

[54] **GAS CIRCULATING AND TIMER MEANS WITH MAGNETIC COUPLING DRIVE MEANS FOR CAM ACTUATED SWITCHES**

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[57] **ABSTRACT**

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[51] Int. Cl.... **H01h 7/08, H01h 35/40, H01h 36/00**

[58] Field of Search **200/38 R, 38 B, 56 R, 200/81.9 M; 335/205, 207**

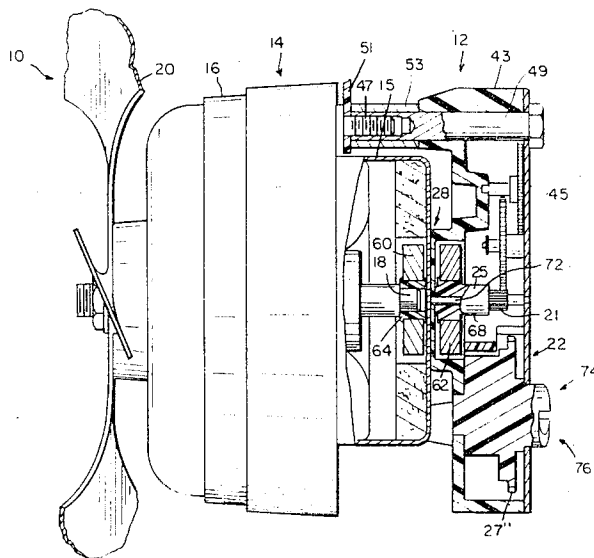
A shaft extends through a motor. A fan is carried on one end of the shaft and on the other end a magnet. A rotor is spaced from and in axial alignment with the magnet. A second magnet is carried by the rotor juxtaposition the first magnet such that the motor, when operating, rotates the fan and the first magnet, the first magnet causing rotation of the second magnet and thereby the rotor. A cam means which operates switch means is coupled to the rotor.

[56] **References Cited**

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11 Claims, 4 Drawing Figures



