

"AUTOMATIC FEEDER"

The present invention relates to an automatic feeder, e.g. for automatically supplying a given amount of granular feed at each of a number of predetermined times.

5 An example of a granular feed which needs to be dispensed at a number of predetermined times is feed for goldfish and tropical fish. Such feed for goldfish and tropical fish must be supplied in a given amount at each of the predetermined times, but it is very difficult to
10 remove such feed from a feed box at each of these predetermined times. There are also the difficulties that an excessive amount of feed can be mistakenly supplied and that feeding may be forgotten owing to the pressure of daily work. A particular problem is that
15 goldfish and tropical fish will sometimes die if feed cannot be supplied in the case of absence from home for a long period.

 According to the present invention, there is provided an automatic feeder comprising a rotatable
20 shaft; a driving motor for rotating the rotatable shaft; a timer for periodically starting and stopping the driving motor so that the rotatable shaft is periodically turned through a predetermined angle; and a feed container which is adapted to receive a granular feed and which is mounted
25 on the rotatable shaft so as to be driven by the latter, the feed container having a partition wall therein which divides the interior of the feed container into a feed receiving part for receiving the granular feed and a discharge path through which the granular feed may be
30 discharged from the feed container, the partition wall

being spaced from a wall of the feed container so as to provide a communicating hole through which the granular feed can pass from the feed receiving part to the discharge path.

5 Preferably, the said predetermined angle is one complete revolution of the feed container.

The present invention enables a small and inexpensive automatic feeder to be provided which can be easily used in most homes. It also enables a given
10 amount of feed which has been received in the feed container to be always discharged from the container regardless of the amount of feed received thereby.

Preferably, the feed container is provided with an adjusting member for adjusting the effective width of
15 the communicating hole, the adjusting member being disposed within the feed container. The adjusting member is preferably slidably engageable with the partition wall and may have a manually engageable member which extends externally of the feed container.

20 In one embodiment of the invention, the feed container is provided with flow dividing means for dividing the flow of the granular feed passing to the communicating hole into two parts one of which passes into the discharge path and the other of which is
25 returned to the feed receiving part. The flow dividing means may comprise a projection on an internal surface of the feed container, the said projection being disposed adjacent to the communicating hole.

30 The granular feed received in the feed receiving part of the feed container can flow into the discharge path through the communicating hole when the feed container is caused to rotate. The amount of the granular feed which flows into the discharge path can be adjusted by previously adjusting the effective width of

the communicating hole, e.g. by operating the adjusting member when the latter is provided. The granular feed which flows into the discharge path can then be discharged from a discharge port to the outside when the feed container is further rotated.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a cut-away sectional view of a first embodiment of an automatic feeder according to the present invention,

Figure 2 is a cut-away sectional view of the said first embodiment showing a timer mechanism;

Figure 3 is a front view of a principal portion of the said timer mechanism;

Figure 4 is a rear view of the said principal portion;

Figure 5 is a front elevation, partly in section, of a feed container forming part of the said first embodiment;

Figure 6 illustrates the rotational operation of the said feed container; and

Figure 7 is a sectional view of a feed container forming part of a second embodiment of an automatic feeder according to the present invention.

Terms such as "right" and "left", as used in the description below, are to be understood to refer to directions as seen in the accompanying drawings.

As shown in Figure 1, a first embodiment of an automatic feeder according to the present invention comprises a driving motor 2 which is mounted in a housing 1 and which has a driving shaft 2a to which a pinion 3 is secured. A rotatable shaft 4 is formed integrally with a gear 5 and with a rotatable plate 6, the rotatable plate 6 having an engagement projection 6a

which forms the stop mechanism described below. The rotatable shaft 4 is driven by the driving motor 2 through the pinion 3 and a gear train comprising gears 7, 8 and 5. The rotatable shaft 4 has a rectangular cross-sectional form (not shown) and an end at which resilient claws 4a, 4a are formed. A feed container 10 for receiving granular feed 9 (shown in Figure 6) engages with the rotatable shaft 4 through a rectangular central hole 11 (best seen in Figure 5) in the feed container 10 so as to prevent relative rotation therebetween, the feed container 10 being connected to the rotatable shaft 4 by virtue of the resilient claws 4a, 4a which engage parts of the feed container 10 adjacent to the central hole 11.

A description will now be given of a timer mechanism T with reference to Figure 2.

