

Feb. 1, 1955

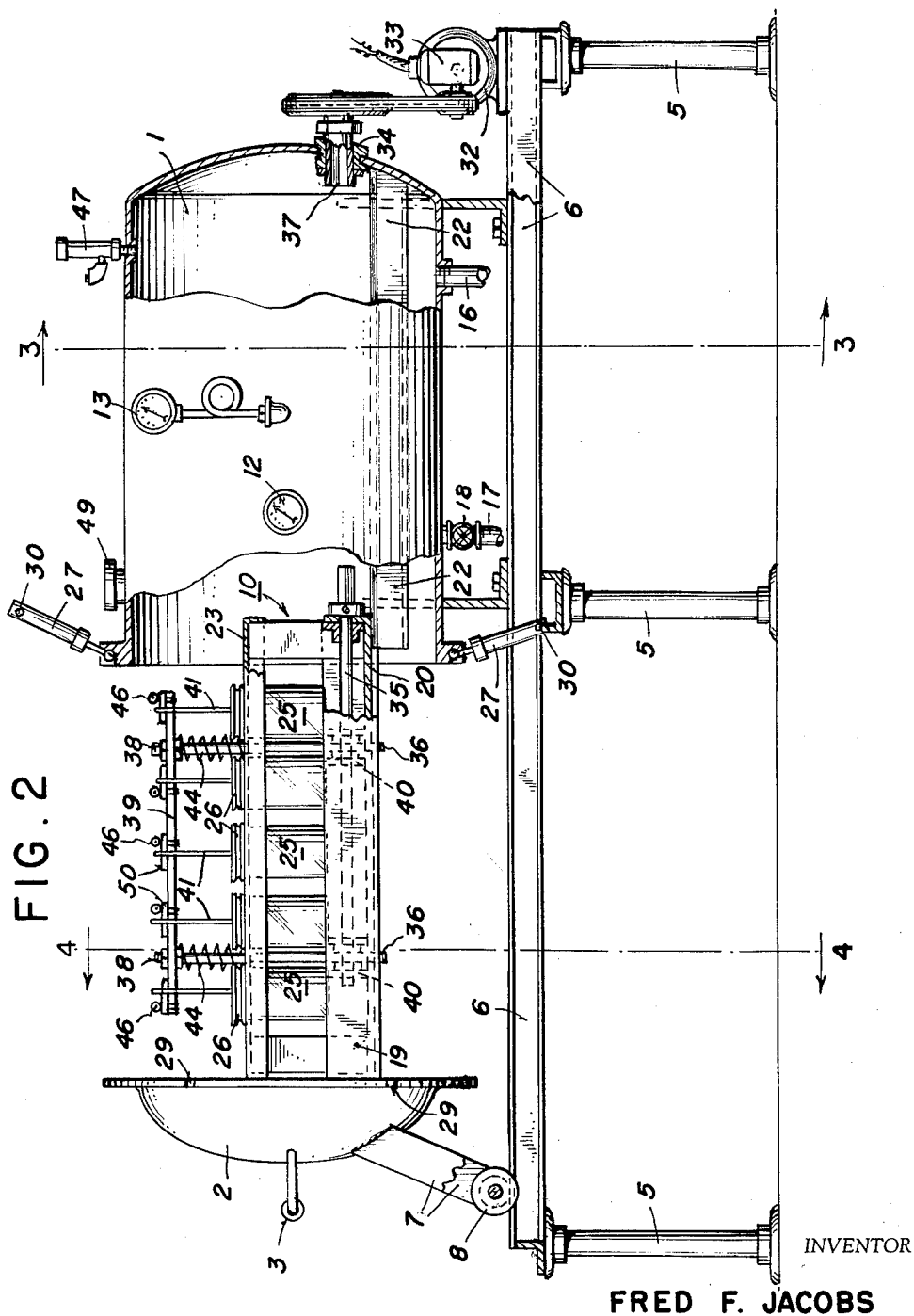
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PRESSURE AND AGITATING APPARATUS FOR DYEING OF SKEINS

