Jan. 16, 1968 ISAO MATSUSHIMA 3,363,779

AUTOMATIC GREENWARE REPLACING DEVICE FOR CONTINUOUS POTTERY FORMING MACHINE

Filed Oct. 17, 1966 2 Sheets-Sheet 1

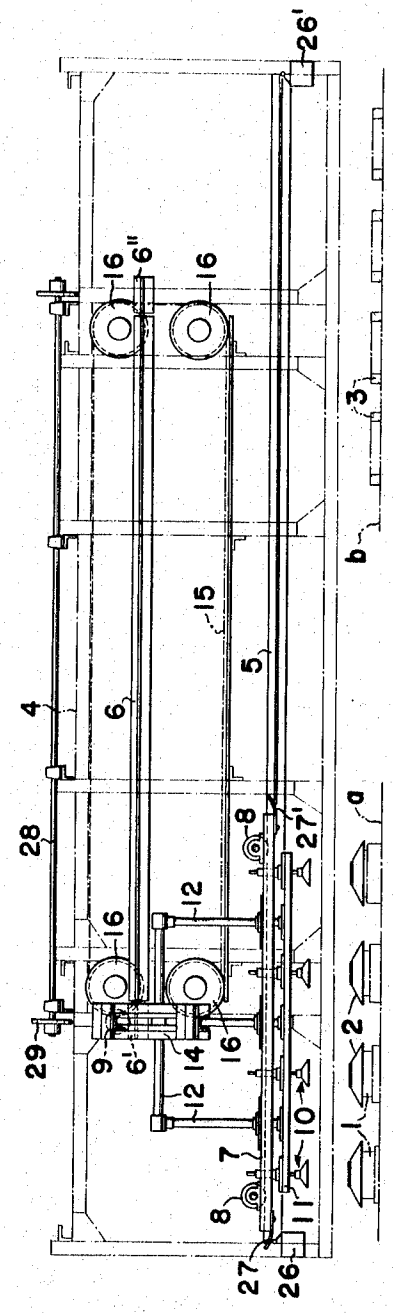


FIG. 1.

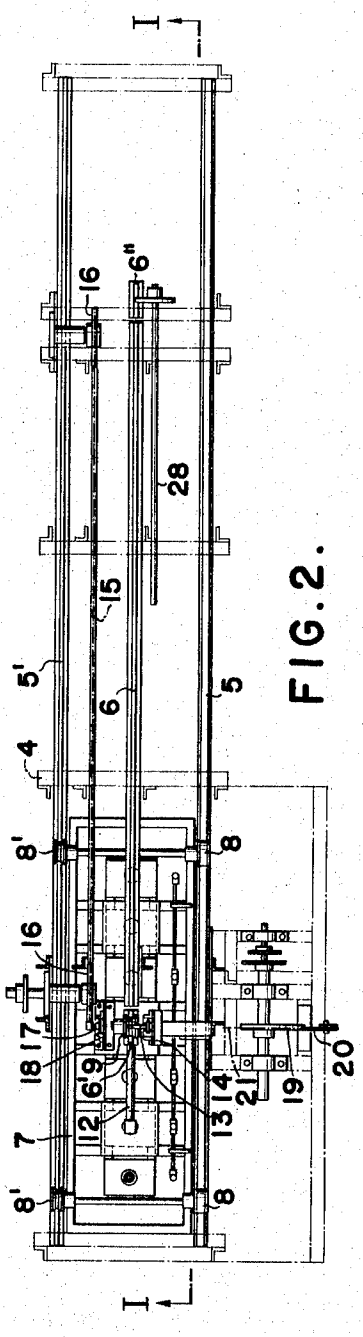


FIG. 2.

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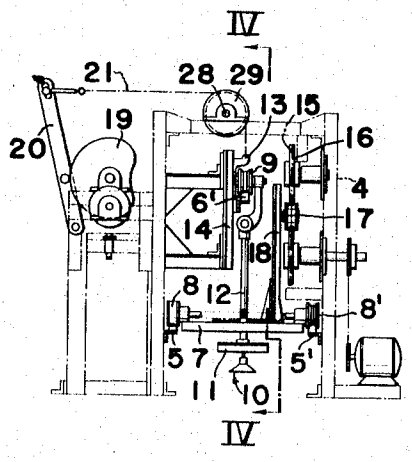


FIG. 3.

