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SWIMMING POOLS AND SPAS****Publication Classification**(71) Applicant: **Zodiac Pool Systems LLC**, Carlsbad,
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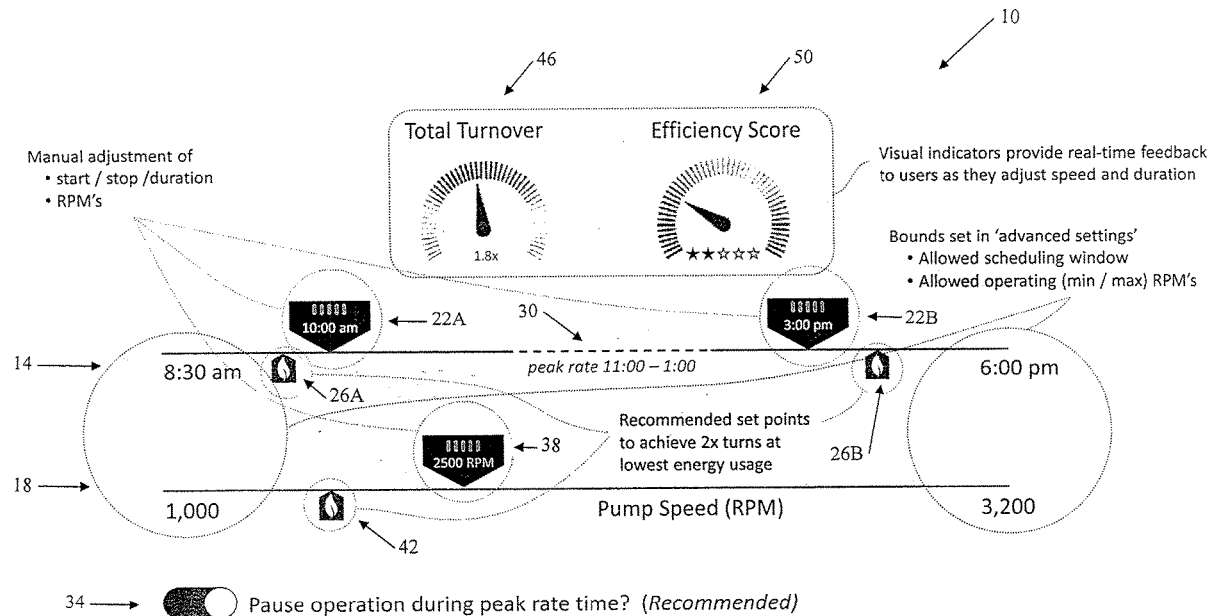
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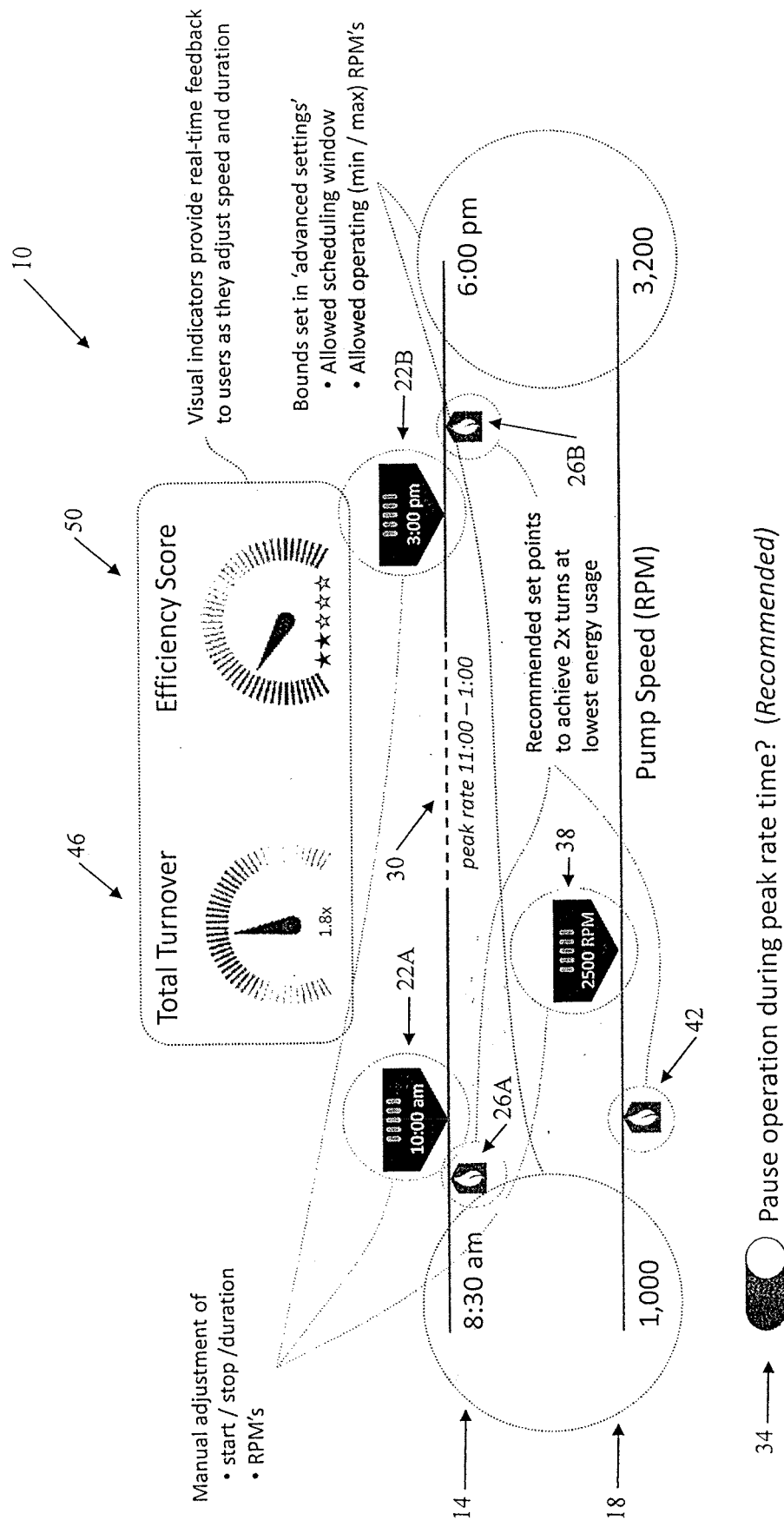
(2) Date: **Aug. 10, 2020****Related U.S. Application Data**(60) Provisional application No. 62/629,921, filed on Feb.
13, 2018.

