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RESPIRATOR

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This invention relates to respirators and this application is a continuation in part of my copending application Serial No. 303,293 filed August 8, 1952.

Said copending application discloses a fume respirator having a face piece including an exhale valve and a supporting member having an inhale valve, wherein the supporting member is substantially circular and peripherally provided with a screw threaded flange and has an annular resilient gasket therein, wherein a unique fume absorbing cartridge having an annular shoulder is received in the supporting member against the resilient gasket, and wherein a screw threaded ring having an inwardly extending flange engages the annular shoulder on the cartridge for removably securing and sealing the cartridge in place in the supporting member, against the resilient gasket.

An object of this invention is to provide an improved dust filter means which may be removably secured and sealed in the supporting member of the aforementioned respirator in lieu of the fume absorbing cartridge so that the respirator may be utilized as a fume respirator or a dust respirator merely by interchanging the fume absorbing cartridge and dust absorbing means.

Another object of this invention is to provide an improved dust filter means for a respirator which has maximum dust removal efficiency, which is simple and sturdy in construction, which is inexpensive to manufacture, which may be readily and simply secured in a respirator, and which is at all times visible for inspection purposes.

A further object of this invention is to provide an improved exhale valve for a respirator which is extremely efficient in operation, which is simple and sturdy in construction, which is inexpensive to manufacture, and which may be readily and simply embodied in the respirator.

Further objects of this invention reside in the details of construction of the respirator and in the cooperative relationships between the component parts thereof.

Other objects and advantages of this invention will become apparent to those skilled in the art upon reference to the accompanying specification, claims and drawing in which:

Fig. 1 is a perspective view of the respirator of this invention with the dust filter means mounted therein.

Fig. 2 is a vertical sectional view taken substantially along the line 2—2 of Fig. 1.

Fig. 3 is an exploded perspective view illustrating the relationships between the backing member and filter pad of the dust filter means and the securing ring.

Fig. 4 is a sectional view through the exhale valve and taken substantially along the line 4—4 of Fig. 1.

Fig. 5 is a sectional view partly broken away and taken substantially along the line 5—5 of Fig. 4.

Fig. 6 is an enlarged sectional view through a portion of the filter pad and the perforated wall of the

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backing member showing the manner of obtaining maximum dust removal efficiency.

Fig. 7 is a vertical sectional view similar to Fig. 2 but illustrating a fume absorbing cartridge secured in the supporting member of the respirator in lieu of the dust filter means.

The respirator of this invention is generally designated at 10. It includes a face piece 11 preferably formed of molded rubber or the like. The face piece 11 covers the nose and mouth of the wearer and is held in place by adjustable straps 12. The face piece 11 is provided with an exhale valve assembly 13 through which the breath is exhaled. A pair of supporting members 14 is secured to the face piece 11. Each supporting member is substantially circular and is peripherally provided with a screw threaded flange 15. Each supporting member 14 is secured and sealed to the face piece 11 by means of a sleeve 16 extending through holes in the supporting member 14 and in an enlarged portion 17 of the face piece 11 and being flanged over against the supporting member 14 and the face piece 11. An inhale valve 18 is associated with each supporting member 14 and is carried by a pin 19 which in turn is carried by a cross bar 20 suitably secured to the sleeve 16. These inhale valves 18 are preferably formed of rubber or the like and seat against the flanged end of the sleeve 16. These valves 18 are utilized for inhaling purposes. Upon inhaling, air is drawn through the supporting members 14 and inhale valves 18 and upon exhaling, air is discharged through the exhale valve assembly 13.

An annular resilient gasket 21 is located in each supporting member 14 adjacent the flange 15 thereof for sealing purposes. The supporting member 14 is adapted to receive a fume absorbing cartridge generally designated at 22 which may be of the type disclosed in the aforementioned copending application. The cartridge includes a casing member preferably made of aluminum or the like. The casing member is made in the form of a cup-shape member having a substantially circular end wall 23. This end wall is provided with a plurality of perforations 28 and it is also formed outwardly to provide an annular seating surface 24. The cup-shape member also has a substantially cylindrical side wall which is divided into two portions having different diameters. The larger portion 25 of the side wall is adjacent the end wall 22 and it joins with the portion of the side wall 26 of smaller diameter through an annular shoulder 27. A disc of fibrous material 29 such as felted paper or the like is located against the end wall 22 of the cup-shape member. Granular fume absorbing material such as activated carbon or the like is packed in the cup-shaped member against the fibrous disc 29 and substantially completely fills the same. Another disc of fibrous material 31 such as felted paper or the like overlies the granular fume absorbing material 30. A perforated disc 32 preferably in the form of a metallic screen is secured in the open end of the cup-shaped member by spinning over the open end as indicated at 33. These cartridges thus formed may be conveniently interchangeably secured in the supporting members 14 of the respirator.

