Nov. 13, 1956 A. TARCICI 2,770,230

SOLAR HEATING APPARATUS

Filed March 8, 1952

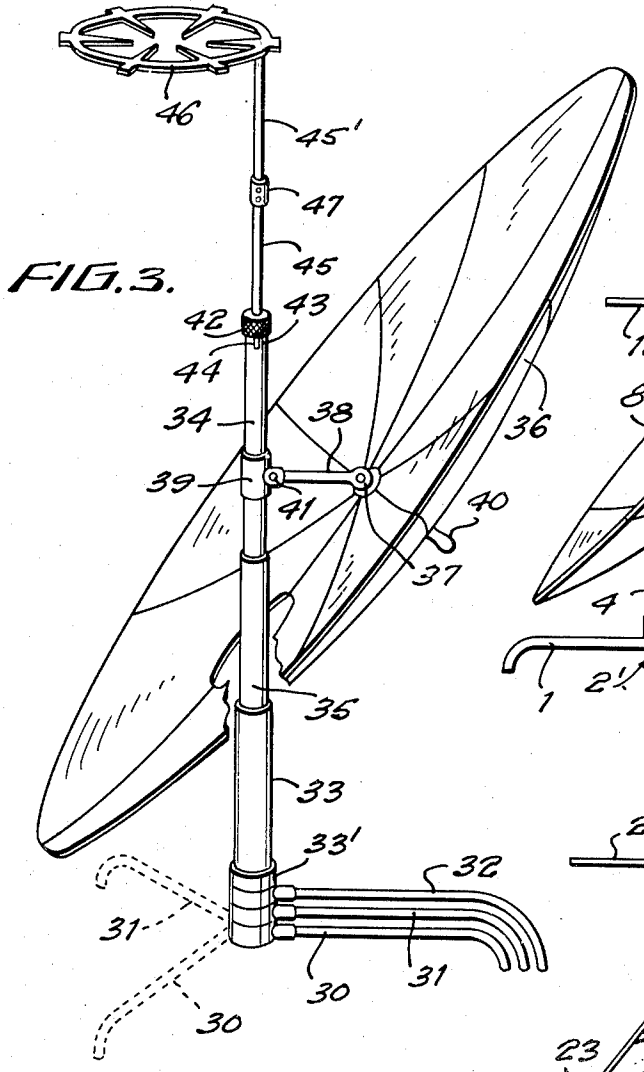

FIG. 3.

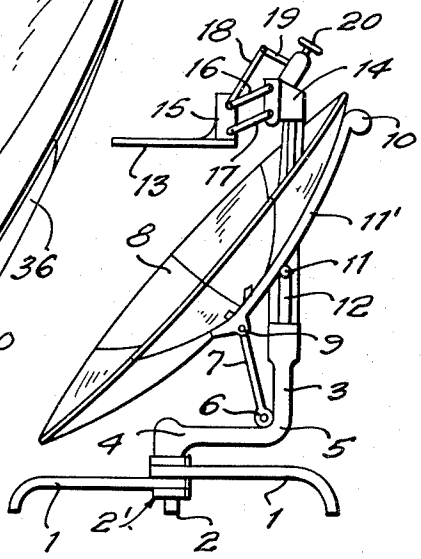

FIG. 1.

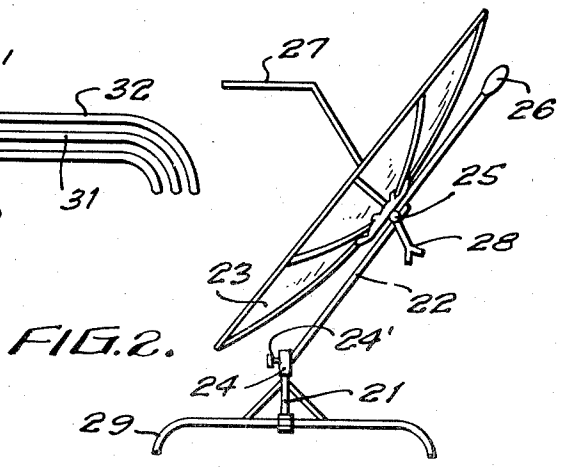

FIG. 2.

