

April 9, 1963

R. E. ONSTAD
AIR CONDITIONING SYSTEM

3,084,609

Filed July 25, 1960

3 Sheets-Sheet 1

FIG. 1.

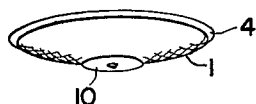


FIG. 9.

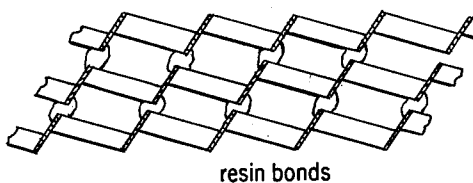


FIG. 2.

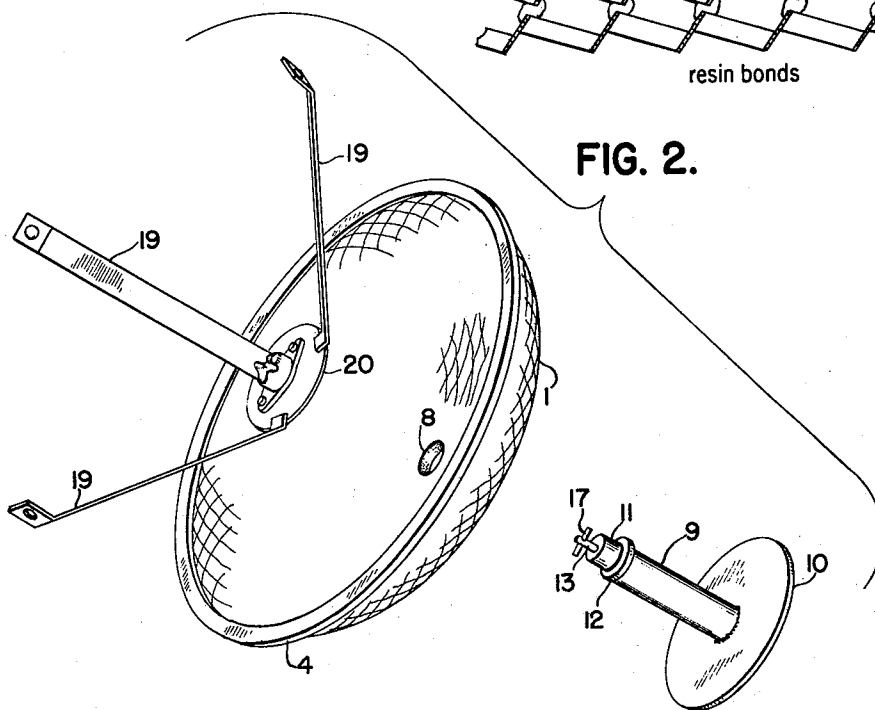
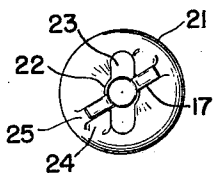


FIG. 3.



INVENTOR.
RAGNAR E. ONSTAD
BY
ANDRUS & STARKE
Attorneys

R. E. ONSTAD
AIR CONDITIONING SYSTEM

3 Sheets-Sheet 2

Filed July 25, 1960

FIG. 4.

