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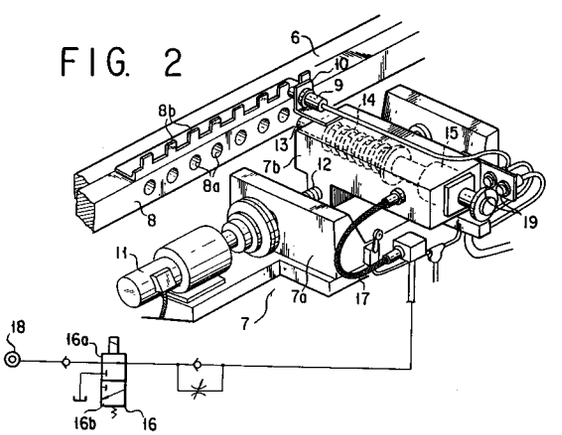
(54) **LOCKING DEVICE OF TRANSFER FEEDER.**

(57) A locking device of a transfer feeder for preventing unexpected movement of a transfer bar or a driving part therefor and capable of locking the transfer bar at any desired position exactly. The locking device includes: a feed carrier (5a); a plurality of catching plates (8) each fixed to an equalizer bar (6) provided for a lift/clamp mechanism and having a plurality of catching holes (8a) drilled at intervals lengthwise; and a plurality of locking pins (13) fixed to a press itself at several points so as to oppose the catching plates (8) and movable right and left as well as back and forth by driving units (11, 15) so that each pin can engage with any one of the catching holes.

FIG. 2



EP 0 531 523 A1

FIELD OF THE INVENTION

The present invention relates to a locking device for a transfer feeder employed in a transfer press.

BACKGROUND OF THE INVENTION

A transfer feeder employed in the conventional transfer press is constructed to have a pair of transfer bars which are movable in two-dimensional or three-dimensional directions, and to clamp a work by means of a finger provided in opposition to these transfer bars for transporting the work.

On the other hand, the transfer bars are adapted to be driven in feeding direction, lifting direction and clamping direction by means of a cam driven to rotate by a driving force taken-off by a power take off of the transfer press. A clutch, a brake and so forth are provided in the power take off for controlling transmission and blocking of the driving power.

In the above-mentioned conventional transfer feeder, when maintenance or repairing of the driving section in the feeder, an engineer enters within the feeder to perform maintenance or repair by stopping motion of the feeder side by a brake in a press main body side when the clutch of the power take off is engaged and by stopping motion of the feeder by means of a brake of the power take off when the clutch of the power take off is released.

However, since the brake of the press main body and the brake of the power take off employ friction plates, it is possible to cause unexpected movement of the transfer bars so forth due to slip of the friction plates due to weight of the transfer bars or so forth. Therefore, in the prior art, it cannot ensure safety of maintenance and repair.

SUMMARY OF THE INVENTION

The present invention is to solve the above-mentioned problems. Therefore, it is an object of the present invention to provide a locking device for a transfer feeder which can certainly lock transfer bars at desired positions so that the transfer bars and their driving portions will never initiate motion unexpectedly.

In order to accomplish the above-mentioned object, there is provided, in accordance with the first aspect of the invention, a locking device for a transfer feeder of a transfer press, which transfer feeder includes a pair of transfer bars driven in two or three dimensional directions, which comprises engaging means provided in a drive mechanism of the transfer bar, locking means provided at a plurality of stationary portions of a press main body for engaging with the engaging means, and driving means for driving the locking means.

In order to accomplish the above-mentioned object, there is provided, in accordance with the second aspect of the invention, and in the locking device according to the above-mentioned first aspect of the invention, the engaging means comprises a plurality of engaging plates fixed on a feed carrier and equalizer bar provided in lift/clamping mechanism and having a plurality of engaging holes formed in alignment in the longitudinal direction with a regular interval, and the locking means comprises a plurality of locking pins provided at plurality of portions of the press main body respectively in opposition to the engaging plates and movable in axial and lateral directions by means of the driving means to engage with one of a plurality of the engaging holes.

In order to accomplish the above-mentioned object, there is provided, in accordance with the third aspect of the invention, and in the locking device according to the above-mentioned second aspect of the invention, each of the engaging plates has dogs at predetermined positions corresponding to each engaging holes, and engagement and release of the locking pin relative to the engaging holes is controlled by detecting one of the dogs by means of a detector.