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SOLAR HEATING APPARATUS

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6 Claims. (Cl. 126—270)

The present invention relates to a heating apparatus.

More particularly the present invention relates to a heating apparatus which is adapted to concentrate the rays of the sun within a given area so as to heat an article located at this area.

This application is a continuation-in-part of application Serial No. 181,076, filed August 23, 1950, and entitled "Sun-Operated Heating Devices."

One of the objects of the present invention is to provide a heating apparatus of the above type which may be very easily oriented to the rays of the sun.

A further object of the present invention is to provide a simple apparatus of the above type which is, to a great degree, collapsible so that the apparatus may be conveniently carried about on camping trips, for example.

An additional object of the present invention is to provide a device of the above type with an adjustable holder for the article to be heated so that this article may be independently located at a predetermined position.

Yet another object of the present invention is to provide an apparatus capable of accomplishing all of the above objects while at the same time being made of relatively few, simple, inexpensive parts which are very reliable in operation.

With the above objects in view, the present invention mainly consists of a solar heating apparatus having a reflector, which may for example take the form of a parabolic mirror. A support means is connected to the reflector to support the same for turning movement about two axes which are perpendicular to each other, one of these axes generally being vertical and the other horizontal so that the reflector can be easily oriented with the sun. This support means preferably takes the form of a post extending through an opening in the reflector, the latter being mounted on the post for turning movement about the post axis and for turning movement about a horizontal axis. A holder for holding the article to be heated is adjustably mounted on the post in front of the reflector so that the article being heated may be located at a predetermined position with respect to the reflector. Most of the parts of the device of the present invention may be made collapsible, so that a portable heating apparatus is provided.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is an elevational view of one possible apparatus constructed in accordance with the present invention;

Fig. 2 is an elevational view of another embodiment of an apparatus constructed in accordance with the present invention; and

Fig. 3 is an isometric view of a still further embodiment of the present invention.

Referring now to the drawings, there is illustrated in Fig. 1 a heating apparatus having a frame means which includes a supporting post provided with a vertically extending portion 3, an arm 4 extending at right angles to the portion 3 and being joined thereto at 5, and a vertically extending portion 2 perpendicular to the arm 4. This portion 2 has fixedly mounted thereon a collar 2', the latter being fixed on portion 2 by any suitable means such as a set screw, or the like. A plurality of foot members 1 are pivotally mounted on the post portion 2 for turning movement about the vertical axis of the latter, these foot members having inner apertured ends embracing the portion 2 so that the foot members may be swung out to an operative position or located over each other in an inoperative position. The post portion 2, which is rigid with the post portion 4, is provided with a shoulder against which the inner end of the topmost foot member bears, this inner end being the only part of the latter foot member which is visible in Fig. 1. The vertically extending portion 3 of the post is formed with a vertically extending groove 12.

A reflector means, which may take the form of the parabolic mirror 8 illustrated in Fig. 1, is formed with an opening (not visible in Fig. 1) through which the portion 3 of the post extends, this opening being of a substantially larger size than the cross-section of post portion 3 so that the mirror is movable through a substantial distance without contacting the post portion 3.

A rigid member 11' terminating in a handle 10 is fixedly connected to the underside of mirror 8 and is pivotally connected at 9 to the link 7 which has a lower end pivotally mounted on the pin 6 fixedly connected to the post at part 5 thereof, this pin 6 being bent, for example, so that it extends away from the post and through an opening in the lower end of link 7. A lug 11 is fixedly connected to the rigid member 11' and extends into the groove 12 so that when the operator grasps the handle 10 he may move the mirror about the horizontal axis of pivot 9 which is located at the center of mirror 8. The raising and lowering of handle 10 causes the link 7 to turn about the pivot 6, and the vertical movement of the mirror is controlled by the cooperation of lug 11 and groove 12. The collar 2' does not clamp the foot members 1 to the post very tightly so that these foot members may be easily turned between their operative and inoperative positions, and so that the entire post may be turned on the foot members 1 about the vertical axis of post portion 2. In this way the position of the parabolic mirror 8 may be varied with respect to both vertical and horizontal axes so that the mirror 8 may be conveniently oriented to the sun. It should be noted that since the sun is moving all the time it is necessary to adjust the mirror 8, but this adjustment need only be made periodically since the mirror 8 is turnable about an axis passing through its center. This latter arrangement permits the mirror to be oriented to the sun by turning the mirror through only a fraction of the angle through which the sun moves.

