This invention relates to a filter pack and method of and apparatus for forming the same, and particularly relates to a filter pack intended for use in the casing of a filter by means of which the lubricating oil of an engine is filtered and thus cleared of dirt and other foreign matter so that use of the oil may be continued over a long period of time.

One object of the invention is to provide a filter pack including a core of screening mounted about a perforated tube of special formation, and layers of cotton or other fibrous material formed about the core before reaching the screening and passing through the screening to the inlet perforations of the tube, the cotton batting or waste and the coil of screening being firmly held in place about the tube and prevented from slipping out of proper relation thereto.

Another object of the invention is to provide a filter pack wherein the coil of wire screening and layers of cotton batting or waste are each bound with cord to compress and confine them and thus preserve their density and dimensions and cause the oil to be properly filtered in a very efficient manner.

Another object of the invention is to provide a filter pack of such formation that the fabric layers about the wire screening and the tube are enclosed in a covering formed of strips of woven fabric which are so applied that they will be firmly held smoothly against the outer layer of fabric.

Another object of the invention is to provide an improved mechanism for carrying the tube during formation of the filter pack and drawing the tube and layers of fabric covering the same, downwardly into a cylinder during application of the fabric strip to cover the fabric layers and enclose the same.

The invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a view partially in elevation and partially in vertical section, showing a filter pack of the improved construction partially formed.

Fig. 2 is a fragmentary view showing the partially formed filter pack in elevation and portions of the apparatus in vertical section.

Fig. 3 is a fragmentary view showing the pack downwardly into the cylinder of the apparatus and ends of fabric strips forming the outer covering of the pack bound together at the top of the pack.

Fig. 4 is a view similar to Fig. 3, showing the pack shifted upwardly during application of a binding cord.

Fig. 5 is a view showing the pack shifted upwardly out of the cylinder and the binding cord completely applied.

Fig. 6 is a view of the finished pack.

Fig. 7 is a view on an enlarged scale showing the filter pack partially in elevation and partially in longitudinal section.

Fig. 8 is a view showing the tube in elevation.

Fig. 9 is a sectional view taken transversely through the filter pack, on the line 9—9 of Fig. 7.

This improved filter pack is for use in a filter employed as means for removing dirt and other foreign matter from the lubricating oil of an engine and is to be mounted in a casing with the threaded end of the perforated tube screwed into the outlet of the casing. Therefore, oil entering the casing through an inlet opening and seeping through the filter pack may enter the tube through the inlet openings or perforations as clean oil and flow from the lower end of the tube into a pipe constituting a portion of the lubricating system of the engine and delivered in a clean state to bearings of the engine.

The upper end portion of the tube is solid, as shown in Fig. 7, and terminates in a squared end for engagement by a wrench when screwing the lower end of the tube into the outlet opening of the filter casing. Upper and lower annular flanges or collars surround the tube in spaced relation to its ends and, between the upper flange and the squared end, the tube carries a pin which passes transversely through the solid upper portion of the tube and constitutes an anchoring member having portions projecting from opposite sides of the tube.

The tube is surrounded by filtering material and, upon referring to Fig. 7, it will be seen that a sheet of coarse woven wire is first wound about the tube between the flanges in shielding relation to the inlet perforations. This coarse screening is secured by cord which is wound about it and a sheet of fine screening is then coiled about the coarse screening and secured by cord or string wound about it. A sheet of coarse fabric surrounds the fine wire screening with its upper and lower portions projecting beyond the collars and bound tightly about upper and lower portions of the tube by end portions of the cord which is wound about the fabric spirally thereof. The coarse screening and the fine screening serve as shields for the perforations in the tube and very
effectively prevent the perforations from becoming clogged by lint or the like and the fabric 12 prevents contact between the fine screening and fibrous material surrounding the same. The fibrous material consists of an inner layer 15 bound by cord 16, an intermediate layer 17, bound by cord 18, and an outer layer 19 bound by cord 20. The layer 15 is of soft cotton batting, the intermediate layer of waste having absorbent qualities, and the outer layer is also formed of waste. The waste may seep through the layers or wrappings 16, 17 and 19, but dirt and other foreign matter will be held back and only clean oil will pass through the screening and enter the tube 3 through the inlet perforations thereof. As the screening will hold back any lint or the like which may work loose from the wrappings, danger of the perforations in the tube becoming clogged will be eliminated. As the protruding end portions of the pin 7 will be embedded in the wrappings or layers of cotton batting and waste, these layers will be anchored and prevented from shifting about the screening and the sheet of fabric 13 covering the same. The collars 6 and the portions of the fabric 13 which are tightly bound to the tube between these collars and ends of the pin 7 to prevent any dirty oil from working along the tube and reaching the inlet perforations 3 of the tube.