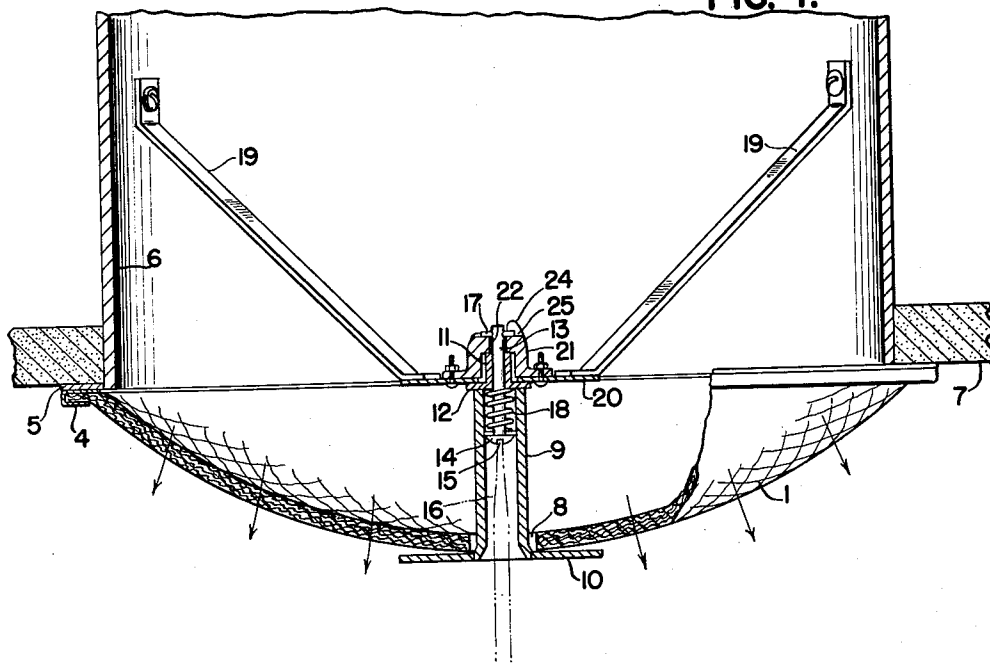
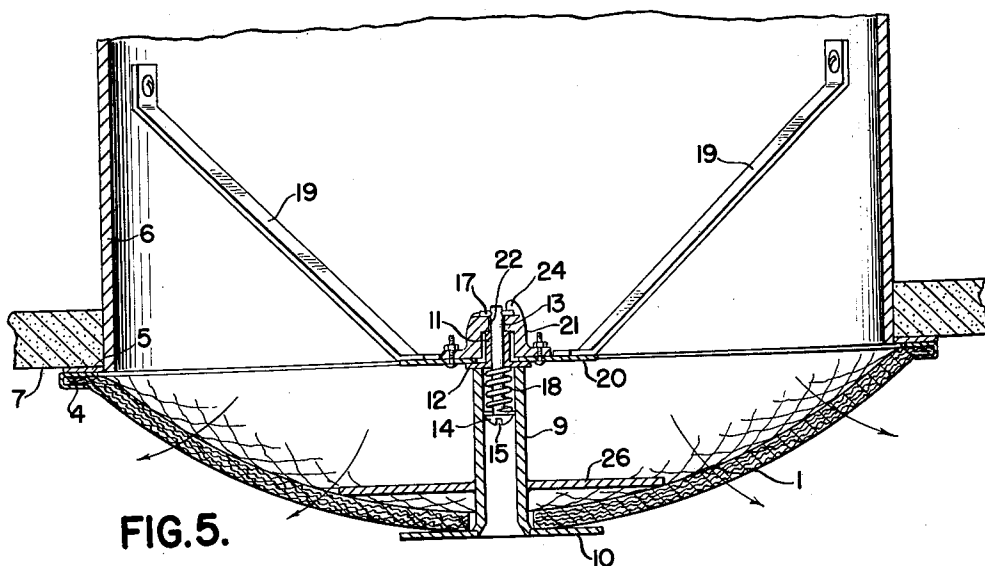


FIG.5.



INVENTOR.
RAGNAR E. ONSTAD
BY ANDRUS & STARKE
Attorneys

April 9, 1963

R. E. ONSTAD

3,084,609

AIR CONDITIONING SYSTEM

Filed July 25, 1960

3 Sheets-Sheet 3

FIG. 6.

