July 30, 1968 C. R. ACKER 3,394,645

COOLING BAFFLE AND TAMPER SHIELD FOR UNDERGROUND TRANSFORMER VAULTS

Filed March 27, 1967

Fig. 1

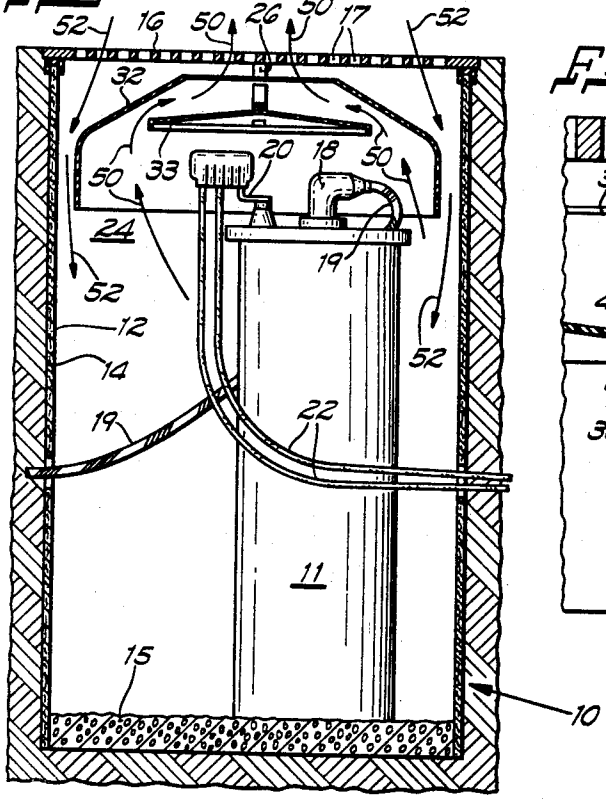


Fig. 5

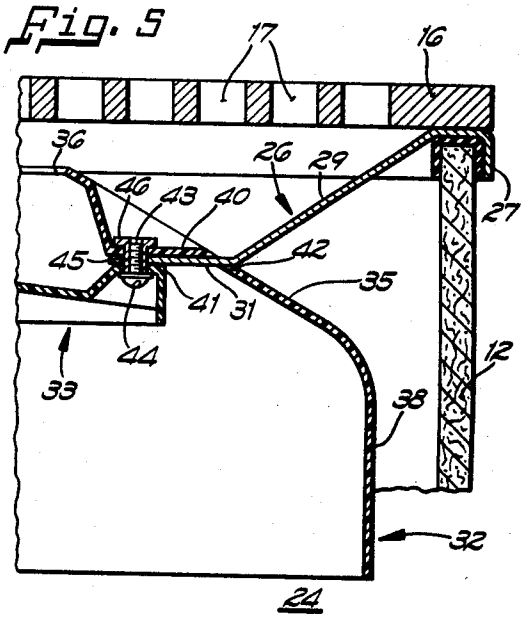


Fig. 2

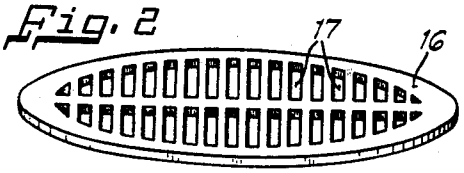


Fig. 4

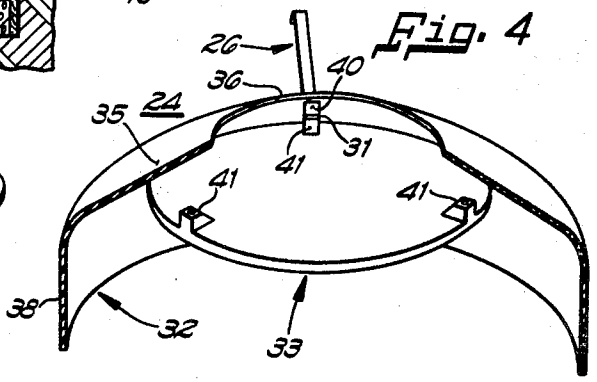
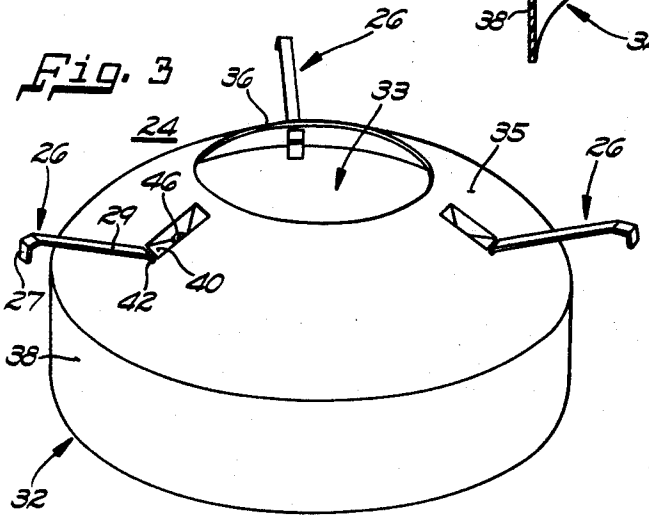


Fig. 3



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COOLING BAFFLE AND TAMPER SHIELD FOR UNDERGROUND TRANSFORMER VAULTS

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ABSTRACT OF THE DISCLOSURE

A below-ground level vault for a transformer and having a vertical side wall portion, a cover grate and a baffle assembly disposed adjacent the upper end of the vault and including an outer, open-ended, truncated conical member and a second member spaced from and disposed within the first member. The outer member separates and directs heated air discharging from the vault and cool incoming air, and the second member acts as a tamper shield and coacts with the first member for directing heated air away from the incoming cooling air.

Background of the invention

This invention relates to vaults for housing electrical apparatus, such as transformers, and which are disposed wholly or partially below ground level, and more particularly to a baffle assembly for ventilation and safety.

Vaults disposed below ground level for housing transformers should be vented if the transformer is to be operated at its rated value. Simple grate-type covers are not satisfactory, however, because they expose high voltage portions of the transformer and do not properly separate the cool incoming air from the heated air discharging from the vault.

