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(54) **AUTOMATIC PRESSED ARTICLE MANUFACTURING SYSTEM USING DOUBLE ROBOT LINE FOR TANDEM PRESS LINE**

(57) The present invention relates to an automatic press-molded article manufacturing system using a double robot line for a tandem press line and, more specifically, to an automatic press-molded article manufacturing system using a double robot line for a tandem press line, wherein a plurality of destakers and positioners are disposed, each group having two robots is separately disposed and moves alternately, so as to continuously and rapidly transfer and supply the raw material in proportion to a press working time, in a raw material transfer process, a material supply process, an article supply process, and a product withdrawal process.

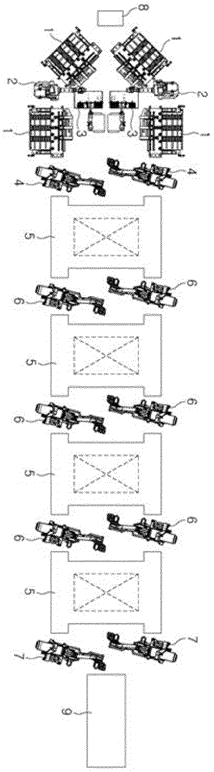

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to an automatic press-molded article manufacturing system using a double robot line for a tandem press line, and more specifically, to an automatic press-molded article manufacturing system using a double robot line for a tandem press line, which enables automatically controlled, seamless transfer and supply of raw materials or press-molded articles, thus leading to a high yield of press-molded articles.

DISCUSSION OF RELATED ART

[0002] Press molding is a technique in which, a raw material, e.g., an iron plate, is forced into a mold in order to take the shape of the mold. Conventionally, the process has been conducted manually by people, but is now being automated for higher productivity and lower occurrence of industrial accidents.

[0003] A recently developed automatic manufacturing system adopts multi-axis driving robots to carry raw materials or press-molded articles from one processing stage to another.

[0004] Such conventional system is deployed so that each one of the multi-axis driving robots is positioned between two neighboring ones of multiple presses, overall configuring a single raw material supply line. Press molding by the presses is done relatively faster than the transfer or supply by the robots. Thus, the presses may be left idle until they are reloaded by the robots, resulting in a poor yield of final products.

SUMMARY

[0005] The present invention has been conceived to address the above issues, and an object of the present invention is to provide an automatic press-molded article manufacturing system using a double robot line for a tandem press line, which includes a plurality of destackers, a plurality of positioners, and pairs of robots for transferring and supplying raw materials and press-molded articles and carrying out the press-molded articles, each robot pair having two robots positioned apart from each other. The paired robots may alternately move, accelerating the stages of supplying and transferring the raw materials or press-molded articles to catch up with the processing stages by the presses. Thus, a higher yield of final products may be obtained.

[0006] Since each pair of robots is in charge of its respective stage of supplying, transferring, and carrying out the raw materials or press-molded articles, one of the paired robots may function as a redundancy in preparation of when the other breaks down, which allows the system into a seamless operation

[0007] According to the present invention, an automatic press-molded article manufacturing system using a double robot line for a tandem press line comprises: a plurality of destackers positioned apart from each other at a predetermined distance and loaded with multiple raw materials; a pair of raw material transfer robots transferring the raw materials loaded on the destackers while holding the raw materials by suction; a plurality of positioners positioned between the raw material transfer robots to position the raw materials transferred by the raw material transfer robots; a pair of raw material supply robots positioned apart from each other behind the raw material transfer robots and alternately moving to supply the raw materials from the positioners to a press while holding the raw materials by suction; a plurality of presses sequentially positioned behind the raw material supply robots and press-molding the raw materials received from the raw material supply robots into press-molded articles; a plurality of pairs of press-molded article supply robots, each pair of press-molded article supply robots positioned between a first press and a second press of the plurality of presses and alternately moving to supply the press-molded articles from the first press to the second press, wherein the press-molded article supply robots in each pair is spaced apart from each other; a pair of product carrying-out robots positioned apart from each other behind a rearmost press of the presses and alternately moving to carry out final press-molded articles; and a controller configured to control the raw material transfer robots, the raw material supply robots, the presses, the press-molded article supply robots, and product carrying-out robots.

[0008] According to the present invention, an automatic press-molded article manufacturing system using a double robot line for a tandem press line includes a plurality of destackers, a plurality of positioners, and pairs of robots for transferring and supplying raw materials and press-molded articles and carrying out the press-molded articles, each robot pair having two robots positioned apart from each other. The paired robots may alternately move, accelerating the stages of supplying and transferring the raw materials or press-molded articles to catch up with the processing stages by the presses. Thus, a higher yield of final products may be obtained.

