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Kernen

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[54] **MOULDING APPARATUS**

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[52] **U.S. Cl.** **425/4,** 425/146

[51] **Int. Cl.** **B29d 27/04**

[58] **Field of Search** 425/4, 817, 146; 264/51

[56] **References Cited**

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[57] **ABSTRACT**

The invention concerns a moulding apparatus provided with a cooling system and comprising at least one mould chamber having walls defining a mould cavity, at least one wall defining a wall cavity and also defining a plurality of apertures to allow communication between the mould cavity and the wall cavity; a steam distribution means comprising a steam distributor pipe having a first and a second section; a plurality of steam connecting pipes extending from the first and second sections of the steam distribution pipe and connected to the said wall to communicate with said wall cavity thereof; a coolant inlet pipe connected to the distribution pipe to define a junction between said first and second sections thereof; a coolant output means comprising a coolant outlet pipe connected to the first section of the steam distribution pipe; a multi position shut-off valve mounted at the junction of the first and second sections of the distribution pipe with the coolant inlet pipe and having at least two shut-off positions, a first position to shut off the coolant inlet pipe and a second position to shut off the first section of the steam distribution pipe; and a multi position shut-off valve switch-over means for switching from first said shut-off position to second said shut-off position and vice versa.

2 Claims, 2 Drawing Figures

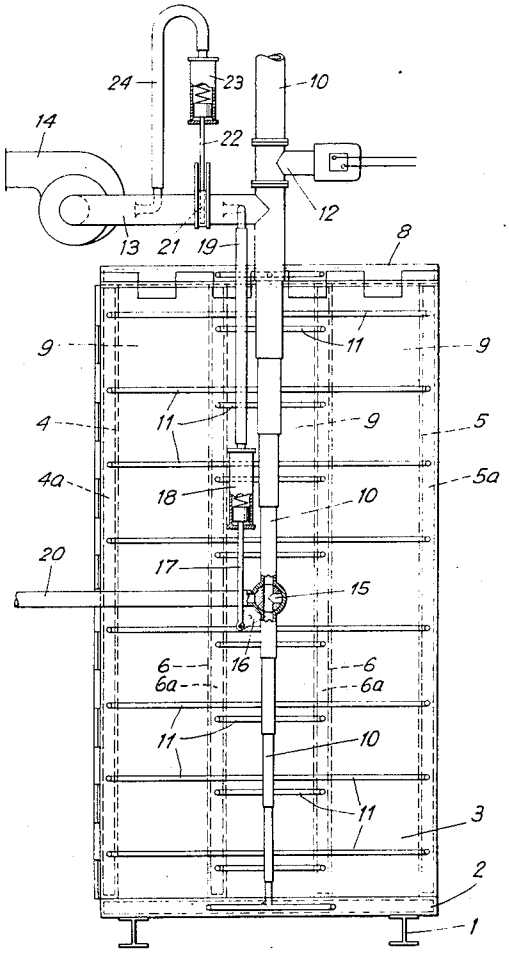


FIG. 1

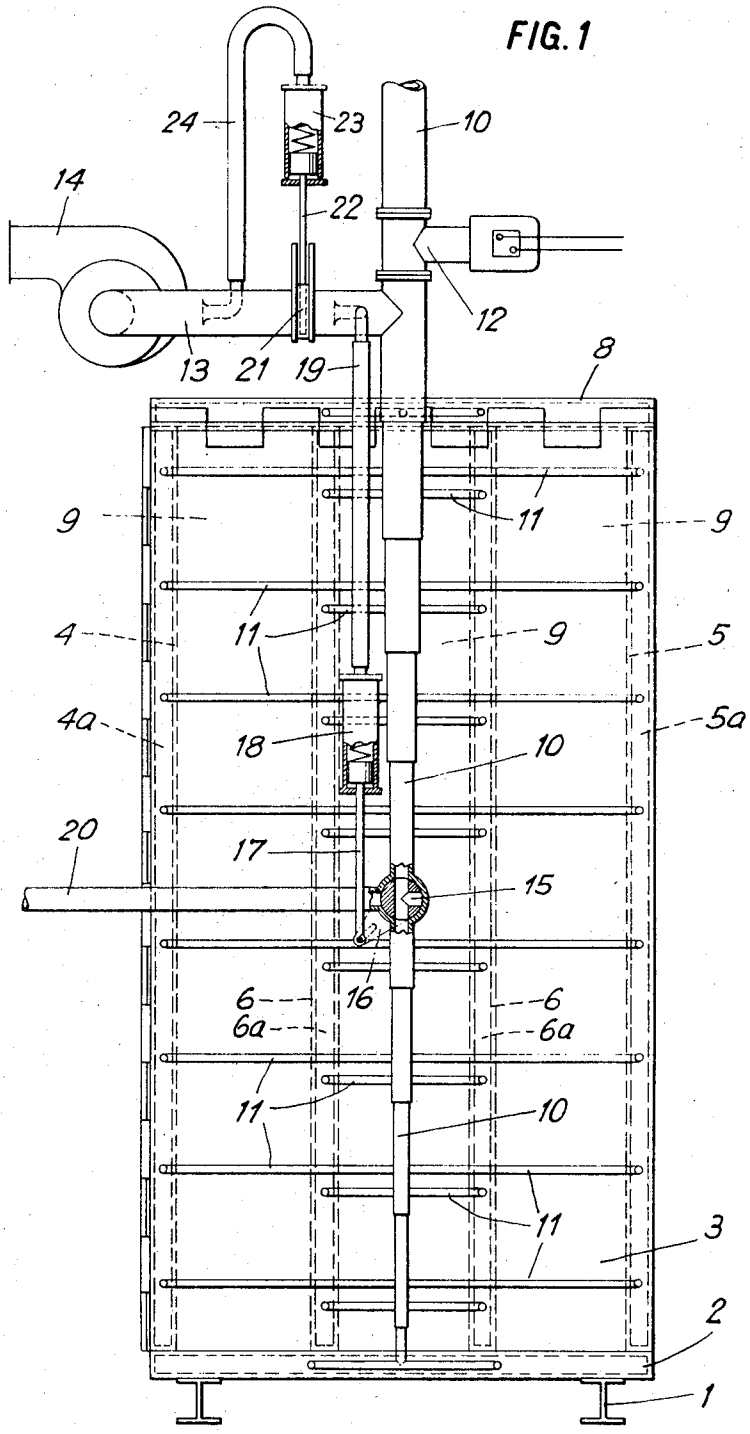
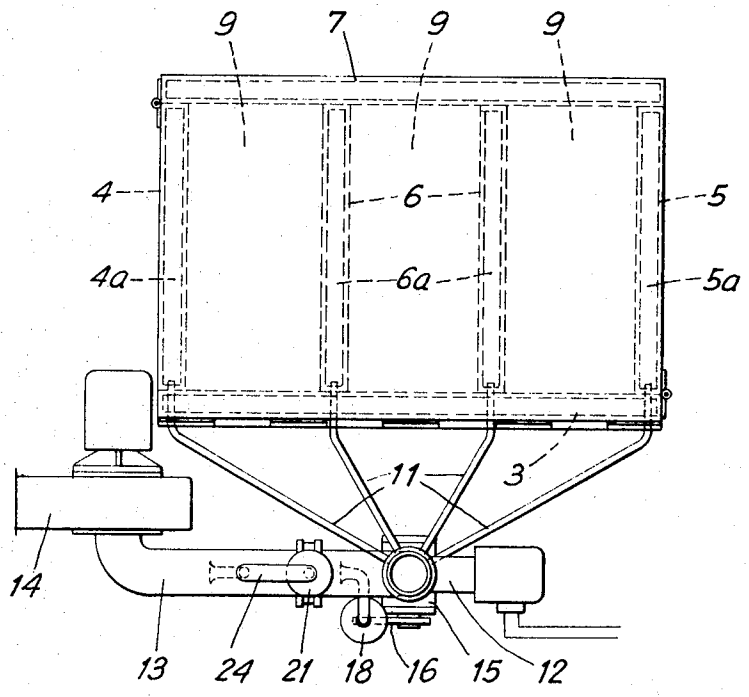

