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2,391,161

APPARATUS FOR TESTING THE FIRE-RESISTANCE OF MATERIALS

Filed Sept. 15, 1944

2 Sheets-Sheet 1

Fig. 1.

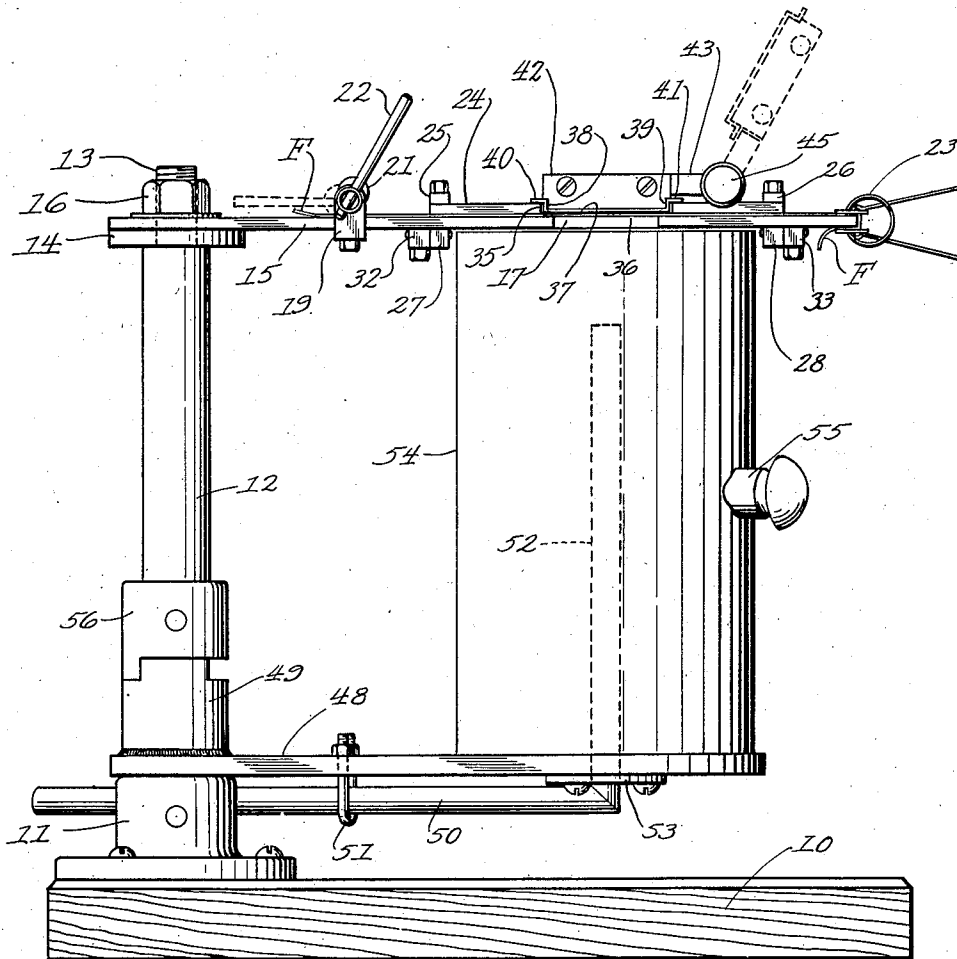
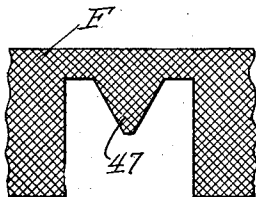


Fig. 5.