[0009] Since each pair of robots is in charge of its respective stage of supplying, transferring, and carrying out the raw materials or press-molded articles, one of the paired robots may function as a redundancy in preparation of when the other breaks down, which allows the system into a seamless operation.

BRIEF DESCRIPTION OF DRAWINGS

[0010] Fig. 1 is a plan view illustrating a deployment of an automatic press-molded article manufacturing system using a double robot line for a tandem press line, according to the present invention.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0011] According to the present invention, an automatic press-molded article manufacturing system using a double robot line for a tandem press line comprises: a plurality of destackers positioned apart from each other at a predetermined distance and loaded with multiple raw materials; a pair of raw material transfer robots transferring the raw materials loaded on the destackers while holding the raw materials by suction; a plurality of positioners positioned between the raw material transfer robots to position the raw materials transferred by the raw material transfer robots; a pair of raw material supply robots positioned apart from each other behind the raw material transfer robots and alternately moving to supply the raw materials from the positioners to a press while holding the raw materials by suction; a plurality of presses sequentially positioned behind the raw material supply robots and press-molding the raw materials received from the raw material supply robots into press-molded articles; a plurality of pairs of press-molded article supply robots, each pair of press-molded article supply robots positioned between a first press and a second press of the plurality of presses and alternately moving to supply the press-molded articles from the first press to the second press, wherein the press-molded article supply robots in each pair is spaced apart from each other; a pair of product carrying-out robots positioned apart from each other behind a rearmost press of the presses and alternately moving to carry out final press-molded articles; and a controller configured to control the raw material transfer robots, the raw material supply robots, the presses, the press-molded article supply robots, and product carrying-out robots.

[0012] Hereinafter, preferred embodiments of the present invention are described in detail with reference to the accompanying drawings.

[0013] Fig. 1 is a plan view illustrating a deployment of an automatic press-molded article manufacturing system using a double robot line for a tandem press line, according to the present invention.

[0014] Referring to Fig. 1, the automatic press-molded article manufacturing system using a double robot line for a tandem press line, according to the present invention, includes destackers 1, raw material transfer robots 2, positioners 3, raw material supply robots 4, presses 5, press-molded article supply robots 6, product carrying-out robots 7, and a controller 8.

[0015] According to the present invention, the manufacturing process including transferring and supplying raw materials, pressing, and carrying out products may be performed under automatic control, not on manual, thus enabling a yield of about twenty press-molded articles per minute. The transfer and supply of raw materials, pressing, and carry-out of press-molded articles may be continuously conducted, thus leading to a reduced manufacturing time together with a significantly increased yield of products.

[0016] Provided are a plurality of destackers 1 that are arranged apart from each other at a predetermined distance and that use, e.g., a forklift, to load multiple metallic materials thereon.

[0017] The plurality of destackers 1, respectively, are positioned adjacent to the plurality of raw material transfer robots 2. A first one of the destackers 1 is positioned at a rear side of one of the raw material transfer robots 2, and a second one of the destacker 1 is positioned at a front side of the other raw material transfer robot 2, thus free from mutual interference when the raw material transfer robots 2 are in operation. However, the deployment may be varied without being limited thereto. Two more destackers 1 (third and fourth destackers) may be provided in preparation for the exhaustion of the ram materials loaded on the first and second destackers 1. The third and fourth destakers 1 are positioned to respectively correspond to the first and second destakers 1. The destackers 1 arranged at the front sides of the raw material transfer robots 2 preferably form an angle of about 30 to about 45 degrees therebetween, so as to avoid interference between the raw material transfer robots 2.

[0018] The destackers 1 are hydraulic equipment that are put in wide use. Each destacker 1 includes a support elevating means and multiple rollers on the top on which raw materials are loaded. As the raw materials are sequentially supplied and thus run out, the support elevating means of the destacker ascends.

[0019] The raw material transfer robots 2 are provided in pair. The pair of raw material transfer robots 2 are spaced apart from each other. The raw material transfer robots 2 transfer the raw materials loaded on the destackers 1, while holding the raw materials by suction.

[0020] The raw material transfer robots 2 and all the other robots to be described below are equipment for transferring and supplying metallic materials or press-molded articles, and each may have multiple axes. The robots may be industrial robots that may be operated under the control of the controller 8. The robots are being widely used in electronic or machine industries, and thus, detailed descriptions thereof are omitted.