Filed Sept. 12, 1952

4 Sheets-Sheet 2



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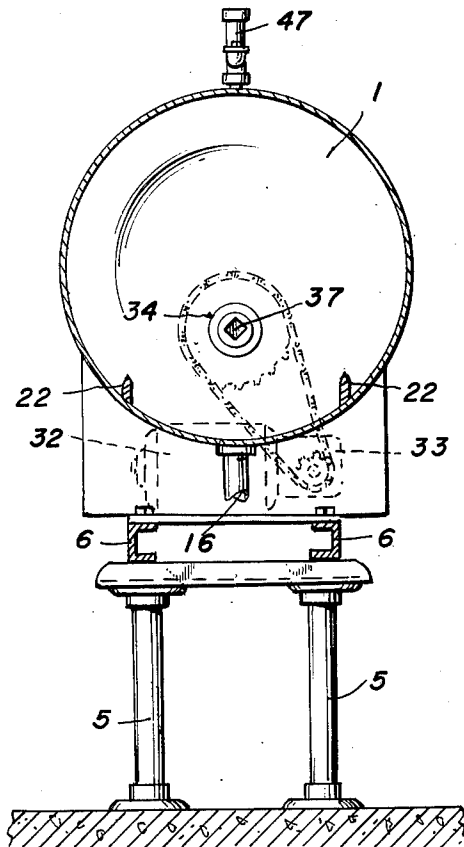