A known mechanical clock 12 is mounted in the housing 1 and has an hour shaft 12a which rotates through one rotation every 12 hours. A gear 13 fixed to the hour shaft 12a engages with a gear 14, and a pinion 14a engages with a pinion 15a which is formed in a boss of a time setting plate 15 of the timer mechanism T. The time setting plate 15 is thus caused to rotate through one rotation every 24 hours in the direction shown by an arrow A₁ in Figure 3. A time correcting lug 16 is secured on a minute shaft 12b. As shown in Figure 3, recess portions 15c are formed at the peripheral edge 15b of the time setting plate 15 at intervals corresponding to 10 minutes, and numerals of time (not shown) are printed on the surface of the time setting plate 15 in correspondence with the recess portions 15c. A substantially U-shaped time setting member 17 is detachably mounted on the time setting plate 15 so as to extend to opposite sides of the recessed portions 15c.

The time setting member 17 can engage with a first cam 18 which is shaped substantially as a cross. The first cam 18 is caused to rotate through 45° in the direction shown by an arrow A_2 in Figure 3 by virtue of its engagement with the time setting member 17. As shown in Figure 2, the shaft of the first cam 18 is press fitted in one end of the shaft of a second cam 19 having a slightly larger cross-like shape, the phases of the two cams being the same. A driving switch 20, which is a switch for the driving motor 2, has a switch lever 20a which is adapted to make pressure contact with the cam 19 by virtue of its own resilient force. The second cam 19 rotates through 45° while interlocking with the first cam 18, the rotation of the second cam 19 being in the direction shown by the arrow A_2 in Figure 3 so as to actuate the switch lever 20a by using a pressure portion 19a of the second cam 19 which presses the switch lever 20a, thereby switching the driving motor 2 on.

If a desired timer time is set by mounting the time setting member 17 adjacent a selected one of the recessed portions 15c corresponding to the desired set time, the time setting member 17 engages with the first cam 18 after a given time has passed. Consequently, the first cam 18 and the second cam 19 rotate, and the driving switch 20 is closed so as to start the driving motor 2.

As shown in Figure 2, a third cam 21 is press fitted at the other end of the shaft of the second cam 19. As shown in Figure 4, the third cam 21 has the same shape as that of the first cam 18 and a phase which differs by 45° from those of the first and second cams 18, 19. An engagement projection 6a which can engage with the third cam 21 projects from the outer periphery of the rotatable plate 6. The engagement projection 6a

engages with the third cam 21 each time the rotatable plate 6 is driven by the driving motor 2 in the direction shown by the arrow A_1 , that is, in the same direction as that of the time setting plate 15. (The arrows shown in Figures 2 and 3 are reverse to each other because these drawings are reverse to each other). This causes the third cam 21 to rotate through 45° in the direction shown by the arrow A_2 . The second cam 19 also rotates through 45° while interlocking with the third cam 21, and the switch lever 20a of the driving switch 20 falls into a recessed portion 19b of the second cam 19 so that the driving switch 20 is opened, whereby the driving motor 2 is stopped. At this time, the positions of the cams 18, 19, 21 are returned to the initial states (shown by the solid lines in Figure 3 and the chain lines in Figure 4).

The feed container 10 is described below.

As shown in Figure 5, a discharge port 23 for the granular feed 9 (shown in Figure 6) is provided in a lower end portion of a side wall 22 of the feed container 10. A partition wall 24 extends inwardly in the feed container 10 from the upper edge of the discharge port 23. The partition wall 24 constitutes a boundary of a discharge path 26 in combination with the opposite side wall 25. The end of the partition wall 24 remote from the side wall 22 is cut off so as to be spaced from a wall 22a of the feed container 10 and so as to form a communicating hole 28 through which the discharge path 26 and a receiving part 27 of the feed container 10 communicate with each other. An adjusting member 29 for adjusting the effective width of the communicating hole 28 is slidably mounted in the discharge path 26. The adjusting member 29 has a sliding wall 30 which slides against the lower surface

of the partition wall 24 (as may be seen also in Figures 1 and 2). Sliding adjustment of the adjusting member 29 enables adjustment of the length of the portion of the sliding wall 30 which projects into the communicating hole 28 and thus enables adjustment of the effective width of the communicating hole 28. The adjusting member 29 is also provided with a resilient piece 31 (as shown in Figures 1 and 2) for resisting movement of the sliding wall 30, the resilient piece 31 serving to hold the adjusting member 29 at a given position by virtue of the frictional force between the resilient piece 31 and the side wall 25 and thus help to maintain a constant effective width of the communicating hole 28. An operational lug 29a formed integrally with the adjusting member 29 projects from an elongated hole 32 in the feed container 10 so that the adjusting member 29 can be operated from the outside.