[0021] The plurality of positioners 3 are arranged between the raw material transfer robots 2, and the positioners 3 place, thereon, the raw materials transferred by the raw material transfer robots 2. For example, the positioners 3 are installed in an operation range of the raw material transfer robots 2, in which the raw materials may be transferred by the raw material transfer robots 2. Each positioner 3 includes a plurality of vertical legs and an upper table plate that is supported by the vertical legs. The upper table plate is inclined inward and downward. The inclined angle of the positioners 3 is preferably about 10 degrees to about 45 degrees.

[0022] Each positioner 3 primarily plays a role to place the raw materials in position to fit the operation range of the robot stationary at a side thereof so that the robot may transfer the raw materials to a predetermined position between the upper and lower pieces of mold of its

corresponding press 5, with the raw materials suctioned to the raw material transfer robot 2.

[0023] Specifically, the raw materials carried from the destackers 1 to the upper portions of the positioners 3 by the raw material transfer robots 2 slide down along the edges of the positioners 3 and are thus placed in position. The raw materials may be then supplied from the positioners 3 to predetermined positions of the presses 5 by the raw material supply robots 4.

[0024] The raw material supply robots 4 are provided in pair. The pair of raw material supply robots 4, respectively, are positioned at the respective rear sides of the raw material transfer robots 2. The raw material supply robots 4 alternately move, holding the raw materials on the positioners 3 by suction and supplying the raw materials to the presses 5.

[0025] As such, a pair of raw material supply lines, each including a raw material transfer robot, a raw material supply robot 4, a plurality of destackers 1, and a positioner 3, may be built up, resulting in a higher yield as compared with the conventional art.

[0026] A plurality of presses 5 are sequentially arranged behind the raw material supply robots 4. The foremost press of the presses 5 receives the raw materials from the raw material supply robots 4 and forces the raw materials into a mold to form the raw materials into press-molded articles of desired shapes.

[0027] Although four presses 5 are shown in Fig. 1, more presses 5 may be provided depending on types or shapes of final press-molded articles. The presses 5 may be controlled by the controller 8 and by their own respective manual controllers.

[0028] The press-molded article supply robots 6 are provided in pairs. Each pair of press-molded article supply robots 6 are spaced apart from each other between the presses 5. The press-molded article supply robots 6 alternately move, supplying the press-molded articles from one press to another.

[0029] The press-molded article supply robots 6 are arranged corresponding to each other in a space between the presses 5 respectively for first and second forming stages, and the press-molded article supply robots 6 may continuously supply the article formed by the press 5 for the first forming stage to the press 5 for the second forming stage.

[0030] The product carrying-out robots 7 are provided in pair. The pair of product carrying-out robots 7 are spaced apart from each other. The product carrying-out robots 7 are positioned behind the rearmost press 5 of the presses 5. The product carrying-out robots 7 alternately move, carrying out the final press-molded articles. A conveyor 9 is preferably provided between the product carrying-out robots 7 to guide the conveyance of the final press-molded articles.

[0031] The controller 8 controls the operation of the raw material transfer robots 2, the raw material supply robots 4, the presses 5, the press-molded article supply robots 6, and the product carrying-out robots 7. The controller 8 may be placed in a separate control room at the foremost side of the system to keep out of reach of others except the worker.

[0032] Now described is a process for manufacturing a press-molded article by an automatic press-molded article manufacturing system using a double robot line for a tandem press line according to the present invention.

[0033] First, a pair of raw material transfer robots 2 individually transfer the raw materials loaded on the destackers 1 to the positioners 3.

[0034] The raw materials transferred to the positioners 3 are alternately supplied to the foremost press 5 by a pair of raw material supply robots 4.

[0035] The raw materials are formed into a predetermined shape by the foremost press 5, and the resultant articles are then supplied to a next press 5 for a subsequent stage by a pair of press-molded article supply robots 6. In this case, the number of presses 5 may be not less than two and not more than N (N is a natural number). As the number of forming stages by the presses 5 increases, more presses 5 may be needed.

[0036] While one of the paired robots 6 transfers a press-molded article from a first press 5 for a first forming stage to a second press 5 for a second forming stage subsequent to the first forming stage, while holding the press-molded article by suction, the other robot 6, after unloading another press-molded article to the second press 5, returns to the first press 5, empty-handed, for another transfer. As such, the paired robots 6 alternately transfer and supply press-molded articles to a next forming stage while moving in opposite directions thereof, significantly reducing transfer time.

[0037] Having undergone the multiple forming stages by the presses 5 for desired shapes, the final press-molded articles are guided via the rearmost press 5 to the conveyor 9 by the product carrying-out robots 7, and are then carried out by the conveyor 9.

