processing position P for applying or sealing. Further in such an apparatus, the work having been moved to the processing position P has to be positioned and fixed against misalignment during processing. Therefore, transition from completion of processing of one work to start of processing of a next work takes time. That is, the production rate cannot be improved.

Also, since the work processed as above is finally a product and should be handled carefully against breakage, excessive reduction of the moving time will be rather a problem to reliability assurance of the final product.

Also, for a conveyance rate as high as possible, the before-processing wait position Q and after-processing wait position R should be provided on the work conveyance line in addition to the processing position P. Thus, the entire processing apparatus will be larger in size since such positions lead to requirement of a correspondingly wider space.

Further, since the loading and unloading sections have to be provided at one and other ends, respectively, of the processing apparatus, so the entire processing system including the processing apparatus is larger in size.

Moreover, in case it is necessary to adjust the temperature of works, a temperature controller or heater has to be provided in each of the before-processing wait position Q, processing position P and after-processing wait position R. Thus, the power consumption of the processing apparatus is larger, and heat will stay inside the apparatus to have adverse influence on the mechanical parts and electronic parts that drive the apparatus.

Embodiments of t~~T~~he present invention ~~is to~~ overcome the above-mentioned drawbacks of the related art by providing a processing apparatus and method improved in production rate, the apparatus being reducible in size.

Disclosure of the Invention

The inventors of the present invention devoted themselves to the research and development for implementation of the above processing apparatus and method. As a result, the inventors found that with a plurality of work conveyance lines being provided for processing works on the plurality of conveyance lines sequentially, a work can be carried into place on one of the work conveyance lines while a preceding work is being processed in the processing position on the other work conveyance line so that immediately after the preceding work is processed on the other work conveyance line, the work on the one work conveyance line can start being processed. The inventors completed the present invention as will be described below:

~~Namely, according to an embodiment of the present invention, there is provided a work processing apparatus including a plurality of work conveyance lines on which works are to be moved, a stopping device for stopping a work in a predetermined processing position on each of the work conveyance lines, a processing device for making a desired process on the work stopped by the stopping device, and a moving device for moving the processing device between the work conveyance lines, wherein~~

~~the processing device includes an applicator having a nozzle that discharges a liquid material, and the work processing apparatus further comprises a temperature adjusting device provided for at least one of a yet-to-process work stopping in the processing position and a processed work stopping in the processing position to adjust the temperature of the work.~~

According to a first aspect, there is provided a work processing apparatus comprising: a plurality of work conveyance lines on which works are to be moved; a stopping device for stopping a work in a predetermined processing position on each of the work conveyance lines; a processing device for making a desired process on the work stopped by the stopping device; and a moving device for moving the processing device between the work conveyance lines, characterized in that the processing device includes an applicator having a nozzle that discharges a liquid material, the work processing apparatus further comprises a temperature adjusting device provided at the predetermined processing position on each of the work conveyance lines and configured to adjust the temperature of at least a processed work stopping in the processing position out of a yet-to-process work stopping in the processing position and a processed work stopping in the processing position for increasing a fluidity of the liquid material applied from the nozzle to the work stopping in the processing position, and the work processing apparatus further comprises a controller configured to control the apparatus so as to make the processed work stay in the work processing position undergoing the temperature adjustment for a certain time so that the liquid material applied from the nozzle to the work stopping in the processing position flows to have a desired state.

In the above work processing apparatus, there may be provided a controller that controls the apparanus so that before a work having been processed on one of the work conveyance lines is completely carried out from the processing position, a next to-be-processed work is carried in, and stopped in, the processing position on the other work conveyance line.

In the above work processing apparatus, there may also be provided a controller that controls the apparatus so that before a work stopped in the

processing position on one of the work conveyance lines is completely processed, a next to-be-processed work is carried in, and stopped in, the processing position on the other work conveyance line.

Also in the above work processing apparatus, there may be provided a controller that controls the apparatus so that when a work stopped in the processing position on one of the work conveyance lines starts being processed, other work completely processed on the other work conveyance line where the preceding process was done has been stopped in the processing position.

Also in the work processing apparatus according to an embodiment of the present invention, there may be provided at one end of the work conveyance lines a magazine holding device for holding magazines each capable of housing a plurality of works, and a work take-out device configured to take out works from the magazine held by the magazine holding device and supply them to all the work conveyance lines.