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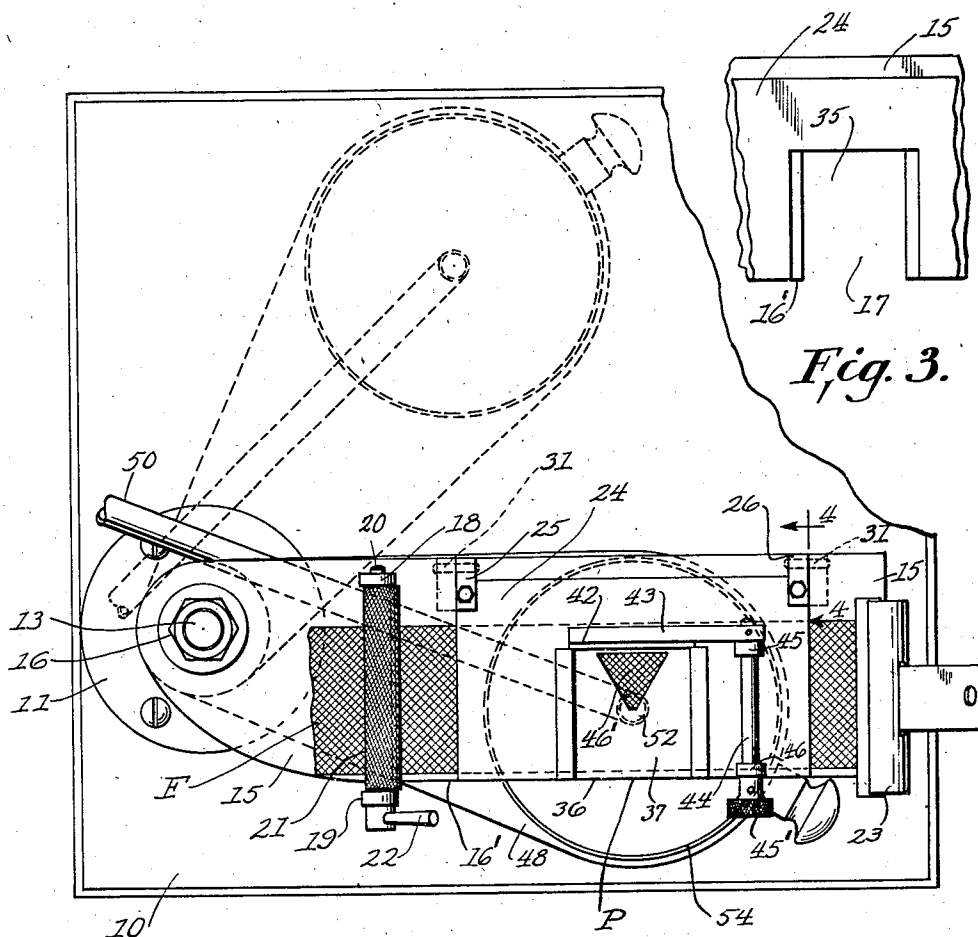


Fig. 3.

Fig. 2.

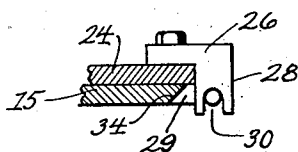


Fig. 4.

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APPARATUS FOR TESTING THE FIRE-
RESISTANCE OF MATERIALS

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1 Claim. (Cl. 73-15)

This invention relates to apparatus for testing the fire resistance of materials, particularly of chemicals and of treated fabrics. A main object of the invention is to provide a method enabling the efficacy of different chemicals and of differently treated fabrics to be readily observed and compared and to provide relatively simple apparatus for carrying out the method. Illustrative apparatus is shown in the accompanying drawings with reference to which the invention will be described. In these drawings

Figure 1 is a side elevation of the new apparatus.

Figure 2 is a plan view thereof.

Figure 3 is a fragmental plan view omitting an element which appears in Figure 2.

Figure 4 is a section on line 4-4 of Figure 2, and

Figure 5 is a face view of a portion of a fabric strip which has been subjected to a test in accordance with the invention.

Referring to the drawings, reference numeral 10 designates a base to which is secured a socket 11 in which is received and secured the lower end of an upright round post 12. At its upper end the post has a reduced and threaded portion 13 receiving a washer 14 which lies against the adjacent shoulder.

Reference numeral 15 designates a plate provided at one end with an opening receiving the reduced portion 13 of the post, the plate being secured against the washer 14 by means of a nut 16 so that the plate occupies a fixed angular relation to the post. Plate 15 has a rectilinear edge 16' interrupted by a rectangular opening or recess 17 which appears more clearly in Figure 3.

