United States Patent

Lang

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[54] **FILTER CLEANER HAVING ROTATABLE SUPPORT AND SPRAY MEANS**

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[58] **Field of Search** 134/140, 143, 148, 149, 153, 134/162, 170, 152; 68/189, 198

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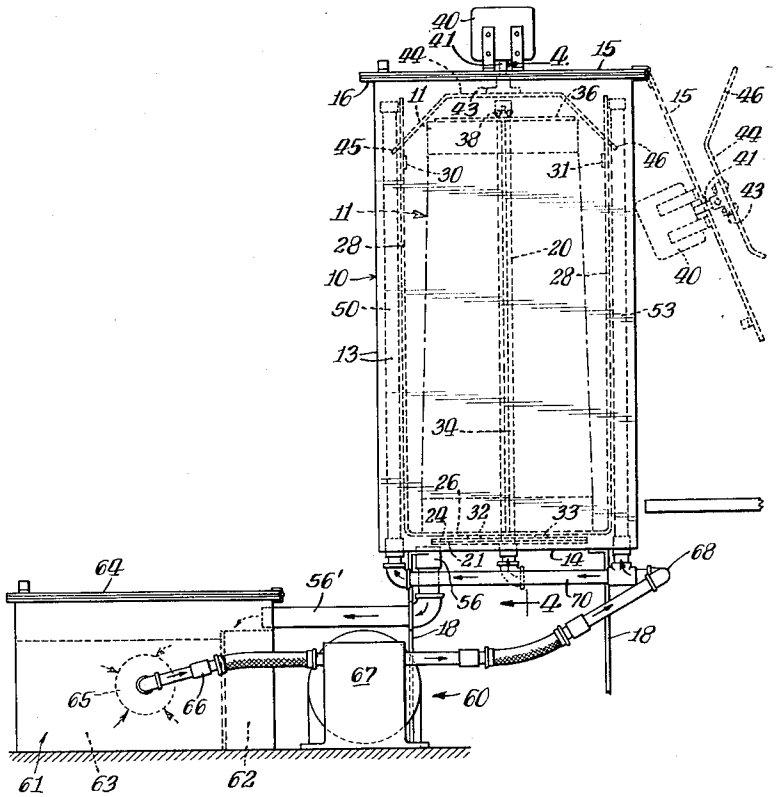
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[57] **ABSTRACT**

A cleaning apparatus for filters of the cylindrical type used with carburetors of internal combustion engines comprising a tank for receiving cleaning fluid and a plurality of spray means for discharging cleaning fluid therein extending axially into the tank, a turntable adapted to support the filters rotatable about an axis concentric with one of the spray means and the turntable having axially extending means terminating adjacent the upper end of the tank, a cover adapted to close the upper end of the tank with a drive motor mounted thereon and a drive shaft extending into the upper end of the tank with means associated therewith for engaging the axially extending means of the turntable to effect rotation of the turntable.

5 Claims, 6 Drawing Figures



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SHEET 1 OF 2

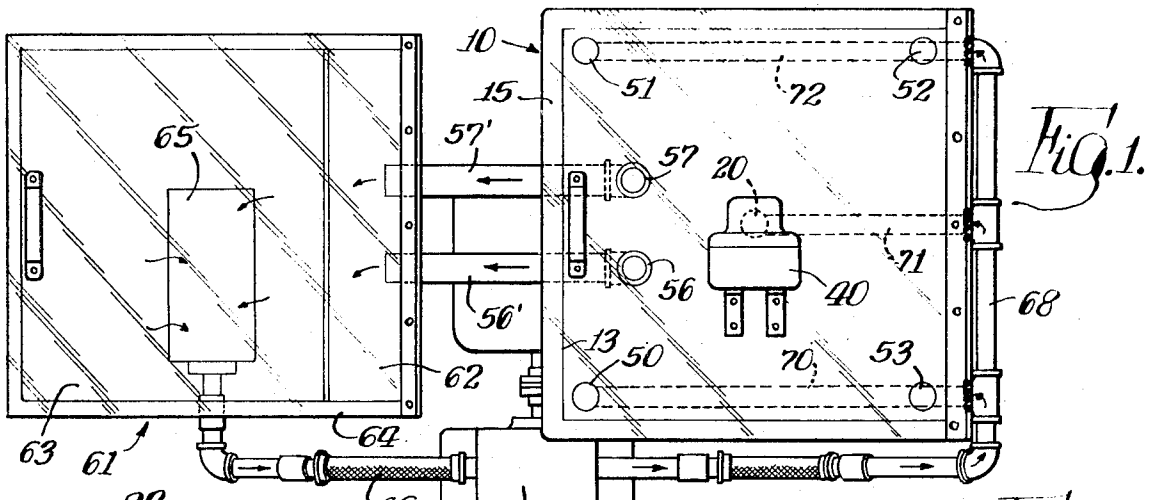


Fig. 1.