In order to accomplish the above-mentioned object, there is provided, in accordance with the fourth aspect of the invention, and in the locking device according to the above-mentioned first aspect of the invention, the engaging means comprises a engaging plate secured on the press main body in upright fashion and having a plurality of engaging holes formed in alignment in a feed direction of a feed carrier with a regular interval, an engaging portion having a plurality of recessed grooves formed in the a clamping drive lever in alignment in the longitudinal direction thereof with a regular interval and an engaging portion having a plurality of recessed grooves formed in a lifting drive lever in alignment in the longitudinal direction thereof with a regular interval, and the locking means comprises a plurality of locking cylinders secured on the feed carrier and two portions of the press main body respectively in opposition to the engaging plate and two engaging portions to engage with respective one of engaging holes and recessed groove.

In order to accomplish the above-mentioned object, there is provided, in accordance with the fifth aspect of the invention, and in the locking device according to the above-mentioned fourth aspect of the invention, the locking cylinder is placed at locking position by a biasing means and at an unlocking position by a hydraulic pressure.

With the present invention having the above-mentioned respective features, since the locking

device for mechanically locking the drive mechanisms for driving the transfer bars in feeding, lifting and clamping directions, even when engineer performs maintenance or repair by entering into the transfer feeder, the transfer bars or its driving portions will never move unexpectedly due to their own weight or so forth to ensure safety in maintenance and repairing operations.

In addition, since it is constructed that the locking pin detecting the engaging hole in the engaging plate enters into the detected engaging hole, lock can be certainly established even when the transfer bars are stored at any desired position.

The above-mentioned and other objects, aspects and advantages of the present invention will become clear to those skilled in the art from the discussion described and illustrated in connection with the accompanying drawings which illustrate preferred embodiments meeting with the principle of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of in the vicinity of a feed driving mechanism, in which the preferred embodiment of the present invention is employed;

Fig. 2 is an enlarged perspective view of the preferred embodiment of the present invention;

Fig. 3 is schematic illustration showing overall construction of a lock system of a transfer feeder employing another embodiment of the present invention;

Fig. 4 is a schematic plan view of a lock cylinder employed in the embodiments of the invention and elements in the vicinity thereof; and

Fig. 5 is a section of the lock cylinder to be employed in the embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will be discussed herebelow in connection with the accompanied drawings.

At first, discussion will be given for the first embodiment of the present invention with reference to **Figs. 1** and **2**.

In **Fig. 1**, the reference numeral **1** denotes a main body of a transfer press, which includes a moving bolster **2**. A pair of transfer bars **4** of a transfer feeder **3** are provided above the moving bolster **2**.

The transfer bars **4** are provided in parallel relationship orienting in parallel to the transfer direction of not shown works. The transfer bars **4** are adapted to be driven in three-dimensional directions of feeding direction, lifting direction and clamping direction by a driving force taken off by a not shown power take off provided in the main body of the press **1**. A locking device **7** according to the present invention, is provided in the vicinity of a feed carrier **5a** of a feed drive mechanism **5** or an equalizer bar **6** provided in a lift and clamp mechanisms (both being not shown).

As shown in **Fig. 2**, the locking device **7** has an engaging plate **8** fixedly secured on the feed carrier **5a** or the equalizer bar **6**.

The engaging plate **8** is formed with a plurality of engaging holes **8a** aligned in the longitudinal direction with a regular interval and dogs **8b** at the positions corresponding to the engaging holes **8a**. The dogs **8b** are adapted to be detected by means of a detector **9**, such as a proximity switch, movable along the engaging plate **8**.

The detector **9** is mounted on a sliding member **7b** movably supported on a base **7a** of the locking device **7** via a bracket **10**. A thread shaft **12** which is rotatingly driven by a feeding motor **11** is engaged with the lower portion of the sliding member **7b** so that the sliding member **7b** is driven to move along the engaging plate **8** by means of the feeding motor **11**.

The sliding member **7b** carries a locking pin **13** in opposition to the engaging plate **8**, which lock pin **13** has a tip end entering into the engaging hole **8a** of the engaging plate **8** to lock the engaging plate **8**.