Also in the work processing apparatus according to an embodiment of the present invention, there may be provided at one end of the work conveyance lines a magazine holding device for holding magazines each capable of housing a plurality of works, and a work take-up device configured to pick up works from on all the work conveyance lines and house them into the magazine held by the magazine holding device.

Also in the work processing apparatus according to an embodiment of the present invention, there may be provided at one end of the work conveyance lines a magazine holding device for holding magazines each capable of housing a plurality of works, a work take-out device configured to take out works from the magazine held by the magazine holding device and supply them to all the work conveyance lines, and a work take-up device configured to pick up works from on all the work conveyance lines and house them into the magazine held by the magazine holding device.

Also in the work processing apparatus according to an embodiment of the present invention, there may be provided at both end of the work conveyance lines magazine holding devices for holding magazines each capable of housing a plurality of works, a work take-out device configured to take out works from the magazine held by the magazine holding device and supply them to all the work conveyance lines, and a work take-up device configured to pick up works from on all the work conveyance lines and house them into the magazine held by the magazine holding device.

In the above work processing apparatus, the work take-out device or work take-up device may be provided for each of the work conveyance lines and the magazine holding device be adapted to be so movable that works are taken out by the work take-out device corresponding to each work conveyance line from the magazine held by the magazine holding device or works are picked up by the work take-up device corresponding to each work conveyance line.

Also in the above work processing apparatus, there may be provided a controller to control the apparatus in such a manner that works are sequentially taken out from the magazine held by the magazine holding devices and supplied to the respective work conveyance lines, and works are picked up and housed into the magazine in the same sequence as that in which the works have been supplied to the respective work conveyance lines.

In the above processing apparatus, there may be provided a controller to control the apparatus in such a manner that after a work is picked up from on one of the work conveyance lines and housed into the magazine held by the magazine holding device and before a work is taken out and supplied to the other work conveyance line and picked up from on the latter, a work is taken out to the work conveyance line from the magazine having housed the picked-up work.

Also in the work processing apparatus according to an embodiment of the present invention, there may be provided a controller to control temperature adjustment by the temperature adjusting device.

Also in the work processing apparatus according to an embodiment of the present invention, the process may desirably be an application in which the liquid material is applied from the nozzle to a desired spot on a work and let to flow owing to its fluidity to have a desired state of application.

Also the work processing apparatus according to an embodiment of the present invention may be configured so that a work stopping in the processing position is processed and then let to stay there until the liquid material applied to the work starts flowing and has a desired state, and then carried out from the processing position.

Disclosed herein is ~~According to another embodiment of the present invention, there is provided~~ a work processing method of making, in a processing apparatus having a plurality of work conveyance lines, a process on a work carried in, and stopped in, a processing position provided in place on each work conveyance line and carrying it out, wherein the process is application in which a liquid material is discharged from a nozzle, and the process is sequentially made by the same processing device on each work conveyance line and, before a work completely processed on one of the work conveyance lines is completely carried out from the processing position, other work is carried in, and stopped in, a processing position on the other work conveyance line where a next process is to be processed, and further at least one of a yet-to-process work stopping the processing position and a processed work stopping in the processing position is subjected to temperature adjustment.

According to a second aspect, there is provided a work processing method of making, in a processing apparatus having a plurality of work conveyance lines, a process on a work carried in, and stopped in, a processing position provided in place on each work conveyance line and carrying it out, characterized in that: the process is application in which a liquid material is discharged from a nozzle, and the process is sequentially made by the same processing device on each work conveyance line and, before a work completely processed on one of the work conveyance lines is completely carried out from the processing position, other work is carried in, and stopped in, a processing position on the other work conveyance line where a next process is to be processed, further, at least a processed work stopping in the processing position of a work conveyance line out of a yet-to-process work stopping in the processing position of said work conveyance line and a processed work stopping in the processing position of said work conveyance line is subjected to temperature adjustment for increasing a fluidity of the liquid material applied from the nozzle to the work stopping in the processing position, and said processed work is stayed in the work processing position undergoing the temperature adjustment for a certain time so that the liquid material applied from the nozzle to the work stopping in the processing position flows to have a desired state.

Also the work processing method according an embodiment of to the present invention may be adapted so that the process is application in which a liquid material is applied from a nozzle to a desired spot on a work and flows owing to its fluidity to have a desired state of application, and the work stopping in the processing position is processed and then let to stay there until the liquid material applied to the work starts flowing and has a desired state, and then carried out from the processing position.