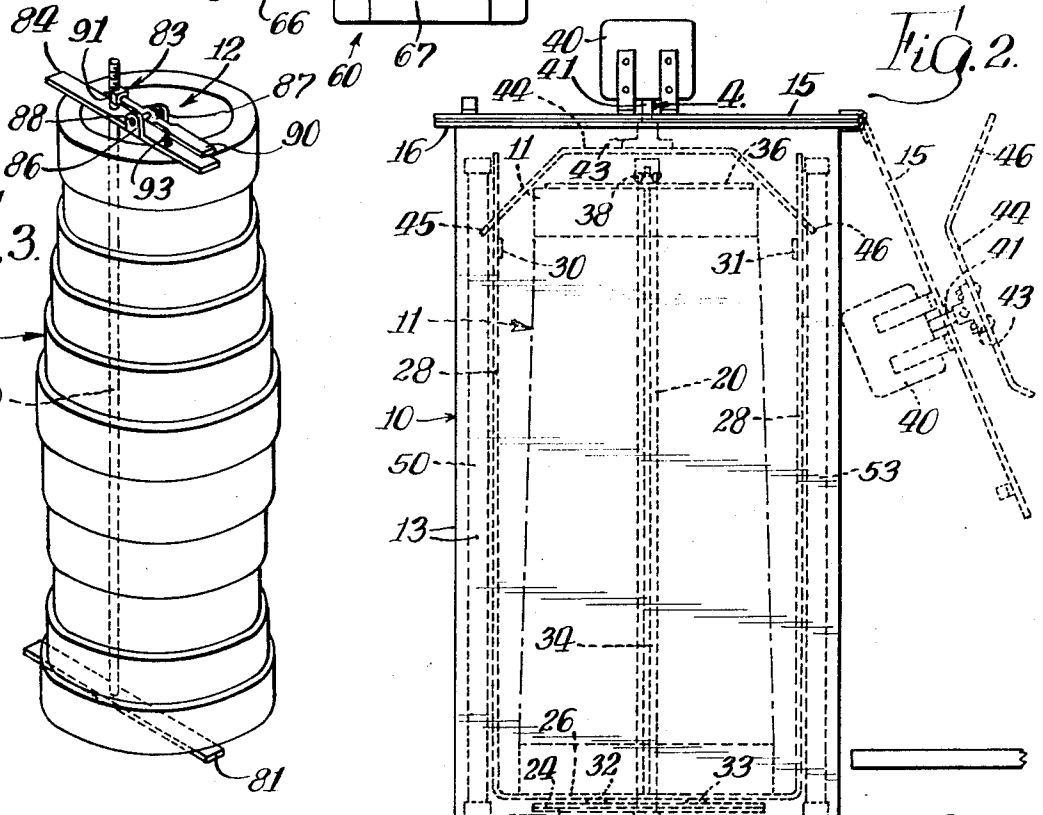


Fig. 2.

Fig. 3.

