Aug. 22, 1967 H. S. SMITH, JR 3,336,632

APPARATUS FOR THE FORMATION OF WALLED STRUCTURES

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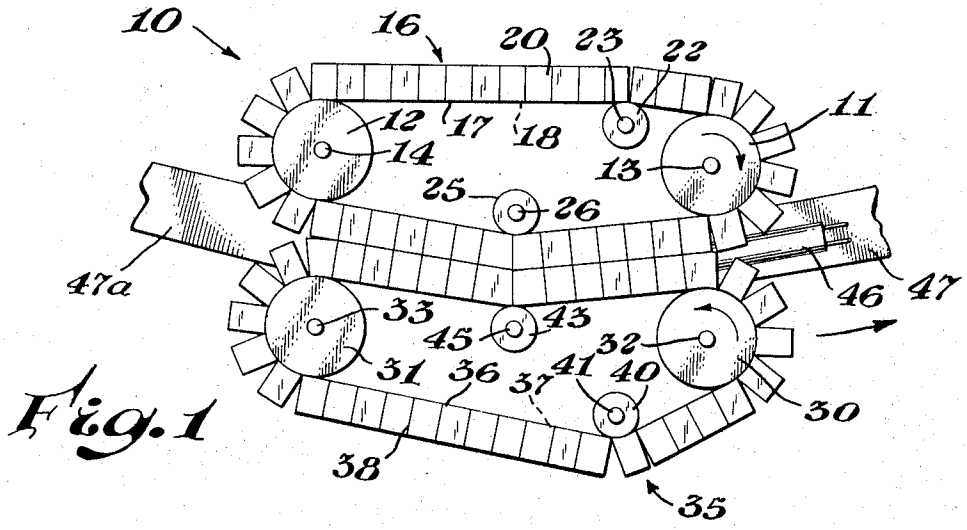

Fig. 1

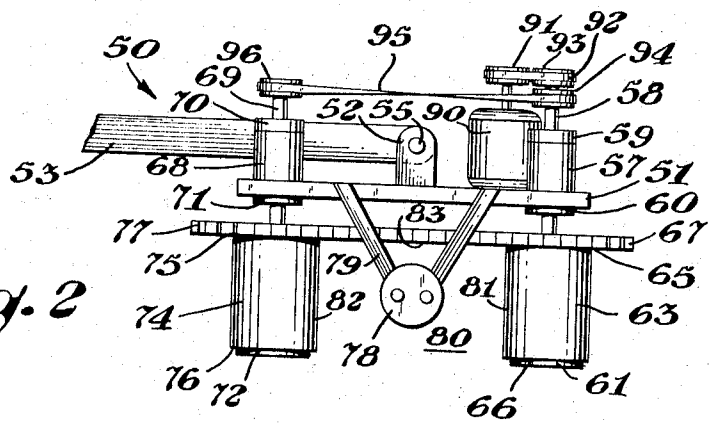

Fig. 2

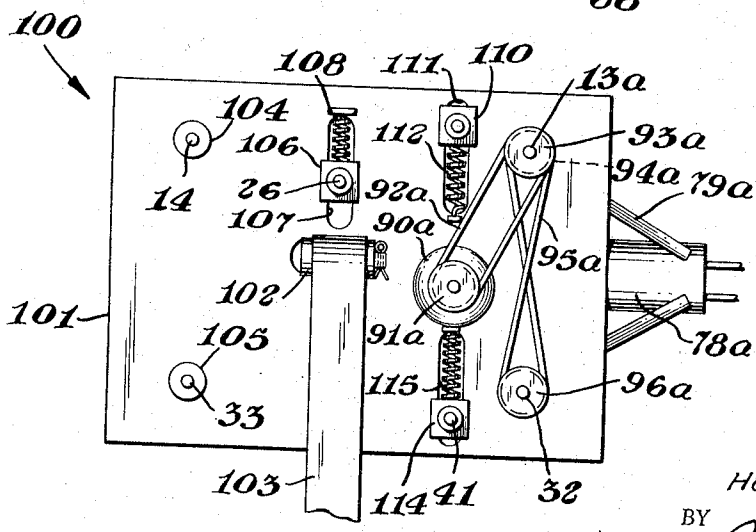

Fig. 3

INVENTOR.
Hubert S. Smith Jr.
BY
Robert B. Ingraham
AGENT

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APPARATUS FOR THE FORMATION OF WALLED STRUCTURES

Hubert S. Smith, Jr., Bay City, Mich., assignor to The Dow Chemical Company, Midland, Mich., a corporation of Delaware

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5 Claims. (Cl. 18—5)

This invention relates to an improved apparatus for the formation of walled structures and more particularly relates to an improved walled structure from a liquid, hardenable, foam-forming composition.

