April 21, 1964 H. A. WELLNITZ 3,129,482

CONTROL SYSTEM FOR A CONCRETE BLOCK FORMING MACHINE

Filed May 9, 1962 2 Sheets-Sheet 1

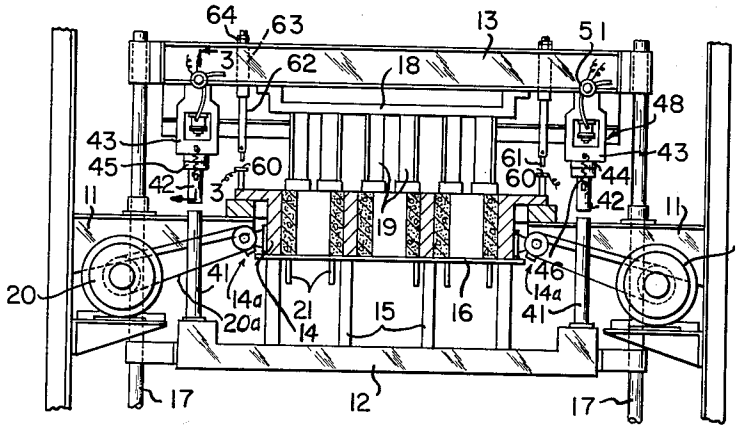


FIG-1

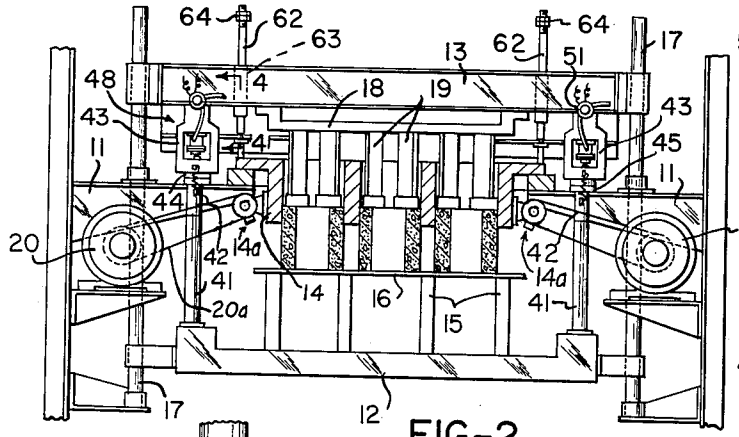


FIG-2

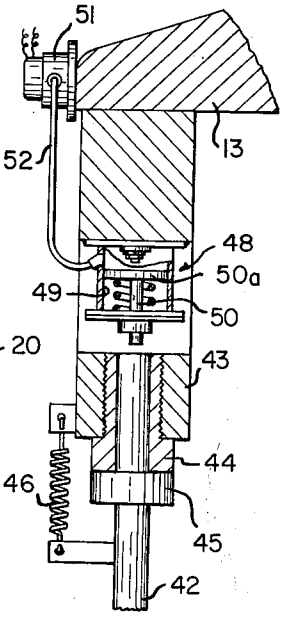


FIG-3

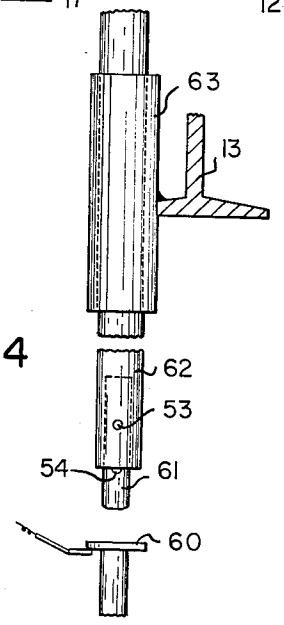


FIG-4

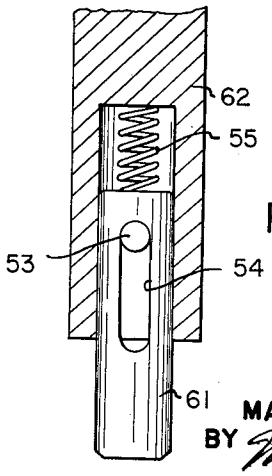


FIG-5

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April 21, 1964 H. A. WELLNITZ 3,129,482