[0038] While the inventive concept has been shown and described with reference to exemplary embodiments thereof, it will be apparent to those of ordinary skill in the art that various changes in form and detail may be made thereto without departing from the spirit and scope of the inventive concept as defined by the following claims.

Claims

1. An automatic press-molded article manufacturing system using a double robot line for a tandem press line, comprising:

   a plurality of destackers positioned apart from each other at a predetermined distance and loaded with multiple raw materials;
   a pair of raw material transfer robots transferring the raw materials loaded on the destackers while holding the raw materials by suction;
   a plurality of positioners positioned between the

raw material transfer robots to position the raw materials transferred by the raw material transfer robots;

a pair of raw material supply robots positioned apart from each other behind the raw material transfer robots and alternately moving to supply the raw materials from the positioners to a press while holding the raw materials by suction;

a plurality of presses sequentially positioned behind the raw material supply robots and press-molding the raw materials received from the raw material supply robots into press-molded articles;

a plurality of pairs of press-molded article supply robots, each pair of press-molded article supply robots positioned between a first press and a second press of the plurality of presses and alternately moving to supply the press-molded articles from the first press to the second press, wherein the press-molded article supply robots in each pair is spaced apart from each other;

a pair of product carrying-out robots positioned apart from each other behind a rearmost press of the presses and alternately moving to carry out final press-molded articles; and

a controller configured to control the raw material transfer robots, the raw material supply robots, the presses, the press-molded article supply robots, and product carrying-out robots.

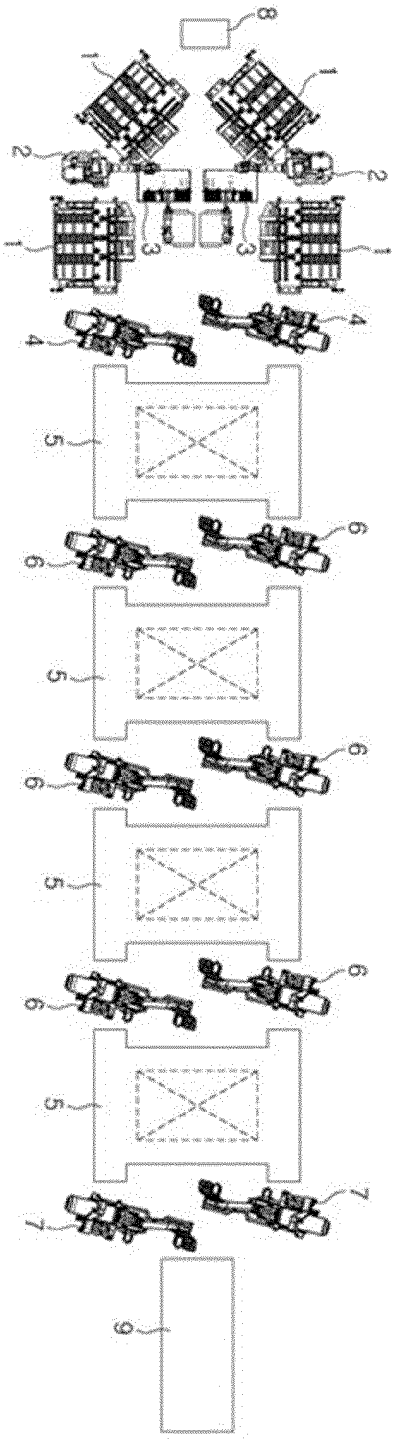

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2012/010915

A. CLASSIFICATION OF SUBJECT MATTER

B21D 43/00(2006.01)i, B21D 53/00(2006.01)i, B30B 15/30(2006.01)i, B30B 9/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B21D 43/00; B23K 37/02; B21D 43/05; B23K 37/00; B30B 13/00; B30B 15/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: tandem press line, robot line, material transfer robot, material supply robot, molded part supply robot, product

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-0878652 B1 (KOMATSU LTD.) 15 January 2009 See abstract; claims 3-5 and figures 1-2.	1
A	KR 10-2010-0036152 A (ILJI TECHNOLOGY CO., LTD.) 07 April 2010 See abstract; paragraph 31 and figure 3.	1
A	JP 2010-221271 A (HITACHI ZOSEN FUKUI CORP.) 07 October 2010 See abstract; claim 1 and figure 1.	1
A	JP 4394074 B2 (KOMATSU LTD.) 23 October 2009 See abstract; claims 4-5 and figure 1.	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 APRIL 2013 (08.04.2013)	**08 APRIL 2013 (08.04.2013)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2012/010915

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Form PCT/ISA/210 (patent family annex) (July 2009)