One type of prior art underground transformer ventilation system includes inlet pipes which open at their upper end into the ambient and at their other end to the lower end of the vault. In addition, discharge openings are disposed above the upper end of the transformer. This type of installation was not found to be wholly satisfactory, because it tends to cause an inordinately high transformer top oil temperature when the transformer is operated under overload or high thermal conditions.

Summary of the invention

In general terms, the invention comprises an enclosure having a vented upper end and side walls for enclosing electrical apparatus and a baffle assembly disposed between the upper end of the enclosure and the electrical apparatus for intercepting all straight line paths therebetween, wherein the baffle assembly is constructed and arranged to intercept heated air from the electrical apparatus and to direct the same toward a central portion of the vented upper end and for intercepting cooling air entering the enclosure through the vented upper end and to direct the same toward the side walls of the enclosure.

Brief description of the drawings

FIG. 1 is a side elevational view, with parts broken away, of a transformer vault incorporating the shield assembly according to the instant invention;

FIG. 2 is a perspective view illustrating the vault cover;

FIG. 3 is a perspective view illustrating the shield assembly;

FIG. 4 is a perspective view, with parts broken away, of the shield illustrated in FIG. 3; and

FIG. 5 is an enlarged fragmentary view illustrating how the shield assembly of FIGS. 2 and 3 is mounted in the vault illustrated in FIG. 1.