The top end of post portion 3 terminates in a rigid member 14 to which one end of each of the arms 16 and 17 is pivotally connected, these arms 16 and 17 having their opposite ends pivotally connected to the upstanding portion 15 of the holder 13 for the article to be heated. Mounted on member 14 is a screw device 20 which cooperates with an arm 19 to move the same along the length of the screw device. This arm 19 is linked at one end to an arm 18 which is itself linked to the upstanding part 15 of holder 13. The screw device may conveniently take the form of a housing in which a screw is mounted for

rotation about its axis, this housing being formed with an elongated slot through which the arm **19** extends and the latter being in threaded engagement with the screw so as to be movable along the length of the housing upon turning of the screw. It is evident that the parts **14–17** form a parallelogram type of linkage which, upon turning of the screw means **20**, permits the holder **13** to be moved toward and away from the parabolic mirror **8** while being maintained level so as to properly support an article thereon. It is thus apparent that with the above described structure not only is the parabolic reflector **8** capable of easily being oriented to the sun, but also the holder **13** may be independently adjusted so as to be properly located with respect to the reflector **8**.

Another embodiment of the invention is illustrated in Fig. 2 where the support for the heating apparatus takes the form of a frame means which includes a vertical post **21** extending upwardly from the foot members **29** and being held vertically with respect to the latter by means of struts or the like, as shown. A sleeve **24** is mounted on the upper end portion of the post **21** for turning movement thereabout, this sleeve **24** having a manually turnable screw member **24'** extending through the same to engage the post **21** so that the position of sleeve **24** may be fixed. If desired this sleeve **24** may have a closed, or partially closed, top end resting on the top end of post **21** so that part **24** forms a cap member located on post **21**.

A rod **22** is fixedly connected at its lower end to the member **24** and extends angularly upwardly therefrom, as illustrated in Fig. 2. A horizontally extending screw member **25** is fixedly mounted on the rod **22** adjacent the upper end thereof, and a handle **26** is fixedly connected to the underside of a reflector means in the form of the parabolic mirror **23** at the center of the latter, this handle **26** being freely turnable on the screw member **25**.

Also freely movable on the screw member **25** is a handle **28** which carries at its upper end a holder **27** for the article to be heated. This handle **28** may extend through a suitable opening of the mirror **23**, or the screw member **25** may be of a sufficient length to permit the handle **28** to be located slightly beyond the periphery of the parabolic mirror so that an opening need not be provided in the latter. Also, if desired, the handle **28** may be provided with a U-shaped bent portion extending horizontally about part of the parabolic mirror so that in this way it is also possible to avoid providing an opening in the parabolic mirror **23**. Any suitable means such as lock nuts or the like (not shown) may be provided on the screw member **25** to lock the mirror **23** in its adjusted position about its horizontal axis passing through its center, and to also lock the handle **28** in its adjusted position on the screw member **25**. This handle **28** may be formed with an elongated slot (not shown) extending along the length thereof and located about the screw member **25** so that the handle **28** may be moved along the screw member **25** to raise and lower the holder **27** without tilting the same.

