This invention relates to reflector systems. More particularly, it relates to controlling the amount of reflection from a reflector.

The invention will be described in connection with a reflector system in which heat rays are reflected from a parabolic surface to a boiler located at the focal point of the parabolic surface, but it is to be expressly understood that the invention is applicable to any reflector system in which any form of energy is reflected either from a point outside the reflector to an energy device associated with the reflector such as in the present system, or in which energy is reflected from an energy device to a point outside the reflector system, such as in a radar system or other electromagnetic wave transmitters. A feature of this invention is a device which interferes with and controls the transmission of energy between the reflecting surface and the energy device.

The invention may be used in connection with a reflector system for outer space such as that described in U.S. application Serial No. 21,988, now Patent No. 3,064,534, which is assigned to the assignee in the present application. In such a reflector system it is desirable to control the amount of heat reflected from the reflecting surface to the boiler. Accordingly, a feature of this invention is the control of the amount of heat delivered to the boiler from the reflecting surface. Another feature of this invention is the control of the amount of heat delivered to the boiler in any amount from a desired maximum to a desired minimum. Still another feature of this invention is the control of the amount of heat reflected to the boiler by interfering with the heat rays reflected from the reflecting surface.

The reflector system operates on the principle of reflecting heat rays, and concentrating them at the focal point of the reflecting surface, and a boiler is located adjacent to the focal point. If heat rays are reflected to a point other than the focal point of the reflecting surface, it is possible that structural parts of the boiler or supporting members may become weakened by excessive heating. Therefore, a feature of this invention is the diverting of some of the heat rays entirely away from the reflector system.

The reflector system described in U.S. application Serial No. 21,988, now Patent No. 3,064,534, is designed to fit into an extremely small package while being transported through the atmosphere, and it is expanded into the operating position when it arrives at its destination in space. Another feature of the present invention is to contain the device within a very small space when the reflector is collapsed so as not to interfere with the collapsing and packaging of the reflector for travel.

Other features and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate an embodiment of the invention.

FIG. 1 is a view showing the reflector system in its closed position.

FIG. 2 is a view showing the reflector system in its extended position.

FIG. 3 is a view showing the details of the reflection controlling mechanism.

FIG. 4 is a view along line 4-4 of FIG. 3.

FIG. 5 is a plan view showing the reflector system in its extended position.

FIGS. 1 and 2 show a reflector system 2 which is composed of a plurality of reflector sectors 4, a boiler 6 and a plurality of blades 8 interposed between reflector sectors 4 and boiler 6. The outer ends of reflector sectors 4 extend well beyond the outer ends of the blader 8, and hence the blades 8 are contained entirely within the extremities of the reflector. Boiler 6 is located adjacent to the focal point of extended reflector sectors 4 and is attached to a base 10 by struts 12, and reflector sectors 4 are rotatably connected to base 10. Reflector sectors 4 and blades 8 can be retracted so that in the closed position, the reflector system can be encased in a container 14, the diameter of which is substantially equal to the diameter of base 10. Reference is made to U.S. application Serial No. 21,988, now Patent No. 3,064,534, for the details of the actuating and controlling mechanisms.

Referring now to FIG. 3, a ring 16 is attached to struts 12 and a pair of bearings 18 are attached to ring 16. A shaft 20 is rotatably mounted in bearings 18, and a pair of springs 22 are attached to shaft 20. Springs 22 are attached to and support the reflector sectors 4. An arm 26 extends from shaft 20, and a roller 28 is mounted on arm 26. A spring 30 is connected to one of the bearings 18 and to shaft 20. The reflector system contains a plurality of units consisting of bearings 18, shaft 20, springs 22, blade 8, arm 26, roller 28 and spring 30.

A fluid filled temperature bulb 32 of well-known construction is located in boiler 6 to sense the temperature of the fluid in the boiler. In a well-known manner, bulb 32 communicates through fluid filled line 34 with fluid filled bellows 36. A plate 38 is attached to bellows 36, and a spring 39 is mounted on plate 38. Ring 39 is in contact with roller 28. Changes in temperature in boiler 6 cause an expansion or contraction of bellows 36 and result in translation of plate 38 and attached ring 39. This translation of plate 38 and ring 39 acts through roller 28 and arm 26 to rotate shaft 20 and vary the position of blade 8. As can best be seen in FIG. 4, arm 26 is inclined to the surface of ring 39 to insure ease of motion of arm 26. The diameter of ring 39 is such that there is no interference between ring 39 and bearings 18, and, thus, arm 26 can be raised above the axis of shaft 20 so that shaft 20 can be rotated a full 90°.

Heat rays are reflected from sectors 4 to the focal point of the sectors. Blades 8 are interposed between sectors 4 and boiler 6 to interfere with the reflection of the heat rays. Blades 8 can themselves be reflecting surfaces and the heat rays are inclined at an angle to the axis of the reflecting surface formed by sectors 4 so that the heat rays which strike blades 8 are reflected away from the reflector system. Thus, there is no concentration of heat rays back to reflector sectors 4 or on any structural members of the reflector system due to the action of blades 8.