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FIG. 2



MOULDING APPARATUS

BACKGROUND FIELD OF INVENTION

1. FIELD OF INVENTION

The present invention relates to a moulding apparatus, and more specifically to apparatus for moulding blocks of rigid plastic foam.

2. Description of the Prior Art

Some apparatus for moulding blocks of rigid plastic foam comprise a plurality of moulding chambers having hollow side walls, the hollow cavities within the side walls being connected by steam connecting pipes to a main steam distribution pipe through which steam may be passed. The moulding chamber cavities communicate with the hollow side wall cavities by means of a series of fine slits, such that on filling the mould chambers with prefoamed plastic granulate material, steam may be admitted into the mould chambers from the distribution pipe through the connecting pipes into the hollow side wall cavities and through the slits, so that blocks of rigid plastic foam may be moulded.

Hitherto, when passage of steam into the mould chamber cavities is discontinued, the apparatus and thus the blocks of plastic foam, have been allowed to cool merely under the influence of the surrounding air. With moulding apparatus having one only moulding chamber, this process delays the removal of the moulded rigid plastic foam block, thereby not allowing the most efficient operation of the moulding apparatus. Furthermore, with apparatus having a plurality of moulding chambers, in side-by-side relationship, in view of the slower natural cooling of the intermediate chambers with respect to the outer chambers, forced cooling of at least the intermediate chambers is clearly desirable in order to achieve efficient operation of the moulding apparatus.

SUMMARY OF THE INVENTION

The present invention has as an object to provide a moulding apparatus with a cooling system and allow greater efficiency of operation of the moulding apparatus. Accordingly, the invention provides a moulding apparatus comprising

a. at least one mould chamber having walls defining a mould cavity, at least one wall defining a wall cavity and also defining a plurality of apertures to allow communication between the mould cavity and the wall cavity,

b. a steam distribution means comprising a pipe having a first and a second section,

c. a plurality of steam connecting pipes extending from the first and second sections of the distribution pipe and connected to the said wall to communicate with said wall cavity thereof,

d. a coolant inlet pipe connected to the distribution pipe to define a junction between said first and second sections thereof,

e. coolant outlet means comprising a coolant outlet pipe connected to the first section of the steam distribution pipe,

f. a multi-position shut-off valve mounted at the junction of the first and second sections of the distribution pipe with the coolant inlet pipe and having at least two shut-off position, a first position to shut off the collant inlet pipe and thus to allow communication between the first and second sections of the steam distribution pipe only, and a second position to shut off the first section of the steam distribution pipe and thus to allow communication between the coolant inlet pipe and the second section of the steam distribution pipe, and

g. multi-position shut-off valve switch-over means for switching from said first shut-off position to said second shut-off position and vice versa,

Further objects and advantages will appear from the following description of a preferred embodiment of the invention, and the novel features will be particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a moulding apparatus of a preferred embodiment,