Description of the preferred embodiment

FIG. 1 shows a vault **10** disposed below ground level and for enclosing a transformer **11**. The vault **10** may include a generally tubular, open-ended housing member **12**, which is composed of any suitable material, such as bituminous fiber, and which is disposed in a prepared excavated opening **14**. The floor of the vault **10** may be covered with gravel **15** for supporting the transformer **11** and to promote drainage.

A grate **16**, or other suitably vented member, covers the exposed upper end of the vault to provide ventilation and prevent tampering. The grate **16** is shown in FIG. 2 to have a large plurality of closely spaced openings **17** to permit the free flow of air into the vault **10**.

The transformer **11** may be of any conventional type and may, for example, have a high voltage bushing **18** connected to a primary conductor **19** and low voltage bushings **20** which are connected to secondary conductors **22**. A baffle assembly **24** is mounted adjacent the upper end of the vault **12** and above the transformer **11** for separating and directing the incoming cooling air and the heated discharge air and to prevent tampering with the transformer **11**.

The shield assembly **24** is mounted at the upper end of the housing **12** by means of a plurality of elongate strap members **26** whose opposite ends engage the housing **12** and the assembly **24**. More specifically, each of the strap members **26** may be bent at one end to form support hooks **27** for engaging the upper edge of the housing **12**. In addition, each of the strap members **26** may also include a central portion **29** which extends downwardly and inwardly toward the center of the housing **12** and terminates at their inner ends in a generally horizontally extending portion **31** for engaging the shield assembly **24**.

The shield assembly **24** is shown in FIGS. 1, 3 and 4 to include a hollow, inverted, generally bowl-shaped outer shield member **32** and a generally more shallow inner shield member **33** which is disposed within and spaced from the outer member **32**. The assembly **24** is generally symmetrical about a vertical axis and is supported by the strap members **26** in a generally concentric relation relative to the longitudinal axis of the housing **12**.

The outer shield member **32** includes a generally frustoconical upper portion **35** which has an enlarged central opening **36**. In addition, a generally cylindrical skirt portion **38** extends downwardly from the upper portion **35** and in general parallelism with the housing member **12**. The opening **36** is disposed directly below and has a diameter substantially smaller than that of the grate **16**. The upper portion **35** of shield member **32** slopes downwardly and outwardly toward the housing **12** with the skirt portion **38** having a diameter smaller than that of said housing **12**.

The second shield member **33** is spaced from the upper member **32** and disposed directly below the opening **36**. The diameter of the second shield member **33** is between that of the opening **36** and the skirt portion **38**.

Each of the shield members **32** and **33** may have a plurality of spaced apart embossments **40** and **41**, respectively, which extend toward the other and are in substantial registry for embracing the opposite sides of the strap portion **31**. Toward this end member **32** has a small slot **42** formed adjacent each embossment **40** to permit the strap members **26** to pass therethrough.

In addition, the shield members **32** and **33** may be secured to tbe strap members **26** and each other in any suitable manner to provide a unitary assembly. In the illustrated embodiment, for example, this is achieved by a screw **43** whose head **44** engages the inner shield **33** and an internally threaded metallic sleeve member **45** which is threadably engaged by the screw **43** and which

has a head portion **46** for engaging the upper shield member **32**.

As those skilled in the art will appreciate, the shield members **32** and **33** may be formed of any suitable electrical insulating material, such as, for example, polyvinyl chloride.

Referring again to FIG. 1, it can be seen that the heated air rising from the transformer **11** and represented by the arrows **50** will be forced by the inner shield **33** to move outwardly toward the outer shield **32**. The heated air **50** is then intercepted by the outer shield **32** and directed along the conical portion **35** and through the gap between the shields **32** and **33** and toward the central opening **36**. In this manner the shields **32** and **33** direct the heated air rising from the transformer **11** toward the central portion of the grate **16**. Simultaneously, cool outside air, represented by the arrows **52**, is drawn into the vault **10** along the outside portion of the grate **16** and is intercepted by the upper surface of the outer shield **32** and is directed outwardly and downwardly through the gap between the skirt portion **38** and the housing **12**.