The locking pin **13** is normally biased toward the engaging plate **8** by means of a compression spring **14** so as to establish locking for the engaging plate by the effect of the compression spring **14**. The rear end of the locking pin **13** is connected to a hydraulic cylinder **15** so as to unlock the engaging plate in response to a hydraulic pressure supplied from a pressurized fluid source **18** via an electromagnetic valve **16** and a piping **17**.

It should be noted that, in the drawings, the reference numeral **19** denotes a detector for detecting locking and unlocking states of the locking pin **13**.

Next, discussion will be given for operation. Upon maintenance or repair of the transfer feeder **3**, once the transfer feeder **3** is stopped, the sliding member **7b** is driven by revolution of the feeding motor **11** to move along the engaging plate **8**.

Since the detector **9** is provided on the sliding member **7b**, the detector **9** detects the dogs **8b** of the engaging plate **8**. In response to a signal from the detector **9**, an electromagnetic valve **16** is switched from a communicating position **16a** to a drain position **16b** so that a work fluid in the hydraulic cylinder is drained.

By this, the locking pin **13** is projected in the direction toward the engaging plate **8** by the action of the compression spring **14** and thus inserted into

the engaging hole **8a** at the corresponding position to the detected dog **8b**. Therefore, the feed carrier **5a** or the equalizer bar **6** of the lifting and clamping mechanisms fixed to the engaging plate **8** can be mechanically locked. Therefore, unexpected movement of the transfer bars due to its own weight during maintenance or repairing operation can be certainly prevented.

Next, the second embodiment of the present invention will be discussed in connection with **Figs. 3** to **5**.

As can be clear from **Fig. 3**, by a power take off **25** mounted thereon, a press main body **21** takes off the driving force for rotatingly driving a cam shaft **26** by the taken off driving force.

A feeding cam **26a**, a clamping cam **26b** and a lifting cam **26c** are provided on the cam shaft **26**. A feed carrier **7** is driven by the feeding cam **6a**. A clamping drive lever **8** is driven by the clamping cam **6b**. A lifting drive lever **9** is driven by the lifting cam **6c**. The transfer bars **4** are driven in a three-dimensional directions, i.e. feeding and returning direction, clamping and unclamping direction and lifting and lowering direction, by the feed carrier **7**, the clamping drive lever **8** and the lifting drive lever **9**.

Locking devices **10**, according to the present invention, are respectively provided in the vicinity of the feed carrier **7**, the clamping drive lever **8** and the lifting drive lever **9**.

The locking device **10** provided for the feed carrier **7** has locking cylinders **11** arranged at both sides of the feed carrier **7**. A piston rod **11a** projected from the locking cylinder **11** is adapted to insert the tip end portion thereof into an engaging hole **12a** of an engaging plate **12** provided on the upright side **1a** of the press main body **1** for locking the feed carrier.

On the other hand, the locking devices **10** provided in the vicinity of the clamping drive lever **8** and the lifting drive lever **9** have locking cylinders **11** which are constructed to engage the tip ends of the piston rods **11b** to a plurality of recess form engaging portions **8a** and **9a** respectively aligned in the longitudinal directions of the clamping drive lever **8** and the lifting drive lever **9**.

The locking cylinders **11** are mounted on a stationary portion, such as a bed of the press main body **1** by means of brackets **10a**. As shown in **Figs. 3** and **4**, the interior space of the lock cylinder **11** is divided into a pressure chamber $\mathbf{11}_1$ and a spring chamber $\mathbf{11}_2$ by the piston **11a**. A hydraulic pressure is supplied to the pressure chamber $\mathbf{11}_1$ from a pressurized fluid source **13** via an electromagnetic valve **14**. On the other hand, a compression spring **11c** for biasing the piston **11a** in the locking direction is housed within the spring chamber $\mathbf{11}_2$.

An actuation rod **11c** provided on the piston **11a** to project toward the spring chamber $\mathbf{11}_2$ externally extends from the cylinder **11**. A dog **15** is carried on the tip end of the actuation rod. A lock detector **16** comprising a proximity switch is adapted to detect the dog **15**.