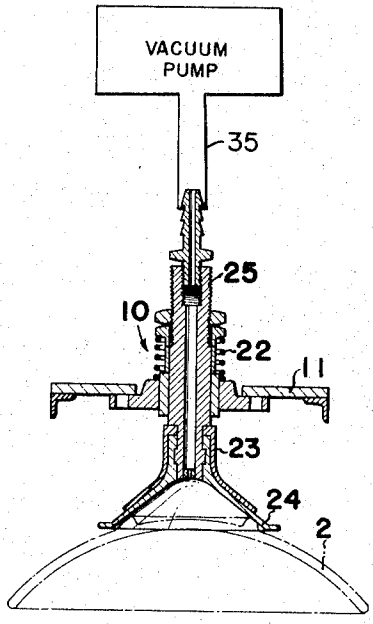


FIG. 5.

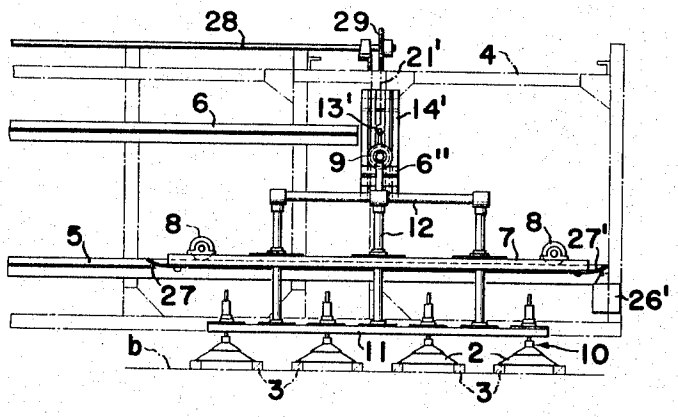


FIG. 4.

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3,363,779

AUTOMATIC GREENWARE REPLACING DEVICE FOR CONTINUOUS POTTERY FORMING MACHINE

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2 Claims. (Cl. 214—1)

ABSTRACT OF THE DISCLOSURE

A device for automatically transferring a plurality of articles between two predetermined positions, said device including a transfer means carrying an article retaining means and movable along a frame to and from positions wherein the article retaining means is immediately adjacent said predetermined positions. Means are also provided to move the article retaining means with respect to the transfer means in a direction normal to the direction of movement of the latter so that the article retaining means can move to and from engagement with said articles.

This invention relates to an automatic greenware replacing device for a continuous pottery forming machine.

In general a continuous pottery forming machine is designed for automatic accomplishment of all the operations from mixing of clay till forming, drying and finishing. During the early part of the continuous operation, each bat is shaped on a mold and each greenware thus shaped is delivered, while being held on the mold, to a first drying unit for primary drying. Next, the greenware is taken out of the original mold and is replaced in a secondary drying unit, that is, on ring-shaped seats, for example, in the secondary unit. Thus, the greenware is secondarily dried in the secondary unit, and is then finished.

Hitherto, the delivery or replacement of greenwares from the first to the second drying unit in a continuous forming machine of the type described has been achieved by hand.

It is therefore the object of the present invention to provide a device which is capable of accomplishing the replacing of a plurality of greenwares automatically, safely and promptly.

The present invention provides a device for automatically transferring a plurality of articles, such as greenware, between two positions. The positions can be on a first conveyor for a first drying unit and on a second conveyor for a second drying unit, said first conveyor of said first drying unit and said second conveyor of said second drying unit being arranged substantially in parallel or series with each other. The device comprises a transfer means adapted to run between the two conveyors, and an article retaining means mounted on said transfer means and adapted to be moved up and down with respect thereto, said article retaining means including means for attracting by suction the articles from the molds on said first conveyor and means for subsequent release of the attraction, whereby the articles on the molds on said first conveyor can be replaced onto ring-shaped seats on said second conveyor.

Other objects and advantages of the present invention will become apparent from the following detailed description taken in connection with a preferred embodiment of the invention illustrated in the accompanying drawings, in which:

FIGURE 1 is a front elevation, in section, of the embodiment of the invention taken along the line I—I in FIGURE 2;

FIGURE 2 is a plan elevation of the embodiment;

FIGURE 3 is a side elevation of the embodiment;

FIGURE 4 is a front elevation of a part of the embodiment taken along the line IV—IV of FIGURE 3 illustrating the way in which replacement of greenwares is accomplished;

FIGURE 5 is a front elevation in section, of a greenware holding means.