Further the process method according to an embodiment of the present invention may be adapted so that for making, in a work processing apparatus having a plurality of work conveyance lines, a process on a work in a processing position provided in place on each of the work conveyance lines, a work completely processed on one of the work conveyance lines is carried out from the processing position, and a new to-be-processed work is carried in to the processing position, after the process on said one work conveyance line is complete and before the process on a work on said one work conveyance line is started again after completion of the process on works on all the other work conveyance lines.

For example, in case the processing apparatus has four work conveyance lines (Nos. 1, 2, 3 and 4), works are processed on the work conveyance lines Nos. 1, 2, 3, 4. 1, ... in this order. Namely, the sequence of processes is such that a work is processed on the conveyance line No. 1, then works are processed on all the conveyance line Nos. 2, 3 and 4, the processed work is carried out from the conveyance line No. 1, and then a new work is carried in to the conveyance line No. 1.

According to embodiments of the present invention, a work can completely be carried in to the

CLAIMS

1. A work processing apparatus comprising:

a plurality of work conveyance lines on which works are to be moved;

a stopping device for stopping a work in a predetermined processing position on each of the work conveyance lines;

a processing device for making a desired process on the work stopped by the stopping device; and

a moving device for moving the processing device between the work conveyance lines, wherein

the processing device includes an applicator having a nozzle that discharges a liquid material, and

the work processing apparatus further comprises a temperature adjusting device provided for at least one of a yet-to-process work stopping in the processing position and a processed work stopping in the processing position to adjust the temperature of the work.

2. The apparatus according to claim 1, further comprising a controller that controls the apparatus so that before a work having been processed on one of the work conveyance lines is completely carried out from the processing position, a next to-be-processed work is carried in, and stopped in, the processing position on the other work conveyance line.

3. The apparatus according to claim 1, further comprising a controller that controls the apparatus so that before a work stopped in the processing position on one of the work conveyance lines is completely processed, a next to-be-processed work is carried in, and stopped in, the processing position on the other work conveyance line.

4. The apparatus according to claim 1 or 3, further comprising a controller that controls the apparatus so that when a work stopped in the processing position on one of the work conveyance lines starts being processed, other work completely processed on the other work conveyance line where the preceding process was done has been stopped in the processing position.

5. The apparatus according to any one of claims 1 to 4, further comprising a magazine holding device provided at one end of the work conveyance lines for holding magazines each capable of housing a plurality of works, and a work take-out device configured to take out works from the magazine held by the magazine holding device and supply them to all the work conveyance lines.

6. The apparatus according to any one of claims 1 to 4, further comprising a magazine holding device provided at one end of the work conveyance lines for holding magazines each capable of housing a plurality of works, and a work take-up device configured to pick up works from on

all the work conveyance lines and house them into the magazine held by the magazine holding device.

7. The apparatus according to any one of claims 1 to 4, further comprising a magazine holding device provided at one end of the work conveyance lines for holding magazines each capable of housing a plurality of works, a work take-out device configured to take out works from the magazine held by the magazine holding device and supply them to all the work conveyance lines, and a work take-up device configured to pick up works from on all the work conveyance lines and house them into the magazine held by the magazine holding device.

8. The apparatus according to any one of claims 1 to 4, further comprising magazine holding devices provided at both ends of the work conveyance lines for holding magazines each capable of housing a plurality of works, a work take-out device configured to take out works from the magazine held by any one of the magazine holding devices and supply them to all the work conveyance lines, and a work take-up device configured to pick up works from on all the work conveyance lines and house them into the magazine held by the other magazine holding device.

9. The apparatus according to claim 7 or 8, further comprising a controller to control the apparatus in such a manner that works are sequentially taken out from the magazine held by the magazine holding

device and supplied to the respective work conveyance lines, and works are picked up and housed into the magazine in the same sequence as that in which the works have been supplied to the respective work conveyance lines.

10. The apparatus according to claim 7, further comprising a controller to control the apparatus in such a manner that after a work is picked up from on one of the work conveyance lines and housed into the magazine held by the magazine holding device and before a work is taken out and supplied to the other work conveyance line and picked up from on the latter, a work is taken out to the work conveyance line from the magazine having housed the picked-up work.

11. The apparatus according to claim 1, further comprising a controller to control temperature adjustment by the temperature adjusting device.

12. The apparatus according to claim 1, wherein the process is an applying process in which the liquid material is applied from the nozzle to a desired spot on a work and let to flow owing to its fluidity to have a desired state of application.

13. The apparatus according to claim 12, wherein the apparatus is configured such that the work stopping in the processing position is processed and then let to stay there until the liquid material applied to the

work starts flowing and has a desired state, and then carried out from the processing position.