Spaced to the left of the recess 17 and supported by upwardly extending ears 18 and 19 mounted on plate 15 is a spindle 20 to which is fixed a knurled eccentric roll 21, an operating arm 22 being fixed to the spindle in radial relation. In Figure 2, F designates a strip of combustible fabric which extends under the roll 21, across recess 17, and beyond the right hand edge of plate 15. The fabric is freely disposable under roll 21 when the handle is in the full line position of Figures 1 and 2, swinging of the handle counter clockwise causing the fabric to be firmly clamped between the roll and the underlying plate 15. The fabric is then pulled taught and clamped over the right hand edge of plate 15 by clamping means such as the spring clamp 23. In Figure 1 the free ends of the fabric show outwardly of the clamping means.

Reference numeral 24 designates a rectangular

plate shown as resting on the fabric strip with an edge registering with the edge 16' of plate 15. Adjacent its opposite edge plate 24 has fixed thereto angular hinge brackets 25 and 26 having depending legs 27 and 28, Figures 1 and 4, which are received freely in notches as at 29, Figure 4, in the adjacent margin of plate 15. At their lower extremity the legs are provided with notches as at 30 in which are engaged horizontally aligned pintles carried by blocks 32 and 33 fixed to the under side of plate 15. The described hinging means permits the plate 24 to lie flatly on the fabric regardless of the thickness of the latter. In order that the fabric may be readily placed or removed, plate 24 can be swung upwardly and backwardly to be retained past dead center through engagement of the legs 27 and 28 with the notch end walls as at 34, Figure 4.

Plate 24 has a rectangular edge recess 35 registering with recess 17 when plate 24 is in its illustrated down position, recess 35 being somewhat wider than recess 17 so that the top margins of the latter are exposed as shown in Figure 3.

Reference numeral 36 designates a mask member of thin metal in the form of a shallow channel having a rectangular bottom wall 37, parallel side walls 38 and 39, Figure 1, and wings 40 and 41 projecting outwardly in the same plane from the upper edges of the side walls. An upstanding end wall 42 joins the bottom and side walls and is secured to an arm 43 in turn secured to a spindle 44 mounted in upwardly projecting ears 45 and 46 on plate 24, the spindle being rockable by means of a thumb wheel 45'. The mask is of a size to be closely but freely receivable in recess 35 with its bottom wall 37 resting on the fabric and supported on the under lying side margins of the recess 17 with wings 40 and 41 projecting over the side margins of recess 35. Bottom wall 37 is provided with substantially triangular opening 46', Figure 2, which is symmetrically disposed with its base adjacent and parallel to the end wall 42, the apex of the opening being slightly truncated or blunted as here shown.

In testing the fire proofing capacity of a chemical, in accordance with the invention, a strip of fabric is clamped in place, as heretofore described, and plate 24 and mask member 36 are swung into engagement with the upper surface of the fabric so that an area of the latter is framed in the recesses 17 and 35. The chemical, ordinarily in finely powdered form, is applied or deposited on the fabric exposed by the opening 46'

and carefully tamped and leveled off. The mask is then swung to the dotted line position of Figure 1 so that a triangular pattern of the chemical, smaller than the framed area of the fabric left and of the thickness of wall 37, is left on the fabric. The fabric is now ignited at its edge at the point P which is on the bisector of the opening 46'. The flame and glow are allowed to creep in toward the apex of the triangle and beyond so that the fabric area beneath the pattern is subjected to the burning effect. Preferably the glow along the sides of the path of travel of the flame is extinguished in order to keep the pattern even.

The action of the chemical in preventing flame and glow from destroying the fabric beneath it is now observed. The complete destruction of the fabric in the frame area indicates least resistance. If, as in Figure 5, there remains an intact and uncharred tongue 47 of the same size as the original pattern, highest resistance is indicated. Intermediate conditions of cloth and shapes of pattern give indications of fire resistance between the two extremes. The pointed pattern gives a useful result in showing whether the chemical under test causes the flame to part and proceed down each side of the apex or whether it continues on through without parting. The rapid selection of the most promising chemical out of a long list of possible fire retardants is thus made possible. Tests quickly show, for example, that borax leaves a triangular tongue of unburned cloth beneath it; that zinc oxide permits flame and glow to travel beneath it, charring and destroying the fabric; and that calcium metaborate prevents flame but permits glow to travel beneath, charring and destroying the fabric.