To mount the cartridges 21 in the respirator the larger diameter end of the cartridge is inserted in the supporting member 14 and the annular seating surface 24 engages the annular resilient gasket 21. A screw threaded ring 35 is then screwed on to the screw threaded flange 15 of the supporting member 14. This screw threaded ring 35 is provided with an inwardly extending flange 36 for engaging the annular shoulder 27 of the cartridge for the purpose of releasably securing the cartridge in

the supporting member and sealing the cartridge against the annular resilient gasket 21. In this respect, the annular shoulder 27 of the cartridge lies adjacent the outer edge of the screw threaded flange 15 so that it may be engaged by the inwardly extending flange 36 of the screw threaded ring 35. To replace the cartridge when it becomes spent, all that is necessary is to remove the screw threaded ring 35. The structure of the respirator and the structure of the fume absorbing cartridges thus far described is very much like that disclosed in the aforementioned copending application.

In accordance with this invention there is provided an improved dust filter means which may be removably secured and sealed in the supporting members 14 of the respirator as illustrated in Fig. 2 in lieu of the fume absorbing cartridge as illustrated in Fig. 7 so that the respirator 10 may be utilized as a fume respirator or a dust respirator merely by interchanging the fume absorbing cartridges and the dust absorbing means. The dust absorbing means is illustrated in detail in Figs. 2 and 3.

The dust filter means includes a substantially circular backing member 38 which may be formed of any suitable material such as aluminum or the like. The backing member 38 includes a substantially cylindrical side wall 39, an inner annular flange 40 and an outer wall 41. The outer wall 41 is perforated as indicated at 42. The outer perforated wall 41 is preferably provided with a marginal seating surface 43. The backing member 38 is received in the supporting member 14 with the inner annular flange 40 engaging and seating against the resilient gasket 21 and with the outer perforated wall 41 being in substantial alignment with the outer edge of the screw threaded flange 15 of the supporting member. The dust filter means also includes a substantially circular filter pad 44 made of felt or any other suitable dust absorbing material. The filter pad 44 overlies the outer face of the perforated wall 41 of the backing member 38. When the screw threaded ring 35 is screwed on to the screw threaded flange 15 of the supporting member, its inwardly extending flange 36 engages the filter pad 44 adjacent its edge to hold the filter pad 44 against the perforated wall 41 of the backing member and also to seal the inner annular flange 40 of the backing member against the resilient gasket 21. In clamping the filter pad 44 against the backing member 38 for backing purposes, the edge of the filter pad 44 is clamped between the inwardly extending flange 36 of the ring 35 and the annular seating surface 34 of the backing member 38 so as to seal the edges of the filter pad 44. In this way, the filter pad is firmly backed by the backing member and its outer surface is completely exposed for maximum dust removal efficiency and for continuous visual inspection as to its condition.

In dust respirators heretofore known a protective guard has been secured over the outer surface of the filter pads thereof to protect the same from damage. Such protective guards however, operate to channel the air flow through the filter pad and to cover portions of the outer surface of the filter pad. Thus the entire outer surface of the filter pad is not traversed by the air being filtered and hence the efficiency of the filter pads is relatively low. In accordance with the instant invention however, the outer surface of the filter pad 44 is completely exposed so that there is no channeling and the entire outer surface of the filter pad is utilized for dust removal purposes. The filtering action of the dust filter means of this invention is illustrated in detail in Fig. 6. In a filter pad the outer fifth of the filter pad filters out substantially 50% of the dust as indicated by the dimension lines AA in Fig. 6. In the next fifth of the filter pad as indicated by the dimension lines BB, about only 30% of the dust is removed. In the third fifth of the filter pad as indicated by the dimension lines CC, about only 15% of the dust is removed. In the fourth fifth as