In operation, when the driving switch 20 is closed at a given time by the above-described timer mechanism T, the driving motor 2 is started, and the rotatable shaft 4 is caused to rotate. As a result, the feed container 10 rotates in the direction shown by an arrow A_3 in Figure 6 while being subjected to successive rotational displacement from state (A) to states (B), (C) and (D) and then returned to state (A). A given amount of the granular feed 9 flows into the discharge path 26 from the communicating hole 28 in the course of displacement from state (B) to state (C) and is then discharged to the outside through the discharge port 23 in the course of displacement from state (C) to state (D). When the feed container 10 is caused to rotate further while being displaced from state (D) to state (A), the engagement projection 6a of the rotatable plate 6 engages with the third cam 21, and the driving switch 20

is opened through the second cam 19 so that the driving motor 2 is stopped, whereby the rotation of the feed container 10 is stopped. Since the granular feed 9 is successively guided by the side walls of the feed container 10 and flows into the discharge path 26 in the course of the rotation of the feed container 10, no granular feed remains in the feed container 10.

The amount of feed to be supplied each time to the fish depends upon the size and the number of the fish, and it is necessary to keep a constant amount of feed. However, it was found that there is a variation in the amount of feed discharged caused by the change in the amount of feed 9 received in the receiving part 27 even if the effective width of the communicating hole 28 is adjusted by the adjusting member 29.

A large amount of granular feed 9 is first contained in the receiving part 27, and the discharge port 23 of the feed container 10 faces upwards before the rotation of the feed container 10 commences. That is, in the state wherein the communicating hole 28 is disposed at the bottom, a load is applied to the portion of a large amount of feed received in the container 10 which is placed at the bottom thereof and which thus becomes dense. If the rotation of the feed container 10 is started in the counter-clockwise direction, the feed 9 is not easily transferred to the communicating hole 28 because the feed 9 is subjected to a load.

Most of the feed 9 which is discharged is arranged to be the feed placed in the corner extending from the vicinity of the communicating hole 28 to the discharge path 26.

When the amount of feed gradually decreases to a medium value, the feed placed at the bottom of the receiving part 27 is freed from the load which is

applied by the feed placed in an upper portion of the container 10 at a time when the discharge port 23 faces upwards (i.e. in the state wherein the communicating hole 28 is placed at a lower position), as described above. When the feed container 10 rotates, therefore, the feed 9 continuously flows toward the discharge path 26, resulting in an increase in the amount of the feed discharged.

In a second embodiment of the present invention shown in Figure 7, a feed container 41 has a projection 41B on an inner surface 41a and of the feed container near a communicating hole 48.

In the Figure 7 construction, the feed container 41 is used for receiving granular feed 42 and has a central hole which engages with a driving means 43 and which is formed at the centre of the container 41. A discharge port 44 for feed is provided at a portion of one side wall of the feed container 41, and a partition wall 45 extends inwardly from the edge of the discharge port 44 so as to partition the interior of the feed container 10 into a feed receiving part 46 and a discharge path 47 which are caused to communicate with each other through a communicating hole 48 formed by cutting off the end of the partition wall 45. An adjusting member 49 is in slidable contact with the partition wall 45 for the purpose of adjusting the effective width of the communicating hole 48.

On the adjusting member 49 there is formed a click projection 49a which engages with a plurality of click projections 41c which project from the feed container 41. The adjusting member 49 can be fixed at a position such that the effective width of the communicating hole 48 can be kept at a constant value.

The projection 41B is provided at a position on

the inner surface 41a of the feed container 41 which is close to the communicating hole 48, for example, at a small distance from a line which extends from the partition wall 45 toward the feed receiving part 46 (to the upper right as viewed in Figure 7). A surface 41b of the projection 41B has a tapered form such that an extension thereof is at a predetermined angle with respect to the partition wall 45.

A description will now be given of the operation of the Figure 7 embodiment.

When the motor (not shown) which drives the feed container 41 is stopped, the discharge path 47 of the feed container 41 is placed above the receiving part 46, with the discharge port 44 facing to the left. When the feed 42 is supplied to the fish, the feed container 41 is caused to rotate through one rotation by the operation of a timer (not shown) which has been previously set and then stopped. The rotation of the feed container 41 starts in the clockwise direction from the state wherein the discharge port 44 faces to the left. As the feed container 41 rotates, the discharge path 47 is moved to the right of the receiving part 46, and the discharge port 44 turns upwards. If the receiving container 47 rotates further, it assumes a state wherein the communicating hole 48 for effecting communication between the receiving part 46 and the discharge path 47 is positioned at the lowermost part of the feed container 41.