After testing, the test strips of fabric are pasted on cardboard sheets and labeled. This provides a ready reference to tests made on any chemical or group of chemicals, and a record sheet furnishes the recorded data. The tests quickly determine whether a chemical intumesces upon contact with the flame, melts into the fabric, decomposes, produces flame-resisting gas or gases, decomposes or alters the fabric, loses water, combines two or more of these characteristics, or is simply inert.

For testing of the fire resistant character of treated fabrics, the apparatus includes the following structure:

Referring to Figures 1 and 2, reference numeral 48 designates a plate welded to a collar 49 and supported on socket 11 for swinging on the axis of post 12. Reference numeral 50 designates a gas pipe supported under plate 48 by means of a hanger 51 and running to a vertical burner tube 52 which extends through an opening in plate 48, being fixed in a mounting ring 53 which is screwed to the bottom of the plate. Mounted on plate 48 concentrically with the burner top 52 is a cylindrical chimney 54 which extends upwardly almost to the height of the lower surface of plate 15, the chimney having a door provided with nob 55 so as to give access to the burner. Collar 49 is equipped at its upper end with stop means cooperable with stop means on a collar 56 fixed on a post 12 so that the plate 48 and appurtenances are swingable between the

dotted line position and the full line position (where exposed), Figure 2, and in the latter position the burner 52 is centered beneath the apex of the opening 46', i. e., substantially centrally of the framed area of a fabric strip which is to be tested. Plate 48 occupies the dotted line position when tests such as first described are to be made.

The fabric to be tested for flame and glow resistance is ordinarily a light weight fabric such as poplin, twill, etc., used, for example, in flying suits or for other purposes where light weight fabrics are necessary. Standard tests as used to test the resistance of canvas and duck fabrics are too severe for the light weight fabrics for which the present test has been principally devised. In making the tests, the mask 36 is moved out of the way to the dotted line position of Figure 1. The burner, occupying the dotted line position of Figure 2, is lighted and the flame length is adjusted so that when the burner is moved under the fabric the point of the flame ($500^{\circ}\text{F.} \pm 10^{\circ}$) will just touch the lower surface of the framed area, and the air vent at the base is entirely closed off. The burner is now swung under the exposed fabric, left, for example, for five seconds, and then swung away. The period of flaming and glowing are observed after removal of the flame. Untreated cloth ignites and burns out completely, leaving a rectangular opening in the test piece. In the case of a treated fabric the pattern and extent of the charring are important indications of fire resistant character in cases where no flame or glow remains after removal of the test flame.

This method of testing has been found useful in determining the difference in the fire resistance of leached and unleached halves of standard two inch by twelve inch fabric test strips. These strips after treatment throughout with the fire retardant solution are suspended in a leaching tank with the lower half only of the strip in the water and leached, for example, for twenty-four hours at the rate of seventeen gallons per hour. After drying and conditioning, the halves of each strip are successively clamped in the testing apparatus and exposed to the test flame.

It will be evident that the described procedures and apparatus are susceptible of variations. Consequently, I do not limit myself to the specific disclosure herein, except in the following claim:

I claim:

Apparatus for subjecting fabrics to a fire test, comprising a horizontal plate having a rectilinear edge and a recess terminating at said edge, means associated with said plate and spaced from the sides of said recess for clamping a strip of fabric on said plate and across said opening, a second plate adapted to rest on the clamped fabric between said clamping means and having an edge recess registering with the first mentioned recess, said second plate being hinged to the first on an axis beyond the inner ends of said recesses, and a mask hinged on said second plate and removably receivable in the recess of said second plate to rest on the fabric and define thereon a pattern smaller than the framed area for the application of a chemical to be tested.

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