CONTROL SYSTEM FOR A CONCRETE BLOCK FORMING MACHINE

Filed May 9, 1962

2 Sheets-Sheet 2

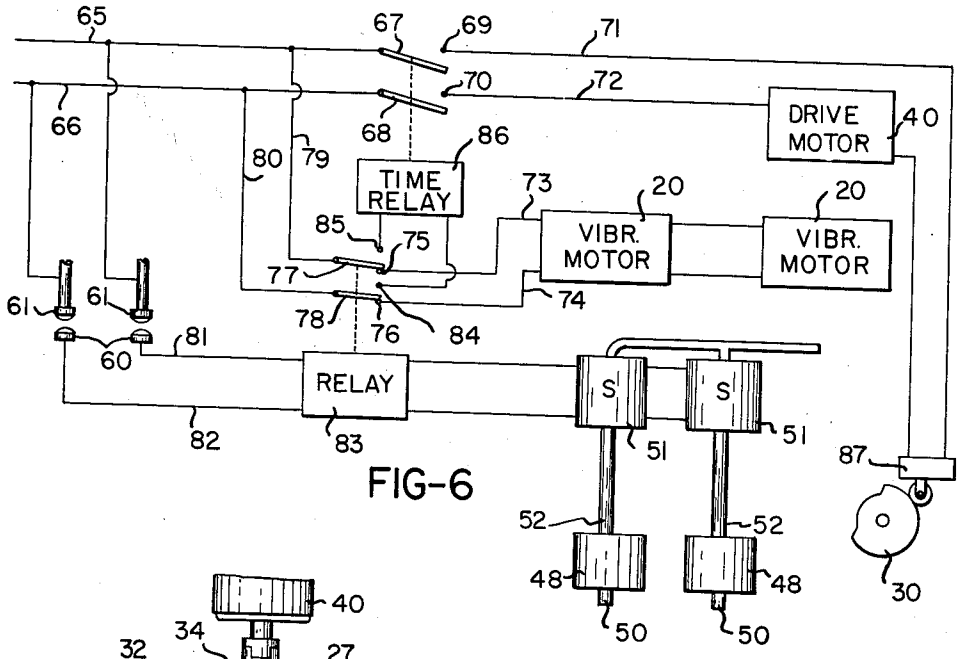


FIG-6

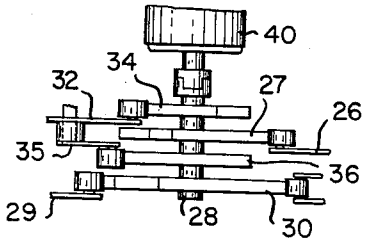


FIG-8

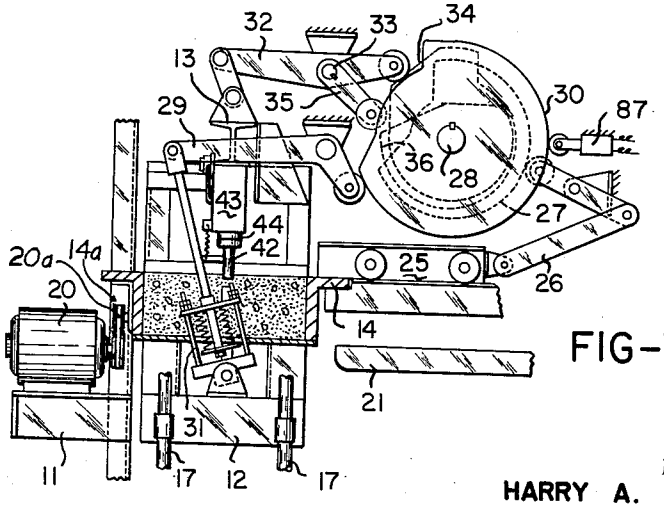


FIG-7

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3,129,482

CONTROL SYSTEM FOR A CONCRETE BLOCK FORMING MACHINE

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Filed May 9, 1962, Ser. No. 193,565
2 Claims. (Cl. 25—41)

This invention relates to a control system for a concrete block forming machine. It has to do, more particularly, with a control arrangement which is applicable to a type of concrete block machine now commonly in use for insuring that the blocks formed thereon are of accurate predetermined height without regard to the thickness of the pallets upon which the blocks are formed.