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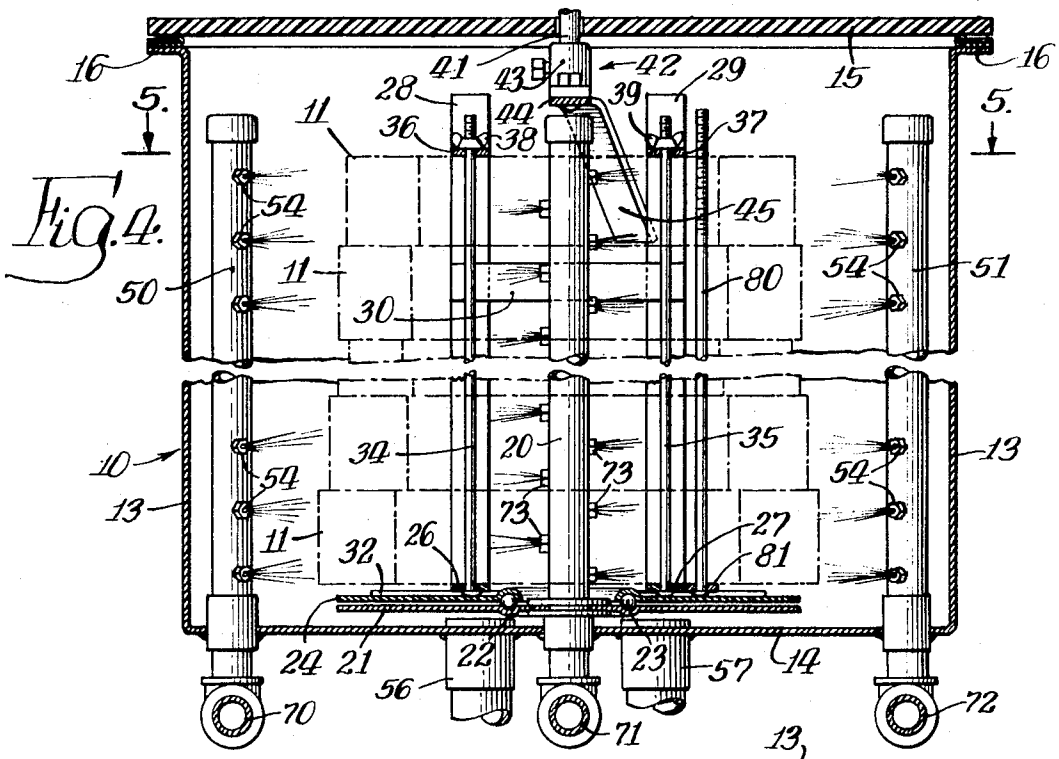


Fig. 4.

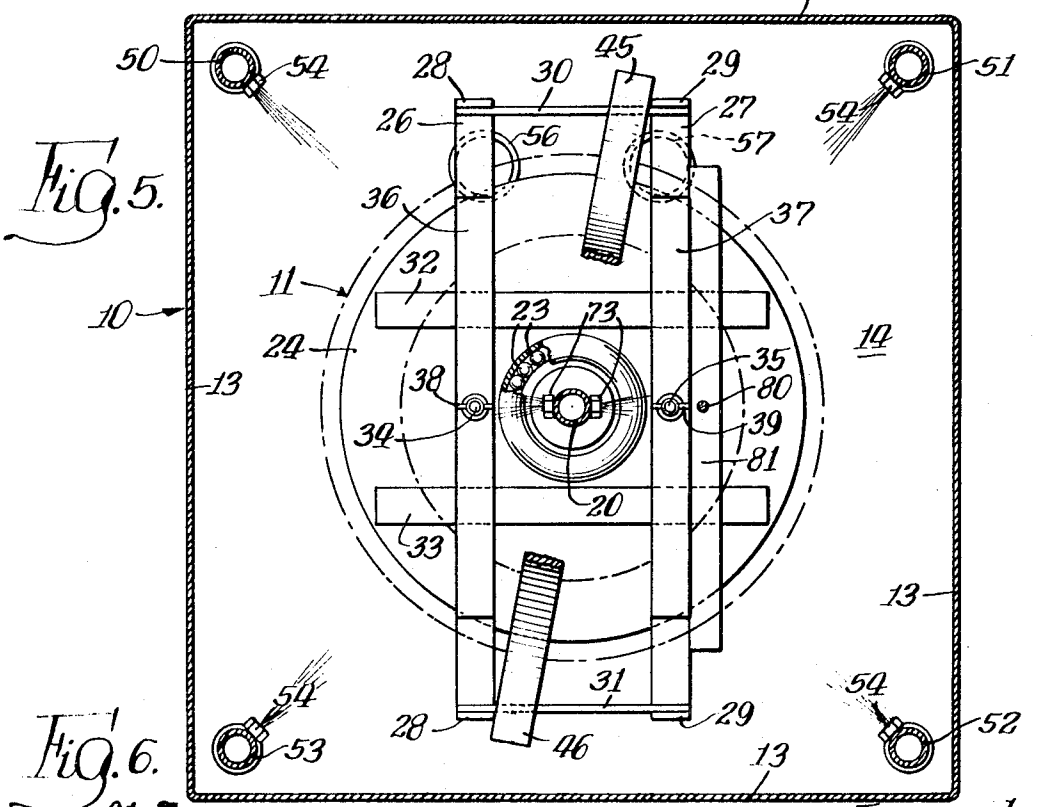
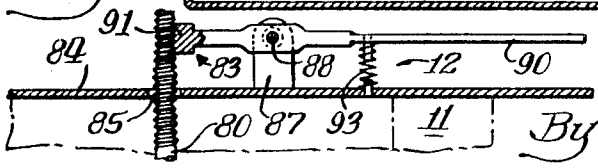


Fig. 5.