Next, operation of the foregoing embodiment will be discussed. Upon maintenance or repair of the transfer feeder **3**, once the transfer feeder **3** is stopped, the hydraulic pressure supplied to respective of the pressure chambers $\mathbf{11}_1$ if the locking cylinders **11** are drained by switching respective electromagnetic valves **14** from communicating position s **14a** to drain positions **14b**. By this, the piston rods **11b** maintained at the retracted position by the hydraulic pressure project toward the engaging plate **12**, the clamping drive lever **8** and the lifting drive lever **9**. As a result, tip ends of respective piston rods **11b** enters into the engaging portions **12a**, **8a** and **9a** to lock the feed carrier **7**, the clamping drive lever **8** and the lifting drive lever **9**.

Since the motion of the transfer bars **4** in the feeding and returning direction, the clamping and unclamping direction and lifting and lowering direction is restricted, unexpected motion of the transfer bars **4** due to their own weight can be certainly prevented.

Claims

1. A locking device for a transfer feeder of a transfer press, which transfer feeder includes a pair of transfer bars driven in two or three dimensional directions, comprising:

engaging means provided in a drive mechanism of said transfer bars;

locking means provided at a plurality of stationary portions of a press main body for engaging with said engaging means; and

driving means for driving said locking means.

2. A locking device as set forth in claim 1, wherein said engaging means comprises a plurality of engaging plates fixed on a feed carrier and equalizer bar provided in lift/clamping mechanism and having a plurality of engaging holes formed in alignment in the longitudinal direction with a regular interval, and said locking means comprises a plurality of locking pins provided at plurality of portions of said press main body respectively in opposition to said engaging plates and movable in axial and lateral directions by means of said driving means to engage with one of a plurality of said engaging holes.

3. A locking device as set forth in claim 2, wherein each of said engaging plates has dogs at predetermined positions corresponding to each engaging holes, and engagement and release of said locking pin relative to said engaging holes is controlled by detecting one of said dogs by means of a detector.

4. A locking device as set forth in claim 1, wherein said engaging means comprises a engaging plate secured on the press main body in upright fashion and having a plurality of engaging holes formed in alignment in a feed direction of a feed carrier with a regular interval, an engaging portion having a plurality of recessed grooves formed in the a clamping drive lever in alignment in the longitudinal direction thereof with a regular interval and an engaging portion having a plurality of recessed grooves formed in a lifting drive lever in alignment in the longitudinal direction thereof with a regular interval, and said locking means comprises a plurality of locking cylinders secured on said feed carrier and two portions of the press main body respectively in opposition to said engaging plate and two engaging portions to engage with respective one of engaging holes and recessed groove.

5. A locking device as set forth in claim 4, wherein said locking cylinder is placed at locking position by a biasing means and at an unlocking position by a hydraulic pressure.