One type of concrete block forming machine now commonly in use includes a sliding material feed box movable between a material-receiving position and a material-discharge position over a mold box open at its top and bottom edges. By a suitable pallet conveyor arrangement, mold pallets are moved successively into association with the mold box at its lower edge. As it is moved into association with the mold box, each pallet is supported by a frame and is raised thereby into contact with the lower edge of the mold box and remains there during the molding operation. Part of this molding operation occurs after the feed box is moved away from the mold box and at which time a stripper head is moved downwardly by its supporting frame into association with the upper edge of the mold box and will rest freely on the material therein. The mold box is provided with means for vibrating it during the molding operation. This vibration causes the block material to settle in the mold box on the pallet with the pressure stripper head freely following and contacting the settling material so as to effectively compact it. The pressure stripper head is positively moved downwardly relative to the mold box to strip the block from the mold box shortly after the vibration of the mold box is interrupted. At the same time, by a suitable positive mechanical connection between the pressure stripper head frame and the pallet frame, the pallet support frame is also moved downwardly so that the pallet moves downwardly simultaneously with the pressure stripper head, the formed block being held between the pallet and the head during this downward movement. This positive mechanical connection comprises fixed depending push rods on the pressure stripper head frame which will gradually move into engagement with fixed upstanding push rods on the pallet frame as the pressure stripper head frame settles downwardly during the mold vibration. When the push rods on the pressure stripper head frame contact the push rods on the pallet support frame, an electric control circuit is actuated which stops the vibrating means, and actuates an electric drive motor to drive a series of cams which force the pressure stripper head frame and the pallet support frame downwardly together and starts other operations of the machine.

An attempt was made in connection with this machine to accurately control the height of the formed block by having the push rods form the electrical contacts for the electric circuit which, when engaged, stop the vibration and start the stripping operation. However, since one of these contacts was carried by the pallet support frame, the thickness of the pallet had an influence on the instant of contact. Consequently, the thickness of the pallet affected the height of the formed block, variations in thicknesses of successive pallets producing variations in height of the successively formed blocks.

According to the invention disclosed in my Patent No. 2,985,935, issued May 30, 1961, the control circuit was

so arranged that the thickness of the pallet would have no effect on the height of the formed block. The push rods on the pressure stripper head frame and the pallet support frame were not relied upon to complete the circuit to stop the vibration and start the stripping action but the circuit control contacts were provided on the pressure stripper head frame and the mold box so that they would gradually come into contact during the vibrating operation. Thus, the block height measurement was taken off the mold box rather than off the pallet support frame. However, to insure proper positive rigid connection between the pressure stripper head frame and the pallet support frame during the stripping action, there was also provided, according to that patent, electrically actuated means for bringing the adjacent ends of the push rods into firm mechanical contact at the instant of engagement of the circuit control contacts, regardless of the exact relative vertical positions of the two frames at that time. This insured that there would be no sudden compressive action on the formed green block, thereby avoiding fracture, but the block would be firmly held between the pressure stripper head and the pallet which would be moved downwardly simultaneously at the same speed.

The control system of this present invention, like that disclosed in said patent, will be readily adaptable to a standard machine of the type discussed above with only minor changes in such machine. However, the present invention provides a novel structure for bringing the adjacent ends of the push rods into firm mechanical contact when desired. This means takes the form of a fluid-actuated cylinder and piston unit which is coaxially aligned with one of the push rods which is slidably mounted relative to the other push rod. This cylinder and piston unit, when actuated by the circuit control contacts, will bring the push rods into firm mechanical contact and hold them in contact.

In the accompanying drawings, there is illustrated diagrammatically a block forming machine of the general type disclosed in my prior patent with the control system of this present invention applied thereto.

In these drawings:

FIGURE 1 is a front elevational view of the block-forming machine with the control system of this invention applied thereto showing certain parts of the machine in the relative positions they occupy during the block-forming operation.

FIGURE 2 is a similar view but showing the relative positions of the parts of the machine during the stripping operation.

FIGURE 3 is a vertical sectional view taken along line 3—3 of FIGURE 1 showing the electrically controlled fluid-actuated cylinder and piston unit for establishing a rigid connection between the push rods carried by the pressure stripper head frame and pallet support frame.

FIGURE 4 is a vertical sectional view taken along line 4—4 of FIGURE 2 showing the block height control electrical contacts carried on the stripper frame and the mold box.

FIGURE 5 is an enlarged detail of the spring-loaded contact of the structure of FIGURE 4.

FIGURE 6 is a schematic circuit diagram of a suitable control circuit for the machine.

FIGURE 7 is a schematic illustration in vertical section of the cam means controlled by the circuit associated with the units which they control.