Fig. 6.



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FILTER CLEANER HAVING ROTATABLE SUPPORT AND SPRAY MEANS

The present invention relates generally to cleaning apparatus, and more particularly to apparatus for cleaning filters commonly used on automobiles and the like internal combustion engines for cleaning the air supplied to the carburetor or combustion chamber.

Air filters for automobile engines and other internal combustion engines remove dust and dirt particles contained in the air before the air enters the carburetor or combustion chamber. Unless the filter is cleaned or replaced periodically, the efficiency of the engine is substantially reduced. Since the cost of an air filter is not insignificant and since the means heretofore suggested for cleaning air filters have failed to provide an inexpensive and convenient way for cleaning the air filters, there remains a need for improving apparatus for cleaning air filters of the type used in automobiles and the like internal combustion engines.

It is therefore an object of the present invention to provide an improved apparatus for cleaning filters of the type commonly used by internal combustion engines.

It is also an object of the present invention to provide a more convenient and inexpensive ways and means of cleaning air filters of internal combustion engines.

Other objects of the present invention will be readily apparent from the following detailed description and claims when used in conjunction with the accompanying drawings, wherein:

FIG. 1 is a top plan view of the air filter cleaning apparatus of the particular invention;

FIG. 2 is a side elevational view of the apparatus of FIG. 1;

FIG. 3 is a perspective diagrammatic view of an assembly of air filters ready for placing in the apparatus of FIG. 1;

FIG. 4 is a vertical sectional view partially in elevation of the apparatus of FIGS. 1 and 2 taken along the line 4—4 of FIG. 2;

FIG. 5 is a horizontal sectional view taken along the line 5—5 of FIG. 4; and

FIG. 6 is a fragmentary vertical sectional view partially in elevation of a portion of a clamp means used to form the assembly of FIG. 3.

The filter cleaning apparatus of the present invention comprises a cleaning tank **10** which can have a rectangular or cylindrical cross section and which is adapted to receive therein a stack or assembly of air filter units **11** superimposed one over the other and preferably held in assembled relationship by a suitable holder or clamp means **12**, as best shown in FIGS. **3** and **6** of the drawings. If desired, separators can be placed between the adjacent filter units. In the embodiment illustrating the present invention the tank **10** has a rectangular form defined by vertically extending lateral wall sections **13** and a lower wall section **14**. The upper end of the tank **10** is closed by a cover member **15** pivotally mounted on one of the outwardly extending flanges **16** formed at the upper end of the wall sections **13**. The tank **10** is supported on a stand **18** above floor level to facilitate drainage of liquid therefrom.

A capped spray pipe **20** extends axially into the interior of the tank **10** through a passage formed in the lower wall **14** and terminates a short distance below the cover member **15**. A fixed turntable base plate **21** is secured to the spray pipe **20** at a point thereon a short distance above the lower wall **14**. A circular ball bearing raceway **22** is formed concentrically with the pipe **20** and the ball bearings **23** are retained in the raceway **22** between the base plate **21** and a rotatable support means or turntable **24**. The turntable **24** comprises a circular or rectangular plate rotatable about the spray pipe **20** and provides a rotatable support means for the assembly of filter units **11**. The turntable **24** has two spaced support bars **32, 33** extending transversely across the upper surface of the turntable **24** which are fixedly secured thereto for supporting the assembly of filter units **11** and the axially extending means described hereinafter. The support bars **32, 33** have fixedly attached to the upper surface thereof a plurality of spaced axially extending means which preferably comprise two spaced U-shaped members **26, 27** having axially extending drive arm sections **28, 29** thereof terminating at a point slightly below the upper end of tank **10** and spaced sufficiently to accept therebetween the largest filter unit **11** to be cleaned in the tank **10**. The vertically extending arm sections **28, 29** are connected by horizontally extending cross braces **30, 31** at points spaced inwardly from the upper ends thereof.