Desirable structures are fabricated from synthetic resinous foamable materials as set forth in United States Letters Patent 3,206,899, wherein the strips of a plastic foam material are bonded to each other and spirally deposited to form a walled structure. U.S. 3,206,899 also discloses the preparation of such structure using particulate expandable granular plastic material which on expansion foams and forms a unitary body. Frequently, for many applications such techniques are not desirable and it would be beneficial to prepare a walled structure from a liquid foamable, hardenable material deposited generally in the manner set forth in the Wright patent; however, considerable difficulty is encountered in the restraining of the hardenable, foamable material in a channel having the desired rectangular configuration.

It would be desirable if there were available an apparatus for the preparation of walled structures by a spiral generation technique which would permit the use of a foamable, hardenable material.

It would also be advantageous if there were available a simplified foam depositing head which would deposit a foam strip of generally rectangular cross-sectional configuration from a foamable, hardenable substance.

It would also be advantageous if such an apparatus were available which would conform generally to the curvature of the structure being prepared.

These benefits and other advantages, in accordance with the present invention, are obtained in a foam depositing head for the spiral generation of walled structures, the foam depositing head comprising in cooperative combination a frame, the frame supporting a first pair of side rolls and a second pair of side rolls, the rolls being rotatably mounted in generally parallel relationship to each other, a first forming belt, the first forming belt having a first edge and a second edge, the first edge of the first forming belt defining a plurality of adjacent segments projecting outwardly therefrom and being in adjacent generally contiguous arrangement, the first edge of the first forming belt being disposed generally adajcent the frame, the first forming belt passing over the first pair of side rolls, a second forming belt passing over and being supported by the second set of side rolls, the second forming belt having a first edge and a second edge, the first edge of the second forming belt having a plurality of outwardly extending generally contiguous segments, the first and second forming belts defining therebetween a channel having three sides and a first end and a second end, the first and second ends of the channel being open, the first side being defined by the first forming belt, the second side being defined by the second forming belt and a third side defined by the segments of the first and second forming belts, means to rotate the first and second pairs of rolls and to move the adjacent surfaces of the first and second forming belts in a like direction, means to provide a foamable, hardenable composition to the channel defined by the belts.

Further features and advantages of the present invention will become more apparent from the following specification and drawing wherein:

FIGURE 1 is a schematic representation of the forming belt and roll portion of the apparatus of the invention;

FIGURE 2 is a schematic end view of the apparatus in accordance with the invention; and

FIGURE 3 is a schematic representation of the support and drive mechanism for the roll configuration of FIGURE 1.

In FIGURE 1 there is schematically depicted a forming configuration generally designated by the reference numeral **10**. The forming configuration **10** comprises a first pair of rolls **11** and **12**. The rolls **11** and **12** have shafts **13** and **14** about which they are rotated. A forming belt **16** passes about the periphery of the rolls **11** and **12**. The belt **16** has a first edge **17** and a second edge **18**. A plurality of dependent segments **20** project from the first edge **17** of the belt **16**. The segments **20** project outwardly from the rolls **11** and **12**. An outward tensioning roll **22** is disposed generally adjacent the roll **11** and is rotatble about a shaft **23**. An inwardly tensioning roll **25** is disposed about midway between the rolls **11** and **12** and is rotatable about the shaft **26**. Oppositely disposed and generally parallel to the rolls **12** and **13** are a second set of forming rolls **30** and **31**. The rolls **30** and **31** have shafts **32** and **33**, respectively. A second belt **35** passes about the periphery of rolls **30** and **31**. The second forming belt **35** has a first edge **36** and a second edge **37**. A plurality of contiguous segments **38** project outwardly from the upper edge **36** of the second belt **35**. An outwardly tensioning roll **40** is disposed generally adjacent the roll **30** and is rotatably mounted upon the shaft **41**. A second forming belt tensioning roll **43** is disposed within the loop formed by the belt **35** and is rotatable about the shaft **45**. A dispenser **46** is disposed generally adjacent the rolls **11** and **30**. The dispenser **46** is adapted to deliver a foamable, hardenable material to a channel, not shown, defined by forming belts **16** and **35** which form two sides of the channel. A third side of the channel is formed by the cooperation of the segments **20** and **38**. A fisrt foam layer **47** is illustrated generally adjacent the dispenser **46** and a freshly formed walled layer **47*a*** is shown generally adjacent the rolls **12** and **31**. The forming apparatus moves in the direction indicated by the arrow.

