Oct. 14, 1941. C. A. CAMPBELL 2,258,926

AIR FILTER

Filed Jan. 12, 1939

Fig. 1

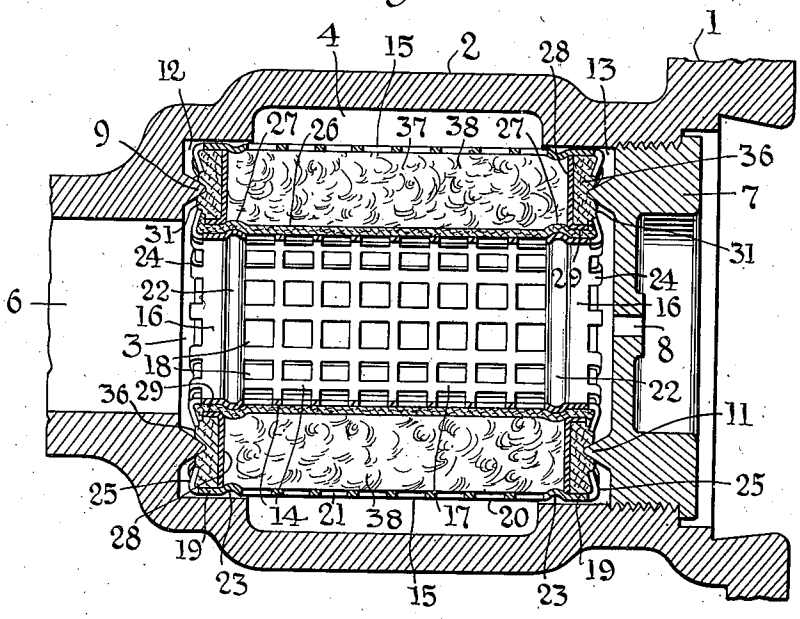


Fig. 2

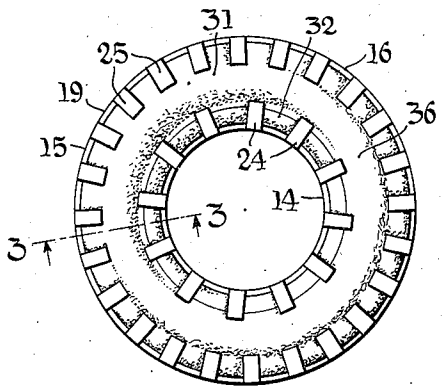
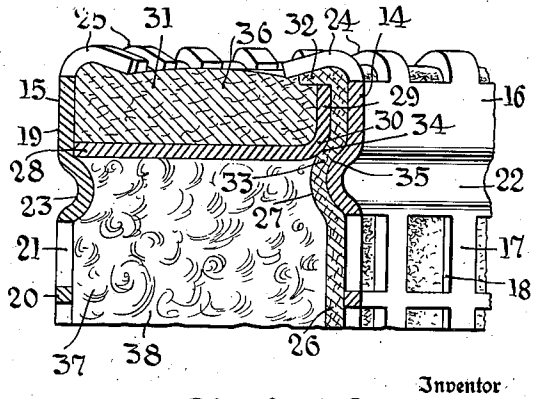


Fig. 3



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2,258,926

AIR FILTER

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6 Claims. (Cl. 183—49)

The present invention relates to air filters, and especially to filters of the type employed to protect the automatic valves of railway air brake systems (for example, triple valves, vent valves, application valves, etc.) from dust, scale and other harmful substances which enter the brake pipe.

A well known example of the type of filtering device to which the present improvements relate, although not limited thereto, is the tubular filter which is mounted in the pipe bracket of the AB freight brake now standard on American railways. This filter unit is interposed between the brake pipe on the one hand, and the piston chambers of the service and emergency portions of the AB triple valve on the other, so as to filter the air passing to the latter from the brake pipe.