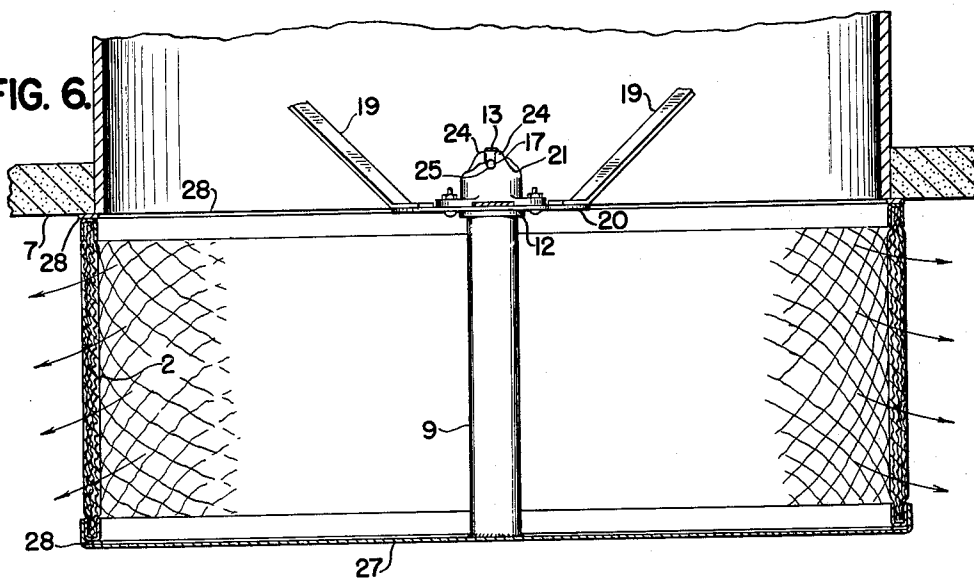


FIG. 7.

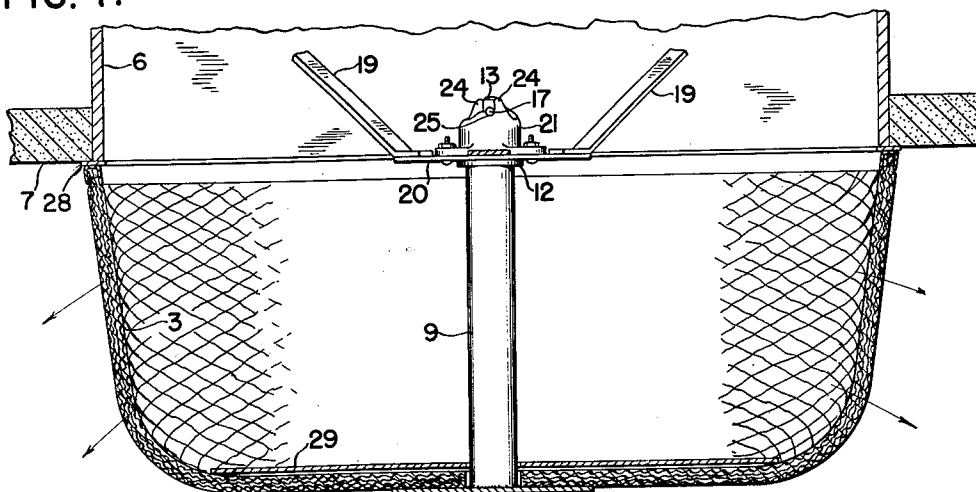
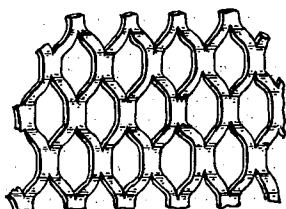


FIG. 8.



INVENTOR.
RAGNAR E. ONSTAD
BY
ANDRUS & STARKE

Attorneys

1

3,084,609

AIR CONDITIONING SYSTEM

Ragnar E. Onstad, Madison, Wis., assignor to Research Products Corporation, Madison, Wis., a corporation of Wisconsin

Filed July 25, 1960, Ser. No. 45,063

5 Claims. (Cl. 98-40)

This invention relates to a filter diffuser for air conditioning outlets as in the ceilings of rooms and halls.

In air conditioning systems including both heating systems, cooling systems and combined systems it has been customary to filter the air on the intake side of the fan or impeller so that the filter functions by air suction rather than by air pressure. This tends to keep the fan and equipment which heats or cools the air clean for more efficient heat transfer and reduces the amount of air-borne dirt discharging into the ventilated space.

Also in air conditioning systems it has been customary to employ adjustable baffle-type diffusers for distributing the air being discharged from a duct into the room space. Such diffusers are generally rated with respect to characteristics of air direction control, air throw and velocity, and of noise. Pressure drop through a diffuser outlet is usually kept at a minimum to provide freedom of air flow, and results principally from changing of direction and from surface contact resistance and possible limitation of cross sectional flow area.

With open baffle-type diffusers in ceilings and walls there is always a problem of smudge, and manufacturers generally provide what is called anti-smudge rings to prevent the room air from contacting the ceiling or wall immediately adjacent the diffuser. This smudging comes from secondary room air in many instances.