A further embodiment of the invention is illustrated in Fig. 3 of the drawings, this particular embodiment being especially suitable for a portable heating apparatus since it may be easily and quickly collapsed and dismantled so as to occupy very little space when it is in its inoperative position. As is shown in Fig. 3, three foot members **30**, **31** and **32**, of the same general construction as the foot members **1** described above, are located adjacent the bottom end of a post made up of the telescoped tube sections **33**, **34** and **35**. The lower foot member **30** may threadedly engage the outer surface of the tube section **33** so as to be disconnectable therefrom, and the upper foot members **31** and **32** may simply turn freely about the tube section **33**, a collar **33'** being fixedly mounted on the tube section **33** above the foot member **32** by any suitable means such as a set screw, or the like. The telescoped tube sections **33**, **34** and **35** of the post shown in Fig. 3 may be maintained in their extended position by any suitable means, such as the frictional contact between these tube sections or by a pair of screws respectively extending through the tube sections **33** and **35** adjacent the upper ends thereof so that these screws may fix the adjustment between a pair of adjacent tube sections while permitting the same to be collapsed when the screws are loosened. The foot members may be arranged distant from each other, as shown in dotted lines in Fig. 3, to assume an operative position where they vertically support the post.

The tube section **34** is formed with a plurality of slots **44** extending downwardly from the top end thereof so as to provide a plurality of springy tongues **43**, these tongues being provided with a tapered thread on their outer surface adjacent the top of tube **34**. A nut **42** having an inner tapered thread engages the threads of the tongues **43** so that the turning of the nut **42** will cause the tongues to move toward or away from each other. A rod **45** extends slidably through the nut **42** and is of a slightly smaller diameter than the inner diameter of tube **34** so that the rod **45** may extend coaxially with the post and into the tube **34**. The nut **42** may be loosened to adjust the distance by which the rod **45** extends into the tube **34**, and then the nut **42** may be tightened to clamp the rod **45** with the tongue **43** so as to fix the rod **45** in its adjusted position.

Arranged in end to end relation with the rod **45** is a rod **45'**. The rods **45** and **45'** are releasably connected to each other by means of a sleeve **47** which overlaps the adjacent ends of these rods, this sleeve being riveted to one of the rods and being releasably connected to the other of the rods by means, for example, of a pin extending through opposite openings in the sleeve and through an aligned opening in the said other rod.

The upper end of the rod **45'** may be threaded so that the rod **45'** may be releasably connected to a plate **46** which has on its underside a threaded opening to receive the threaded end of rod **45'**, this plate **46** being adapted to support an article to be heated. Thus, elements **30—34** and **42—46** form a supporting arrangement which includes a supporting means in the form of plate **46** for supporting the article to be heated.

A sleeve **39** is slidably mounted on the tube section **34** for movement along the length thereof, and this sleeve **39** is also turnable about the post axis. In order to fix the position of sleeve **39** on tube section **34**, the sleeve **39** is split and has a screw member **41** extending across the split in the sleeve so that this screw member **41** may increase or decrease the diameter of the sleeve **39** and in this way respectively unclamp or clamp the sleeve **39** in an adjusted position.

A bar **38** is fixedly connected at one end thereof to the sleeve **39** and is pivotally connected at its opposite end to a pin **37** located at the center of the parabolic mirror **36**. This parabolic mirror carries at its underside a handle **40** so that the mirror may be turned about the horizontal axis of pin **37**, and the parabolic mirror **36** is formed with an opening through which the post extends. It will be noted from Fig. 3 that this opening is of a considerably larger size than the cross-section of the post so that the parabolic mirror may be turned through an appreciable distance about the horizontal axis passing through its center. Also, it will be appreciated that the opening through the mirror **36** does not in any way limit the turning of the mirror about the vertical axis of the post. The parabolic mirror **36** may have the construction disclosed in the co-pending application Serial No. 181,076, filed August 23, 1950, so that the mirror is itself collapsible.

