FIG. **1** is a schematic view of the pump apparatus in a preferred embodiment of the invention showing a supply container, a pump assembly, a controller for controlling the pump assembly, and a dispensing head;

FIG. **2** is a partial cross-sectional side view of the pump assembly and supply container;

FIG. **3** is a top view of the supply container;

FIG. **4** is a cross-sectional view of a vacuum generation device;

FIG. **5** is a cross-sectional view of the pump assembly showing an impeller, pressure plates with their corresponding gear, and ring gear;

FIG. **6** is a perspective view of the impeller;

FIG. **7** is a perspective view of a pressure plate in a first embodiment of the invention;

FIG. **8** is a perspective view of the pressure plate in an alternative embodiment of the invention;

FIG. **9** is a top view of a magnetic plate attached to the impeller in a first embodiment;

FIG. **10** is a top view of the magnetic plate in an alternative embodiment of the invention;

FIG. **11** is an end view of the pressure plate of FIG. **7**;

FIG. **12** is a partial end view of the pump assembly showing the impeller and the pressure plates in a first position;

FIG. **13** is a partial end view of the pump assembly showing the impeller and the pressure plates in a second position;

FIG. **14** is a partial top view of a lower spur gear on the pressure plate, a ring gear and a tower gear;

FIG. **15** is a cross-sectional view of the dispensing head in one embodiment of the invention showing the flow paths and a pressure switch assembly;

FIG. **16** is a schematic top view of the dispensing head showing the flow paths of the material being pumped;

FIG. **17** is a bottom view of the dispensing head in a first embodiment showing the material outlet, smoothing plate and doctor blade;

FIG. **18** is a top view of the dispensing head of FIG. **17**;

FIG. **19** is a side view of the dispensing head in the embodiment of FIG. **17**;

FIG. **20** is a side view of the dispensing head in an alternative embodiment having a V-shaped bottom surface for applying material to a corner;

FIG. **21** is a perspective view of the dispensing head of FIG. **20**;

FIG. **22** is a schematic block diagram of the controller for the pump apparatus constructed in accordance with a preferred embodiment of the present invention; and

FIGS. **23**A, **23**B and **23**C are a flow chart depicting a sequence of operations for controlling the pumping apparatus in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, the present invention is directed to a pulseless pumping apparatus **10** for dispensing a fluid material including a supply container **12**, pump assembly **14**, dispensing head **16** and controller **18** for controlling the output of the pumping assembly. The pumping apparatus **10** of the invention is particularly well suited for pumping viscous materials to a dispensing head **16** for applying the material to a work surface. Controller **18** is connected to dispensing head **16** to sense the flow conditions and pump requirements for the particular dispensing task and control the output flow from the pump assembly **14**. A supply tube **20** connects pump assembly **14** to dispensing head **16**.

Pumping apparatus **10** in preferred embodiments is mounted on a suitable carriage or provided with shoulder straps and harness (not shown) for carrying on the operator's back. The apparatus can be connected to power outlet or be provided with a self-contained internal power source, such as a battery pack, as discussed hereinafter in greater detail.

Pumping apparatus **10** is able to pump a variety of different viscous materials efficiently and easily. Controller **18** is designed to determine the type of material being pumped and control the operation of pumping assembly **14** according to the type of material by continuously monitoring internal pump pressure and output pressure at dispensing head **16** and adjusting the output flow to meet the requirements of dispensing head **16**.

Examples of suitable viscous materials include wallboard joint compound, floor mastics, ceramic tile mastics, wallpaper adhesives and ceiling tile adhesives. Dispensing head **16** is in a form to accommodate the particular material being pumped and includes appropriate tooling to effectively apply the material. For example, a wallboard joint compound uses a tool having a smoothing blade and joint tape dispenser as discussed hereinafter in greater detail. The compositions pumped by pumping apparatus **10** can be standard commercially available materials or can be specially formulated for the particular end use.

FIG. **2** shows a partial cross-sectional view of pump apparatus **10** and supply container **12**. Supply container **12** can be a variety of shapes and sizes depending on the material being dispensed and the volume needed. In one preferred embodiment illustrated in FIGS. **2** and **3**, supply container **12** includes a hollow plastic jug-like container **30** having an outlet **32** defined by a neck **34**. Container **30** preferably has thin flexible walls so that container **30** can collapse as material is withdrawn from within. In this manner, it is not always necessary to vent container **30**, although an optional one-way venting valve **36** can be included to allow air to enter container **30**.

Neck **34** of container **30** is dimensioned to provide a sufficiently large opening to allow the material to flow easily to pump assembly **14**. The outer surface of neck **34** preferably includes external threads **38** for mating with internal threads of a closure cap (not shown). Alternatively, neck **34** can include a lip (not shown) for receiving a suitable closure by an interference fit. Container **30** is preferably housed within a protective housing **44** to prevent crushing or puncturing of container **30**. Typically, housing **44** is a crush-resistent cardboard carton enclosing the sides and ends of container **30** and including an opening **46** for neck **34** of container **30**.

Supply container **12** in embodiments of the invention includes an identification device for identifying the material in container **30**. In the embodiment of FIG. **2**, an annular magnet **48** is fixed to container **30** around neck **34**. Magnet **48** is characterized by a predetermined gauss assigned to a particular material as a means to identify the material in container **30**. Magnet **48** is positioned so that, when supply container **30** is coupled with pump assembly **14**, a magnetic reed switch **78** contacts magnet **48** and, after being converted to a digital signal, sends an identifying signal to controller **18** identifying the contents. Controller **18** operates