The rotatable turntable **24** also has operatively associated therewith preferably at diametrical opposite points two axially extending tie rods **34, 35**. The tie rods **34, 35** preferably extend upwardly from about the midpoint of said U-shaped members **26, 27** and are adapted to have the filter units **11** mounted thereover so that the tie rods **34, 35** extend through the axial passage in the filter units **11**. The upper end of each tie rod **34, 35** is preferably threaded and is adapted to have detachably mounted thereon a transversely extending compression bar **36, 37** and held in clamping engagement with the upper filter unit **11** of the assembly of filters by means of wing nuts **38, 39** or other detachable connector means mounted on the threaded end of each tie rod.

The turntable **24** is rotatably driven by a drive mechanism mounted in the cover member **15** and comprises an electric motor **40** having suitable reduction gear means associated therewith and with the drive shaft **41** extending downwardly through an axial opening in the cover member **15** a short distance into the interior of the cleaning tank **10**. The axis of the drive shaft **41** coincides with the axis of rotation of the turntable **24**. The drive shaft **41** has secured to the lower end thereof a drive bracket **42** which comprises a detachable coupling means **43** to which is bolted or otherwise fastened a drive member **44** having oppositely disposed outwardly extending end sections **45, 46** and which preferably are inclined downwardly. The end sections **45, 46** extend between the upper ends of the arm sections **28, 29** and laterally outwardly beyond the arm sections **28, 29**; whereby the end sections **45, 46** engage the edges of the arm sections **28, 29**, respectively, when the drive bracket **42** is rotated clockwise by the motor **40** and thereby effecting rotation of the turntable **24** along with the associated means for rotatably supporting the assembly of filter units **11**.

The cleaning tank **10** is also provided with additional spray pipes **50, 51, 52** and **53** which extend upwardly through the bottom wall **14** at each corner of the tank **10**. Each of the spray pipes **50–53** has a plurality of high velocity spray nozzles **54** disposed at spaced points along the length thereof with the nozzles **54** directed inwardly toward the vertical axis of the tank **10**. The lower wall **14** has formed therein drain openings **56, 57** adapted to withdraw liquid cleaning fluid which collects in the bottom of the cleaning tank **10**.

The several spray pipes **20** and **50–53** and the drain openings **56, 57** are operatively connected with cleaning liquid recycling means **60** for continuously supplying a cleaning liquid to the spray pipes and withdrawing cleaning liquid from the tank **10**. The recycling means **60** comprises a cleaning liquid or solvent reservoir **61** with which the drain openings **56, 57** are connected by suitable conduits **56', 57'**. A minimal amount of cleaning liquid is allowed to remain in the bottom of tank **10** during the cleaning cycle. The conduits **56', 57'** discharge cleaning liquid into an overflow chamber **62** where the larger dirt particles are concentrated and from which the cleaning liquid flows into the main chamber **63** of the reservoir **61**. A removable cover **64** prevents escape of fumes from the reservoir **61**.

A filter element **65** is disposed in the main chamber **63** of the reservoir **61** below the liquid level in the reservoir **61**, and cleaning liquid is drawn through the filter element **65** and conduit **66** by means of a circulating pump **67**. The circulating pump **67** discharges the filtered cleaning liquid to a plenum chamber or header means operatively connected with the lower ends of each of the spray pipes **20** and **50–53**. In the form illustrated the header means comprises the manifold **68** which has three parallel branches **70, 71, 72** extending trans-

versely below the lower wall **14** of the cleaning tank **10**. The branches **70** and **72** communicate with the lower ends of the spray pipes **50, 53** and **51, 52**, respectively, and the branch **71** communicates with the lower end of the axial spray pipe **20**. The spray pipe **20** has two sets of high velocity spray nozzles **73** for spraying cleaning liquid in diametrically opposite directions against the inner surface of the filter units **11**.