indicated by the dimension lines DD about only 4% of the dust is removed. Finally in the last fifth of the filter pad as indicated by the dimension lines EE, only about 1% of the dust is removed. As shown in Fig. 6 the only portion of the filter pad 44 in which any channeling of the air through the filter pad takes place is adjacent the solid portions 41 of the perforated wall around the holes 42, this channeling being indicated at 45. However, this slight amount of channeling takes place in those portions of the filter pad 44 which are the least effective for removing dust from the air passing therethrough. On the other hand the outer portions of the filter pad 44 in which the large majority of the dust removal takes place are completely exposed to the atmosphere. As a result, the entire outer surface of the filter pad 44 is effective for removing dust and thereby providing maximum dust filtering efficiency. Because the filter pad 44 is firmly backed by the perforated wall 41 of the backing member 38 puncturing of the filter pad 44 or other damage thereto is substantially completely eliminated. Further the filter pad 44 is at all times exposed so that its condition may at all times be readily visually inspected which is not the case where filter pads are located behind a guard member.

The exhale valve means of the respirator of this invention is illustrated in more detail in Figs. 4 and 5. It includes a spider integrally formed in the rubber face piece 11 during the molding thereof. The spider includes an annular rim 46, a central hub 47 having an opening or hole 48 therein and spokes 49 connecting the central hub 47 to the annular rim 46. The outer edge of the annular rim 46 is preferably provided with an outwardly extending protecting flange 50. The valve means also includes a valve diaphragm 51 formed of rubber or the like and it has an integrally formed stem 52 provided with a smaller diameter projection 53. The outer edge of the valve diaphragm 51 is preferably provided with an annular bead 54. The valve diaphragm 51 overlies the outer face of the spider and it seats against the annular rim 46 of the spider. In assembling the valve diaphragm on the spider the extension 53 is thrust through the opening or hole 48 and then is pulled inwardly to cause the stem 52 frictionally to engage within the opening 48. In pulling on the projection 53 and stem 52 their diameters are somewhat decreased so that the stem 52 is readily received in the opening 48. The stem 52 expands in order firmly to secure the valve diaphragm 51 in place against the spider. The annular bead 53 on the edge of the valve diaphragm 51 in seating on the annular rim 46 of the spider assures high valve seating efficiency. The outwardly extending protecting flange 50 on the rim 46 of the spider protects the edges of the valve diaphragm 51 from damage, the edges being received within the protecting flange.

While for purposes of illustration one form of this invention has been disclosed other forms thereof may become apparent to those skilled in the art upon reference to this disclosure and therefore this invention is to be limited only by the scope of the appended claims.

I claim as my invention:

1. A dust respirator comprising a face piece including an exhale valve and a supporting member having an inhale valve, said supporting member being substantially circular and peripherally provided with a screw threaded flange, an annular resilient gasket in the supporting member, filter means including a substantially circular backing member having a substantially cylindrical side wall received within the screw threaded flange of the supporting member, an inner annular flange engaging the resilient gasket for sealing purposes and an outer perforated wall substantially in alignment with the outer edge of the screw threaded flange of the supporting member, and a substantially circular filter pad overlying the outer face of the perforated wall of the backing member, and a screw threaded ring screw threadedly secured to the screw

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threaded flange of the supporting member and having an inwardly extending flange engaging the filter pad adjacent its edge for marginally securing the filter pad against the perforated wall of the backing member whereby the filter pad is interiorly backed by the backing member and exteriorly exposed to the atmosphere for maximum dust removal efficiency.

2. A dust respirator comprising a face piece including an exhale valve and a supporting member having an inhale valve, said supporting member being substantially circular and peripherally provided with a screw threaded flange, an annular resilient gasket in the supporting member, filter means including a substantially circular backing member having a substantially cylindrical side wall received within the screw threaded flange of the supporting member, an inner annular flange engaging the resilient gasket for sealing purposes and an outer perforated wall substantially in alignment with the outer edge of the screw threaded flange of the supporting member and having an outwardly facing annular seat adjacent its edge, and a substantially circular filter pad overlying the outer face and annular seat of the perforated wall of the backing member, and a screw threaded ring screw threadedly secured to the screw threaded flange of the supporting member and having an inwardly extending flange engaging the filter pad adjacent its edge for marginally securing the filter pad against the annular seat of the perforated wall of the backing member whereby the filter pad is marginally sealed and interiorly backed by the backing member and exteriorly exposed to the atmosphere for maximum dust removal efficiency.