FIGURE 8 is a plan view of the cam means of FIGURE 7.

With particular reference to the drawings, there is shown in FIGURES 1 and 2, the main elements of a con-

crete block forming machine which is generally of standard form and which includes mold-box supporting arms **11**, a pallet support frame **12**, and a pressure stripper head supporting frame **13**. A mold box **14** normally rests on the arms **11** which are fixed in a vertical position. The mold box loosely rests on the fixed supporting arms so it can be lifted slightly therefrom during vibration. The mold box **14** is open at its upper and lower sides. The pallet support frame **12** carries the upstanding laterally spaced pallet supports **15** which at their upper ends receive and support a pallet **16** directly below the open bottom of the mold box **14**. The pallet support frame **12** is mounted for vertical movement on suitable guides indicated as the fixed guide posts **17**. The pressure stripper head frame **13** is provided with the stripper head **18** which includes the depending plungers **19**, the lower ends of which will engage the block forming material during the molding operation and the formed blocks during the stripping operation. The pressure stripper head frame **13** is also mounted for vertical movement on a suitable guide structure which may be the same fixed guide posts **17** that carry the pallet frame **12**, as shown. Thus, the pallet support frame **12** is movable vertically relative to the mold box **14**, the pressure stripper head frame **13** is movable vertically relative to the mold box **14** and the two frames are also movable vertically relative to each other.

The mold box **14** may be vibrated by any suitable means and for this purpose the mold box supporting arms **11** carry at each side of the machine an electric vibrating motor **20**. These motors **20** drive through flexible belts **20*a***, suitable vibrating means carried by the mold box **14** indicated generally at **14*a*** and which may be in the form of shafts carrying eccentric weights. As will appear later, at the time of vibrating the mold box **14**, it is lifted slightly from the arms **11**.

A suitable conveyor system is provided for successively bringing the empty pallets into association with the pallet support frame **12** preparatory to the molding operation and for removing the block carrying pallets therefrom after the molding operation. This conveyor system is not shown in detail but includes the pallet engaging arms **21** (FIGURES 1 and 7) which will move in vertical planes in rectilinear paths, portions of which will be between the pallet supports **15**, to move the empty pallet **16** rearwardly over and deposit it on the pallet supports **15**, when the pallet support frame **12** is lowered, and for lifting the block-carrying pallet from the supports **15** and withdrawing it forwardly of the support frame **12** after the molding operation.

The machine also includes the feed box **25** which is mounted for forward and rearward movement on the frame **11**. The box **25** is movable from a rearward position, shown in FIGURE 7, where it will receive a charge of block-forming material from a feed hopper (not shown) to a forward position in registry with the mold box **14**. At this time, the frame **13** and the pressure stripper head **18** carried thereby will be in a raised position so as not to interfere with the reciprocating movement of the feed box.

The feed box **25** may be reciprocated by suitable linkage **26** actuated by a cam **27** keyed to a driven shaft **28** (FIGURES 7 and 8). The pallet support frame **12** is lifted on the guides **17** by means of suitable linkage **29** actuated by a cam **30** keyed on the shaft **28**. This linkage includes a compression spring unit **31** to insure that the pallet is held firmly up against the lower edge of the mold box **14**, being compressed slightly upon contact of the pallet **16** with the mold box. The pressure stripper head frame **13** is moved downwardly, the pallet support frame **12** moving therewith as will later appear, by means of linkage including a lever **32** keyed on a supporting shaft **33**. This lever **32** is rocked about the axis of the shaft **33** by a cam **34** keyed on the shaft **28**. The lever **32** is also rocked about the axis of the shaft **33** by a crank arm **35** which is rocked by a cam **36**, keyed on the shaft **28**, to raise the pressure stripper head frame **13** without raising the pallet support frame **12**. The driven shaft **28** is driven by an electric drive motor **40**.

The pallet support frame **12** is provided at each side thereof with an upstanding push rod **41** (FIGURES 1 and 2) rigidly mounted thereon. The pressure stripper head frame **13** is provided with aligning depending push rods **42** but, according to this invention, these rods are not rigidly attached to the frame **13** but are mounted for limited vertical movement relative to the frame.

