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(54) Tempering apparatus for tempering a steel plate.

(57) A tempering apparatus for tempering a steel plate includes a furnace, an inlet for putting a product which is quenched into the furnace, the inlet is disposed on the furnace, an outlet for taking the product which is tempered out the furnace, the outlet is disposed at an upper portion of the inlet, a fixed die disposed under a roof of the furnace, a pressing member moving in a vertical direction under the fixed die, a plurality of movable dies disposed between the fixed die and the pressing member so as to lie one upon another, the movable dies which sandwich the products each other, a conveying member disposed in the furnace adjacently to the pressing member and which is moved in a vertical direction, a first transmitting member which transmits at least one of the movable die from the conveying member to the pressing member, a second transmitting member which transmits at least one of the movable die laid on a top of the movable dies held by the pressing member to a near portion to the outlet, a first holding member disposed between the pressing member and the fixed die and which holds the plurality of movable dies and a second holding member disposed at an upper portion of the first holding member and which holds at least one of the movable dies.

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Fig. 3(a)

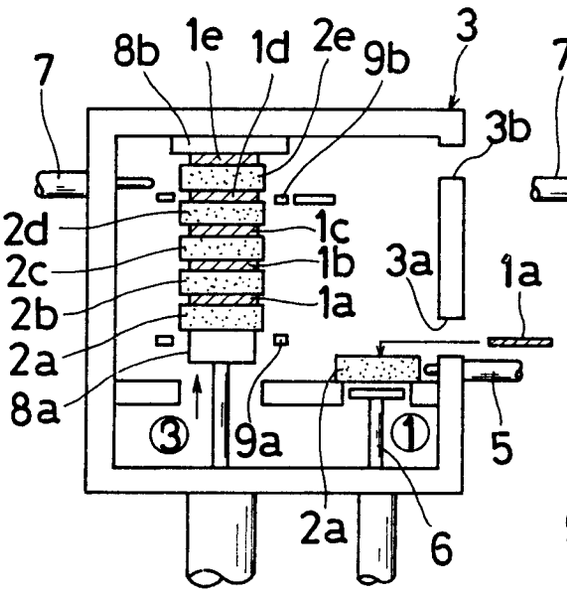
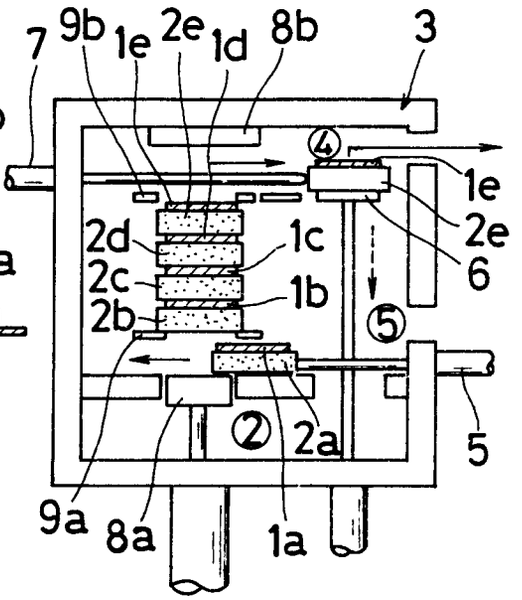

7
8b
1e
1d
2e
9b
3
3b
2d
2c
2b
2a
8a
1c
1b
1a
3a
1a
③
9a
①
5
2a
6

Fig. 3(b)


7
9b
1e
2e
1d
8b
3
④
1e
2e
6
2d
2c
2b
1c
1b
⑤
②
2a
5
9a
8a
1a

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a tempering apparatus for tempering a steel plate mainly applied to a process of making a clutch diaphragm spring or a clutch disk plate.