3. A respirator for interchangeably receiving a substantially circular dust filter means or a substantially cylindrical fume absorbing cartridge having an annular shoulder intermediate its ends, comprising a face piece including an exhale valve and a supporting member having an inhale valve, said supporting member being substantially circular and peripherally provided with a screw threaded flange for internally receiving the dust filter means or the fume absorbing cartridge, an annular resilient gasket in the supporting member for sealing the dust filter means or the fume absorbing cartridge, and a screw threaded ring of substantially the same depth as the screw threaded flange screw threadedly secured to the screw threaded flange and having an inwardly extending flange for engaging the outer surface of the substantially circular dust filter means or the annular shoulder of the substantially cylindrical fume absorbing cartridge for removably and interchangeably securing the same in the supporting member in sealing relation with the resilient gasket.

4. A dust filter means for a dust respirator having a substantially circular supporting member peripherally provided with a screw threaded flange and an inhale valve, an annular resilient gasket in the supporting member, and a screw threaded ring provided with an inwardly extending flange removably carried by the screw threaded flange, comprising a substantially circular backing member having a substantially cylindrical side wall received within the screw threaded flange of the supporting member, an inner annular flange engaging the resilient gasket for sealing purposes and an outer perforated wall substantially in alignment with the outer edge of the screw threaded flange of the supporting member, and a substantially circular filter pad overlying the outer face of the perforated wall of the backing member and being backed thereby,

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the inner annular flange of the backing member being held in sealing relation with the resilient gasket and the filter pad being exteriorly exposed and held against and backed by the perforated wall of the backing member by the inwardly extending flange of the screw threaded ring engaging the filter pad adjacent its edge when screwed onto the screw threaded flange of the supporting member.

5. A dust filter means for a dust respirator having a substantially circular supporting member peripherally provided with a screw threaded flange and an inhale valve, an annular resilient gasket in the supporting member, and a screw threaded ring provided with an inwardly extending flange removably carried by the screw threaded flange, comprising a substantially circular backing member having a substantially cylindrical side wall received within the screw threaded flange of the supporting member, an inner annular flange engaging the resilient gasket for sealing purposes and an outer perforated wall substantially in alignment with the outer edge of the screw threaded flange of the supporting member and having an outwardly facing annular seat adjacent its edge, and a substantially circular filter pad overlying the outer face and annular seat of the perforated wall of the backing member and being backed thereby, the inner annular flange of the backing member being held in sealing relation with the resilient gasket and the filter pad being exteriorly exposed and held in sealing relation against the annular seat of and backed by the perforated wall of the backing member by the inwardly extending flange of the screw threaded ring engaging the filter pad adjacent its edge when screwed onto the screw threaded flange of the supporting member.

6. In a respirator having a face piece molded from rubber or the like, an exhale valve comprising a spider integrally formed in the face piece and including an annular rim, a central hub having an opening therein and spokes connecting the central hub to the annular rim, and a substantially circular flexible valve diaphragm formed of rubber or the like overlying the outer face of the spider and seating against the annular rim of the spider and having an integrally formed flexible stem frictionally received in the opening in the central hub of the spider for maintaining the same in place thereon, said flexible stem having an integral extension of smaller cross sectional area which is grasped during insertion of the stem into the central hub for stretching the stem to facilitate insertion thereof.

7. In a respirator having a face piece molded from rubber or the like, an exhale valve comprising a spider integrally formed in the face piece and including an annular rim, a central hub having an opening therein and spokes connecting the central hub to the annular rim, and a substantially circular flexible valve diaphragm formed of rubber or the like overlying the outer face of the spider and having a marginal bead seating against the annular rim of the spider and an integrally formed stem frictionally received in the opening in the central hub of the spider for maintaining the same in place thereon.

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