The present standard form of the above-mentioned filter comprises inner and outer, foraminous, tubular retaining or shell members of metal, and a wool-fabric filter covering wrapped around the inner tubular member. Between the fabric covering and the outer foraminous tubular member is packed a mass of curled hair for the purpose of filtering out coarse foreign substances from the air and also preventing direct impingement of foreign substances against the fabric cover on the inner tube. The filter unit is also provided, at each end, with an annular felt washer which is located between the tubular shell members and rests against the mass of curled hair, the washer being held in place by annular series of bent-over lugs on the ends of the inner and outer tubular retaining members.

When the above-described filter unit or assembly is in place in its chamber in the pipe bracket of the AB brake, the unit is clamped between a pair of opposed, narrow, annular sealing ribs, of V-shaped transverse-sectional form, provided on the bracket structure, these annular ribs engaging the pair of felt end washers on the filter unit to form tight seals therewith, so that all air flowing from the brake pipe to the AB valve will pass through the curled hair, the filter fabric and the felt end washers. It has been found in practice, however, that, due to the resilient nature of the curled hair pack which supports the felt end washers, these washers in a short time are forced inwardly towards each other by the clamping pressure to such an extent that the inner edges of the annular felt end washers are drawn away from the inner tubular member. This permits foreign substances in the brake pipe air to short-circuit between the felt end washers and the inner fabric-covered tubular member, whereupon they pass to the valve mechanism.

A further serious objection to the above method of supporting the felt end washers is that, once the curled hair pack takes a permanent set, the end washers become distorted to such an extent that, when the filter unit is removed for cleaning and then re-applied to the valve bracket chamber or recess, imperfect end sealing is invariably encountered. As a result, leakage of unfiltered air occurs between the end washers and the annular sealing ribs on the bracket.

The present invention provides a filter unit construction of the above type which completely overcomes the defects mentioned and insures against leakage of unfiltered or incompletely filtered air around or through the filter unit even under the most severe operating conditions. In general, this is accomplished by incorporating rigid means in the filter structure which serve to adequately support and retain the felt end washers in place independently of the curled hair pack, or other filtering medium used for the purpose. This permits the curled hair pack to be made of any desired resilience without affecting the air-tight end seals between the washers and the sealing ribs on the pipe bracket, and the same is true even though the hair pack be completely destroyed or lose its resilience. A further feature of the improved construction is the direct coaction of the washer supporting means with the fabric-covered, inner retainer tube to prevent all possibility of passage of unfiltered or incompletely filtered air between the end washers and the fabric covered tube, and thence into the valve parts.

The improved construction also provides a much more rigid filter unit, whereby likelihood of distortion thereof is minimized and proper functioning of the various parts, when the unit is in use, is assured.

The practical embodiment of the invention illustrated in the accompanying drawing will be described as used in conjunction with the AB brake valve.

Figure 1 is a fragmentary section through the pipe bracket of the AB brake valve, the section being taken on the longitudinal axis of the filter unit chamber or recess characteristic of this bracket structure. The improved filter unit is shown, in longitudinal axial section, clamped in place in its chamber in the pipe bracket.

Fig. 2 is an end view of the filter cartridge or unit removed from the pipe bracket.

Fig. 3 is an enlarged fragmentary section taken on line 3—3 of Fig. 2.

In Fig. 1 of the drawing, 1 indicates a part of the AB pipe bracket. This has a generally cylindrical casing portion 2 providing a chamber or recess 3 in which the improved filter unit is shown clamped in operative position. The annular space 4 surrounding the filter unit communicates directly with the brake pipe.

Passage 6, opening into one end of chamber 3, leads to the piston chamber of the service portion of the AB valve. The opposite end of chamber 3 is closed by an adjustable and removable plug 7 threaded into the bracket. Small port 8 in this plug offers communication with the piston chamber of the emergency portion of the valve. A narrow, annular sealing rib or bead 9, V-shaped in transverse section, is provided at the inner end of chamber 3 and a similar rib 11 is formed on plug 7. The extremities of the filter cartridge, which is clamped between and has its ends sealed by annular ribs 9 and 11 as a result of adjustment of plug 7, are located in the reduced end portions 12, 13 of chamber 3.