Description of the Related Art

A conventional automatic forming apparatus for forming a clutch diaphragm spring is disclosed in the Japanese Patent Laid Open No. 3(1991)-6328. The conventional forming apparatus disclosed in the prior art comprises a pressing process portion, a quenching process portion, a first tempering process portion and a second tempering process portion which are arranged in order and each of which automatically presses, swages, quenches, tempers a whole product and tempers a circumferential portion of the product. The quenching process portion of the apparatus receives a product from the pressing process portion and quenches the product one by one. The first tempering process portion of the apparatus receives the product from the quenching process portion and tempers the whole product one by one. Further, the second tempering portion includes three tempering devices each of which tempers the circumferential portion of the product applying cold air to a center portion of the product.

In the prior art the first tempering process portion and the second tempering process portion of the conventional forming apparatus include the plurality of tempering devices. Because the tempering devices are arranged horizontally, the conventional apparatus are enlarged.

Further, the first tempering process portion and the second tempering process portion have to include a plurality of conveying devices each of which transmits the product between the tempering devices. Further, the first tempering process portion and the second tempering process portion have to include a predetermined time to transmit the product between the tempering devices. Furthermore, because each of the tempering devices includes a die, the tempering devices include errs between the dies. That is to say, the dies include errs of the scale each other. Therefore, the deformation of the products tempered by the first tempering process portion and the second tempering process portion fail to be completely removed.

SUMMARY OF THE PRESENT INVENTION

It is an object of the present invention to provide an improved tempering apparatus for tempering a steel plate which is simple in structure and small in size.

It is another object of the present invention to provide an improved tempering apparatus for tempering a steel plate which can manufacture a product, a deformation of which is sufficiently removed.

It is a further object of the present invention to provide an improved tempering apparatus for tempering a steel plate which can reduce a time to temper a product.

It is a further object of the present invention to provide an improved tempering apparatus for tempering a steel plate which comprises durability.

It is a further object of the present invention to provide an improved tempering apparatus for tempering a steel plate which can easily temper a product.

It is a further object of the present invention to provide an improved tempering apparatus for tempering a steel plate which is low in cost.

To achieve the above mentioned objects, a tempering apparatus for tempering a steel plate in accordance with this invention comprises a furnace, an inlet for putting a product which is quenched into the furnace, the inlet is disposed on the furnace, an outlet for taking the product which is tempered out the furnace, the outlet is disposed at an upper portion of the inlet, a fixed die disposed under a roof of the furnace, a pressing member moving in a vertical direction under the fixed die, a plurality of movable dies disposed between the fixed die and the pressing member so as to lie one upon another, the movable dies which sandwich the products each other, a conveying member disposed in the furnace adjacently to the pressing member and which is moved in a vertical direction, first transmitting means which transmit at least one of the movable die from the conveying member to the pressing member, second transmitting means which transmit at least one of the movable die laid on a top of the movable dies held by the pressing member to a near portion to the outlet, a first holding member disposed between the pressing member and the fixed die and which holds the plurality of movable dies and a second holding member disposed at an upper portion of the first holding member and which holds at least one of the movable dies.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the tempering apparatus for tempering a steel plate according to the present invention will be more clearly appreciated from the following description in conjunction with the accompanying drawings wherein:

FIG. 1 (a) is a plan view of a clutch disk plate tempered by a tempering apparatus for temper-

ing a steel plate of the present invention;

FIG. 1 (b) is a sectional view of a clutch disk shown in FIG. 1 (a);

FIG. 2 is an elevational view, partly in cross section, of a tempering apparatus for tempering a steel plate of the present invention;

FIG. 3 (a) is a sectional view of a tempering apparatus for tempering a steel plate in explaining the tempering operation of the invention;

FIG. 3 (b) is a sectional view of a tempering apparatus for tempering a steel plate in explaining the arrangement operation of the invention; and

FIG. 4 is a detail view of a tempering apparatus for tempering a steel plate in explaining the tempering operation of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT OF THE INVENTION

In accordance with the invention, a tempering apparatus is used for tempering a product which is quenched such as a clutch disk plate 1 shown in the FIGS. 1 (a) and 1 (b) so as to strength the product and remove a deformation of the product. At a circumferential portion 1a of the clutch disk 1 as an attached portion to a clutch facing, the deformation is generated through a quenching (curburizing) process provided after a pressing process. The circumferential portion 1a of the clutch disk 1 is tempered by a tempering apparatus for tempering a steel plate M shown in the FIG. 2 in order that the deformation of the clutch disk plate 1 is removed.