The mounting for each of these rods **42** is shown in FIGURES 1, 2 and 3 as comprising a rectangular open bracket **43** which is rigidly secured to and depends from the pressure stripper head frame **13**. A bushing **44** is threaded into the lower side of the bracket **43** and the rod **42** is splined for free vertical sliding but non-rotative movement therein. A stop **45** limits upward movement of the rod **42** relative to the bushing to a position where its upper end is substantially flush with the upper end of the bushing. A tension spring **46** is connected to the rod **42** and to the lower part of the bracket **43** and normally holds the rod **42** upwardly to cause the stop **45** to engage the lower end of bushing **44**. Also, the spring prevents dropping of the rod from the bushing. Thus, the rod **42** is normally suspended from the bracket **43**.

Within the bracket **43** there is positioned a fluid-actuated unit or ram which is shown as being a cylinder and piston unit **48**. This unit comprises a cylinder **49** which is provided with a vertically movable piston **50*a*** having a downwardly projecting piston rod **50**. The cylinder is rigidly secured within the bracket **43** so that the piston rod **50** is coaxial with the bushing **44** and the upper end of the rod **42** positioned therein. The unit **48** may be hydraulically or air controlled, and is of the single acting type, with the piston normally held upwardly by a compression spring associated therewith. Supply and exhaust of actuating fluid to the upper end of the cylinder **49** is controlled by a solenoid-actuated valve **51** which is supported on the pressure stripper head frame **13** and which is connected thereto by a line **52**.

When the piston rod **50** is moved downwardly, by opening of the valve **51** to supply fluid to the upper end thereof, it enters the upper end of the bushing **44** and as it does so it engages the upper end of the rod **42**. The engaging ends of these members are flat so as to produce a firm contact. When the valve **51** is actuated to remove pressure from the upper end of the piston **50*a***, the spring in the cylinder **49** will return the piston **50*a*** and the connected rod **50** to its uppermost position out of contact with the rod **42**. At this time, the stop **45** will contact the lower end of the bushing **44**, since the rod **42** is lifted to this position by the spring **46**. Thus, the rods **41—42** and the associated units **48** cooperate to provide a normally yieldable connection between the pressure stripper head frame **13** and the pallet support frame **12** which can be rendered non-yieldable by supplying fluid pressure to the units **48**.

It will be realized that at the stage when the positive rigid connection is to be made between the rods **41—42** that the vertical extent of the spaces between them will vary with variation of thickness of the successive pallets. The units **48** and the mounting thereof inherently provide variable lengths of axially disposed connectors to compensate for any variations in the vertical extent of such spaces and fill them notwithstanding such variations. When the valves **51** are actuated, the piston rods **50** will engage the rods **42** and move them downwardly to take up any space between the adjacent ends of the rods **41** and **42** which is variable in accordance with pallet thickness.

As previously indicated, the measurement which controls the height of the block being formed is taken, according to this invention, from the mold box **14** so that the thickness of the pallet **16** will have no effect on the height of the block. By taking the height measurement

from the mold box 14, the upper surface of the pallet 16 is used as a basic reference point whereby block height measurement during finish compaction thereof cancels out any pallet thickness variations between the pallet support frame 12 and the pressure stripper head frame 13, thereby producing block of uniform height therebetween. Therefore, as indicated, the mold box 14 is provided at each side thereof with a contact block or disc 60 which is supported in fixed position on the mold box. For cooperating with each of the contact discs 60, a movable spring-loaded contact point 61 is associated therewith (FIGURE 5), being mounted in axial alignment in a rod 62. Each rod 62 is mounted for vertical sliding movement in a sleeve 63 carried by the frame 13. The upper end of the rod 62 is threaded and is provided with lock nuts 64, the lower of which will engage the upper end of the sleeve 63 normally to suspend the rod in the sleeve. Obviously, adjustment of these nuts 64 on each rod 62 will vary the vertical position of the contact point 61 relative to the frame 13. The point 61 is mounted for sliding vertical movement in a socket in the lower end of the rod 62, and downward or outward movement is limited by a transverse pin 53 carried by the rod 62 and cooperating with a vertical slot 54 in the pin. A spring 55 tends to force the contact 61 outwardly or downwardly. As will later appear, these contacts 60 and 61, when engaged, will complete a circuit to the electromagnetic valves 51 and to the drive motor 40 and interrupt the circuit to the vibrator motors 20. The yieldably mounted point 61 will make proper contact regardless of the vibration of the contact disc 60.

In actual practice, the drive motor 40 will be a continuously operating motor and a magnetic clutch (not shown) will be provided between its drive shaft and the driven cam shaft 28. However, for simplicity, the circuit is shown as directly controlling the motor.