Referring to the drawings, a first conveyor adapted to run through the first drying unit is generally indicated at *a*. On the conveyor a plurality of molds **1** are placed in parallel rows in such a way that in a preforming stage greenwares **2** are formed on these molds **1** and are subjected, as they are, to the primary drying in the first drying unit. The molds **1** are of multi-head type and are arranged in a large number in plural rows. In the drawings, the molds **1** are shown in parallel rows each consisting of four molds.

Generally indicated at *b* is a second conveyor adapted to run through the second drying unit. It is arranged substantially in parallel or series with the first conveyor *a*. Ring-shaped seats **3** are mounted on the second conveyor *b*, and greenwares **2** subjected beforehand to the primary drying in the first drying unit are replaced onto these seats **3** and are secondarily dried on both inner and outer sides in the second drying unit. In the drawings, the seats **3** are shown as arranged in parallel rows, each of four seats.

A frame **4** is extended to the outlet of the first drying unit and to the inlet of the second drying unit, also saddling over the first conveyor *a* and the second conveyor *b*. A pair of parallel rails **5**, **5'** are provided along the longitudinal direction of the frame adjacent the lower part thereof, one rail **5'** having an angular cross section. One swing rail **6** is provided parallel to said rails **5**, **5'** along the longitudinal direction of the frame adjacent the upper part thereof. A transfer carriage **7** is placed on the travelling rails **5**, **5'** with two sets of wheels **8**, **8'**, and is also also suspended by the swing rail **6** through the medium of a swing wheel **9** secured to the transfer carriage **7**. One set of the wheels **8'** are of grooved type and are placed fittingly on the rail **5'** having an angular cross section so that the transfer carriage **7** can run safely.

One or more of holding means **10** for holding the greenwares **2** in position are mounted on a support frame **11** which is connected to the axle of swing wheel **9** by way of a swing rod **12**. In the drawings there are shown four such holding means **10**. The vertical suspended portion of the swing rod **12** passes through the transfer carriage **7** in such manner that it can move up or down with respect thereto.

On both ends of the swing rail **6** there are provided two short split rails **6'**, **6''**, which are secured, respectively, to hooks **13**, **13'** which in turn are fitted in vertical guide rails **14**, **14'** so that they can move in the vertical direction. The guide rails **14**, **14'** are secured fixedly to the frame **4**. The hook **13'** and guide rail **14'** are shown in FIGURE 4, though they are omitted in FIGURES 1 and 2. In FIGURES 1 and 3, the holding means **10**, support frame **11**, swing rod **12**, and swing wheel **9** are all shown in the lifted positions, together with the short rail **6'** and hook **13**. FIGURE 4 shows these parts in the descended positions, together with the short rail **6''** and hook **13'**.

An endless chain **15** is spread over several chain wheels **16** mounted on the frame along the vertical plane thereof. The chain **15** reciprocates in the longitudinal direction of the frame **4** and also travels along the verti-

cal plane of the frame. Onto the chain **15** is fitted a pin **17** which engages operatively with a sliding rail **18** mounted vertically on the transfer carriage **7**. As the chain wheels **16** are driven, the chain **15** travels in the longitudinal direction of the frame **4** along the vertical plane thereof, and the pin **17** slides along the sliding rail **18** with the result that the transfer carriage **7** runs in the longitudinal direction of the frame **4**.

A cam **19** (shown in FIGURES 2 and 3) is journaled rotatably on one side of the frame **4**, and about the intermediate portion of a lever **20** is in contact with the cam face of the cam **19**, while the lower end of the lever **20** is journaled to the frame **4**. To the upper end of the lever **20** one end of the chain **21** is secured, and the other end of the chain **21** is connected to the hook **13** by way of a wheel **29** mounted on a shaft **28**. As the cam **19** is revolved, the lever **20** is revolved along the cam face and accordingly stretches or relaxes the chain **21** thereby to raise or lower the hook **13**, short rail **6'**, swing wheel **9**, swing rod **12**, support frame **11**, and holding means **10**.