At the same time, the feed 42 received in the receiving part 46 passes through the communicating hole 48, fills up the corner near the communicating hole 48 and then flows into the discharge path 47. Since the feed container 41 continuously rotates, the flow of the feed 42 is divided into two parts from the receiving

part 46 by the projection 41B and the adjusting member 49. One of the two parts flows into the discharge path 47, and the other is returned into the receiving part 46. This state is shown in Figure 7.

5 When the feed container 41 rotates further, the whole of the feed 41 is guided along the adjusting member 49 and the partition wall 45 by the projection 41B and returned to the receiving part 46. In this
10 state, since the discharge port 44 of the discharge path 47 turns downwards, the feed 42 is discharged from the discharge port 44.

15 When the discharge path 47 is placed above the receiving part 46 with the discharge port 44 facing to the left, the rotation of the feed container 41 is stopped.

20 The amount of the feed 42 which is discharged from the discharge path 47 is limited to the sum of the feed in the vicinity of the communicating hole 48 and a slight amount of the part of the feed which is divided by the projection 41B. The amount of the feed discharged is therefore hardly affected by the change in the amount of the feed contained in the receiving part 46.

25 The adjusting member is not limited to those employed in the above-mentioned embodiments. Namely, it is possible to use any member which is capable of sliding on the surface of the partition wall, which can adjust the effective width of the communicating hole,
30 and which can be operated from the outside. An example of an adjusting member that may be used is one comprising guide projections (not shown) formed on the inner surfaces of the upper and lower walls of the feed container and a sliding plate interposed between the guide projections and the partition wall for the purpose

of adjusting the effective width of the communicating hole, an outwardly projecting operational lug being formed on the sliding plate.

Although the adjusting member is effective to
5 adjust the amount of feed discharged corresponding to the size and number of the fish by adjusting the effective width of the communicating hole, if the amount of feed need not be adjusted, the adjusting member also need not be provided. In addition, if the effective
10 width of the communicating hole is reduced by increasing the length of the partition wall to a value greater than that shown in the drawings, and the discharge of the feed is controlled by adjusting the time set in the timer, the adjusting member can be omitted.

15 Although the embodiments of the present invention shown in the drawings employ a rectangular feed container, sectoral, triangular and other angular containers may also be used.

As described in detail above, the present
20 invention is capable of automatically supplying granular feed at a time set in a timer. It can thus be used to ensure that goldfish and tropical fish are fed regularly and to ensure that they will not die in the case of absence of the owner from home for a long period.

25 In addition, in the Figure 7 embodiment, since the flow of feed is divided by the projection 41B when the feed contained in the feed receiving part 46 is discharged from the discharge path 47, and since the whole of the feed is returned to the feed receiving part
30 46 by the projection 41B after a given time has passed, a given amount of feed is discharged from the discharge port 44 to the outside regardless of the amount of the feed received in the feed receiving part 46.

Further, since an automatic feeder according to

the present invention can be provided at a low cost, a small size and a light weight, the feeder can be installed in many places in a home.

CLAIMS

1. An automatic feeder comprising a rotatable shaft; a driving motor for rotating the rotatable shaft; a timer for periodically starting and stopping the driving motor so that the rotatable shaft is
5 periodically turned through a predetermined angle; and a feed container which is adapted to receive a granular feed and which is mounted on the rotatable shaft so as to be driven by the latter, the feed container having a partition wall therein which divides the interior of the
10 feed container into a feed receiving part for receiving the granular feed and a discharge path through which the granular feed may be discharged from the feed container, the partition wall being spaced from a wall of the feed container so as to provide a communicating hole through
15 which the granular feed can pass from the feed receiving part to the discharge path.
2. An automatic feeder as claimed in claim 1 in which the said predetermined angle is one complete revolution of the feed container.
- 20 3. An automatic feeder as claimed in claim 1 or 2 in which the feed container is provided with an adjusting member for adjusting the effective width of the communicating hole, the adjusting member being disposed within the feed container.
- 25 4. An automatic feeder as claimed in claim 3 in which the adjusting member is slidably engageable with the partition wall.
5. An automatic feeder as claimed in claim 4 in which the adjusting member is provided with a manually
30 engageable member which extends externally of the feed



container.

6. An automatic feeder as claimed in any preceding claim in which the feed container is provided with flow dividing means for dividing the flow of the granular feed passing to the communicating hole into two parts one of which passes into the discharge path and the other of which is returned to the feed receiving part.

7. An automatic feeder as claimed in claim 6 in which the flow dividing means comprises a projection on an internal surface of the feed container, the said projection being disposed adjacent to the communicating hole.

8. An automatic feeder substantially as hereinbefore described with reference to and as shown in Figures 1-6 or Figure 7 of the accompanying drawings.