The improved filter cartridge, which is of the same construction at each end, is of cylindrical form and comprises inner and outer, foraminated, tubular retaining or shell members 14, 15, respectively, each preferably formed of brass tubing. These tubular retaining members 14, 15, which are of the same length, are arranged concentrically one within the other to provide space therebetween for the reception of air straining material. Inner retainer member or core 14 is formed at its opposite ends with short, annular, imperforate webs 16 which are connected together by an extended annular foraminated portion 17 having perforations 18 therein. The outer retainer member or casing 15 is similarly constructed with imperforate, annular end webs 19 and an extended foraminated central portion 20 having perforations 21.

Each end web 16 of the inner retainer or core member 15 is formed, as by rolling, with an annular external rib 22 which is outwardly-curved in transverse section. A similar internal annular rib 23 is provided on each end web 19 of the outer retainer or body member 15. Each annular rib 23 is disposed somewhat out of transverse alinement with the corresponding annular rib 22 on inner retainer 14, rib 23 being offset slightly with reference to rib 22 lengthwise of the filter unit and towards the middle thereof. As best shown in Fig. 2, each end of inner retainer member 14 is formed with an annular series of bent-over lugs 24, and the ends of outer retainer member 15 are provided with similar lugs 25.

Closely encircling inner retaining member 14 and covering the openings 18 therein is a sleeve 26 of porous material, preferably wool fabric, such as felt. Felt covering 26 extends at each end so as to cover the imperforate end web 16 on core member 14 and partially overlap end lugs 24 (see Fig. 3 particularly). Thus there is formed near each end of cover 26 an annular rib 27 which surrounds and closely conforms to rib 22 on core member 14.

Located between inner and outer retainer members 14 and 15, at each end thereof, is a substantially rigid, metal annulus or thrust member 28 having a flat, disk-shaped body portion and a cylindrical hub portion 29 projecting outwardly from the rim of the central opening in the annulus. The outer rim of thrust member 28 seats on the annular supporting ledge formed by rib 23 on outer retainer member 15. Hub or inner rim portion 29 of the thrust member, which has an internal diameter preferably slightly less than the external diameter of annular rib 22 on inner retainer 14, fits snugly around the felt-covered, end web portion 16 of the retainer member. Hub 29 is connected to the body portion of the thrust member by an annular, transversely-curved or flared portion 30 and the latter seats on rib 27 of felt cover 26 which is supported in turn by rib 22 on inner retainer 14.

Each thrust member 28 carries a thick annular felt sealing washer 31 which fills the space between outer retainer 15 and hub 29 of the thrust member. Felt sleeve 26 at each end is flared outwardly to form an annular flange 32 engaging the outer end of hub 29 and the outer face of washer 31. Bent-over lugs 24 and 25, on inner and outer retainer members 14 and 15, retain felt washer 31 in place and, by their compression of the washer and flange 32 of felt sleeve 26, tightly force thrust member 28 against both annular rib 23 on the outer retainer, and the annular seat formed by rib 22 on the inner retainer and the interposed annular portion 33 of the felt sleeve. Thus the flared inner rim portion 30 of thrust member 28 provides an annular tapered surface 34 which surrounds and coacts with the annular tapered surface 35 on rib 22 to tightly wedge or clamp and compress the annular portion 33 of the felt sleeve therebetween. This forms an effective annular seal at this point.

Lugs 24 not only secure the end of the felt sleeve against the end of hub 29, but in so doing effect an annular seal between the felt flange 32 and the hub end. The annular space between the ends of the inner series of lugs 24 and the outer series of lugs 25 provides an annular free portion 36 on each washer 31. These annular portions 36, 36 of the washers are clamped in tight sealing engagement with annular pipe bracket ribs 9 and 11 and the opposed thrust members 28, 28, as appears clearly in Fig. 1.