For convenience of placing the filter units **11** in the cleaning tank **10** and removing the filter units **11** from the tank **10**, the filter units **11** are preferably stacked one on top of another over a vertically extending tie rod **80** having a cross-support bar **81** fixed to the lower end thereof, as best shown in FIG. **3**. The upper end of the tie rod **80** is threaded and has mounted thereon a quick detachable latch means **83**, as best shown in FIG. **6**, which holds the stacked filter units in assembled relationship. The latch means **83** comprises a compression bar **84** preferably having a length greater than the diameter of the largest filter unit **11** to be cleaned. A passage **85** is formed in the bar **84** at about the midpoint thereof which has a diameter larger than the diameter of the rod **80**, and which permits the compression bar **84** being inserted over the end of the rod **80** and moved axially therealong without engaging the threaded section of the rod **80**. Oppositely disposed spaced flange members **86, 87** extend upwardly from the upper surface of the bar **84** at a point between the midpoint and one end of the bar **84**. A pin **88** is supported in openings formed in the flange members **86, 87** and a lever arm **90** is pivotally mounted on the pin **88**. The forward end **91** of arm **90** is enlarged and has the front surface thereof adapted to engage the threads on the tie rod **80**. The thread engaging surface of the lever arm **90** is normally urged into latching engagement with the tie rod **80** by a compression spring means **93** mounted between the lower surface of the lever arm **90** and the upper surface of the compression bar **84** at a point spaced outwardly from the pivotal support for the lever arm **90**. When the lever arm **90** is depressed, compressing the spring means **93**, the forward end **91** of the lever arm is disengaged from the rod **80**, and the latch means **83** can then be freely moved axially relative to the tie rod **80** and removed therefrom, if desired. The latch means **83** can, of course, be used in place of the compression bars **36, 37** and wing nuts **38, 39** on the tie rods **34, 35**.

In operation, several air filters of the type used with automobile carburetors and which conventionally have a large diameter axial passage extending therethrough are stacked one above the other and are preferably held in assembled relationship, as shown in FIGS. **3** and **6** of the drawing. The assembly of filter units **11** is placed as a unit in the cleaning tank **10** with the tie rods **34, 35** extending through the axial openings of the filter units. When the filter units are in position within the tank **10**, the latch means **83** is preferably removed and the filter units **11** secured in place on the turntable **24** by placing compression bars **36, 37** over the ends of the tie rods **34, 35** respectively, and moving the bars **36, 37** into engagement with the uppermost filter unit **11** by means of wing nuts **38, 39**. With the filter units **11** held in position on the turntable **24**, the cover **15** of the tank **10** is lowered into position on the upper end of the tank **10** with the end sections **45, 46** of the drive member **44** disposed between and engaging the upper ends of the drive arm sections **28, 29**. When the electric motor **40** turns the drive member **44** the drive arm sections **28, 29** rotate the turntable **24** relatively slowly, preferably at a speed between about 12 and 20 r.p.m. As the turntable **24** and the filter units are rotated, a cleaning liquid, such as a detergent solution or an organic cleaning solvent, is simultaneously sprayed onto both the inner and outer surfaces of the filter units by means of the nozzles of the axial spray pipe **20** and the corner spray pipes **50, 51, 52** and **53**. The spraying of cleaning liquid continues for about 5 to 10 minutes or until all the accumulated dirt is removed from the filter units **11**.

I claim:

1. A cleaning apparatus for filters which comprises: a tank for receiving cleaning liquid and provided with transversely spaced cleaning liquid spray means with said cleaning liquid spray means extending axially within said tank, a rotatable support means for said filters disposed concentrically with one of said spray means having secured thereto spaced arm members extending longitudinally upwardly within said tank and terminated adjacent the upper end of said tank, a cover member adapted to close the upper end of said tank, drive means supported by said cover member which extend into the interior of said tank for engaging said spaced arm members and rotating said support means, means associated with said support means for exerting an axial compression force on said filters and restraining said filters against axial movement relative to said support means, and means associated with said tank for continuously supplying cleaning liquid to said spray means and withdrawing cleaning liquid from said tank.

2. A cleaning apparatus as in claim **1**, wherein said rotatable support means comprises a turntable for supporting said filters concentrically with said liquid spray means within said tank, and said means associated with said turntable for restraining axial movement of said filter comprising at least one tie rod member extending longitudinally upwardly from said turntable and having a compression bar associated therewith for exerting a clamping engagement with a said filter mounted on said turntable.

3. A cleaning apparatus as in claim **2**, wherein said turntable has two diametrically oppositely disposed tie rod members which extend upwardly therefrom within said tank with each of said members having a said compression bar associated therewith for exerting a clamping engagement on a said filter supported on said turntable.

4. A cleaning apparatus as in claim **2**, wherein said compression bar has a quick detachable connector means engageable with said tie rod member.

5. A cleaning apparatus as in claim **4**, wherein said quick detachable connector means associated with said compression bar has a transverse passage therethrough adapted to freely receive said tie rod member, a lever arm pivotally supported on a surface of said compression bar at a point spaced from said passage, said arm having the forward end thereof adapted to form a secure engagement with said tie rod member, and said forward end of said arm normally urged into engagement with said tie rod member.

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