(57)

ABSTRACT

Systems and techniques for guiding or advising users as to how to control motor speeds of pumping systems are detailed. The systems may solicit input from users and provide recommendations as to settings users may employ in connection with water-circulation systems of, principally, swimming pools and spas. The systems also may permit a user to retain control of both the duration the pool-filtration system will be active and the pump motor speed while providing suggestions to the user that may maximize efficiency of the system or minimize its power consumption (or both).





PUMPING SYSTEMS PRINCIPALLY FOR SWIMMING POOLS AND SPAS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of and priority to U.S. Provisional Patent Application Ser. No. 62/629,921, filed Feb. 13, 2018, and having the same title as appears above, the entire contents of which application are hereby incorporated herein by this reference.

FIELD OF THE INVENTION

[0002] This invention relates to systems and techniques for pumping fluid and more particularly, although not necessarily exclusively, to systems and techniques for controlling water-circulation systems of swimming pools and spas.

BACKGROUND OF THE INVENTION

[0003] U.S. Pat. No. 7,686,589 to Stiles, Jr., et al., whose entire contents are incorporated herein by this reference, describes certain methods of controlling a variable-speed motor of a pump useful “for an aquatic application such as a pool.” See Stiles, Jr., col. 1, 11. 14-33. A user may identify a volume of a pool, a time period, and a desired number of turnovers of water within the pool during the identified time period. Based on this information, a controller may determine a target flow rate and a minimum speed of the variable-speed motor and then operate the motor by “substantially continuously” varying the motor speed “in order to maintain the target flow rate using substantially minimum energy consumption.” See *id.*, col. 18, 11. 27-40.

SUMMARY OF THE INVENTION

[0004] Automatically controlling the speed of a variable-speed motor of a pumping system may be beneficial in some situations. By contrast, allowing a homeowner or other user of a pool or spa to control the motor speed may be advantageous in other situations. Hence, systems and techniques of the present invention seek to guide or advise users while allowing them to maintain control over speeds at which the motors operate in use.