The annular space 37 between felt sleeve 26 and outer shell 15 is packed with curled hair 38, or any other suitable straining medium, the curled hair being confined at the ends of the unit by thrust members 28, 28.

In assembling the filter unit described, the first operation is to place the cylindrical felt sleeve 26 on the inner retainer tube 14. At this time the lugs 24 at each end of tube 14 are not yet bent over but are in their original straight form extending axially from the ends of retainer 14. After felt sleeve 26 is in place, the end of the sleeve is held against the annular series of straight lugs 24 at one end of tube 14 and a thrust member 28 slipped over the felt covered end of the tube. After tightly pressing thrust member 28 against the annular portion 33 of felt sleeve 26 and its annular supporting rib 22 on the inner retainer, a pair of diametrically-opposed lugs 24 is bent over the end of hub 29 of the thrust member. In so doing, the end of felt sleeve 26 is flared outwardly to form the flange 32 abutting against the end of hub 29, and thrust member 28 is firmly secured in place on retainer member 14.

The above assembly is then inserted as a unit into one end of the outer retainer member 15, the lugs 25 of which are straight at this time, until the rim of thrust member 28 engages an-

nular rib 23 on outer retainer member 15. Following this, washer 31 is inserted in place and then the remaining lugs 24 and all of the lugs 25 are bent over to clamp the parts firmly together at one end of the assembly.

The assembled end of the filter is now placed downward and the annular space 37 between outer retainer member 15 and felt-covered inner retainer member 14 packed with the mass of curled hair 38. After this, the other thrust member 28 is slipped over the opposite end of felt-covered inner retainer 14 and a washer 31 placed on the thrust member. When this thrust member has been tightly pressed inwardly against annular rib 23 on the outer retainer 15, and against annular portion 33 of felt sleeve 26 and its supporting rib 22 on inner retainer 14, the lugs 24 and 25 are bent over to firmly clamp all of the parts together at this end of the unit.

The improved filter unit, when inserted and clamped in place in the air brake pipe bracket as shown in Fig. 1, provides a filtering device which completely precludes entrance of abrasive dust into the brake valve parts from the brake pipe under all conditions encountered in operation. Compressed air entering annular space 4 from the brake pipe, in order to reach passage 6 and port 8 leading to the valve parts, must pass first through the foraminous outer retainer member 15, curled hair pack 38, felt sleeve 26 and foraminous inner retainer member 14. The completely filtered air, from which all dust has been removed by curled hair 38 and felt sleeve 26, then flows from the interior of inner retainer member 14 to the valve parts.

The filter cartridge presents a rugged, unitary structure which is quite rigid and therefore not easily distorted so as to interfere with its proper functioning in use. Each thrust member 28 forms a rigid element which is rigidly mounted in the end of the unit so as to fully support its felt washer 31 entirely independently of the curled hair pack 38. Consequently, the degree of resilience of the hair pack or the absence of such resilience, or even the complete destruction of the hair pack, will have no effect upon air-tight sealing of end washers 31, 31 with annular ribs 9, 11 and thrust members 28, 28. Each thrust member 28 provides a flat, rigid annular surface which always supports its washer 31 in its normal flat condition and thus prevents distortion or displacement thereof in use. Therefore, even after the unit has been removed for cleaning and is replaced again, there is always complete annular sealing engagement between end washers 31, 31, annular bracket ribs 9, 11, and thrust members 28, 28. This prevents all possibility of unfiltered or incompletely filtered air leaking between the end washers and sealing ribs 9 and 11, or between the washers and thrust members 28, 28, and then flowing to the valve parts.

