing tractive effect through which thread passes to said pair of said rolls and a linkage between said weight and said shifting member to shift said member with the movement of said weight.

6. An apparatus for continuously testing the extensibility of a moving thread which comprises a pair of traction rolls between which said thread may be drawn, the surfaces of said rolls being arranged to provide a tractive effect on said thread progressively decreasing longitudinally of said rolls, means for displacing said thread to a variable extent under constant load, and means controlled by the displacement means to shift said thread longitudinally of said rolls in one direction or the other, whereby to vary the tractive grip of said rolls on said thread.

7. An apparatus for continuously testing the extensibility of a moving thread which comprises two pair of traction rolls through which thread to be tested may be passed in series, means for displacing said thread to a variable distance under constant load in passing from the rolls of one pair to the rolls of a second pair, the surfaces of the rolls of one pair being arranged to provide a tractive effect that decreases progressively longitudinally of said rolls, means to drive the rolls of one pair at a different speed from the rolls of the other pair, and means to shift said thread longitudinally of said pair of rolls of progressively decreasing tractive power in one direction or the other as said displacement varies.

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