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COMBINED BACK FIRE TRAP AND AIR
CLEANER FOR INTERNAL COMBUSTION
ENGINES

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7 Claims. (Cl. 123—142)

This invention has for its object a particularly simple, economical and efficient back fire trap construction for internal combustion engines and in addition a combined back fire trap and air cleaner wherein the back fire feature in addition to preventing back fire also gives a whirling motion to the incoming air so that solid particles are thrown out by the centrifugal force of the whirling air and trapped by the air cleaning means.

The invention consists in the novel features and in the combinations and constructions herein-after set forth and claimed.

In describing this invention, reference is had to the accompanying drawing in which like characters designate corresponding parts in all the views.

Figure 1 is a longitudinal sectional view, partly in elevation, of a combined air cleaner and back fire trap for internal combustion engines.

Figure 2 is a face view looking to the left in Figure 1, the greater part of the inlet wall being broken away and also the end of the intake pipe of the carburetor shown in Figure 1 being omitted.

Figure 3 is a longitudinal sectional view similar to Figure 1 of a slightly different form of this combined air cleaner and back fire trap.

Figures 4 and 5 are respectively fragmentary plan views of the corrugated and plain strips forming the inlet wall of this combined fire trap and air cleaner.

This combined fire trap and air cleaner comprises generally a casing preferably cylindrical in general form having an air inlet and an air outlet arranged concentric with the axis of the casing, the inlet of the casing being provided with a wall provided with inclined passages arranged in layers, the inclination of the passages being in general in a tangential direction in order to set up a whirling motion to the incoming air and the casing being provided with means for trapping solid particles as dust thrown centrifugally out during the whirling of the air created by the inclined passages.

1 designates the cylindrical casing having an inlet 2 and an outlet 3. In Figure 1, these are shown as arranged concentric with each other. The outlet is connected to the intake pipe 4 of the carburetor of an engine. The inlet 2 is provided with a wall formed with the inclined passages which give a swirling motion to the air. This wall is composed of alternate layers of plain and corrugated strips 5, 6 which are wound up together, and although the winding causes the strips to take a slightly spiral course, nevertheless the inclined air passages 7 are arranged substan-

tially concentric relatively to the axis of the casing 1. The corrugations of the strip 6 extend on a bias relatively to the edges of the strip and are preferably arranged at about an angle of forty-five degrees and all the corrugations are inclined in the same direction which is in a tangential direction in order to give a whirling motion to the air being thrown through the passages formed by the corrugated strips 6 and the plain strips 5.

The means for trapping solid particles as dust in the air current is here shown as a centrifugal chamber 8 and an outlet 8^b into a receptacle 9, the passages 8^b being arranged with shield portions which project into the whirling air stream to catch the dust particles carried thereby. The chamber 8 is formed with central deflector walls 11 which guide the air issuing from the inlet 2 into the outlet opening and which are streamlined to change the direction of the air flow with a minimum amount of velocity loss due to skin friction and eddy currents. The inlet end of the outlet 3 is flared outward at 10 and serves the purpose of directing the whirling air to a position advantageously situated for efficient separation of the dust particles from the air and also functions to increase the velocity of the cleaned air as it passes toward the exit of the outlet.

The inlet end of the outlet 3 is substantially funnel-shaped along a cross section on its longitudinal axis. More specifically the walls of the outlet taper from the inlet end thereof inwardly at a gradually decreasing rate to the exit portion of the outlet. The general flared external contour of the outlet serves to direct the air issuing from the inlet around the flared end of the outlet member, along a path most advantageous for efficient separation of the dust particles from the air. The specific shape of the flared end of the outlet member serves to increase the velocity of the air passing through the outlet.

The dust receptacle 9 is a cap fitting over the rear end of the casing 1 and removably secured in position in any suitable manner as by a wing nut 12 threading on a stud 13.

Means is preferably provided for restraining the whirling motion of the air after the air passes through the separating chamber 8. This means is here shown as one or more baffle plates 14 extending lengthwise of the outlet 3 substantially diametrically of the baffle plate having a twist therein at the entrance end of the outlet in the same direction as the whirling motion of the air. The twist provides the deflector portion 15 at the entrance end of the outlet passage.

The operation of the device illustrated in Figure

1 will now be briefly described to clearly define the exact function of the various parts. With the device functioning normally, air is drawn in through the inlet 2 and in the course of the progress through the inclined passages 6 receives a velocity component tangential to the normal direction of flow. As the air issues from the exit end of passages 6 it is directed along a converging path which includes the walls of the casing 1 and the flared inlet end of the outlet member. The convergence of the path in this region of the air path serves to increase the velocity of the air as it passes beyond the inlet end of the outlet member to chamber 8 and increased velocity at this point is very desirable since it results in an increase in the velocity of the dust particles carried by the air, thereby increasing the efficiency of the cleaning action explained herein-after. The flared end of the outlet also functions to direct the air stream against the walls of the casing with the result that the relatively heavy dust particles impinge on the surface of the walls and cling to the surface thereof. At the same time the whirling action of the air carries the dust particles around the surface of the walls until they encounter the shield portions of the openings 8^a which guide the particles into the dust collecting chamber 9. It will be readily understood that with normal operation of the device a pressure is created in chamber 9 which substantially precludes the passage of air from the separating chamber to the dust collecting chamber. The stream of cleansed air is guided into the outlet opening by the stream lined portion 10 of the casing and as previously explained, the velocity of the air is increased as it passes toward the exit of the outlet, due to the particular contour of the flared portion of the outlet. The function of the baffle plates 14 was noted in the preceding paragraph. It will be apparent from the above description of the operation that the air passage converges steadily from the inlet exit to the outlet exit and that such convergence serves to increase the velocity which means the volume of air passed in a unit of time with a given size of unit is much greater than would be obtainable if a different structure were used.