In FIGURE 2 there is schematically illustrated a front view of a forming roll assembly generally as depicted in FIGURE 1 and designated by the reference numeral **50**. The assembly **50** comprises in cooperative combination a frame **51**. The frame **51** defines a support pivot **52**. A support arm **53** is pivotally affixed to the support **52** by means of a pivot pin **55**. The frame **51** has affixed thereto a first bearing means **57**. The bearing means **57** has journaled therein a shaft **58** secured in position by the set collars **59** and **60**. A roll **61** is rigidly affixed to the shaft **58**. A first forming belt **63** passes over the roll **61** and a second roll, such as the roll **12** of FIGURE 1, not shown. The forming belt **63** has a first edge **65** and a second edge **66**. A plurality of segments **67** project outwardly from the first edge **65** of the belt **63**. A second bearing **68** is rigidly supported adjacent the bearing **57**. A shaft **69** is journaled within the bearing **68** and is generally parallel to the shaft **58**. The shaft **69** is maintained in position by means of the set collars **70** and **71**. A roll **72** is rigidly and coaxially affixed to the shaft **69**. A second forming belt **74** passes over the roll **72** and another roll such as the roll **33** of FIGURE 1. The belt **74** has a first edge **75** and a second edge **76**. A plurality of segments **77** project outwardly from the first edge **75** of the belt **74**. A foam dispensing head **78** is supported in a position generally adjacent the rolls **61** and **72** by means of support means **79**. The belts **63** and **74** define a three sided channel **80**. The channel **80** is bound on a

first side **81** by the belt **63**, on a second side **82** by the belt **74**, and on a third side **83** by the segments **67** and **77** which project from the belts **63** and **74**. The foam dispenser **78** has a discharge end directed toward the channel **80**. A motor **90** is operatively connected to a pulley **91** which drives a belt **92** which in turn engages a pulley **93** affixed to the shaft **58**. A second pulley **94**, affixed to the shaft **58**, is in operative engagement with a belt **95** which engages a pulley **96** rigidly affixed to the shaft **69** and provides positive drive to the rolls **61** and **72** in such a manner that the surfaces of the belts **63** and **74**, which are affixed to travel at like speeds and in a like direction.

In FIGURE 3 there is schematically illustrated a drive and bearing arrangement suited for the roll arrangement of FIGURE 1, generally designated by the reference numeral **100**. The arrangement **100** comprises a frame **101**. The frame **101** defines a pivotal support **102** which is in operative engagement with the support arm **103**. A bearing **104** is rigidly affixed to the frame **101** which provides support which rotatably carries the shaft such as the shaft **14** of the roll arrangement of FIGURE 1. A second bearing **105** is disposed generally adjacent the bearing **104** and rotatably supports the shaft **33** of the roll **31** of FIGURE 1. A transversely sliding bearing **106** is supported by the frame in an elongate transverse slot **107**. The bearing **106** is tensioned toward the support **102** by means of the spring **108**. The bearing **106** received the shaft **26** of the roll **25** of FIGURE 1. A similar bearing arrangement, not shown, is disposed under the support arm **103** and carries the shaft **43** of the roll **45**. An outwardly tensioned bearing **110** is disposed generally adjacent the bearing **106** and remote from the bearing **104**. The bearing **110** moves laterally in a slot **111** defined by the frame **101**. The bearing **110** is outwardly tensioned by means of a spring **112**. The bearing **110** carries the shaft **23** of the tensioning roll **22**. A similar bearing **114** is disposed in a slot **115** defined by the frame **101**. The bearing **114** is outwardly tensioned by means of the spring **116**. The bearing **114** rotatably supports the shaft **41** of the roll **40** of FIGURE 1. A dispenser **78***a* of hardenable resinous material is supported from the frame **101** by means of the support **79***a*. A motor **90***a* is rigidly affixed to the frame and supports a pulley **91***a* which drives a belt **92***a* which is in operative engagement with a pulley **93***a* affixed to a shaft **13***a*. The pulley **94***a* is in operative engagement with a twisted belt **95***a*. The belt **95***a* engages a pulley **96***a* which is rigidly affixed to a shaft such as the shaft **32** of the roll arrangement of FIGURE 1.