A length of rope 21 formed of cotton waste is coiled about the tube under the lower collar and lower ends of the fibrous layers of cotton batting and waste, and this cotton rope is compressed by the fabric covering 22 enclosing the fibrous layers to form a tight packing which assists in preventing oil from working upward along the tube. The fabric covering 22 consists of fabric strips extending longitudinally of the tube in overlapping relation to each other and firmly secured by a circumferentially extending binding 24 formed of cord wound spirally about the cover and a companion binding 25 formed of cord extending longitudinally of the tube project therefrom so that when the filter pack is installed for use it may be thrust into the casing of a filter through an open end thereof and the upper end of the tube is provided with a threaded outlet opening of the filter casing through the medium of a wrench engaged with the squared upper end portion 5 of the tube. During operation of the improved filter pack, the apparatus illustrated in Fig. 1 is employed and the steps shown in Figs. 1 through 6 followed. Referring to Fig. 1, it will be seen that during the formation of the filter pack the threaded lower end portion of the tube is screwed into a threaded socket 26 formed at the lower end of a piston 27 which is slidably received within a vertically disposed cylinder 28. This cylinder is mounted vertically in a frame 29 with its lower end engaging a yoke 30 having a bearing sleeve 31 through which slides a shaft 32. The shaft 32 extends through the cylinder axially thereof and its upper end is secured to the depending lugs 33 of the piston 27 by a pin 34. The base 35 of the frame carries a bearing 36 through which the shaft 32 is rotatably mounted between the sleeve 31 and the bearing 38 upon which it rests and this worm gear meshed with a worm 39 carried by the shaft of a reversing motor 40 mounted upon the base 35. By employing a reversing motor, directional rotation of the worm 39 may be controlled and the shaft 32 shifted longitudinally to lower or raise the piston.

The coarse screening and the fine screening are applied to the tube 2 and secured by the binding cords 9 and 11, after which the heavy fabric 12 is applied and secured by the cord 14 which, in addition to securing the fabric about the screenings, also serves to tightly bind portions of the fabric in close contacting engagement with the tube above and below the collars 15. The threaded end of the tube is then screwed tightly into the socket of the piston which is at the upper end of the cylinder 28. Before screwing the tube into the socket, it is passed through registering openings formed midway the length of the fabric strips 23 which are disposed across the upper end of the cylinder with portions of the strips resting upon the platform or table 40 at the top of the frame 29. The rope 21 formed of cotton waste is wrapped about the lower portion of the tube, as shown in Fig. 1, of cotton batting 15 and waste 17 and 19 then applied and secured by their binding cords 16, 18 and 20. If so desired, the layers of cotton and waste may be applied and then the cotton rope. The strips of fabric 23 are then brought into contact with the outer layer of waste by starting the motor and turning the gear 38 in a direction to shift the shaft 32 and piston 27 downwardly in the cylinder 28. This not only disposes the strips longitudinally of the filter pack but, in addition, holds their side edge portions in overlapping relation to each other while the free upper ends of the strips are brought together and twisted, as shown at 41, the twisted ends of the strips being temporarily secured by a rubber band 42. At this time, the filter pack will be housed in the cylinder, as shown in Fig. 3, with the piston at the lower end of the cylinder. The motor is then reversed to shift the shaft and the piston upwardly and eject the filter pack from the cylinder. During this upward movement of the piston, the cord 24 is wound about the lower end of the tube covering 22 formed by the strips 23, the cord being guided in a spiral path by engagement with the upper end of the cylinder, as shown in Fig. 4. When the piston is at the upper end of the cylinder, as shown in Fig. 5, the motor is shut off and the filter pack bound longitudinally by the cord 24. The twisted ends 41 of the strips 23 are cut off to expose the squared upper end portion of the tube and the tube is then unscrewed from the socket of the piston. The filter pack is then completed and ready for use.