Leakage of unfiltered or incompletely filtered air between the ends of fabric sleeve 26 and felt end washers 31, 31, even though the curled hair body 38 be completely destroyed, is positively prevented at each end of the filter by the annular seal formed between the fabric sleeve and the inner rim of the thrust member 28 by the direct coaction of these parts with the rib 22 on inner retainer 14, as already described. In this connection it is important to note that the greater the end thrust applied to felt end washers 31, 31, by annular bracket ribs 9, 11 in clamping the filter unit in place, the greater will be the pressure exerted by each thrust member 28 to clamp annular portion 33 of the fabric sleeve against rib 22, thus insuring maintenance of the annular seal at this point at all times. Further guarantee against leakage around the ends of fabric sleeve 26 and of maintenance of the sleeve ends in place on inner retainer 14 is afforded by the clamping and sealing of each end flange 32 of the fabric sleeve against the end of the hub of the thrust member 28 by lugs 24.

What is claimed is:

1. In a filter unit, the combination of a foraminous tubular body member; a foraminous tubular core member arranged within said body member in spaced relation thereto, said body member being provided with an internal projection spaced inwardly of one end of the unit and said core member being formed with an annular external rib also spaced inwardly of said end of the unit; a porous fabric sleeve on the core member covering the openings therein; a rigid annular thrust member arranged between the body and core members with its outer rim bearing on said projection on the body member and the sleeve tightly clamped between the inner rim of the thrust member and the rib on the core member; an annular washer between the body and core members and engaging the outer face of the thrust member; and bent-over lugs on the adjoining ends of the body and core members for clamping said parts in assembled and sealed relation.

2. In a filter unit, the combination of a foraminous tubular body member; a foraminous tubular core member located within said body member in spaced relation thereto, said members at one end of the unit being provided inwardly thereof and between the members with a pair of opposed annular ribs; a porous fabric sleeve mounted on said core member and covering the openings therein, said sleeve having an annular end flange; a rigid annular thrust member located between said members with its outer rim engaging the rib on the body member and the sleeve tightly clamped between the inner rim of the thrust member and the rib on the core member; an annular washer between the body and core members and engaging the outer face of the thrust member, said thrust member having an outwardly extending hub with its outer end sealing with said sleeve flange; and bent-over lugs on the adjoining ends of the body and core members for clamping said parts in assembled and sealed relation.

3. The combination in a filter of a foraminous tubular shell member; a sleeve of pervious material mounted on the shell member and covering the openings therein; a rigid annular thrust member rigidly mounted on the sleeve on each end of the shell member and having annular sealing engagement between its inner rim and said sleeve, each of said thrust members including a disk-like washer-receiving portion; a compressible washer sealing against the outer face of each of said thrust members and means for clamping said parts in assembled and sealed relation.

4. The combination in a filter of a foraminous tubular shell member having an annular external enlargement near one end thereof; a sleeve of pervious material mounted on the shell member and covering the openings therein and also said enlargement; a rigid annular thrust member rigidly mounted on said sleeve on said end of the shell member with the sleeve clamped

between annular coacting surfaces on the inner rim of said thrust member and said annular enlargement on the shell member whereby to provide a tight annular seal between the sleeve and the thrust member, said thrust having a disk-like washer-receiving portion; a compressible annular washer sealed against the outer face of the thrust member and means for clamping said parts in assembled and sealed relation.

5. The combination as claimed in claim 4 further characterized in that at least one of said annular coacting sleeve-clamping surfaces on said inner rim of the thrust member and said annular enlargement on the shell member is tapered, whereby to insure tight gripping of the sleeve between said surfaces and an annular seal between the thrust member and the sleeve.

6. The combination in a filter unit of a foraminous tubular body member; a foraminous tubular core member located within said body member in spaced relation thereto; annular washers of compressible material secured between said body and core members at the ends thereof; and separate rigid means, located between said members at each end thereof and each fixedly secured independently of the other to at least one of said members, for supporting said annular end washers against inward movement towards each other.

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