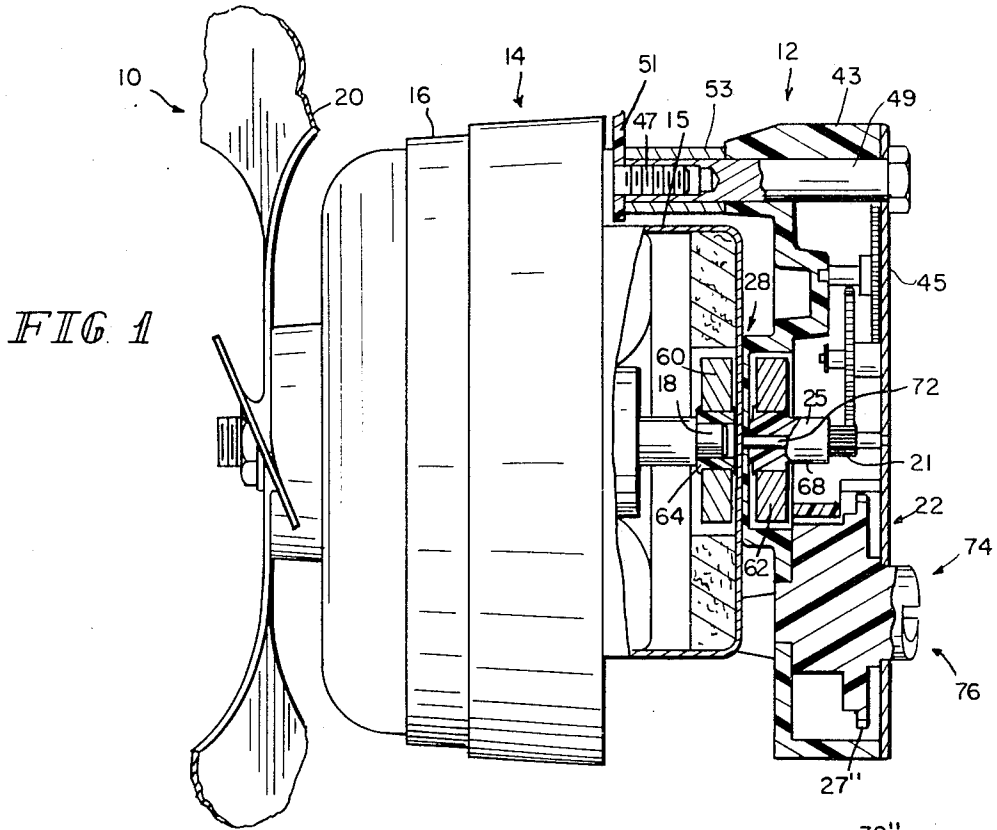


FIG 1

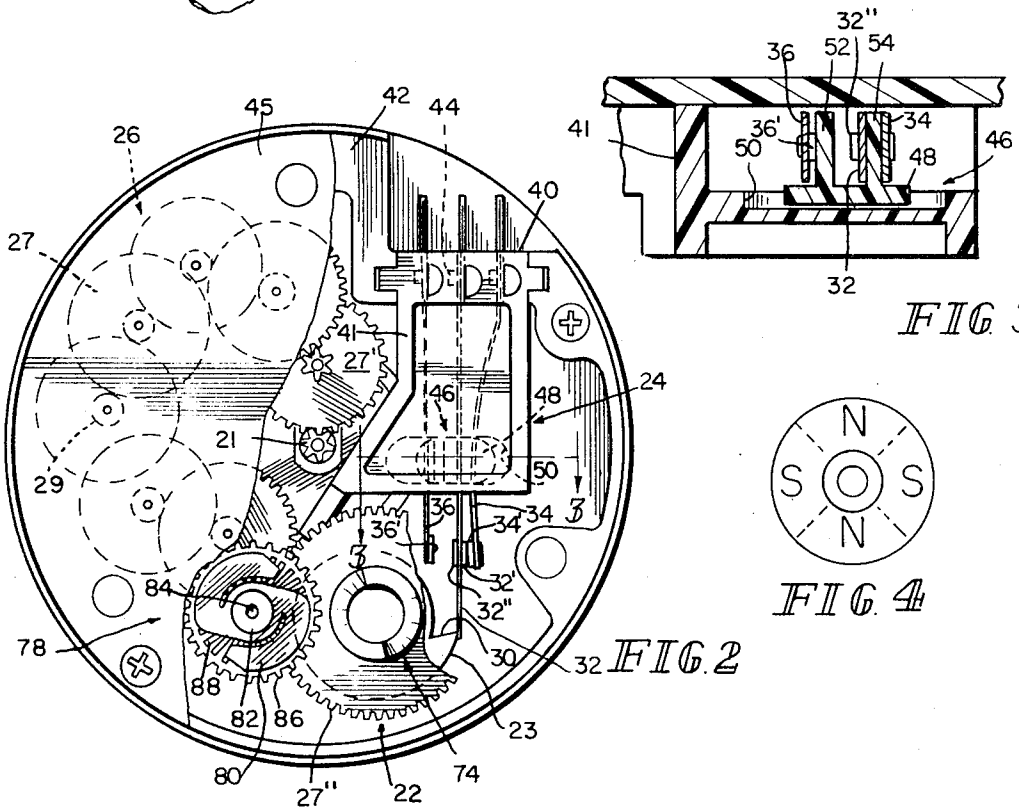


FIG 3

FIG 4

FIG 2

GAS CIRCULATING AND TIMER MEANS WITH MAGNETIC COUPLING DRIVE MEANS FOR CAM ACTUATED SWITCHES

The present invention relates to a timing means; more particularly the present invention relates to a timing means in combination with a gas circulating means for use in appliances such as refrigerators.

Defrost timers have long been used to selectively activate cooling and heating mechanisms in accordance with a predetermined cycle. The timers are usually motor driven through their own separate motor means, the motor means deriving its power from a power source of the refrigerator or components thereof.

Regardless of whether the refrigerator is being heated for defrosting or being cooled, means are generally provided to circulate the air within the storage compartment of the refrigerator. For the most part, the gas circulating means, such as a fan, has been operated apart and distinct from the timing mechanism operating the heating and cooling means of the refrigerator. In the interest of neatness and compactness and fewer number of parts it would be desirable if the gas circulating means could be operable directly off of the timer controlling the operation of the heating and cooling means of the refrigerator.

The present invention is concerned with the provision of a defrost timer in combination with a gas circulating means and has as one of its objects the provision of such a combination which is compact, with a minimum number of parts.

Another object of the invention is to provide a gas circulating means and a timer means both of which are operable off of a single motor.

Still another object of the invention is the provision of a gas circulating means and a timer means wherein the gas circulating means includes a fan carried by a shaft of a motor and wherein the timing means is driven by the same motor.