[0005] In particular, systems of the present invention preferably solicit input from users and provide feedback, at least in the form of recommendations, as to settings the users may employ. Some systems, for example, permit a user to retain control of both the duration the pool-filtration system will be active and the pump motor speed while providing recommendations to the user that may maximize efficiency of the system or minimize its power consumption (or both). The innovative systems also may develop confidence among users that they can create efficient filtration schedules and achieve desired numbers of water turns, and avoid need for any additional or external sensors. Systems also may solicit input from users as to one or more characteristics of desired water quality (e.g., clarity) in pools and furnish operational recommendations in response.

[0006] Additionally, systems of the present invention allow users to prioritize, at their discretion and on a case-by-case basis, either flow or efficiency. For example, when a flow path of a water-circulation system becomes obstructed (e.g., by filter loading), efficiency is reduced. In this example, the best manner of increasing efficiency is to clean the filter so as to reduce back pressure in the system,

thereby restoring flow. By contrast, the Stiles, Jr. patent teaches increasing the pump speed (or operational time) in order to maintain a minimum flow rate per day in order to compensate for the obstructed flow path. In doing so, systems of the Stiles, Jr. patent necessarily prioritize flow rate (water turnovers) over optimum efficiency.

[0007] The increasing filter pressure caused by this approach of the Stiles, Jr. patent drives dirt and debris further into the filter. In the case of a fabric/cartridge filter, this result makes the filter more difficult to clean, resulting in an even less-efficient system. By contrast, systems of the present invention encourage, at a user's option, earlier or more frequent cleanings of filters, resulting in a lower total cost of operation.

[0008] Systems of the present invention may include any appropriate means for receiving desired input from a user. An exemplary such means is or includes a software program (“app”) designed to be executed on a smartphone or similar device. The means preferably may provide visual information to the user, although visual displays are not absolutely necessary.

[0009] It thus is an optional, non-exclusive object of the present invention to provide systems and methods for controlling water-circulation systems of swimming pools and spas.

[0010] It is also an optional, non-exclusive object of the present invention to provide systems and methods for guiding or advising homeowners or pool users as to how to control speeds of variable-speed motors of pumping systems.

[0011] It is an additional optional, non-exclusive object of the present invention to provide systems and methods for allowing users to prioritize either flow rate or efficiency of the water-circulation systems.

[0012] It is a further optional, non-exclusive object of the present invention to provide systems and methods for receiving control inputs from and providing visual information to users.

[0013] Other objects, features, and advantages of the present invention will be apparent to those skilled in the appropriate field with reference to the remaining text and the drawing of this application.

BRIEF DESCRIPTION OF THE DRAWING

[0014] The FIGURE illustrates an exemplary display 10 available to a user of the present systems.

DETAILED DESCRIPTION

[0015] As shown in the FIGURE, two virtual sliders 14 and 18 may be displayed to the user: First slider 14 relates to times during which the filtration system will be active, whereas second slider 18 relates to operating speed of the variable-speed motor. A user may manually set at least one start and stop time for the filtration system by moving virtual boundary markers 22A and 22B, respectively. In the depicted example, (start) marker 22A has been moved to 10:00 am, while (stop) marker 22B has been moved to 3:00 pm.

[0016] Also illustrated in connection with first slider 14 are virtual guide markers 26A and 26B. Guide markers 26A and 26B may supply recommended set points for respective markers 22A and 22B in order to achieve certain results. In the exemplary illustration of the FIGURE, guide marker

26A recommends a start time of approximately 9:30 am and guide marker 26B recommends a stop time of approximately 4:00 pm. Further identified on first slider 14 is time period 30 (e.g. 11:00 am-1:00 pm) during which electricity is more (or most) costly to use. Virtual toggle 34 of display 10 allows a user to decide whether operation of the filtration system should be paused during time period 30.

[0017] Second slider 18 permits a user to identify an operating speed of the pump motor. The user may do so by manually moving marker 38, shown in the FIGURE as having been moved to 2500 revolutions per minute (RPM). Like first slider 14, second slider 18 also includes at least one virtual guide marker 42, which in the FIGURE recommends a lower operating speed (e.g. approximately 2000 RPM) for the motor.

[0018] First slider 14 additionally may display absolute bounds for activation times of the filtration system (e.g. “8:30 am” and “6:00 pm”). These absolute bounds may be set separately either by a user or automatically. Second slider 18 similarly may display absolute bounds for motor speeds (e.g. “1,000” and “3,200” RPM), again with the absolute bounds being set either by a user or automatically.