In operation of the present invention, the dispensing head such as illustrated in the accompanying drawing is pivotally affixed to a support arm such as the support arm **28** of FIGURE 2 of U.S. Patent 3,206,899. Power is applied to the motor such as the motor **90** or **90***a*. The forming belts are caused to travel. Hardenable, foamable material is dispensed into the channel, defined by the belts and a starter strip, on a floor or similar foundation. Speed of the motor and the rate of additional hardenable material is adjusted so that the hardenable material is hardened and foamed to a supporting foam mass when the forming belts travel past its place of deposition.

Beneficially the segments, such as the segments **20**, **38**, **67** or **77** advantageously are prepared from materials such as foam, rubber and other synthetic resinous materials such as foamed polyethylene; however, it is generally beneficial to utilize as a foam contacting surface, on such segments, a non-adhering material which beneficially is a polytetrafluoroethylene, polychlorotrifluoroethylene, and the like. If desired, however, conventional mold release agents may be employed to treat such surfaces, however,

when mold release agents are so utilized, the tendency of deposited foam to adhere to each other is somewhat reduced. Advantageously, the forming belts such as the belts **16**, **35**, **63** and **76** are also faced with a non-adhering material such as polytetrafluoroethylene and the like.

As is apparent from the foregoing specification, the present invention is susceptible of being embodied with various alterations and modifications which may differ particularly from those that have been described in the preceding specification and description. For this reason, it is to be fully understood that all of the foregoing is intended to be merely illustrative and is not to be construed or interpreted as being restrictive or otherwise limiting of the present invention, excepting as it is set forth and defined in the hereto appended claims.

What is claimed is:

1. A foam depositing head for the spiral generation of walled structures, the foam depositing head comprising in cooperative combination a frame, the frame supporting a first pair of side rolls and a second pair of side rolls, the rolls rotatably mounted in generally parallel relationship to each other, a first forming belt having a first edge and a second edge, the first edge of the first forming belt defining a plurality of edge segments projecting outwardly therefrom and being in adjacent generally contiguous arrangement, the first edge of the first forming belt disposed generally adjacent the frame, the first forming belt passing over the first pair of side rolls, a second side forming belt passing over and being supported by the second set of side rolls, the second side forming belt having a first edge and a second edge, the second side belt having a first edge and a second edge, the first edge of the second forming belt having a plurality of outwardly extending generally contiguous segments, the first and second forming belts defining therebetween a channel having three sides and a first end and a second end, the first end and second ends of the channel being open, the first side being defined by the first forming belt, the second side being defined by the second forming belt and a third side defined by the segments of the first and second forming belts, means to rotate the first and second pairs of rolls and to move the adjacent surfaces of the first and second forming belts in a like direction and means to provide a foamable, hardenable composition to the channel defined by the belts.

2. The apparatus of claim **1** including in each of the belts, an inwardly tensioning roll rotating about an axis generally parallel to the side rolls within each of the belts adapted to maintain adjacent segments of the belts in contact with each other.

3. The apparatus of claim **2** including an outwardly tensioning roll disposed within each of the belts adapted to maintain the belt tension.

4. The apparatus of claim **1** wherein the means to provide foamable, hardenable composition is a mixing chamber and nozzle adapted to receive, mix and dispense liquids.

5. The apparatus of claim **1** wherein the segments have a generally rectangular configuration.

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WILLIAM J. STEPHENSON, *Primary Examiner.*