As can best be seen in FIG. 5, blades 8 offer a minimum amount of interference with the transmission of heat rays between sectors 4 and boiler 6 when blades 8 are in a position substantially perpendicular to sectors 4. A 90° rotation of blades 8 places them in a position of maximum interference with the heat rays transmission. It is apparent that any degree of control of heat ray transmission can be obtained by any amount of rotation of blades 8 up to 90°. Of course, it is possible that the boiler temperature may still be above a desired level when blades 8 have been rotated 90° to the position of maximum interference with heat ray transmission. However, any further rotation of blades 8 would operate to increase the amount of heat ray transmission, and, therefore, stops 48 extend from some of the bearings 18 to limit the travel of plate 38. Spring 30 will have been coiled when plate 38 is translated in response to increases
in temperature in boiler 6. Thus, it can be seen that spring 30 will act to rotate shaft 20 to move blades 8 toward the position of minimum interference with heat ray transmission when the temperature in boiler 6 decreases. In the event of a failure of temperature bulb 32, line 34, or bellows 36, spring 30 will insure that blades 8 will assume the position of minimum interference with heat ray transmission.

When the reflector system is being packaged to be transported, blades 8 must be retracted as is shown in FIG. 1. Springs 22 allow blades 8 to be placed at an angle to shaft 20 when the reflector system is packaged, and springs 22 will snap blades 8 into operating position as shown in FIG. 2 when the reflector is extended. In order to package blades 8, shafts 20 are rotated so that the blades are in the position of maximum heat ray interference, and then springs 22 are flexed so that blades 8 are angled with respect to shafts 20. This rotation of shafts 20 loads springs 30 so that when the reflector is extended blades 8 will simultaneously snap into operating position and be rotated by springs 30 to initially assume the position of minimum heat ray interference.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described but may be used in other ways without departure from its spirit as defined by the following claims.

We claim:
1. In combination, a reflector forming substantially a surface of revolution and having an axis and a focal point on the axis, an energy device located substantially at the focal point of said reflector, a plurality of rotatably mounted blades interposed between said reflector and said energy device and entirely within the extremities of said reflector to vary the amount of energy transmission from said reflector to said energy device, each of said blades having a reflecting surface on one side thereof, said blades in a first position allowing a maximum transmission of energy from said reflector to said energy device and in a second position allowing a minimum transmission of energy from said reflector to said energy device, means for rotating said blades to any position between said first and second positions, said blades in said second position having the reflecting surfaces thereof facing said reflector and inclined at an angle to said axis to form an obtuse angle between said blades and said axis on the side of said blades facing said reflector such that signals impinging on said reflecting surfaces from said reflector are directed away from said reflector and away from said axis of said reflector, and means for preventing rotation of said blades beyond said second position.

2. In combination, a reflector forming substantially a surface of revolution and having an axis and a focal point on the axis, an energy device located substantially at the focal point of said reflector, a plurality of rotatably mounted reflector blades interposed between said reflector and said energy device and entirely within the extremities of said reflector to vary the amount of energy transmission from said reflector to said energy device, said reflector blades in a first position allowing a maximum transmission of energy from said reflector to said energy device and in a second position allowing a minimum transmission of energy from said reflector to said energy device, said reflector blades in said second position being inclined at an angle to said axis to form an obtuse angle between said blades and said axis on the side of said blades facing said reflector such that energy incident on said reflector blades from said reflector is directed away from said energy device and away from said reflector, means for rotating said blades to any position between said first and second positions, means biasing said blades toward said first position, and means for preventing rotation of said blades beyond said second position.

3. The combination as in claim 2 including control means responsive to the temperature of the energy device for determining the degree of rotation of the blades between the first and second positions.

4. In a reflector system, first reflector means forming substantially a surface of revolution having an axis and a focal point on the axis, an energy device located substantially at the focal point of said first reflector means, second reflector means interposed between said first reflector means and said energy device for varying the amount of energy transmission from said first reflector means to said energy device, said second reflector means having a reflecting surface at least partially facing said first reflector means and inclined at an angle to said axis to form an obtuse angle between said second reflector means and said axis on the side of said second reflector means facing said first reflector means such that the reflection from said second reflector means is directed away from said first reflector means and away from said energy device, and means associated with said second reflector means for controlling the amount of variation of energy transmission between said first reflector means and said energy device.

5. In a reflector system, a base, a plurality of first reflector means rotatably attached to said base, said first reflector means in a first position extending substantially radially from said base and forming substantially a surface of revolution having an axis and a focal point on the axis, said first reflector means in a second position being aligned in a direction substantially along said axis, an energy device located substantially at said focal point of said first reflector means, and second reflector means interposed between said first reflector means and said energy device, said second reflector means in a first position extending substantially radially from said axis and in a second position extending in a direction substantially along said axis, said first position of said second reflector means corresponding to said first position of said first reflector means and said second position of said second reflector means corresponding to said second position of said first reflector means.

6. A reflector system as in claim 5 wherein said second reflector means includes a plurality of blades, each of said blades being connected to a rotatably mounted shaft, and means for angularly displacing said blades with respect to said shafts.

7. A reflector system as in claim 5 wherein said second reflector means includes a plurality of rotatably mounted blades, and including means for rotating said blades in the first position thereof between positions of minimum and maximum interference with transmission between said first reflector means in the first position thereof and said energy device, and means for preventing rotation of said blades beyond said position of maximum interference.

References Cited by the Examiner

UNITED STATES PATENTS
Re. 25,105 12/61 Cargill 126—270 X
1,479,923 1/24 Moreau 126—270
2,030,350 2/36 Bremer 126—271 X
2,923,222 12/39 Couri 126—270
2,239,902 10/41 McCoy 126—271
2,945,234 7/60 Driscoll 126—270
3,024,700 3/62 McClellan 126—270
FOREIGN PATENTS
993,096 7/51 France.

JAMES W. WESTHAVER, Primary Examiner.
PERCY L. PATRICK, FREDERICK L. MATTESON, JR., ROBERT A. O'LEARY, Examiners.