FIG. 3

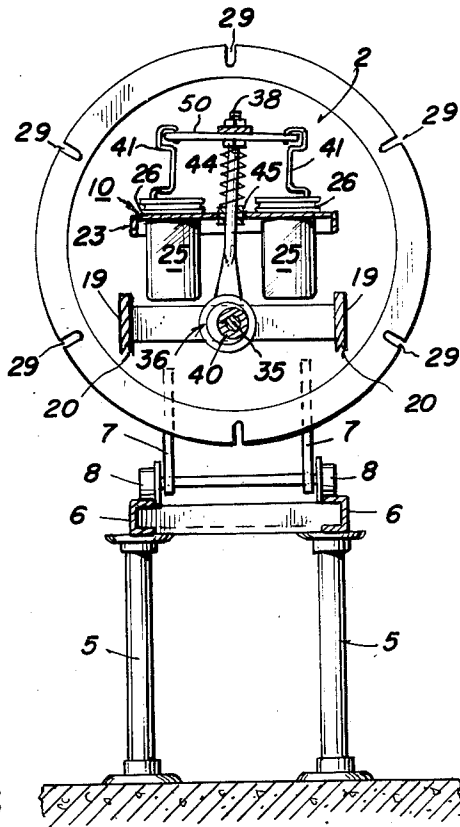


FIG. 4

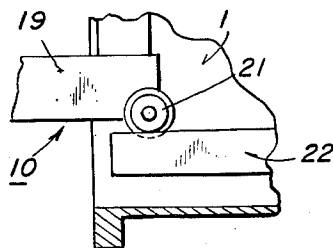


FIG. 9

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FIG. 5

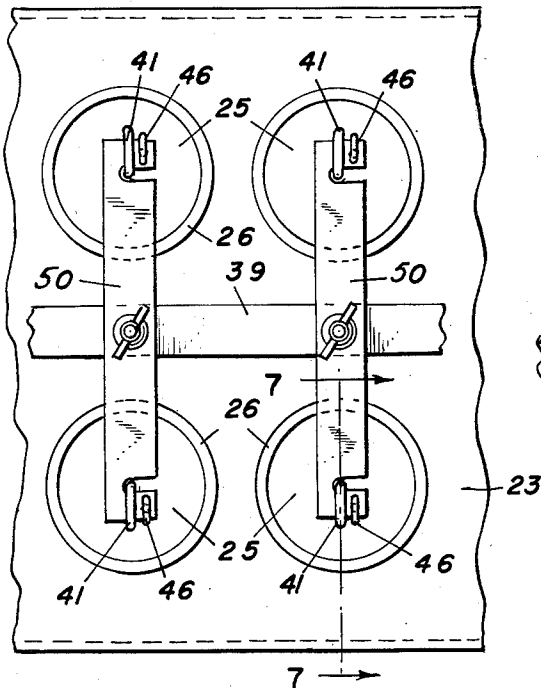


FIG. 7

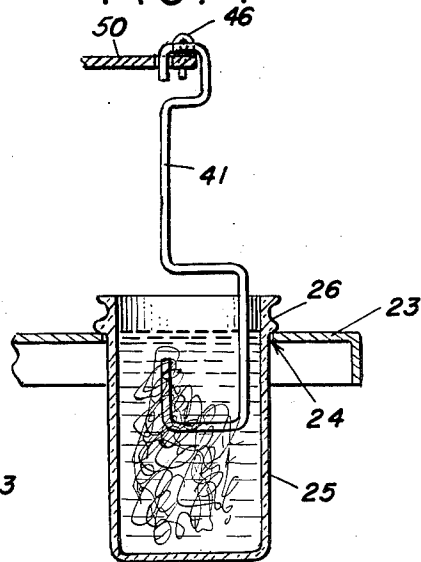


FIG. 8

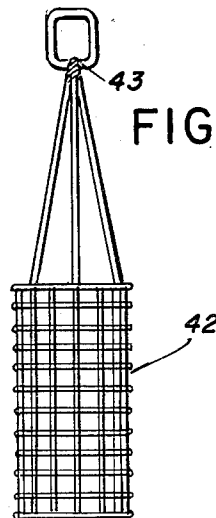
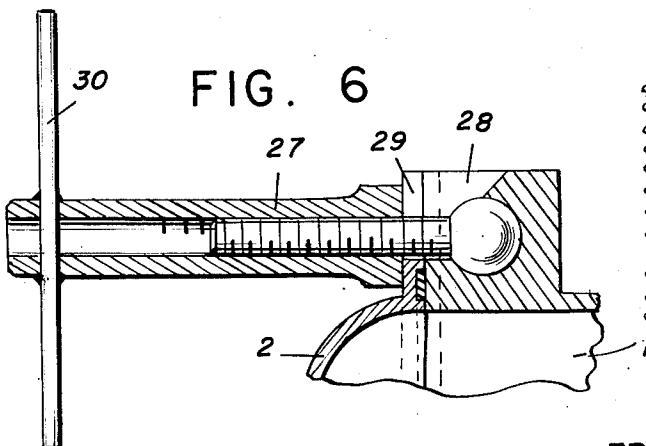


FIG. 6



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PRESSURE AND AGITATING APPARATUS FOR DYEING OF SKEINS

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Application September 12, 1952, Serial No. 309,182

11 Claims. (Cl. 68—5)

The present invention relates to apparatus for dyeing one or more skeins or hanks of yarn under pressure and more particularly to a covered horizontal pressure vessel provided with an automatic agitating device to agitate the hanks or skeins in a dyebath placed in one or more beakers or containers under precisely controlled conditions of pressure and temperature and agitation. The dyebath container or containers are mounted on a frame unit integral with the cover of the pressure vessel or autoclave, said frame unit and pressure vessel cover sliding on rails outside of the pressure vessel to permit the ready assembly and disassembly of the hanks or skeins on the agitating device and of the dyebath containers on the frame unit, and to facilitate the opening and closing of the pressure vessel. Temperature and pressure conditions are precisely measured by means of suitable measuring devices in the pressure vessel and in the dyebath.

The advent of the many synthetic fibers has increased interest in the dyeing of yarns and raw stock at elevated temperatures and elevated pressures. It is recognized in the dye industry that the high temperatures required for dyeing synthetic fibers such as Dacron, Orlon, nylon, etc. involve quite serious problems in view of the requirement that the dye uniformly and effectively penetrate the fiber to be retained thereby and in view of the relative instability of the dyestuff and the fiber in the chemical environment of the dyebath at elevated temperatures. By conducting the dyeing operation in a pressure vessel, certain of these difficulties involved in high temperature dyeing have been partially eliminated.

A wide selection of dyestuffs in a large variety of colors is valuable, but it is necessary to screen the available dyestuffs to select dyes of adequate fastness, penetration and color for the particular fiber which is to be colored. Since this screening is in effect test dyeing, the foregoing considerations are applicable.

Despite the advantage which is obtained in pressure dyeing, for test dyeing or other purposes, ordinary pressure apparatus has not been found to be entirely satisfactory. A home pressure cooker, for example, produces unreliable results, because during the dyeing operation, the skeins which are put into the dyebath beaker within the pressure cooker have to be treated without stirring or agitation, and uneven dyeing results. Further, there is no certainty in the measurement of the dyeing temperature of the dyebath within the pressure cooker, so that the testing operation conducted provides incomplete data which later proves unreliable in attempting to apply the pressure dyeing results to larger scale operations. Further, the necessary manipulation of the pressure cooker to carry out the intended dye testing operation is burdensome and time-consuming, so that considerable effort and time is required to test just one or a few fiber skeins.

In the pressure dyeing of a single "package" of skein or yarn in conventional pressure devices, larger amounts of yarn and of dyestuff are frequently employed, for example, one pound of yarn and the dye necessary for dyeing this quantity of yarn may be used, in order to provide a more typical small scale duplication of plant scale dyeing conditions. Such testing requires about 2 or 3 hours and further requires relatively large amounts of dyestuffs as compared with the testing and evaluation of smaller skeins, e. g. 5 or 10 gram skeins, which are preferable.