A further object of the invention is the provision of a gas circulating and timer means which includes a fan carried by a shaft of a motor with the timer means being driven by the motor through a magnetic coupling.

Another object of the invention is the provision of a timer driven by a motor, the timing mechanism being driven off the motor through a pair of magnets one connected to the timing mechanism and one connected to the motor.

As an additional feature of the present invention, the motor and the timer are each enclosed in separate housings such that each may be "packaged" separately and assembled together where needed. This enables repairs, etc. to be readily made.

These and other objects of the invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevation of a gas circulating and timer means with portions thereof being removed;

FIG. 2 is a view looking at the timer end of the device of FIG. 1;

FIG. 3 is a view taken along the line 3—3 of FIG. 2; and

FIG. 4 is an end view of one of the magnets providing the magnet coupling between the timer and a motor of the device.

Generally speaking, the objects of the invention are accomplished by providing a gas circulating and timer means comprising: a motor drive means including a rotatable shaft extending therethrough; a fan carried at one end of the shaft; a first magnet carried at the other end of the shaft; a rotor spaced from an axial alignment with the first magnet; a second magnet carried by the rotor juxtaposition the first magnet; speed reduction means coupled to the rotor; and cam means coupled to the rotor and switch means responsive to the rotation of the cam means.

Referring now to the drawings, there is shown a gas circulating means 10 and a timer means 12 both of which are power driven through a motor 14. Motor means 14 (the details of which are not shown) is enclosed in a housing 16 and includes a rotatable shaft 18. Housing 16 includes a cup-shaped member 15.

Gas circulating means 10 includes a fan 20 carried at one end of the shaft 18.

Timing means 12, in general, includes a cam means 22 and switch means 24 which are open and closed in response to rotation of the cam means. Cam means 22 is coupled to motor 14 through speed reducing means 26, rotor 25, and magnetic coupling means 28. Cam means 22 includes a single cam 23 having a constant rise terminating in an abrupt step 30. Switch means 24 includes a contact blade 32 centrally disposed between contact blades 34 and 36, blade 32 having electrical contacts 32' and 32'' which alternatively engage electrical contacts 34' and 36' as blade 32 is moved in accordance with the rotation of cam 23. As shown, the contact blades are cantilevered in terminal block 40 which is carried in the outer housing 42 for the timing mechanism 12. The amount that the blade extends from the terminal block is determined and maintained through dimples (not shown) formed as part of the switch blades and which seat in cavities 44 of the terminal block. The terminal block 40 includes a barrier wall 41 which aids in preventing oil or other deleterious material from damaging the switch means. Proper spacing between the blades is maintained through spacer means 46. Spacer means 46 includes a base member 48 slidably carried within cavity 50 of the terminal block and legs 52 and 54 extending from the base member. As more clearly shown in FIG. 3 the legs 52 and 54 maintain the space between the blades as the slides within the cavity.

Speed reducing means 26 includes a series of gears 27 and pinions 29, the number and configuration of which determine the rotational speed of the cam 23. As shown, gear 27' is connected to output pinion 21 with gear 27' carrying the cam 23.

As shown, the timing means and the speed reducing means is enclosed within housing 42. Housing 42 includes a cup shaped member 43 and a cover plate 45. The housing 42 is held against the motor housing through a plurality of cooperating internally threaded bolts 49 and threaded studs 47 holding each housing against mounting plate 51. The cooperating bolts and stud are encased in sleeve 53 which serves to maintain a predetermined distance between the motor and the timer.

Magnetic coupling means 28 includes a pair of spaced magnets 60 and 62, magnet 60 being fixedly carried on shaft 18 through sleeve 64, magnet 62 being included as part of rotor 25. Rotor 25, in addition to including magnet 62, includes a hub portion 68 and out-

put pinion 21 which are rotatably journaled on shaft 72. The magnets are juxtaposition each other and, as shown in FIG. 4, include an even number of radial pole sections of alternate north and south polarity, the polarity along the axis being opposite that shown. A fibrous material such as a laminated paper base phenolic surrounds magnets 60 to protect it from any deleterious material emanating from the motor section 16.