Referring to the FIG. 2, the tempering apparatus M comprises a furnace 3 which includes four walls, a roof and a floor so as to surround in all direction. The furnace 3 includes a heating member 4 which heats a temperature of air in the furnace 3 to a predetermined value applied to the tempering process. An inlet 3a for putting the quenched disk plate 1 into the furnace 3 is disposed on one of the walls of the furnace 3. Further, an outlet 3b for taking the tempered disk plate 1 out the furnace 3 is disposed at upper portion of the wall of the furnace 3.

A pressing member 8a which is able to move in the vertical direction is disposed in the furnace 3. The pressing member 8a is connected with a driving source 81 through a rod 80. A fixed die 8b is disposed under the roof of the furnace 3 so as to be opposite to the pressing member 8a. A plurality of movable dies 2 are disposed between the fixed die 8b and the pressing member 8a so as to lie one upon another. The movable dies 2 sandwich the plurality of disk plates 1 each other. A conveying member 6 is disposed in the furnace 3 adjacently to the pressing member 8a so as to hold the movable die 2 with the quenched disk plate 1. The conveying member 6 is also able to be moved in the vertical direction. A first transmitting member 5 is slidably disposed in the inlet 3a so as to transmit the movable die 2 with the clutch disk 1 held by the conveying means 6 to the pressing member 8a. A second transmitting member 7 is slidably disposed in another wall of the furnace 3 so as to transmit one of the movable dies 2 with the tempered clutch disk 1 laid on a top of the dies 2 held by the pressing member 8a to a near portion to the outlet 3b. Furthermore, a first holding member 9a and a second holding member 9b shown in FIGS. 3 (a), 3(b) are disposed between the pressing member 8a and the fixed die 8b, each of which includes at least a pair of holding portions. Each of the holding members 9a, 9b expands and narrows the holding portions each other so as to hold and let go of the movable dies 2 with clutch disks 1.

A tempering operation of the tempering apparatus for tempering a steel plate M and a tempering method for tempering a steel plate of the invention will be described hereinafter with the FIGS. 3 (a), 3(b) and 4. In the FIG. 3 (a) at first the movable die 2a is set on the conveying member 6 so as to be heated to a predetermined temperature by the air in the furnace 3. The quenched disk plate 1a is put into the furnace 3 through the inlet 3a so as to be laid on the movable die 2a (indicated by ① shown in FIG. 3 (a)). The first transmitting member 5 moves the movable die 2a with the disk plate 1a in the left direction shown in the FIG. 3 (a) in order that the movable die 2a with the disk plate 1a is laid on the pressing member 8a. At this time the movable dies 2b, 2c, 2d and 2e with the disk plates 1b, 1c, 1d and 1e are held by the first holding member 9a. Later on the conveying member 6 is moved to the near portion to the outlet 3b (indicated by ② shown in FIGS. 3 (b), 4).

At the next step the pressing member 8a is moved in the upper direction in order that the disk plates 1a, 1b, 1c, 1d and 1e with the movable dies 2a, 2b, 2c, 2d and 2e are pressed simultaneously between the fixed die 8b and the pressing member 8a. At this moment each of the movable dies 2a and 2e is located at an upper portion to the holding members 9a and 9b respectively. After the process above mentioned, the disk plate 1a with the movable die 2a is pressed once, the disk plate 1b with the movable die 2b is pressed twice, the disk plate 1c with the movable die 2c is pressed three times, the disk plate 1d with the movable die 2d is pressed four times and the disk plate 1e with the movable die 2e is pressed five times. That is to say, in accordance with the invention the disk plate 1 is pressed with the number of times corresponding to the number of the disk plates 1 disposed between the pressing member 8a and the fixed die

8b. After pressed five times, the deformation of the disk plate 1e is completely removed (indicated by ③ shown in FIGS. 3 (a), 4).