In Figure 3 is shown another form of this combined back fire trap and air cleaner in which the air inlet opening 2^a is arranged at one end of the casing 1^a and the outlet 3^a is in axial alinement therewith at the other end of the casing.

In Figure 3, 9^a designates the dust receptacle, 7^a the separating chamber, 8^a the openings leading from the separating chamber. The strips 5 and 6 are comparatively wide and thin so as to present a large cooling surface to the back fire sufficiently to cool the back fire gases below the ignition point or other ignitable substances and gases that may be around internal combustion engines, particularly boat engines, as will be understood by those skilled in the art. These strips 5, 6 are kept cool by the incoming air. When a back fire occurs, the hot back fire gases must pass through or between the strips 5, 6 and in so doing are cooled below dangerous ignition point. The inclined corrugations also offer an obstruction to the outlet of back fire gases causing the gases to come against the cold corrugations.

What I claim is:

1. In an air intake and back fire trap for internal combustion engines, the combination of a casing having an inlet, and an outlet arranged concentric with the axis of the casing, the outlet

being less diameter than the inlet, the inlet being formed throughout its area with passages, the walls of which provide heat exchanging surfaces for cooling back fire gases, said passages being inclined to give a whirling action in one direction to the incoming air, a curved deflector wall arranged opposite to the inlet and arranged to deflect the incoming currents inwardly toward the center of the casing and into the outlet, said deflector wall following stream lines, whereby the currents converge venturi fashion from the outer wall of the casing inwardly into the outlet, the deflector having openings therethrough for separating dust from the air, a closed dust collector communicating with said openings, said outlet being of less diameter than the intake.

2. In a combined air cleaner and backfire trap for internal combustion engines, an inlet member including spaced heat exchange walls defining a plurality of narrow passages set at an angle for imparting a whirling action to the incoming air, stream-lined walls defining a passage for conducting said incoming air to an outlet of smaller cross sectional area than said inlet member, dust openings in said stream-lined walls and a dust collecting chamber in communication with said openings.

3. In a combined air cleaner and backfire trap for internal combustion engines, an inlet member including spaced heat exchange walls defining a plurality of narrow passages set at an angle for imparting a whirling action to the incoming air, stream-lined walls defining a passage for conducting said incoming air to an outlet of smaller cross sectional area than said inlet member, the curvature of said walls being a maximum where the air velocity is the lowest and flattening out as the air velocity increases, dust openings in said stream-lined walls and a dust collecting chamber in communication with said openings.

4. In a combined air cleaner and backfire trap for internal combustion engines, an annular inlet member including spaced heat exchange walls defining a plurality of narrow passages set at an angle for imparting a whirling action to the incoming air, a substantially funnel shaped outlet member encircled at its throat by said annular inlet member and having curved walls which taper inwardly along stream-lines to the outlet, a casing attached to said inlet member and enclosing the flared end of said outlet member, said casing also having stream-lined walls disposed opposite the outlet member and the inlet member whereby air coming through said inlet member is conducted into said outlet member, a dust cap attached to said casing and defining a dust collecting chamber therewith, and dust openings in said casing walls communicating with said chamber.

5. In a combined air cleaner and backfire trap for internal combustion engines, an annular inlet member including spaced heat exchange walls defining a plurality of narrow passages set at an angle for imparting a whirling action to the incoming air, a substantially funnel shaped outlet member encircled at its throat by said annular inlet member and having curved walls which taper inwardly at a gradually decreasing rate to the outlet, a casing attached to said inlet member and enclosing the flared end of said outlet member, said casing having stream-lined walls disposed opposite the outlet member and the inlet member whereby air coming through said inlet member is conducted into said outlet member, the curvature of said stream-lined walls being

a maximum where the air velocity is the lowest and flattening out as the air velocity increases, a dust cap attached to said casing and defining a dust collecting chamber therewith and dust openings in said casing walls communicating with said chamber.

5 6. In a combined air cleaner and backfire trap for internal combustion engines, having a passage therethrough which is substantially larger in cross sectional area at its intake end than at its outlet end, means in said intake end for cooling the backfire gases including a plurality of narrow inclined passages for imparting a whirling action to incoming air, said passage having walls which taper inwardly at a gradually increasing rate toward the central portion thereof and at a gradually decreasing rate from the cen-

tral portion to the outlet, said tapering walls having dust openings therein and a dust collecting chamber in communication with said openings.

7. In a combined air cleaner and backfire trap for internal combustion engines, a substantially funnel shaped member having means located in the large end thereof for cooling the backfire gases including a plurality of narrow inclined passages for imparting a whirling action to incoming air, said funnel-shaped member having walls tapering along a reverse curve whereby the passage therethrough is stream-lined, said tapering walls having dust openings therein and a dust collecting chamber in communication with said openings.

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