14. The apparatus according to any one of the preceding claims further comprising:

a vertical moving device for moving the processing device vertically;

a first moving device having an arm extending in a first direction to moving the vertical moving device in the first direction; and

a second moving device extending in a second direction different from the first one to move the first moving device in the second direction,

the second direction being at right angles at the extending direction of the work conveyance lines.

15. The apparatus according to claim 14, wherein the second moving device is provided to have a moving range across at least one of the work conveyance lines.

16. The apparatus according to claim 15, further comprising a guide rail to hold the first moving device movably in the second direction.

17. The apparatus according to claim 16, further comprising a third moving device for holding the first moving device movably in the second direction.

18. A work processing method of making, in a processing apparatus having a plurality of work conveyance lines, a process on a work carried in, and stopped in, a processing position provided in place on each work conveyance line and carrying it out, wherein

the process is application in which a liquid material is discharged from a nozzle, and the process is sequentially made by the same processing device on each work conveyance line and, before a work completely processed on one of the work conveyance lines is completely carried out from the processing position, other work is carried in, and stopped in, a processing position on the other work conveyance line where a next process is to be processed, and

further at least one of a yet-to-process work stopping the processing position and a processed work stopping in the processing position is subjected to temperature adjustment.

19. The method according to claim 18, wherein before a work stopped in the processing position on one of the work conveyance lines is completely processed, a next another work is carried in, and stopped in, the processing position on the other work conveyance line on which a next work is to be processed.

20. The method according to claim 18 or 19, wherein when a work stopped in the processing position on one of the work conveyance lines starts being processed, a preceding work completely processed in the processing position on the other work conveyance line is stopped in the

processing position.

21. The method according to any one of claims 18 to 20, wherein works are sequentially taken out from a magazine housing a plurality of works to the respective work conveyance lines, and the works are picked up from on the respective work conveyance lines and housed into the magazine in the same sequence as that in which the works have been taken out.

22. The method according to claim 21, wherein the work is carried out from a side from which it was carried in and it is housed into the magazine from which it was taken out.

23. The method according to claim 22, wherein after a work is picked up from on one of the work conveyance lines and housed into the magazine and before another work is taken out to the other work conveyance line and housed, a new work is taken out to the work conveyance line from the magazine having housed that taken-up work.

24. The method according to any one of claims 18 to 23, wherein the process is application in which a liquid material is applied from a nozzle to a desired spot on a work and flows owing to its fluidity to have a desired state of application, and the work stopping in the processing position is processed and then let to stay there until the liquid material applied to the work starts flowing and has a desired state, and then carried out from the processing position.

25. A work processing method for making, in a work processing apparatus having a plurality of work conveyance lines, a process on a work in a processing position provided in place on each of the work conveyance lines, wherein the process is application in which a liquid material is discharged from a nozzle, and a work completely processed on one of the work conveyance lines is carried out from the processing position, and a new to-be-processed work is carried in to the processing position, after the process on said one work conveyance line is complete and before the process on a work on said one work conveyance line is started again after completion of the process on works on all the other work conveyance lines, and

further at least one of a yet-to-process work stopping the processing position and a processed work stopping in the processing position is subjected to temperature adjustment.

Claims

1. A work processing apparatus comprising:

a plurality of work conveyance lines on which works are to be moved;

a stopping device for stopping a work in a predetermined processing position on each of the work conveyance lines;

a processing device for making a desired process on the work stopped by the stopping device; and

a moving device for moving the processing device between the work conveyance lines, characterized in that

the processing device includes an applicator having a nozzle that discharges a liquid material,

the work processing apparatus further comprises a temperature adjusting device provided at the predetermined processing position on each of the work conveyance lines and configured to adjust the temperature of at least a processed work stopping in the processing position out of a yet-to-process work stopping in the processing position and a processed work stopping in the processing position for increasing a fluidity of the liquid material applied from the nozzle to the work stopping in the processing position, and

the work processing apparatus further comprises a controller configured to control the apparatus so as to make the processed work stay in the work processing position undergoing the temperature adjustment for a certain time so that the liquid material applied from the nozzle to the work stopping in the processing position flows to have a desired state.

2. The apparatus according to claim 1, wherein the controller is configured to control the apparatus so that before a work having been processed on one of the work conveyance lines is completely carried out from the processing position, a next to-be-processed work is carried in, and stopped in, the processing position on the other work conveyance line.