At the next step, the pressing member 8a is moved in the lower direction. Later on the second transmitting member 7 moves the movable die 2e with the disk plate 1e held by the second holding member 9b in the right direction shown in the FIG. 3 (b) in order that the movable die 2e with the disk plate 1e is laid on the conveying member 6 which is located near the outlet 3b (indicated by ④ shown in FIGS. 3 (b), 4). After that the disk plate 1e is taken out the furnace 3 through the outlet 3b. The conveying member 6 transmits the movable die 2e to the near portion of the inlet 3a last (indicated by ⑤ shown in FIG. 3 (b)). With the repetition of the above processes from ① to ⑤, each of the disk plates 1 is pressed five times. However, in the invention the tempering apparatus is not restricted to include the five dies 2 disposed between the pressing member 8a and the fixed die 8b as described in the above.

In accordance with the invention, because the plurality of movable dies are laid on in the vertical direction, the tempering apparatus can be small in size. Further, because a number of temperings are applied to the product by the same die, the deformation of the product is sufficiently removed. Further, the tempering apparatus does not have to include a transmitting member and a tempering process which move the product from the die to the next die. Therefore the tempering apparatus can be simple in structure and can reduce the time to temper the product.

While the invention has been particularly shown and described with reference to preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details can be made therein without departing from the spirit and scope of the invention.

Claims

1. A tempering apparatus for tempering a steel plate comprising:

a furnace;

an inlet for putting a product which is quenched into the furnace, the inlet is disposed on the furnace;

an outlet for taking the product which is tempered out the furnace, the outlet is disposed at an upper portion of the inlet;

a fixed die disposed under a roof of the furnace;

a pressing member moving in a vertical direction under the fixed die;

a plurality of movable dies disposed between the fixed die and the pressing member so as to lie one upon another, the movable dies which sandwich the products each other;

a conveying member disposed in the furnace adjacently to the pressing member and which is moved in a vertical direction;

first transmitting means which transmit at least one of the movable die from the conveying member to the pressing member;

second transmitting means which transmit at least one of the movable die laid on a top of the movable dies held by the pressing member to a near portion to the outlet;

a first holding member disposed between the pressing member and the fixed die and which holds the plurality of movable dies; and

a second holding member disposed at an upper portion of the first holding member and which holds at least one of the movable dies.

2. A tempering apparatus as recited in Claim 1, wherein each of the first holding member and the second holding member includes at least a pair of holding portions which expand and narrow each other.

Fig. 1(a)

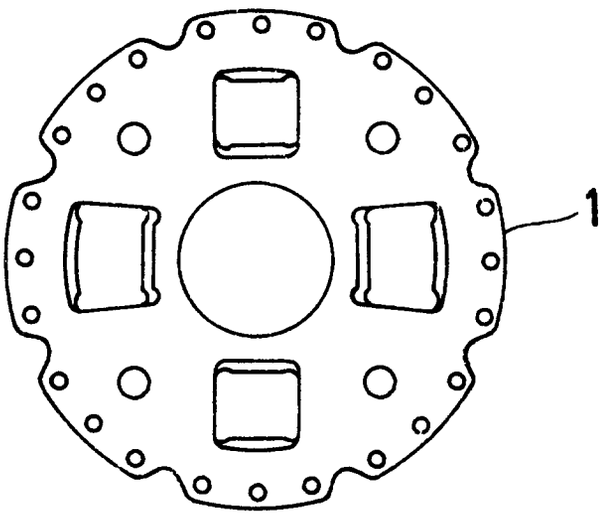


Fig. 1(b)