An additional problem comes from small dirt balls or particles of soot formed in the duct system as by gathering of small dust particles passing in the filtering system, and which are discharged onto the floor, desks, counters and furnishings.

The control of direction of air flow from the diffuser by means of baffles may result in drafts which are undesirable, particularly with temperature changes not compensated by baffle adjustment. Furthermore, the open diffuser transmits the noise of the air circulating equipment unless acoustically lined ducts are employed.

The present invention provides a filter diffuser that filters the air as it is discharged into the room space and at the same time diffuses the air with less tendency to drafts and more uniformly throughout the room.

In carrying out the invention the filter diffuser is constructed of multi-ply expanded aluminum sheets or foil secured together to provide a rigid filter structure preferably of inverted dome shape or semi-spherical so that the air in passing through the filter is discharged at all angles into the room.

If the filter diffuser is to be located in the center of the room and it is desired to have the air discharge principally towards the outer walls of the room the invention employs a metal disc of selective size in the bottom of the dome and which prevents discharge of air directly downward. It is also possible to construct the filter of cylindrical shape with a metal closure plate across the bottom.

The filter diffuser is mounted for ready removal and attachment by a pole in an operator's hands and without the need for a ladder. For this purpose the filter diffuser has a vertical central attaching means adapted to cooperate with a corresponding vertical central bracket in the duct. The coupling between the attaching means and bracket may take various forms, and preferably em-

2

ploy a vertically movable pin with a screw head at its lower end disposed in a vertical tubular housing for retaining the upper end of a pole having a screw driver end adapted to fit the groove in the head. The upper end of the pin has a cross pin adapted to pass upwardly through a slot in the bracket and to turn until it engages a stop which indicates that it will retain the filter in place as in the case of a bayonet fastening. The pin is preferably spring-biased downwardly to effect a tight retention of the filter in place.

The accompanying drawings illustrate the best mode presently contemplated for carrying out the invention.

In the drawings:

FIGURE 1 is a perspective view of the filter-diffuser

in place depending from a ceiling;

FIG. 2 is a perspective view of the filter-diffuser and the parts for mounting it;

FIG. 3 is an enlarged top plan view of the fitting;

FIG. 4 is an axial section of the filter-diffuser shown

mounted in place in fragmentary parts of a ceiling and duct;

FIG. 5 is a view similar to FIG. 4 showing a directional plate inserted and the effect of the same upon the air stream;

FIG. 6 is a similar view showing another embodiment employing a cylindrical filter-diffuser;

FIG. 7 is a similar view showing another shape of filter-diffuser that may be employed;

FIG. 8 is an enlarged plan view showing the detail structure of a layer of expanded metal foil from which the filter is made; and

FIG. 9 is an enlarged fragmentary section of three layers of the filter-diffuser showing the bonding of adjacent layers.

The filter-diffuser 1 illustrated is constructed of a plurality of non-planar plies of expanded aluminum sheets or foil of very thin gauge and which are preferably bonded together as by a vinyl resin 1a into a stiff rigid structure having the shape desired. In FIGS. 1 to 5 the shape of filter-diffuser 1 is that of a dome or segment of a sphere with a circular rim. In FIG. 6 the corresponding filter-diffuser 2 is cylindrical. In FIG. 7 the filter-diffuser 3 is of pan shape with a rectangular rim.

Any number of plies of expanded aluminum sheets may be employed. Applicant has found that ten to fifteen sheets bonded together is generally satisfactory. A good adhesive such as that described in U.S. Patent No. 2,865,466 should be employed to make the filter more effective.

The peripheral margin or rim of the filter-diffuser 1 may be dressed up in any suitable way for better appearance, that shown being a metal ring 4 flanged upwardly and crimped over the edge of the filter-diffuser. The upper crimped edge is larger in diameter than the duct opening and is coated with a tape 5 having a face of suitable soft material such as a soft rubber for sealing to the opening periphery against the end of the duct 6 and the ceiling 7.

The filter-diffuser 1 has a hole 8 through the center of the bottom and which receives a vertical tubular shank 9 for suspending the filter-diffuser. For this purpose the shank 9 has an outward flange 10 at its lower end upon which the filter-diffuser rests. The upper end of shank 9 has secured thereto a closure comprising a tubular member 11 of less diameter than shank 9 with an outward flange 12 at its lower end welded or otherwise secured to the upper end of the shank.