FIG. 1

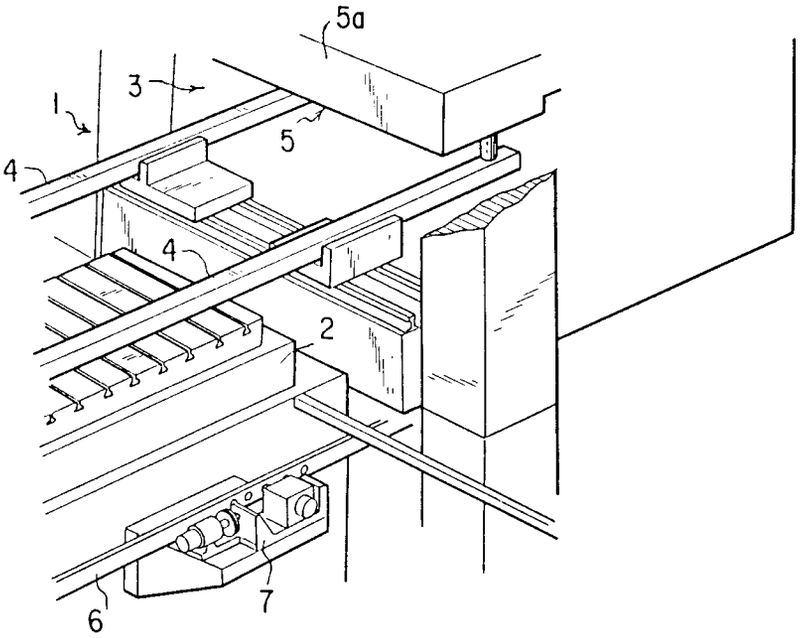
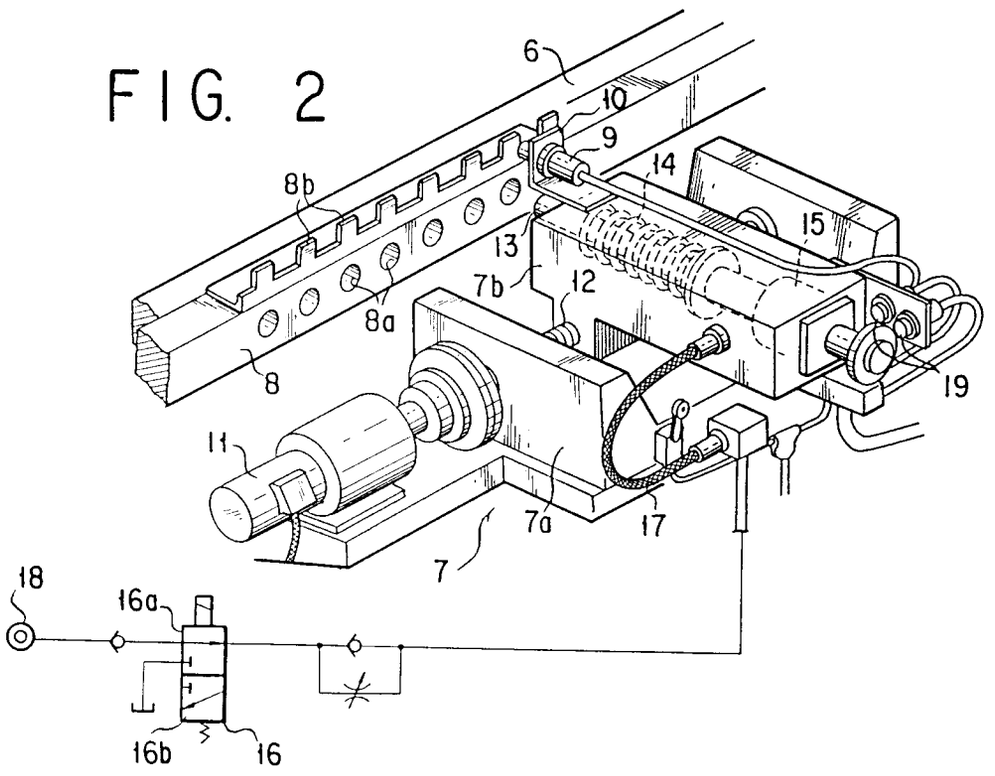