The circuit is illustrated in FIGURE 6 and is shown as comprising the main lines 65 and 66 leading from a suitable source of power. The line 65 is connected to a movable switch arm 67 and the line 66 to a movable switch arm 68. The arms 67 and 68 are normally spaced from the fixed contacts 69 and 70, respectively, which are connected by the respective lines 71 and 72 to the drive motor 40. The vibrating motors 20 are connected in the circuit parallel to the motor 40 by means including the lines 73 and 74 connected to the respective fixed contact points 75 and 76. Normally contacting with these points 75 and 76 are the respective movable switch arms 77 and 78. These arms 77 and 78 are connected to the power lines 65 and 66 by the respective lines 79 and 80. Another circuit parallel with the motor circuits is connected to the lines 65 and 66 and includes the lines 81 and 82. Connected in series in this circuit are the two sets of contacts 60 and 61, a relay 83 and the two solenoid-actuated valves 51. The relay 83 controls the contact arms 77 and 78 which are normally engaged with the points 75 and 76. Associated with these arms 77 and 78 are the respective fixed contact points 85 and 84 that control a time delay relay 86 which, in turn, controls the contact arms 67 and 68. When the relay 83 is energized, it stops the vibrators 20 and starts timing of the relay 86, which after a set period, will energize the motor 40. The time delay relay 86 wil be actuated only when both sets of associated contacts 60 and 61 are engaged. When both of these sets are engaged, the solenoid-actuated valve 51 will also be actuated to control the units 48 to project the piston rods 50 into engagement with the rods 42. A normally closed switch 87 is connected in the line 71 and is controlled by the cam 30 to open and break the circuit to the motor 40 after it has been energized for a predetermined period.

The nuts 64 on the contact rods 62 are adjusted to position the contact points 61 so that they will be at a predetermined level relative to the contact discs 60 at the beginning of the molding operation. The bushing 44 may be screwed into and out of the bracket 43 to determine the uppermost position of the rod 42 when the stop 45 contacts with the lower end of the bushing. At this time, with the piston rod 50 retracted, the lower end of the rod 50 will not contact with the upper end of the rod 42.

Assuming the parts of the machine are in the relative positions indicated in FIGURE 1 as the molding operation is nearing completion with the circuit in the condition illustrated in FIGURE 6 so that the vibrating motors 20 are operating and the drive motor 40 is deenergized, the sequence of operation of the machine will be as follows:

The mold box 14, having been lifted slightly from the arms 11 by the pallet 16 to permit vibration, is at this time vibrating and as the vibration continues, the contact points 61 will gradually move downwardly toward the contacts 60. As soon as contact is made, the relay 83 will be actuated and the vibrating motors 20 will be deenergized and the drive motor control timing relay 86 will be energized. Shortly thereafter the motor 40 will be energized thereby rotating the cam shaft 28. The valves 51 are actuated at the same time as the relay 83 is actuated and, consequently, the piston rods 50 will be projected downwardly into engagement with the rods 42 pushing them axially downwardly where they cause the ends of the cooperating push rods 42 and 41 to contact firmly with each other so that the pressure stripper head frame 13 will push the pallet support frame 12 downwardly with it.

Stopping of the vibrating motors 20 determines the height of the blocks being molded at that time. Rotating the cam shaft 28 will rotate the cams carried thereby and this will produce the required relative movements of the parts of the machine. The stripper head 18 will be moved downwardly and at the same time will force the pallet 16 downwardly at the same speed. The time delay in starting the drive motor 40 after stopping the vibration insures that the units 48 will be actuated before downward movement of the stripper head 18 starts. When the pallet 16 reaches its lower position, the arms 21 will remove the filled pallet and replace it with an empty pallet, Continued rotation of the shaft 28 will raise the pallet support frame 12, raise the stripper head 18, project the feed box 25 forwardly, withdraw the feed box 25, deenergize the drive motor 40 and allow the stripper head to settle on the material in the feed box so that the machine will again be in the condition shown in FIGURE 1.

It will be understood that instead of the pallet support and pressure stripper head frames moving unitarily together relative to the mold box, in the stripping operation, the mold box could move relative to the coupled or connected frames.