A pin 13 extends through the tubular member 11 and has a head 14 at its lower end with a cross slot 15 therein for receiving a screw driver 16 to turn the same. The upper end of pin 13 has a cross pin 17 fixed therein and

normally preventing the pin 13 from dropping through tube 11. A coil spring 18 surrounds the portion of pin 13 between head 14 and flange 12, and biases the pin 13 downwardly relative to the filter-diffuser.

For the purpose of mounting the filter-diffuser in place, the duct 6 is provided with a bracket comprising three angularly disposed metal straps 19 secured separately at their corresponding upper ends to the inside of the circular duct at locations approximately 120° apart. The straps 19 extend downwardly in the duct and converge radially inwardly to support a central plate 20 carrying a bayonet type fitting 21 adapted to receive the tubular member 11.

Fitting 21 has a central vertical hole 22 of a diameter to receive and loosely fit pin 13, and a diametric slot 23 to loosely receive cross pin 17 when pin 13 is moved upwardly to position the filter-diffuser. The upper surface of fitting 21 has a stop 24 against which the cross pin 17 engages upon turning of pin 13 in a clockwise direction after insertion through the fitting, i.e., in the direction a screw head is normally turned by a screw driver to tighten a screw.

It is desired to provide a bayonet effect to prevent loosening of the cross pin 17 by accidental turning of pin 13 and consequent falling of the filter-diffuser. For this purpose a diametric groove 25 is provided in the upper face of fitting 21 adjacent stop 24 and which receives the cross pin 17 when the latter is turned against the stop and screw driver 16 is withdrawn to release spring 18.

Thereafter, spring 18 biases the entire filter-diffuser upwardly against the ceiling and maintains the necessary seal between the facing of member 5 and the end of duct 6.

When the filter-diffuser needs cleaning it is a simple matter to reach vertically upward with a stick having the screw driver 16 at its upper end and enter the screw driver into the tube 11 to engage the slot 15 in pin 13 and turn the latter counter-clockwise to release cross pin 17 through slot 23 and lower the entire filter-diffuser bodily upon the stick. No ladder is necessary and the process of removing the filter-diffuser is so simple that it takes less than a minute. It is just as easy to replace the filter-diffuser after it is cleaned and re-oiled.

The dome shaped filter-diffuser 1 of FIGS. 1-5, can be employed either for room cooling or for room heating systems. In cooling it is generally desirable to discharge the cool air horizontally in all directions from the diffuser along the ceiling, while in room heating it is often more desirable to have a widely spread downward discharge of warm air.

Louver type diffusers are generally constructed for adjustment of the louvers for this purpose. Such construction, however, is too expensive for many installations, and has been found difficult of adjustment, generally requiring an operator to climb on a ladder and mechanically make the change.

The present invention provides a simple adjustment in the form of the removable plate 26 which is merely dropped into the dome after it has been removed as described above and before re-installing the filter-diffuser.

As shown in FIG. 5, plate 26 has the effect of turning the flow of air to a horizontal direction, as for use with cooling systems. In FIG. 4 without plate 26 it will be noted that the air spreads downwardly, as for use with heating systems.

The plate 26 should be of a diameter relative to that of dome filter-diffuser 1 that will give the desired air stream. Various conditions may be considered in determining the size of plate to use just as various conditions determine the size of duct and of the filter-diffuser to be used. The size of the room, closeness of other filter-diffusers and their placement in the room and the velocity of air movement are some of the factors to be considered.

It is a simple matter to remove plate 26 in the fall of the year and to reinsert it in the spring, at which time the filter-diffuser should be cleaned in any event.

Where the system is used principally for cooling, the construction of FIG. 6 is most effective. In this construction the filter-diffuser 2 is formed cylindrically with the closure plate 27 across the bottom to support it upwardly against the ceiling. The shank 9 is secured at its lower end directly to plate 27, as shown.

The filter-diffuser of FIG. 6 is mounted in exactly the same manner as that of FIGS. 1-5. The sealing tape 28 is secured either to the plate 27 or to the lower edge of filter-diffuser 2 and also to the upper edge of the filter-diffuser.

Depending upon the vertical extent of the cylindrical filter-diffuser 2, the air discharge will be substantially horizontal along the ceiling. No adjustment is contemplated for the construction of FIG. 6 except that filter-diffuser elements of different height may be substituted for one another.