FIG. 2



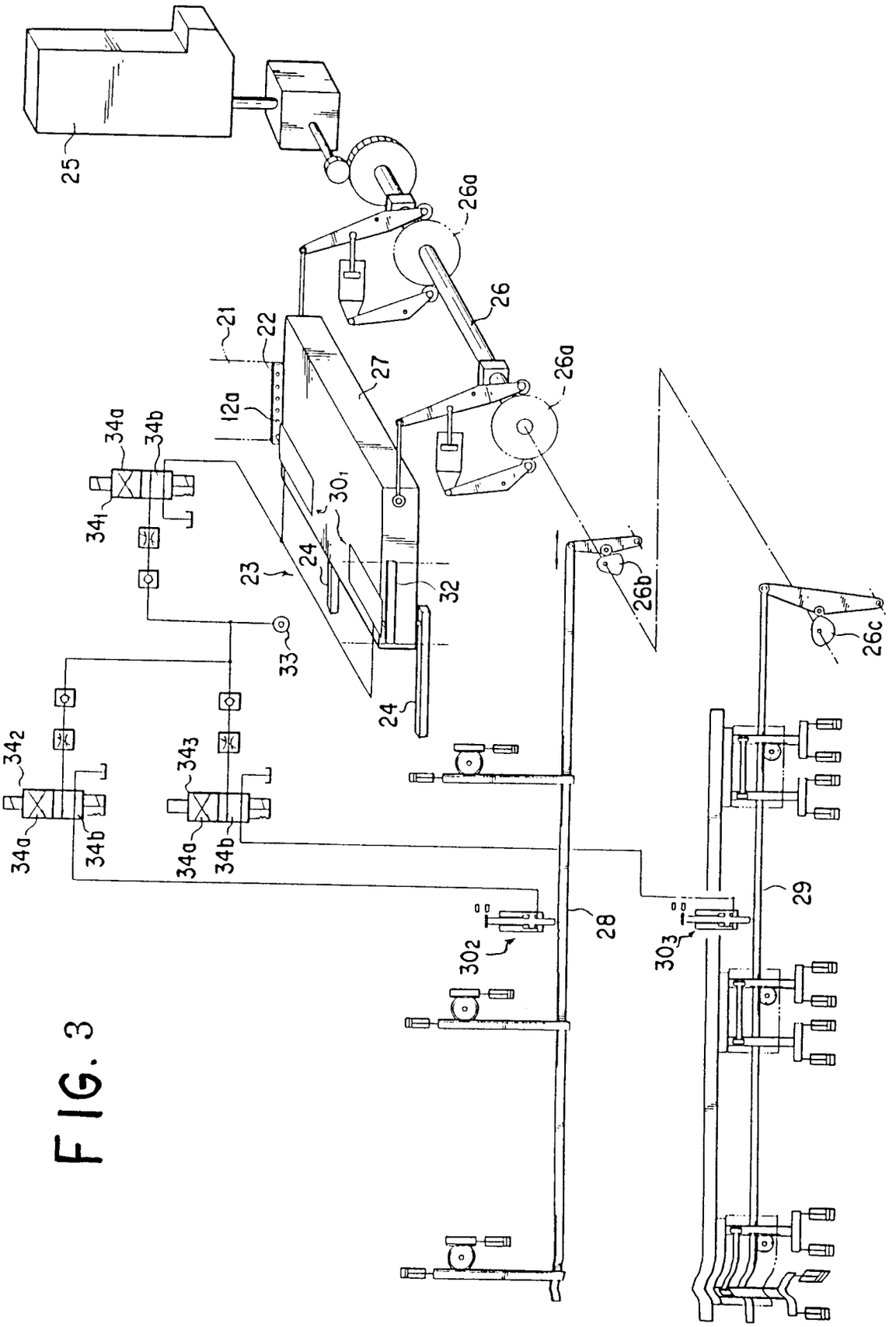

25
26a
26
21
22
27
12a
34a
34b
34₁
30₁
23
24
32
33
26b
26c
34₂
34₃
29
28
30₂
30₃

FIG. 3

FIG. 4

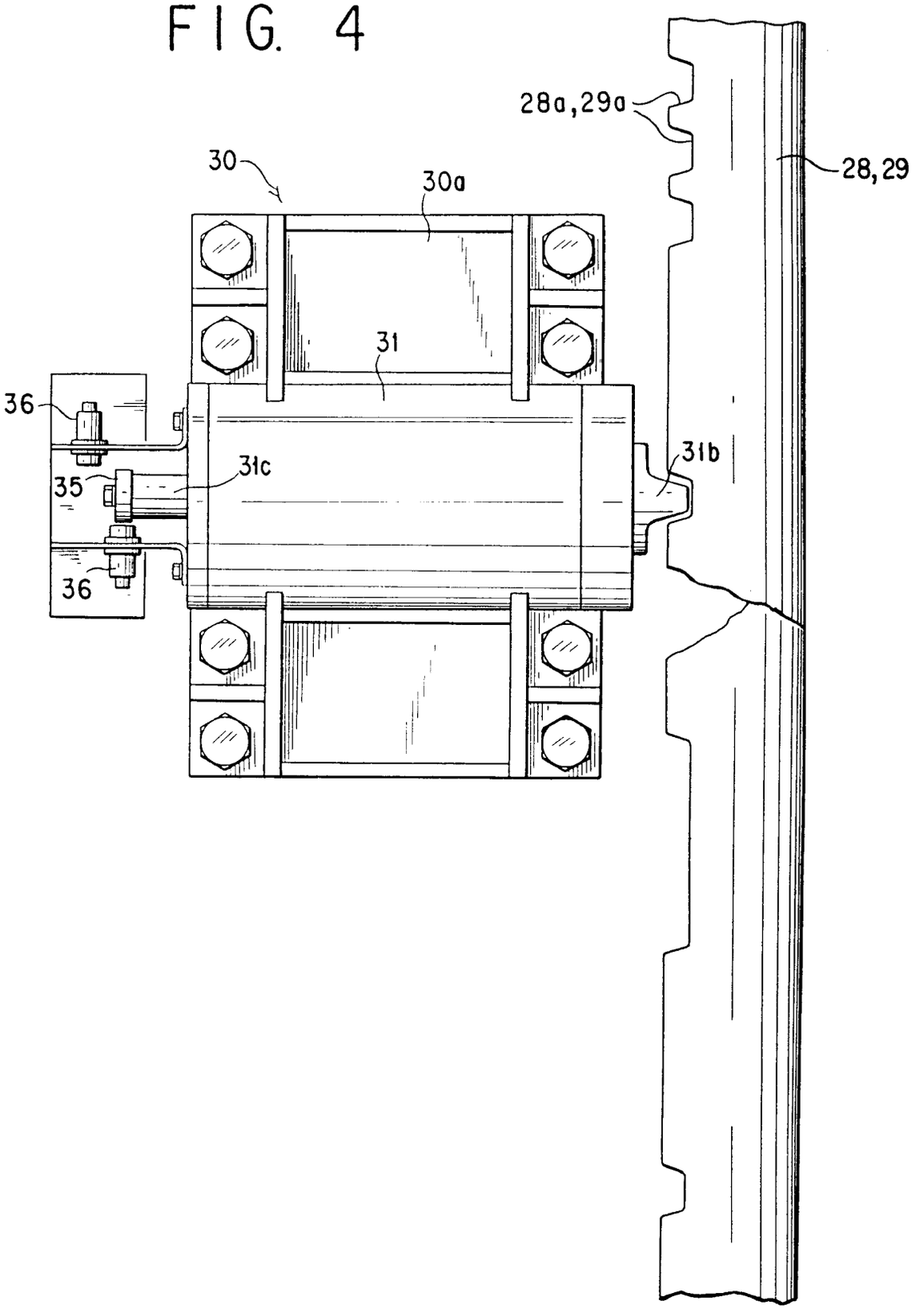
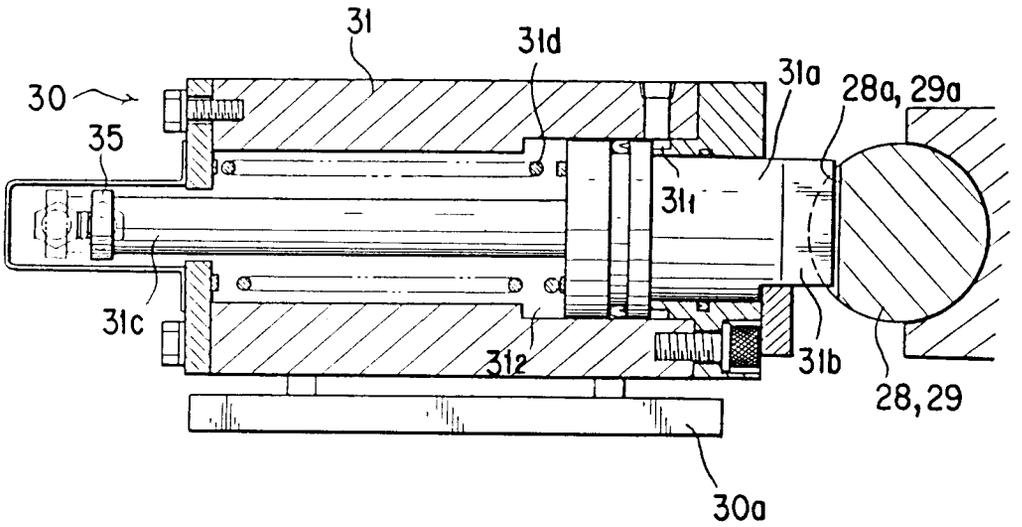


FIG. 5



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00676

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] B21D43/05

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B21D43/05

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1942 - 1990
Kokai Jitsuyo Shinan Koho	1971 - 1990

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	JP, U, 57-49029 (Automation System K.K.), 19 March 1982 (19. 03. 82), (Family: none)	1
Y	JP, A, 61-99530 (Komatsu Ltd.), 17 May 1986 (17. 05. 86), (Family: none) Line 12, right column, page 3 to line 2, left column, page 4; Fig. 2	2
A	Eiju Matsunaga "Transfer Press Working", Nikkan Kogyo Shinbunsha 30 June 1980 (30. 06. 80)	3 - 5

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
July 24, 1990 (24. 07. 90)	August 6, 1990 (06. 08. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	