In operation, and when being used in a refrigerator, when an AC current is applied to the 16, shaft 18 will be rotated. Fan 20 will be rotated in accordance with the rotation of the shaft to circulate air or other gas in the storage compartment of the refrigerator. Magnet 60 will also be rotated in accordance with shaft 18. Because of the magnetic force and the attraction between the two magnets, magnet 62 will also be rotated to thus rotate hub 68 and output pinion 21. Rotation of output pinion 21 causes rotation of cam 23 through speed reduction means 26. As cam 23 is rotated blade 32 will be biased to engage contact 32' with electrical contact 34' to complete an electrical circuit to a defrost device such as a heater to defrost the refrigerator. Upon reaching the arcuate step 30 contact blade 32 will drop to engage electrical contact 32'' with electrical contact 36' to complete an electrical circuit to a cooling means such as a compressor to cool the refrigerator.

The timer section of the device also includes a means 74 to manually set the starting time for the sequential operation of the refrigerator. That is, the time for defrosting or cooling the refrigerator may be set in accordance with the original setting of the cam 23. Means 74 includes a slotted head 76 and clutch means 78. A suitable tool such as a screw driver may engage the head 76 for manual rotation thereof. A knurled knob for fingertip setting may also be used in place of head 76. Clutch means 78 is of the uni-directional type and includes a spring 80 fixedly carried on a hub 82 which is rotatably carried on shaft 84, and gear 86 (part of speed reducing means) have a plurality of slots 88. Upon manual rotation of cam 23 in a predetermined direction, rotation of gear 27'' will cause rotation of shaft 84 through a pinion (not shown) to cause rotation of spring 80. The free ends of spring 80 will pass over the slots 88 so that gear 86 will not be rotated. When cam 23 is being power driven through the motor 16, gear 86 will rotate in the opposite direction, the ends of the spring 80 will engage the slots 88 to be rotated therewith thus causing rotation of hub 82 which through its pinion (not shown) will cause rotation of gear 27''.

Thus there is described a gas circulating and timer means providing two separate functions operating from the same motor the whole unit being neat and compact. Also the timer and motor are "packaged" separately such that each may be handled separately.

What is claimed is:

1. A gas circulating and timer means comprising:

- a. a motor drive means including a rotatable shaft extending through said motor,
- b. a fan carried at one end of said shaft,
- c. a first magnet carried at the other end of said shaft,
- d. a rotor spaced from said first magnet,
- e. said rotor including a second magnet juxtaposition said first magnet,
- f. speed reduction means coupled to said rotor,

g. cam means coupled to said speed reduction means, and switch means responsive to rotation of said cam means.

2. A gas circulating and timer means according to claim 1 wherein said first and second magnets are circular discs each having an even number of poles of alternate north and south polarity, said poles of one of said magnets facing said poles of the other of said magnets.

3. A gas circulating and timer means according to claim 1 wherein said cam means includes a single constant rise cam and said switch means includes a blade having electrical contacts on opposed sides thereof, said blade movable between two spaced fixed blades having electrical contacts cooperating with the first named electrical contacts.

4. A gas circulating and timer means according to claim 3 wherein said blades are cantilevered at one end and wherein spacer means maintains said blades separated a predetermined distance.

5. A gas circulating and timer means according to claim 1 wherein said speed reducing means includes clutch means and means coupled to said speed reducing means permitting manual setting of said timer means.

6. A gas circulating and timer means according to claim 5 wherein said speed reducing means comprises a gear train coupling said cam means to said rotor, said means permitting manual setting includes a shaft carrying said cam means, and said clutch means comprises a spring-biased gear coupling said shaft to said gear train.

7. In a timer wherein a cam means selectively opens and closes switch means in response to motor driven rotation of said cam means, means coupling said cam means to a motor comprising a first magnet coupled to said motor, a second magnet coupled to said cam means such that motor driven rotation of said first magnet causes rotation of said second magnet to cause rotation of said cam means.

8. In a timer according to claim 7 wherein each of said first and second magnets have an even number of poles of alternate north and south polarities, said poles of one of said magnets facing said poles of the other of said magnets.

9. In combination, a timer wherein a cam means selectively opens and closes switch means, and a motor applying power driven rotation to said cam means through speed reducing means connected between said motor and said cam means, said timer and said motor each enclosed in separate housings, means maintaining said housings in spaced relation, first magnetic coupling means coupled to said motor and disposed wholly within said motor housing, second magnetic coupling means coupled to said cam means and disposed wholly within said timer housing, said first and second magnetic coupling means cooperating to operationally couple said motor to said speed reducing means.

10. The combination according to claim 9 wherein said first and second coupling means include permanent magnets.

11. The combination according to claim 9 further including speed reducing means disposed within said timer housing and coupled between said cam means and said second coupling means.

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