Where the basket or dish-pan shape of filter-diffuser 3 of FIG. 7 is employed, the edge of the rim will be sealed against the ceiling or duct as in the construction of FIG. 5.

The basket form of filter-diffuser lends itself readily to adjustment as by the presence or absence of a plate 29.

In all embodiments illustrated the filter-diffuser, if kept reasonably clean, will remove most all residual dirt in the air stream being discharged and will generally prevent smudging of the ceiling or adjacent wall. It does not do away with the usual filters in the system, but supplements them.

Furthermore, since the pores of the filter-diffuser are substantially uniform in distribution, the air discharge is substantially uniform around the periphery of the unit and does not have the pulsating wave patterns which generally accompany other types of diffusers.

Filter-diffusers of various resistances to the passage of air may be provided by changing the size of the pores, thereby making the structure more or less dense, or by changing the number of plies. It is possible where the shape of the filter-diffuser is obtained as by drawing, to provide greater density for the filter in the central bottom portion than for the sides, with substantial uniformity for any given radial portion.

The velocity of discharge of air is substantially more uniform and more constant with the filter-diffuser of the present invention than with adjustable louver type diffusers. Tests have indicated that the filter-diffuser is substantially free from gusts and variable velocities accompanying the best diffusers heretofore known. In many instances heretofore with louver type diffusers the velocity of air flow at selected points near thereto would change substantially and even in direction of flow from instant to instant. Applicant's filter-diffuser is free from these changes in flow and direction at any selected points near thereto.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A filter-diffuser for use with a planar air inlet opening in a wall or ceiling of a room, comprising:

(a) a rigid multi-ply member of individual layers of slit and expanded metal having interconnecting filter pores for the passage of air therethrough into the room,

(b) said member being non-planar for extending from the plane of the opening into the room and having a peripheral edge of a dimension greater than that of the said opening with which the diffuser is to be used,

(c) sealing means disposed along the said peripheral edge and positioned for sealing the said member to the periphery of the said opening to thereby compel substantially all air passing outwardly through said opening to pass through the member,

(d) and means disposed substantially centrally of said

5

member for removably mounting said member in place.

2. The construction of claim 1 in which said member is generally inverted dome-shaped with the rim of the dome providing the said peripheral edge.

3. The construction of claim 1 in which said member is cylindrical with the inner end portion thereof providing the said peripheral edge, and a closure plate extending across the outer end thereof to force air passing outwardly through the diffuser to be discharged laterally through said member.

4. The construction of claim 2 in which a removable plate is provided to rest inside the dome-shaped member and thereby force the air to be discharged substantially laterally through the member.

5. For use with a room ventilating duct opening downwardly through the ceiling, a spider bracket for connection to a duct, a central fitting secured to said bracket and having a vertical bore therethrough and with a stop lug projecting from its upper surface adjacent the bore, a filter-diffuser having a periphery to seal with the duct opening in the ceiling, a tubular shank extending vertically upward centrally of said filter-diffuser and open at its lower end to receive a tool for lifting and fastening the filter-diffuser in place, means connected to the lower end of said shank to support said filter-diffuser, a clo-

6

sure member secured to the upper end of said shank and having a central opening therethrough, a pin in said central opening and having an actuating head at its lower end, a spring surrounding said pin between said closure member and said head to bias the latter and the filter-diffuser upwardly relative to said pin, and a cross pin in the upper end of said first named pin and adapted to make a bayonet connection with said fitting when inserted therethrough and turned against said stop lug, said bore in said fitting having a slot for receiving said cross pin, and said upper surface of said fitting having a groove adjacent said stop for receiving said cross pin.

References Cited in the file of this patent

UNITED STATES PATENTS

1,576,121	Preble	Mar. 9, 1926
2,019,241	Weiss	Oct. 29, 1935
2,128,335	Thayer	Aug. 30, 1938
2,251,660	Chipley	Aug. 5, 1941
2,385,682	Burkholder	Sept. 25, 1945
2,392,393	Kennedy	Jan. 8, 1946
2,722,880	Argentieri	Nov. 8, 1955

FOREIGN PATENTS

566,605	Great Britain	Jan. 5, 1945
---------	---------------	--------------