Considering the large amount of dyestuffs to be tested and the fact that each test must be repeated, perhaps many times, on all of the synthetic fibers in order to have a complete reliable and reproducible evaluation, it is obvious

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that testing with the presently available apparatus presents a time-consuming and impractical, if not impossible, task in view of the necessity of finishing the evaluation in a reasonable time.

The dye manufacturer and dye finisher must solve this problem of rapid, complete and reliable dye-testing and dye-evaluation. Heretofore there has not been available a pressure and agitating apparatus to conduct the multiplicity of dye tests as required for the various synthetic fibers, and to conduct these tests sufficiently rapidly to keep pace with the many technical problems in the dye-finishing plant. The existing dye-testing or dye-screening apparatus of the pressure type is cumbersome in loading and unloading the skeins and dyebath. Effective agitation of the skein in the dyebath under the conditions of pressure and temperature has not been heretofore provided within the pressure vessel. Accurate temperature control of the pressure fluid is not sufficient and the temperature approximation of the dyebath temperature which prevails in the existing pressure apparatus has been found to be inadequate as a control for larger scale dyeing operations. A pressure dye-testing apparatus capable of rapid, accurate and reproducible elevated temperature dye evaluation was not found in any of the apparatus available in the prior art.

A primary object of the invention is the embodiment of apparatus which overcomes the drawbacks above noted and which may be used to test and evaluate under precisely controlled pressure and temperature conditions, the dyeing of a plurality, e. g. dozen, several dozen or almost any number of skeins, limited only by the size of the pressure vessel.

This object and others which may appear from the more detailed description hereinafter set forth and from the drawings, are accomplished by the pressure apparatus of the present invention, which briefly stated, comprises a pressure vessel, a cover therefor, a frame unit having one or more holes therein, each hole adapted to accommodate a dyebath container, the frame unit being integrally associated with the cover of the pressure vessel, rail sliding means supporting the pressure vessel cover to permit the rapid opening and closing of the pressure apparatus and agitating means to facilitate uniform dyeing and dye penetration of the skein under controlled dyeing conditions of high pressure and high dyebath temperature in the pressure apparatus.

The accompanying drawings illustrate, by way of example, presently preferred embodiments of the invention. On the said drawings:

Fig. 1 is a side view of the apparatus in closed condition.

Fig. 2 is a side view as in Fig. 1, the apparatus shown in open condition.

Fig. 3 is a sectional view through the apparatus taken along section line 3—3 of Fig. 2.

Fig. 4 is a cross section of the apparatus of Fig. 2 taken along vertical section 4—4.

Fig. 5 is a top view of a detail of the agitating means.

Fig. 6 is a view partially in section and partially in elevation of a detail in Fig. 1.

Fig. 7 is a section view of a detail of the agitating means, the skein holder, and the dyebath container.

Fig. 8 is a section view of a detail of a modification wherein a wire basket for holding textile materials, e. g., skeins or fibers, is employed.

Fig. 9 is a section view of a detail of a modification of the rail sliding means of Figs. 2, 3 and 4.

In Figure 1, the pressure vessel 1 is closed by means of the pressure vessel cover 2, the pressure vessel being mounted, and fastened by bolting, welding or other suitable means, to longitudinally extending framing members on supporting columns 5, said longitudinally extending framing members forming the outer rails 6 upon which the pressure vessel cover slides. The pressure vessel cover 2 is provided with connecting brackets 7 which rest upon attached rollers 8, the rollers sliding on the outer rails 6, to place the cover in an open or closed position relative to the mouth of the pressure vessel, and as shown in these two positions in Figs. 1 and 2.

As shown in Figs. 2, 4 and 9, a frame unit 10, prefer-

ably rectangular, is connected at one end thereof to the pressure cover member 2, by any suitable means such as bolting, welding, etc., so that the frame unit and pressure cover may be moved as a single piece, by sliding on the outer rails 6. The frame unit 10 is provided with bottom opposite longitudinal sliding members 19, which are indented or chamfered at their bottom surfaces 20, as shown in Fig. 4, or which may be fitted with frame unit wheels 21, as shown in Fig. 9. The frame unit 10 may slide on the indented surface 20 or on frame unit wheels 21 along the surface of inner rails 22, which inner rails are provided along the bottom portion of the pressure vessel.