FIG. 2 is a plan view of the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with a preferred embodiment, a moulding apparatus for moulding blocks of rigid plastic foam comprises a pedestal **1** supporting three moulding chambers. The moulding chambers comprise a floor **2**, a back wall **3**, outer side walls **4** and **5**, intermediate side walls **6**, a front wall **7** and a top wall **8**. The back wall **3** and outer side wall **4** are fixed to the floor **2**. The outer side wall **5**, front wall **7** and top wall **8** are hingedly mounted and movable hydraulically about their respective hinges, by means of piston and cylinder assemblies (not shown). Locking mechanisms (not shown) are also provided for the hinged walls. The walls **2** to **8** are hollow to define wall cavities, the cavities of walls **4**, **5** and **6** being designated **4***a*, **5***a* and **6***a* respectively. The walls **2** to **8** define three aligned mould cavities **9**, the faces of the walls bounding the mould cavities being provided with a plurality of apertures in the form of narrow slits to allow communication between the wall cavities and the mould cavities. Running along the length of the moulding apparatus is a steam distribution pipe **10** generally tapered in steps along its length and comprising a first and second section, the second section being of approximately the same length as half the height of the moulding chambers. A plurality of connecting pipes **11** are connected to the first and second sections of the steam distribution pipe **10** and extend therefrom normal thereto and are connected to the side walls **4**, **5** and **6** to communicate with the wall cavities **4***a*, **5***a* and **6***a* respectively thereof. One end of the steam distribution pipe **10**, i.e., of the second section thereof, terminates in a connecting pipe **11**. The other end of the steam distribution pipe **10**, i.e., of the first section thereof, is connected to a steam source (not shown). Intermediate the steam source and the connecting pipes **11**, in the steam distribution pipe **10** is an electrically operated shut-off valve **12** electrically connected to a collant extractor **14**, described below. Intermediate the shut-off valve **12** and the connecting pipes **11** is a limb of the steam distribution pipe **10** which constitutes a coolant outlet pipe **13** and which is connected to a coolant extractor **14**. The coolant outlet pipe **13** is provided with a shut-off valve **21**. The shut-off valve **21** is operable by means of a pressure sensor comprising a pressure sensor pipe **24** extending from the coolant outlet pipe in the vicinity of the coolant extractor **14** and connected to the cylinder of a piston and cylinder assembly **23**. The piston of the piston and cylinder assembly **23** is spring loaded

towards the fully retracted position thereof and is operably connected by means of a rod **22** to the shut-off valve **21.**

A coolant inlet pipe **20** is connected to the first and second sections of the steam distribution pipe **10** to define a junction therewith. At the junction of the first and second sections of the steam distribution pipe **10** and the coolant inlet means **20** is arranged a shut-off valve **15** in the form of a three way stop valve having two operable positions, i.e., one position to shut off the first section of the steam distribution pipe **10** and another position to shut off the coolant inlet pipe **20.** The shut-off valve **15** is connected to a pressure sensor comprising a pressure snesor pipe **19** connected to the mouth of the coolant outlet pipe **13** and to the cylinder of a piston and cylinder assembly **18,** the piston thereof being spring loaded towards the fully retracted position thereof and being operably connected, by means of a rod **17,** to the shut-off valve **15.**