[0019] Yet further, display 10 may furnish real-time feedback of likely results of the user’s settings (and adjustments of the settings). Depicted in the FIGURE are two visual indicators, with indicator 46 identifying the projected number of turns of pool water and indicator 50 providing information as to efficiency of electricity usage. In the case of the FIGURE, indicator 46 identifies the settings as likely to cause 1.8 turns of the pool water, while indicator 50 provides an exemplary efficiency score of two stars out of a possible five stars.

[0020] Additional information may be furnished by the “app” in order to provide an advanced, or more comprehensive, analysis to a user. The information may be supplied either as part of display 10 or distinct therefrom and comprise, for example, the duration of operation of the filtration system, an estimated number of turnovers, and an estimated energy usage. Persons skilled in the art will, of course, recognize that other or additional information may be delivered to the user. In essence, the invention may provide guidance for empowering a user to make certain decisions himself or herself rather than disabling the user’s ability to make the decisions by making them automatically instead, as in the Stiles, Jr. patent.

[0021] The foregoing is provided for purposes of illustrating, explaining, and describing embodiments of the present invention. Modifications and adaptations to these embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of the invention. As one example, display 10 may differ in any desired way from that shown in the FIGURE. Virtual guide markers 26A-B and 42 additionally may change position over time as, for example, filters of the filtration system load with debris and hence become less efficient at their tasks.

What is claimed is:

1. A method of controlling a water-circulation system of a swimming pool or spa, comprising:

a. receiving input settings from a human to an electronic device relating to operational characteristics of the water-circulation system, the received input settings comprising (i) an operating duration of the water-circulation system, (ii) an operating speed of a motor of a pump of the water-circulation system, (iii) absolute

bounds for activation times of the water-circulation system, (iv) absolute bounds for operating speed of the motor of the pump of the water-circulation system, and (v) whether operation of the water-circulation system is to be paused during a pre-determined time period;

b. using the electronic device, providing recommendations to the human relating to the water-circulation system responsive to the received input settings, the recommendations comprising (i) a start time for operation of the water-circulation system, (ii) a stop time for operation of the water-circulation system, and (iii) an operating speed of the motor of the pump of the water-circulation system; and

c. displaying, on the electronic device, visual information responsive to the received input settings, the visual information comprising (i) a projected number of turns of pool water achievable by the water-circulation system and (ii) information as to projected efficiency of electricity usage of the water-circulation system.

2. A method of controlling a water-circulation system of a swimming pool or spa, comprising:

a. receiving at least one input setting from a human to an electronic device relating to at least one characteristic of the water-circulation system; and

b. using the electronic device, providing at least one recommendation to the human relating to the water-circulation system responsive to the at least one received input setting.

3. A method according to claim 2 in which the at least one recommendation comprises a start time for operation of the water-circulation system.

4. A method according to claim 3 in which the at least one recommendation further comprises a stop time for operation of the water-circulation system.

5. A method according to claim 2 in which the at least one recommendation comprises an operating speed of a motor of a pump of the water-circulation system.

6. A method according to claim 2 in which (a) the at least one received input setting comprises (i) operating duration of the water-circulation system and (ii) operating speed of a motor of a pump of the water-circulation system and (b) the at least one recommendation comprises (i) start and stop times for operation of the water-circulation system and (ii) an operating speed of the motor of the pump of the water-circulation system.

7. A method according to claim 2 further comprising displaying, on the electronic device, visual information responsive to the at least one received input setting.

8. A method according to claim 7 in which the visual information is selected from the group consisting of (a) a projected number of turns of pool water achievable by the water-circulation system or (b) information as to efficiency of electricity usage of the water-circulation system.

9. A method according to claim 6 in which the at least one received input setting further comprises (a) absolute bounds for activation times of the water-circulation system or (b) absolute bounds for operating speed of the motor of the pump of the water-circulation system.

10. A method according to claim 6 in which the at least one received input setting further comprises whether operation of the water-circulation system is to be paused during a pre-determined time period.

11. A method according to claim 2 further comprising receiving at least one revised input setting from the human.

12. A method according to claim **11** further comprising, using the electronic device, providing at least one revised recommendation to the human.

13. A method according to claim **2** in which the at least one received input setting comprises identification of a characteristic of a desired quality of water in the swimming pool.

14. A method according to claim **13** in which the desired quality of water in the swimming pool is clarity.

15. A system for controlling a water-circulation system of a swimming pool or spa, comprising an electronic device comprising means for:

- a. receiving at least one input setting from a human relating to at least one characteristic of the water-circulation system; and
- b. providing at least one recommendation to the human relating to the water-circulation system responsive to the at least one received input setting.

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