Fig. 2

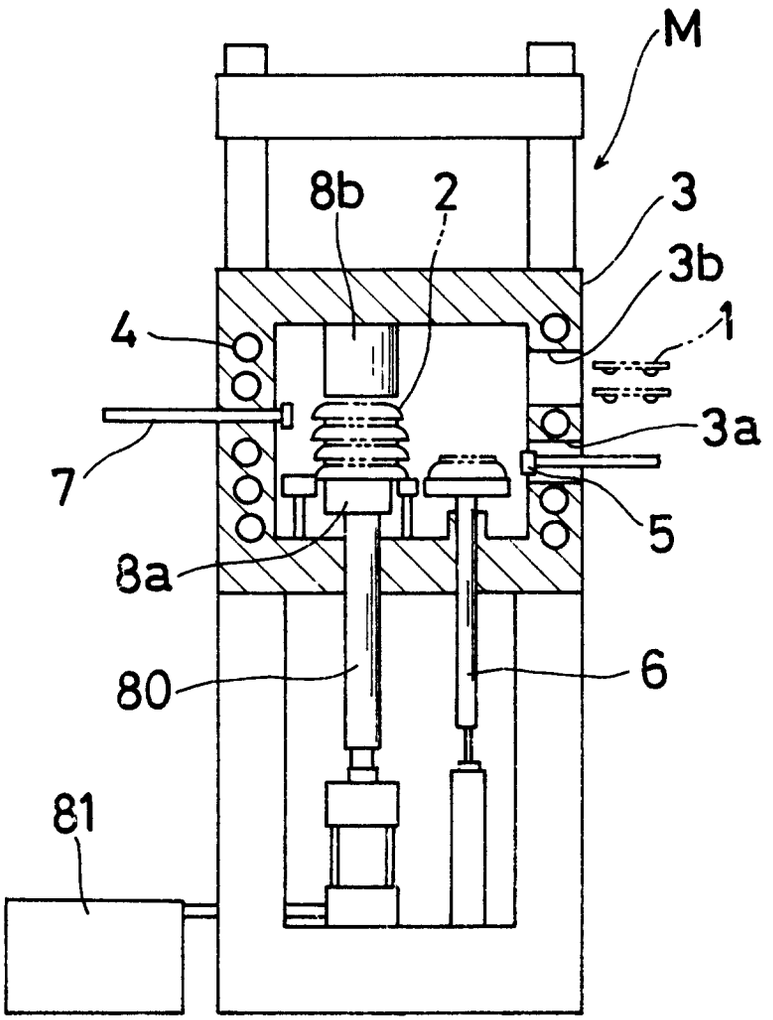


Fig. 3(a)

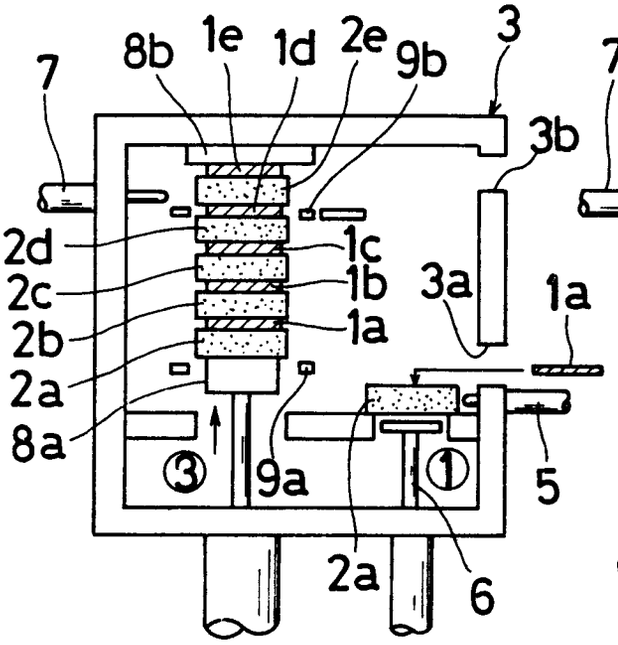


Fig. 3(b)