In use of the moulding apparatus of the embodiment hereinbefore described, the mould cavities **9** of the mould chambers are filled with prefoamed rigid plastic granulate. At this instant, valve **21** is closed, valve **12** is open and valve **15** is in a position that shuts off the coolant inlet pipe **20.** The top wall **8** of the apparatus is replaced and all locking mechanisms have been set. Steam from the steam source (not shown) is admitted to the first section of the steam distribution pipe **10** and flows down the length thereof past the shut-off valve **15** and into the second section thereof. From the steam distribution pipe, the steam flows along the connecting pipes **11** into the side wall cavities **4***a*, **5***a* and **6***a* and thence through the slits in the side walls **4, 5** and **6** into the mould cavities **9** filled with pastic granulate. Steam inlet continues until the plastic foaming and moulding process is completed. To terminate the foaming and moulding process, shut-off valve **12** is actuated to shut off steam inlet to the moulding apapratus. Simultaneously, by means of the electrical connection between the shut-off valve **12** and coolant extractor **14,** in this case on air extractor, coolant extractor **14** is activated to tend to evacuate air from the system comprising the coolant inlet pipe **13** to the shut-off valve **21.** The air pressure within the pipe **19** to the shut-off valve **21** rapidly diminishes until a critical and predetermined reduced pressure is reached whereupon the piston of the piston and cylinder assembly **23** is drawn into the cylinder and by means of connecting rod **22,** shut-off valve **21** is opened to allow communication of the coolant extractor **14** with the distribution pipe **10.** Again the coolant extractor **14** tends to evacuate air and steam from the system comprising the coolant outlet pipe **13,** and in this case, the steam distribution pipe **10,** connecting pipes **11,** side wall cavities **4***a*, **5***a*, and **6***a* and mould cavities **9.** Progressively the pressure within the system diminishes until a critical and predetermined reduced pressure is reached. At this point, the reduced pressure in the pressure sensor pipe **19** causes the piston of piston and cylinder assembly **18** to be drawn into the cylinder thereof to switch the shut-off valve **15** from one operable position to another, whereby, instead of shutting off the coolant inlet pipe **20,** the first section of the distribution pipe **10** is shut off allowing fluid connection between coolant inlet pipe **20** and the second section of the steam distribution pipe **10.** It will be appreciated that, as the whole apparatus is at reduced pressure, almost instantaneously cool outside air is drawn into the coolant inlet pipe **20** to pass down the second section of the distribution pipe **10,** through the corresponding connecting pipes **11,** along the side wall cavities **4***a*, **5***a* and **6***a* out along the connecting pipes **11** connected to the first section of the distribution pipe **10** and out through the extractor via coolant outlet pipe **13.** Thereafter, the action of the extractor **14** maintains air circulation in the above described manner. After the apparauts and the moulded rigid foam plastic blocks have been cooled to the desired temperature, the locking mechanisms (not shown) are unlocked, and the piston and cylinder assemblies (not shown) are actuated to hinge open walls **7** and **8.** Removal of the rigid plastic blocks is effected in conventional manner.

It will be appreciated that the cooling system of the apparatus of the embodiment hereinbefore described avoids or substantially reduces differential cooling that might otherwise occur, by the almost instantaneous expansion of cool air into the low pressure system of the moulding apparatus.

Whilst a preferred form of the present invention has been described, changes and modifications may be made therein within the scope of the appended claims without departing from the scope and spirit of the invention.

What is claimed is:

1. A molding apparatus for molding blocks of rigid plastic foam provided with a cooling system and comprising, at least one molding chamber being bounded by a pair of concentric walls which define a wall cavity, said walls having a plurality of apertures therein to allow communication between said wall cavity and said chamber, said at least a wall cavity being connected by connecting pipes to a generally vertical steam distribution pipe which is connected to a steam source, said steam distribution pipe having upper and lower portions which are connected at a junction, a coolant inlet pipe connected to said distribution pipe at said junction, a coolant extractor connected to a coolant outlet pipe having a coolant shut-off valve, said coolant outlet pipe being connected to said upper section of said steam distribution pipe, a steam shut-off valve disposed in said upper section of said distribution pipe between said source and said coolant outlet pipe, a multiposition shut-off valve mounted at said junction and being movable between a first position in which said coolant inlet pipe is shut off and a second position in which the upper portion of said distribution pipe is shut off, means for switching said valve from said first position to said second position, said coolant shut-off valve having valve operating means associated therewith which valve operating means comprises a pressure sensor interposed in the coolant outlet pipe between the coolant extractor and the coolant shut-off valve and which operating means is effective to open the coolant shut-off valve when a predetermined reduced pressure is sensed.

2. The molding apparatus of claim **1** wherein said means for switching said multiposition shut-off valve comprises a pressure sensor interposed in the coolant outlet pipe between the coolant shut-off valve and the steam distribution pipe, said switching means being effective to switch said multiposition shut-off valve from said first position to said second position when a predetermined reduced pressure is sensed.

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