The frame unit 10 has an upper frame plate 23 having openings 24, as shown in Fig. 7. These openings 24 receive the dyebath containers 25, which containers are provided with an upper engaging collar 26, resting upon the upper frame plate 23. If desired, additional bottom support for containers 25 may be provided.

An agitating device, as illustrated in Fig. 2, Fig. 4, Fig. 5, Fig. 7 and Fig. 8, serves to move the skein or fibers immersed in the dyebath to promote uniform dyeing of the skein or fibers under the elevated temperature and pressure conditions of the dyeing operation. A suitable motor 32 connected to a gear reduction drive 33, as may be necessary, drives an outer horizontally rotating shaft 37, which shaft extends from the outside of the end wall of the pressure vessel through a pressure tight packing or bushing 34 in this end wall, into the inside of the pressure vessel. The outer shaft 37 provides a female coupling to receive and engage the internal horizontal rotated shaft 35 which is suitably mounted in bushings 40 which are secured to the lower portion of the frame unit 10.

The internal rotated shaft 35 is provided with an eccentric cam 36 and a cam follower 38 which extends above the upper frame plate 23 of the frame unit 10 as shown in Figs. 2 and 4. The upper end of the cam follower 38 is secured to a horizontal crosspiece 39, which crosspiece 39 is parallel to the internal horizontal shaft 35 and located above the upper frame plate 23, so that the up and down motion imparted to the crosspiece 39 by the eccentric cam 36 and cam follower 38 moves a bent rod skein holder 41 (shown in detail in Fig. 7) or the wire basket to hold the loose fiber 42 (shown in detail in Fig. 8), up and down in the dyebath.

The vertical cam follower 38 is aligned in a bushing 45 which is provided in the upper frame unit plate 23 and control of the up and down motion of the cam follower is augmented by providing spring 44 about the upper portion of the cam follower which extends above the upper frame unit plate 23. Spring 44 presses against the top of the upper frame unit plate 23 and against the bottom of the horizontal crosspiece 39, to thereby insure a uniform reciprocating action of the crosspiece 39 and to overcome frictional effects.

The horizontal crosspiece 39 is connected with one or more transverse cross arms 50, as shown in Fig. 5, and from the ends of these cross arms a suspended bent rod skein holder 41 or a basket 42, is provided as shown in Figs. 5, 7 and 8. A screw eye or holding pin 46 at the end of the transverse cross arm 50 secures the bent rod skein holder 41 or wire basket handle 43 as shown in Figs. 7 and 8.

To charge the pressure apparatus of the present invention, the dyebath compositions are prepared, the dyebath container 25 holding the bath is accommodated in a hole 24 in the upper frame unit plate 23, and the skein is fitted onto the bent rod skein holder 41, as shown in Fig. 7, or in the basket 42 as shown in Fig. 8. The pressure cover assembly which is prepared as shown in Fig. 2, is slid along outer rails 6 to close the cover of the pressure vessel as shown in Fig. 1. Closing members 27 are secured around the open periphery of the pressure vessel 1, and these members 27 engage a corresponding slot 29 in the periphery of the pressure vessel cover 2. The closing member 27 is shown in Fig. 1 and is shown in detail in Fig. 6. The closing members 27 are symmetrically arranged about the open periphery of the pressure vessel. A universal joint mounting 28 secures the closing member 27 to the edge of the pressure vessel and a handle 30 is provided for the closing member, which handle is inserted into the groove or slot 29 as illustrated in Figs. 4 and 6. The sliding of the pressure vessel cover on the outer rails is facilitated by means

of cover handle 3 secured to the midportion of the exterior of the cover and as shown in Fig. 2.

Any size skein or yarn may be used, with corresponding modification of the size of the skein holder, the dyebath container and the amount of the dyebath employed. However, a skein of from 5 to 10 grams in weight is preferred for test-dyeing or screen-dyeing purposes. Fraying of the skein fibers is avoided and uniform penetration of the dye into the fiber is facilitated by appropriate adjustment of the skein holder 41 or the basket 42, and the agitating device permits wide variation in the agitation as desired.