It is believed to be apparent that the embodiment of the invention which is illustrated in Fig. 3 possesses all of the advantages of all of the above described embodiments illustrated in Figs. 1 and 2. The structure of Fig. 3 may be easily dismantled. Upon loosening of the nut **42**, the rods **45**, **45'** may be removed from the tube sec-

tion 34, and these rods may then be separated from each other and the plate 46 may be separated from the rod 45', as was discussed above. The nut 42 may be removed to permit the sleeve 39 to be slipped over the top end of the tube section 34, or, if desired, this sleeve 39 may be formed from two half sections which can be separated from each other upon loosening of the screw 41, the bar 38 then being fixedly connected to one of the half sections. When the sleeve 39 is separated from the tube section 34, the parabolic mirror 36 may be moved upwardly along the post until the opening in the mirror passes beyond the top end of tube section 34 so as to separate the mirror from the post. Then this parabolic mirror 36 may be collapsed as described in the copending application mentioned above. The lower foot member 30 may then be unscrewed from the lower tube section 33 and the remaining foot members 31 and 32 will then slip off from the tube section 33. Then the tube sections 34 and 35 may be moved into the tube section 33 so that the device is entirely dismantled and collapsed in a very easy and quick manner to provide a portable heating device which does not require much space in order to be conveniently carried about.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of solar heating apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in a collapsible solar heating apparatus it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. Solar heating apparatus, comprising, in combination, an elongated post; support means connected to said post adjacent one end thereof to support said post vertically; attaching means mounted on said post for movement about the axis thereof and for movement along the length thereof; a reflector operatively connected to said attaching means for movement about an axis perpendicular to said post axis; and holding means mounted on said post adjacent an end opposite said one end thereof for holding an article to be heated.

2. Solar heating apparatus, comprising, in combination, an elongated post; support means connected to said post adjacent one end thereof to support said post vertically; a sleeve mounted on said post for movement about the axis thereof and for movement along the length thereof; a reflector operatively connected to said sleeve for movement about an axis perpendicular to said post axis, said reflector being formed with an opening through which said post extends; and holding means mounted on said post adjacent an end opposite said one end thereof for holding an article to be heated.

3. Solar heating apparatus, comprising, in combination, an elongated post; a plurality of foot members pivotally mounted on said post adjacent one end thereof for movement about the axis thereof so that said foot members may be moved from a compact, inoperative position adjacent each other to an operative position distant from each other; a reflector operatively connected to said post for movement about vertical and horizontal axes when said post is vertically supported; and holding means mounted on said post adjacent an end opposite said one end thereof for holding an article to be heated.

4. Solar heating apparatus, comprising, in combination, an elongated post made up of a plurality of telescoped tube sections so that the length of the post may be varied; a plurality of foot members pivotally mounted on said post adjacent one end thereof for movement about the axis thereof so that said foot members may be moved from a compact, inoperative position adjacent each other to an operative position distant from each other; a reflector operatively connected to said post for movement about vertical and horizontal axes when said post is vertically supported; and holding means mounted on said post adjacent an end opposite said one end thereof for holding an article to be heated.

5. Solar heating apparatus, comprising, in combination, an elongated post made up of a plurality of telescoped tube sections so that the length of the post may be varied; a plurality of foot members pivotally mounted on said post adjacent one end thereof for movement about the axis thereof so that said foot members may be moved from a compact, inoperative position adjacent each other to an operative position distant from each other; a reflector operatively connected to said post for movement about vertical and horizontal axes when said post is vertically supported; rod means coaxial with said post and being slidably mounted on the tube section thereof distant from said foot members for movement into and out of said post; and a plate connected to said rod means to support an article to be heated.

6. Solar heating apparatus, comprising, in combination, an elongated post made up of a plurality of telescoped tube sections so that the length of the post may be varied; a plurality of foot members pivotally mounted on said post adjacent one end thereof for movement about the axis thereof so that said foot members may be moved from a compact inoperative position adjacent each other to an operative position distant from each other; a sleeve mounted on one of said telescoped tube sections of said post for movement about the axis thereof and along the length thereof; a parabolic reflector formed with an opening distant from the center thereof and through which said post extends; a bar member connected to said sleeve and being pivotally connected to said reflector at the center thereof to support said reflector for turning movement about an axis perpendicular to said post axis; at least two rods arranged end to end and being coaxial with said post, one of said rods being mounted on the tube section of said post distant from said foot members for movement into and out of said post; releasable connecting means interconnecting said rods so that the same may be disconnected from each other; and a support mounted on the other of said rods for supporting an article to be heated.

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