3. The apparatus according to claim 1, wherein the controller is configured to control the apparatus so that before a work stopped in the processing position on one of the work conveyance lines is completely processed, a next to-be-processed work is carried in, and stopped in, the processing position on the other work conveyance line.

4. The apparatus according to claim 1 or 3, wherein the controller is configured to control the apparatus so that when a work stopped in the processing position on one of the work conveyance lines starts being processed, other work completely processed on the other work conveyance line where the preceding process was done has been stopped in the processing position.

5. The apparatus according to any one of claims 1 to 4, further comprising a magazine holding device provided at one end of the work conveyance lines for holding magazines each capable of housing a plurality of works, a work take-out device configured to take out works from the magazine held by the magazine holding device and supply them to all the work conveyance lines, and a work take-up device configured to pick up works from all the work conveyance lines and house them into the magazine held by the magazine holding device.

6. The apparatus according to any one of claims 1 to 4, further comprising magazine holding devices provided at both ends of the work conveyance lines for holding magazines each capable of housing a plurality of works, a work take-out device configured to take out works from the magazine held by any one of the magazine holding devices and supply them to all the work conveyance lines and a work take-up device configured to pick up works from all the work conveyance lines and house them into the magazine held by the other magazine holding device.

7. The apparatus according to claim 5, wherein the controller is configured to control the apparatus in such a manner that after a work is picked up from one of the work conveyance lines and housed into the magazine held by the magazine holding device and before a work is taken out and supplied to the other work conveyance line and picked up from the latter, a work is taken out to the work conveyance line from the magazine having housed the picked-up work.

8. The apparatus according to claim 1, wherein the controller is configured to control temperature adjustment by the temperature adjusting device.

9. The apparatus according to claim 1, wherein the process is an applying process in which the liquid material is applied from the nozzle to a desired spot on a work and let to flow owing to its fluidity to have a desired state of application.

10. The apparatus according to claim 9, wherein the apparatus is configured such that the work stopping in the processing position is processed and then let to stay there until the liquid material applied to the work starts flowing and has a desired state, and then carried out from the processing position.

11. The apparatus according to any one of claims 1 to 10, further comprising:

a vertical moving device for moving the processing device vertically;

a first moving device having an arm extending in a first direction to move the vertical moving device in the first direction; and

a second moving device extending in a second direction different from the first one to move the first moving device in the second direction,

the second direction being at right angles at the extending direction of the work conveyance lines.

12. A work processing method of making, in a processing apparatus having a plurality of work conveyance lines, a process on a work carried in, and stopped in, a processing position provided in place on each work conveyance line and carrying it out, characterized in that:

the process is application in which a liquid material is discharged from a nozzle, and the process is sequentially made by the same processing device on each work conveyance line and, before a work completely processed on one of the work conveyance lines is completely carried out from the processing position, other work is carried in, and stopped in, a processing position on the other work conveyance line where a next process is to be processed,

further, at least a processed work stopping in the processing position of a work conveyance line out of a yet-to-process work stopping in the processing position of said work conveyance line and a processed work stopping in the processing position of said work conveyance line is subjected to temperature adjustment for increasing a fluidity of the liquid material applied from the nozzle to the work stopping in the processing position, and

said processed work is stayed in the work processing position undergoing the temperature adjustment for a certain time so that the liquid material applied from the nozzle to the work stopping in the processing position flows to have a desired state.

13. The method according to claim 12, wherein before a work stopped in the processing position on one of the work conveyance lines is completely processed, a next another work is carried in, and stopped in, the processing position on the other work conveyance line on which a next work is to be processed.

14. The method according to claim 12 or 13, wherein when a work stopped in the processing position on one of the work conveyance lines starts being processed, a preceding work completely processed in the processing position on the other work conveyance line is stopped in the processing position.

15. The method according to any one of claims 12 to 14, wherein the work is carried out from a side from which it was carried in and it is housed into the magazine from which it was taken out.

16. The method according to claim 15, wherein after a work is picked up from one of the work conveyance lines and housed into the magazine and before another work is taken out to the other work conveyance line and housed, a new work is taken out to the work conveyance line from the magazine having housed that taken-up work.

17. The method according to any one of claims 12 to 16, wherein the process is application in which a liquid material is applied from a nozzle to a desired spot on a work and flows owing to its fluidity to have a desired state of application, and the work stopping in the processing position is carried out therefrom after letting to stay there until the liquid material applied to the work starts flowing and has a desired state.