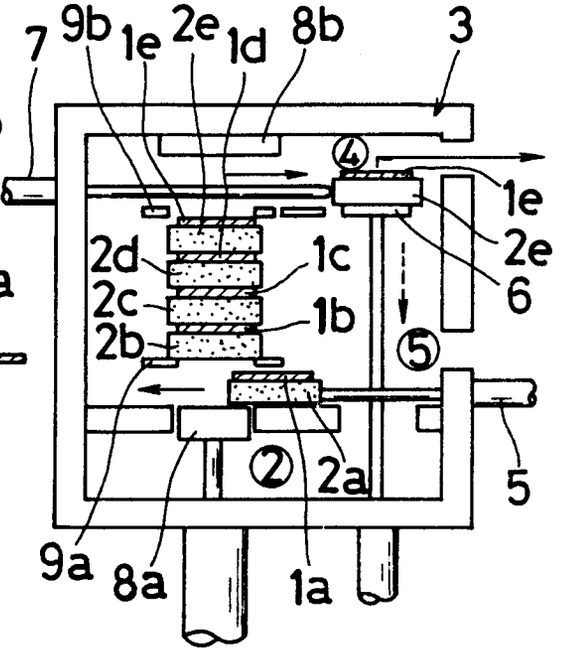
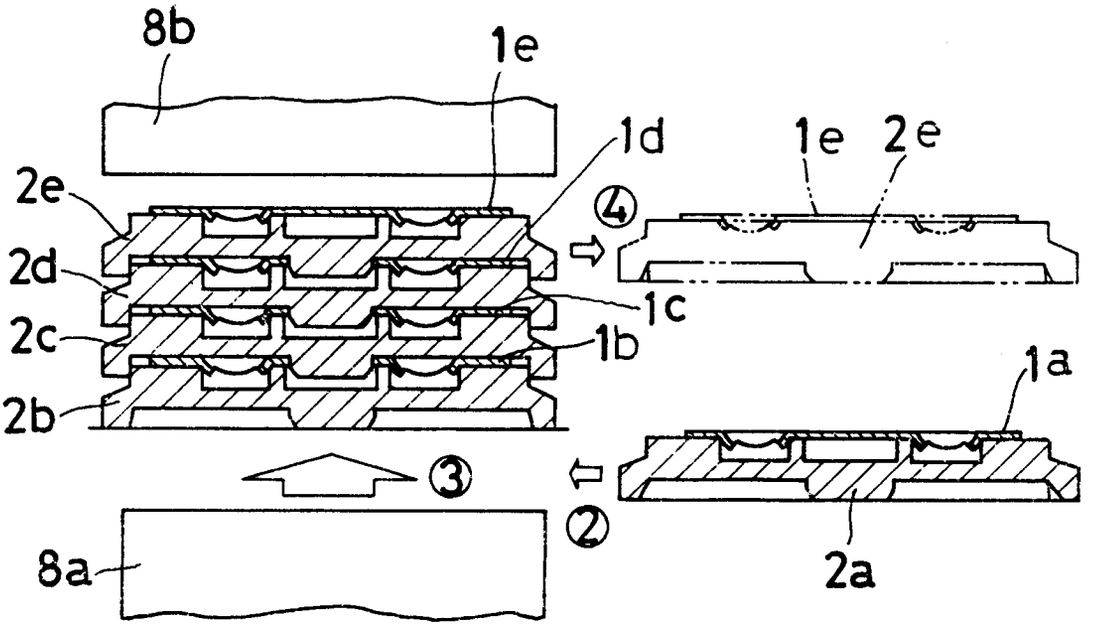


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 94 10 0608

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	US-A-1 894 590 (R. C. INGERSOLL) * figure 1 *	1	C21D9/00
Y	EP-A-0 257 540 (BRITISH STEEL) * claim 7; figures 2-4 *	1	
A D	US-A-5 044 611 (M. BENEY ET AL.) * claim 1 * & JP-A-3 006 328 (...)	1	
A	US-A-3 510 367 (J. E. BERGER) * figure 5 *	1	
A	FR-A-1 598 224 (A. P. H. LABAT - CAMY) * figure 1 *	1	
A	US-A-3 753 798 (N. KOMATSU ET AL.)	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
C21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	9 March 1994	Sutor, W

CATEGORY OF CITED DOCUMENTS

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