Steam under pressure or any other suitable inert heating fluid under pressure is brought into the enclosed pressure vessel through steam inlet line 17 which is provided with a control valve 18 and as shown in Fig. 1. A return steam line 16 fitted with a steam outlet valve 14, a steam trap 11, and a steam valve 15 facilitates additional control of the pressure and temperature within the pressure vessel and serves to remove condensate, as may be necessary, during the dyeing operation. The pressure vessel is provided with a safety valve 47 to prevent any dangerous build-up of pressure during testing. To measure and assist the control of the pressure and temperature conditions in the pressure vessel, there are provided pressure gauge 13 and temperature gauge 12 as is illustrated in Figs. 1 and 2. The control of the temperature in the dyebath is aided by means of the indicating thermometer 48 fitted in a pressure tight fitting 49, the thermometer being immersed in the dyebath and being of the long stem type to permit direct reading on the outside of the pressure vessel.

It will be understood that any other temperature measuring device may be used in lieu of thermometer 48, e. g. a thermocouple immersed in the dyebath fluid and connected to appropriate known devices for direct or indirect reading, etc. Or, the pressure cover may be provided with a sight glass to permit the temperature reading to be visually observed in a short stem thermometer within the pressure vessel. These and other modifications may readily be made without departing from the scope of this invention.

Having thus disclosed the invention what is claimed is:

1. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, inner rail members inside said pressure vessel slidably supporting said frame unit, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

2. A pressure apparatus for testing the dyeing of skeins of yarn at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable with said cover from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, inner rail members inside said pressure vessel slidably supporting said frame unit, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected

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to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

3. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising a pressure vessel provided with pressure and temperature regulating means, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, inner rail members inside said pressure vessel slidably supporting said frame unit, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

4. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis, a vertically extending dyebath container accommodated in said hole and supported by the frame, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, inner rail members inside said pressure vessel slidably supporting said frame unit, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

5. A pressure apparatus for dyeing skeins of yarn or fibers at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, inner rail members inside said pressure vessel slidably supporting said frame unit, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse crossarm connected to and crossing said horizontal crosspiece, a handle connected to said transverse cross arm, a basket supported on the handle for the skein or fibers, and means for rotating said shaft whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm, the handle and the basket supported thereon to move the skein or fibers up and down in the dyebath.

6. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at

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least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, said cover provided with supporting members and wheels which ride on said outer rail members, inner rail members inside said pressure vessel slidably supporting said frame unit, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

7. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising an elongated horizontal pressure vessel, a cover of vertical extent for said pressure vessel at one end thereof, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, horizontal outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, horizontal inner rail members inside said pressure vessel slidably supporting said frame unit, said frame unit provided with opposite bottom supporting chamfered members which slide on said horizontal inner rail members, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

8. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising an elongated horizontal pressure vessel, a cover of vertical extent for said pressure vessel at one end thereof, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, horizontal outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, horizontal inner rail members inside said pressure vessel slidably supporting said frame unit, said frame unit provided with opposite bottom supporting members fitted with rollers to roll on said horizontal inner rail members, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

9. A pressure apparatus for dyeing skeins of yarn or fibers at elevated temperatures comprising a pressure vessel, a cover therefor, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, the frame unit being integrally associated with the cover of the pressure vessel, rail sliding means supporting

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the pressure vessel cover to permit the rapid opening and closing of the pressure apparatus, and agitating means to facilitate uniform dyeing and dye penetration of the skein or fibers under controlled dyeing conditions of high pressure and high dyebath temperature in the pressure apparatus.

10. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a transverse cross arm connected to and crossing said horizontal crosspiece, a bent rod connected to said transverse cross arm for supporting a skein, and means for rotating said shaft, whereupon an up and down motion is transmitted by rotation of the shaft through the cam and cam follower to the horizontal crosspiece, the transverse cross arm the bent rod and the skein supported thereon to move the skein up and down in the dyebath.

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11. A pressure apparatus for dyeing skeins of yarn at elevated temperatures comprising a pressure vessel, a cover for said pressure vessel, a frame unit having at least one hole therein, each hole having a vertical axis and adapted to accommodate a vertically extending dyebath container, said frame unit being connected to said cover so as to be slidably removable from said vessel, outer rail members outside of said pressure vessel supporting said cover and permitting the slidable opening and closing of said cover over said pressure vessel, and an agitating device within the pressure vessel comprising a horizontal shaft, an eccentric cam connected to said shaft, a cam follower, a horizontal crosspiece secured to said cam follower and located above and crossing said frame unit, a skein holder connected to said horizontal crosspiece, and means for rotating said shaft whereby an up and down motion is transmitted by rotation of said shaft through the cam and cam follower to the horizontal crosspiece and the skein holder to thereby agitate the skein in an up and down direction in the dyebath.

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