It can be seen, therefore, that the outer shield separates the heated discharging air **50** and the cooling incoming air **52** and directs the same into a turbulence-free path around the transformer **11**. The configuration of the shields **32** and **33** insures that this air flow will be accomplished with a minimum of turbulence.

In addition, the shield assembly **24** prevents inadvertent or deliberate contact with the transformer **11** or the energized conductors or connectors within the vault **12**. This is accomplished without the introduction of air turbulence between the heated discharge air and the cooler incoming air, as in the case of conventional louvered-type baffles.

It has been found that the baffle configuration of the preferred embodiment of the invention yields a significantly lower transformer top oil temperature than is yielded by the same vault and grate configuration taken alone, as well as various types of louvered covers, baffles and conduits.

While only the preferred embodiment of the invention has been shown and described, and while the invention has been illustrated with respect to a single vault configuration, it is not intended to be limited thereby, but only by the scope of the appended claims.

I claim:

1. In combination, an enclosure including side walls and a cover at its upper end having a plurality of spaced perforations formed therein, electrical apparatus disposed within said enclosure, a baffle assembly disposed between the upper end of said enclosure and said electrical apparatus for intercepting all straight line paths therebetween, said baffle assembly having upper and lower surfaces and being located above said electrical apparatus wherein its lower surface intercepts heated air rising from said electrical apparatus and its upper surface intercepts cooling air entering said enclosure through said cover, said baffle being contoured to direct the heated air upwardly and inwardly toward a central portion of said apertured cover and said cooling air downwardly and outwardly toward the side walls of said enclosure, whereby the heated discharged air will not be recirculated through said enclosure.

2. The combination set forth in claim **1** wherein said baffle assembly includes an outer shield member for intercepting heated air from said electrical apparatus and directing the same toward a central portion of said vented upper end and for intercepting cooling air entering said enclosure through said vented upper end and directing the same toward the side walls of said enclosure and an inner shield member spaced from said outer member and disposed between said vented upper end and said electrical apparatus.

3. The combination set forth in claim **2** wherein said electrical apparatus is inductive and wherein said vented upper end comprises a cover having a plurality of spaced openings formed therein, said baffle assembly being disposed below the upper end of said enclosure and above said inductive apparatus, said outer shield member having a wall portion sloping generally inwardly and upwardly relative to said enclosure and terminating in an aperture disposed below said cover.

4. The assembly set forth in claim **3** wherein said inner shield member is larger than said aperture and smaller than the adjacent portions of said sloping wall portion.

5. The assembly set forth in claim **3** wherein said wall portion has a generally frusto-conical configuration wherein its smaller diameter end is disposed adjacent said cover and defines the margin of said aperture.

6. The assembly set forth in claim **3** wherein said outer shield member includes a skirt portion extending downwardly from the lower end of said sloping wall portion.

7. The assembly set forth in claim **3** and including a plurality of support members having one end engaging the upper end of said enclosure and their other ends engaging said baffle assembly.

8. The combination set forth in claim **3** wherein said enclosure has a substantial cylindrical side wall portion, said baffle assembly is substantially symmetrical about the vertical axis of said enclosure.

9. The assembly set forth in claim **5** wherein said inner shield member is larger than said aperture and smaller than the large diameter end of said wall portion, said inner shield member also having substantially conical configuration which has a shallower slope than said inclined wall portion.

10. The assembly set forth in claim **9** wherein said outer shield includes a skirt portion extending downwardly from the large diameter end of said wall portion.

11. The combination set forth in claim **10** wherein said enclosure has a substantial cylindrical side wall portion, said baffle assembly being substantially symmetrical about the vertical axis of said enclosure.

12. The assembly set forth in claim **11** and including a plurality of support members having one end engaging the upper end of said enclosure and their other ends engaging said baffle assembly.

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ROBERT A. O'LEARY, *Primary Examiner.*