Having thus described the invention, what is claimed is:

1. A filter pack comprising a perforated tube having a closed upper end, collars surrounding said tube in spaced relation to its ends, a pin passing through said tube and spaced from the upper collar, an intermediate fastening about said tube between said collars, fabric covering said screening with portions projecting beyond said collars and bound tightly about the tube, an inner wrapping of cotton batting about said filter pack, an intermediate wrapping of waste about said inner wrapping, an outer wrapping of waste said intermediate wrapping, each wrapping being bound with cord, said pin having its portions projecting from said tube embedded
in upper portions of said wrappings to anchor
the wrappings, fabric enclosing the outer wrap-
ning, and cord bindings for the last mentioned
fabric extending spirally about the same and
longitudinally thereof, said tube having its ends
protruding from the wrappings whereby the tube
may be grasped by its upper end and its lower
end detachably mounted in an outlet of a filter
casing.

2. A filter pack comprising a tube having its
lower end open and threaded for engagement
in an outlet of a filter casing and its upper end solid
formed with wrench-engaging faces, annular collars carried by said tube in spaced relation
to its upper and lower ends, perforations in said
tube between said collars, coarse metal screening
wrapped about said tube between said collars,
fine metal screening about the coarse screening,
a fabric wrapping covering the fine metal screen-
ing, inner, outer and intermediate layers of fib-
brous filtering material about the fabric wrap-
pling projecting beyond said collars, cotton rope
wound about said tube under the lower collar
and enclosed by the lower portions of the layers
of filtering material, and a fabric covering for
the outer layer of fibrous filtering material.

3. A filter pack comprising a tube open at
its lower end and closed at its upper end, collars
carried by said tube, the portion of the tube be-
tween said collars being perforated, metal screen-
ing about the perforated portion of said tube, fab-
ric covering said screening and having portions projecting from said collars and bound tightly
about end portions of the tube, layers of fibrous
filtering material about the fabric, strips of fab-
ric extending longitudinally of the filter pack
in overlapped relation to each other and forming
a fabric cover for the fibrous filtering material,
and means for securing said strips in place.

4. A filter pack comprising a tube open at one
end and closed at its other end, said tube being perforated for a portion of its length, metal
screening about the perforated portion of said
tube, fabric covering said screening, an anchor-
ing pin passing transversely through said tube in
spaced relation to the closed end of the tube, a
length of soft fibrous material wound tightly
about the tube in spaced relation to the open end
of the tube in sealing relation to the perforated
portion of the tube and adjacent portions of the
screening, layers of soft fibrous filtering material
enclosing the screening and the fabric covering
the same and also enclosing the wound length of
fibrous material, and fabric enclosing the soft
fibrous filtering material.

5. The method of forming a filter pack con-
sisting of removably mounting a perforated tube
in a vertical position, securing wire screening
about the perforated tube, covering the wire
screening with fabric having portions extending
from ends of the screening, binding the extended
portions of the fabric in close contacting en-
gagement with the tube, disposing soft fibrous
filtering material in layers about the covered
screening, covering the fibrous filtering material
with strips of fabric extending longitudinally of
the filter pack with side portions of the strips
overlapped, and applying binding cord to hold
the strips in confining and compressing relation
to the filtering material.

6. The method of forming a filter pack consist-
ing of placing strips of fabric in overlapped rela-
tion to each other across the upper end of a ver-

tically disposed cylinder in which a support is
mounted for vertical movement, passing an end
of a perforated tube through overlapped portion
of the fabric strips and removably engaging the
tube with the support to mount the tube verti-
cally, wrapping wire screening about the per-
forated tube, covering the screening with woven
fabric, applying layers of soft fibrous filtering
material about the covered screening, twisting the
support downwardly in the cylinder to cause said
strips to be moved into covering relation to the
filtering material, twisting upper ends of the
strips together above the upper end of the tube
and securing the twisted end portions together
about the upper end of the tube, shifting the
support upwardly to move the filter pack up-
wardly out of the cylinder and while doing so
wrapping a binding cord about the fabric cover-
ing formed by the strips, applying a binding cord
longitudinally of the filter pack, removing the
twisted together end portions of the fabric strips,
and detaching the tube from the support.

7. The method set forth in claim 6, wherein
soft rope is wrapped tightly about the tube be-
tween the lower end of the covered screening and
the portions of the strips through which the tube
passes, the said rope being enclosed and com-
pressed by the strips to form a seal about the
lower portion of the tube.

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