The same means as the cam **19**, lever **20**, and chain **21** described above may also be provided for the short rail **6''** and hook **13'**. In FIGURE 4 a chain **21'** alone is shown.

One example of the holding means **10** is illustrated in FIGURE 5. By support frame **11** a sucker cup **24** is supported with a compression spring **22** in such manner that it can freely move up and down. The sucker cup **24** has a metallic cover **23**. A pipe **25** is provided which communicates on one end to the inside of the sucker cup **24** and on the other end to a vacuum sump as shown, or the like, by way of a flexible tube **35**. As the holder means **10** is lowered until the sucker cup **24** is brought into contact with a greenware **2** and as the inside of the sucker cup **24** is exhausted, the greenware **2** will be sucked up to the sucker cup **24**. This exhaustion and the subsequent release thereof, may be effected in any known manner, such as by the use of valve means or the like.

On both ends of the frame **4** are provided limit switches **26** and **26'**, respectively. Also, on both ends of the transfer carriage **7** are provided detector pieces **27** and **27'**, respectively. When the transfer carriage **7** has arrived at the position adjacent the discharging end of the first drying unit or the charging end of the second drying unit, either the detector piece **27** or **27'** will come into contact with the limit switch **26** or **26'** as the case may be, thus bringing the chain wheels **16** to a stop.

Next, the operation of the device according to the present invention will be described hereunder.

In FIGURE 1, the first conveyor *a* of the first drying unit which has intermittently moved into the direction at right angles to the paper surface of this drawing stops below the holding means **10**, when the cam **19** begins to rotate. As the result, the lever rotates in the clockwise direction, the chain **21** slackens, and the hook **13**, short rail **6'**, swing wheel **9**, swing rod **12**, support frame **11** and holding means **10** are lowered altogether. The holding means **10** thus come into contact with the greenwares **2** placed on the molds **1** on the first conveyor *a* and suck them up.

Next, by the subsequent rotation of the cam **19**, tension is given to the chain **21** and the holding means **10** ascend while holding the greenwares **2**. When the short rail **6'** has reached a level flush with the swing rail **6**, the chain wheels **16** begin running. Thereupon, the pin **17** slides along the sliding rail **18** and guides the transfer carriage **7** rightward as viewed in FIGURES 1 and 2. At this juncture, the swing wheel **9** runs along the swing

rail **6** and the travelling wheels **8**, **8'** run along the rails **5**, **5'**, respectively.

Subsequently when the transfer carriage **7** has reached the position above the second conveyor *b* of the second drying unit, the detecting piece **27** comes into contact with the limit switch **26** and the chain wheels **16** are brought to a stop. At the same time, the cam **19** resumes its rotation whereby the chain **21'** is slackened and the hook **13'** is brought downward. The swing wheel **9** rides on the short rail **6''** at this time. As the holding means **10** descend, air is introduced into the sucker cups **24**, and the greenwares **2** are released from the suction by the sucker cups **24** and are replaced on the seats **3**. (See also FIGURE 4.)

Next, the greenwares are led into the secondary drying unit by the intermittent travelling of the second conveyor *b* and are subjected to secondary drying.

The holding means **10** then ascends and comes back, together with the transfer carriage **7**, to the discharging end of the first drying unit. Thus, the operation cycle above described is repeated. The starting and stopping of all the operations of the components thus far described are accomplished automatically by known means.

What is claimed is:

1. A device for automatically transferring a plurality of articles between predetermined positions, said device comprising a frame having guide means including at least one guide rail having an extension at each end; transfer means slidably mounted on said frame; article retaining means mounted on said transfer means for movement therewith; means to move said transfer means along said frame to and from positions whereby said article retaining means is immediately adjacent said predetermined positions; wheel means mounted on said article retaining means and adapted to engage said guide rail during movement of said transfer means and said article retaining means, said wheel means engaging said extensions when said article retaining means is immediately adjacent one of said predetermined positions; means to move said extensions in directions normal to the directions of movement of said transfer means and said article retaining means so that said article retaining means can move in said normal directions to and from engagement with said articles.

2. The device of claim **1**, wherein said article retaining means includes at least one suction means adapted to engage an article at one end of said suction means, and means to apply a vacuum to the other end of said suction means to retain said article.

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