It will be apparent from the above, that this invention provides a control system for a machine of the type indicated wherein the height of the block is controlled accurately without being affected by the thickness of the pallets which will vary due to the wear of the pallets. According to this invention, the height limitation is taken off the mold box and still means is provided for insuring firm connection between the pressure stripper head frame and the pallet support frame. This latter means embodies sets of push rods carried by the two frames, one set being rigidly carried by the one frame and the other set being connected to the other frame for relative vertical movement but having the fluid-actuated units associated therewith for locking it at times to the other frame. The cylinder and piston units comprise simple, readily available standard units for taking up the space between the adjacent ends of the cooperating push rods which space will vary in accordance with variations in pallet thickness. However, the cylinder and piston units will cooperate with the rods to couple the two frames together regardless of the variation in said space between the push rods.

According to the provisions of the patent statutes, the principles of this invention have been explained and have been illustrated and described in what is now considered to represent the best embodiment. However, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

Having thus described this invention, what is claimed is:

1. A block forming machine having a mold open at its top and bottom and means to vibrate the mold until block-forming material supplied thereto reaches a predetermined level, a pallet below the mold on which the block formed from the material rests, a pallet support frame to position the pallet to close the bottom of the mold, and a pressure stripper head frame having a pressure stripper head movable downwardly and relatively to the pallet support frame to compact said material to the said level, block height sensing means on said pressure stripper head frame and said mold movable relative to each other during the compacting operation to measure the block height from the top of the pallet, first push rod means on said support frame, second push rod means on the pressure stripper head frame vertically disposed and projecting toward each other, one of said rod means being mounted on its associated frame for sliding movement relatively to the other rod means, and coupling means on the machine normally permitting said relative sliding movement of the said rod means and capable of coupling said rod means to prevent said relative sliding movement, said coupling means comprising a fluid-actuated cylinder and piston unit mounted on said frame coaxial with said sliding rod means, said cylinder and piston unit including a piston rod projecting therefrom toward an axially aligned end of said slidable rod means, control means mounted on the machine including said height sensing means, timed to actuate, upon said level being reached, the cylinder and piston unit to couple said push rod means and accordingly said pressure stripper head and pallet support frames against relative vertical movement and to unitarily move such coupled pressure head and pallet frame vertically relative to the mold, whereby the height of the formed block is not affected by the thickness of the pallet, said control means including a control valve for actuating said cylinder and piston unit, said slidable rod means comprising a rod slidably mounted in a bracket on said pressure stripper head frame, a bushing adjustably mounted in the bracket for slidably receiving the upper end of the rod, means for slidably retaining the rod in the bushing, said cylinder and piston unit being carried by the bracket with its piston rod projecting downwardly in coaxial alignment with the upper end of the rod, and a stop on the rod for engaging the lower end of said bushing.

2. A block forming machine having a mold open at its top and bottom and means to vibrate the mold until block-forming material supplied thereto reaches a predetermined level, a pallet below the mold on which the block formed from the material rests, a pallet support frame to position the pallet to close the bottom of the mold, and a pressure stripper head frame having a pressure stripper head movable downwardly and relatively to the pallet support frame to compact said material to the said level, block height sensing means on said pressure stripper head frame and said mold movable relative to each other during the compacting operation to measure the block height from the top of the pallet, first push rod means on said support frame, second push rod means on the pressure stripper head frame vertically disposed and projecting toward each other, one of said rod means being mounted on its associated frame for sliding movement relatively to the other rod means, and coupling means on the machine normally permitting said relative sliding movement of the said rod means and capable of coupling said rod means to prevent said relative sliding movement, said coupling means comprising a fluid-actuated cylinder and piston unit mounted on said frame coaxial with said sliding rod means, said cylinder and piston unit including a piston rod projecting therefrom toward an axially aligned end of said slidable rod means, control means mounted on the machine including said height sensing means timed to actuate, upon said level being reached, the cylinder and piston unit to couple said push rod means and accordingly said pressure stripper head and pallet support frames against relative vertical movement and to unitarily move such coupled pressure head and pallet frame vertically relative to the mold, whereby the height of the formed block is not affected by the thickness of the pallet, said control means including a control valve for actuating said cylinder and piston unit, said slidable rod means comprising a rod slidably mounted in a bracket on said pressure stripper head frame, a bushing threaded upwardly into the bracket for slidably receiving the upper end of the rod, said cylinder and piston unit being carried by the bracket with its piston rod projecting downwardly in coaxial alignment with the upper end of the rod, a stop on the rod for engaging the lower end of said bushing, and a spring connected to said bracket and to said rod and normally pulling it upwardly to cause said stop to engage the lower end of said bushing.

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