(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 332 981 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.06.2018 Bulletin 2018/24

(21) Application number: **17205330.8**

(22) Date of filing: **05.12.2017**

(51) Int Cl.:
B41K 3/10 *(2006.01)* ***B41K 3/12*** *(2006.01)*
B41F 13/00 *(2006.01)* ***B41F 13/004*** *(2006.01)*
B41F 13/008 *(2006.01)* ***B41F 17/00*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(30) Priority: **07.12.2016 JP 2016237310**

(71) Applicant: **Komori Corporation**
Sumida-ku
Tokyo (JP)

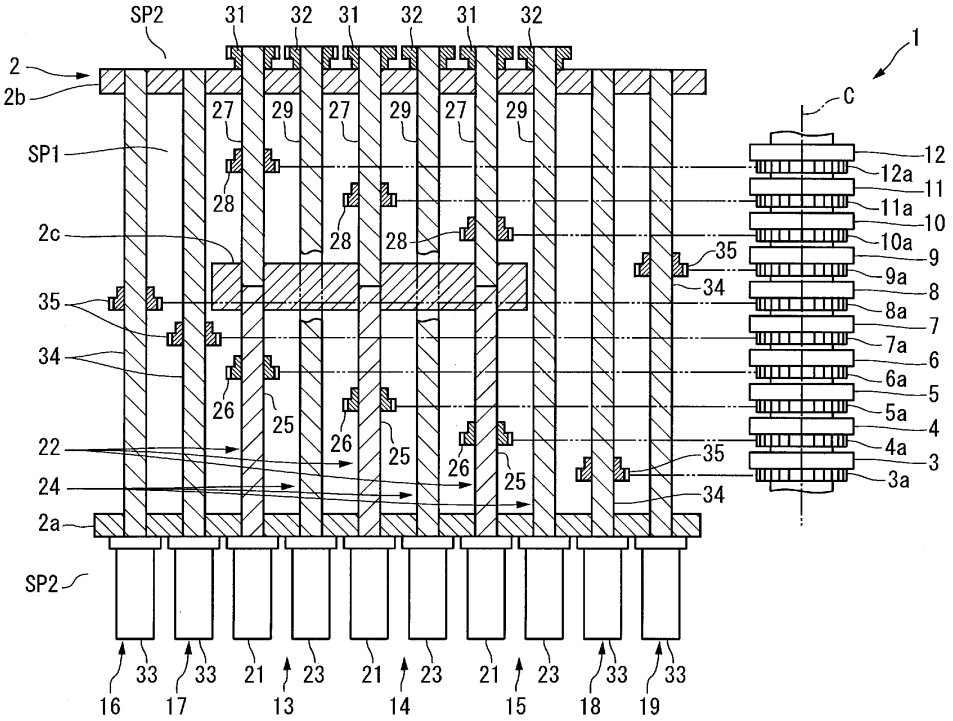
(72) Inventor: **KAMODA, Hiroyoshi**
Tsukuba-shi, Ibaraki (JP)

(74) Representative: **Samson & Partner Patentanwälte mbB**
Widenmayerstraße 6
80538 München (DE)

(54) NUMBERING DEVICE

(57) First driven gears (4a - 6a) of the driven gears of number wheels (4 - 6) mesh with first driving gears (26), and second driven gears (10a - 12a) of the driven gears of number wheels (10 - 12) mesh with second driving gears (28). The first driving gears (26) are fixed to first driving shafts (25), and the second driving gears (28) are fixed to second driving shafts (27). The first driving shafts (25) are located on the same axes as the second driving shafts (27). The second driving shafts (27) are connected to intermediate shafts (29) by gear coupling. The intermediate shafts (29) are arranged on an outer side of the second driving shafts (27) in the radial direction of the number wheels (3 - 12) .

FIG.2



EP 3 332 981 A1

Description

Background of the Invention

[0001] The present invention relates to an electric numbering device that prints a number on a sheet that is a printing target.

[0002] As a numbering device of this type, there is a numbering device disclosed in, for example, Japanese Patent No. 5457175 (literature 1). This numbering device employs an arrangement capable of increasing the number of digits of a number to be printed. This numbering device includes a pair of frames that can be divided in the axial direction of a plurality of number wheels, and a plurality of driving mechanisms provided on these frames, respectively. The driving mechanisms are provided on a number wheel basis.

[0003] Each driving mechanism includes a motor formed long in the axial direction of the number wheels and supported by a frame in a cantilevered state, a driving shaft supported on the frame in a cantilevered state so as to be in parallel to the motor and connected to the rotating shaft of the motor by gear coupling, a driving gear fixed to the driving shaft and meshed with a driven gear of a corresponding number wheel, and the like. The plurality of driving mechanisms are arranged at a plurality of positions spaced apart from each other at a predetermined interval in the circumferential direction of the number wheels when viewed from the axial direction of the number wheels. The motors of the driving mechanisms provided on one frame are arranged at positions where they are adjacent to the plurality of motors on the other frame in the circumferential direction of the number wheels when the two frames are combined with each other.

[0004] In such an arrangement, however, the motors that are heat generating components are stored in a narrow space. For this reason, the temperature of each motor readily rises, and the motor may cause an operation error. Hence, in the numbering device disclosed in literature 1, the reliability of a printed number lowers.

[0005] Additionally, in the above-described arrangement, maintenance is impossible unless the pair of frames are disassembled. Hence, in this numbering device, the operability in the maintenance of the motors is low.

Summary of the Invention

[0006] The present invention has been made to solve these problems, and has as its object to provide a numbering device capable of raising reliability and easily performing maintenance while employing an arrangement capable of increasing the number of digits of a number to be printed.

[0007] In order to achieve the above-described object, according to an aspect of the present invention, there is provided a numbering device (1, 41) characterized by comprising:

a plurality of number wheels (3 - 12) which are individually rotatable and are arranged on the same axis;

a plurality of driven gears (3a - 12a) which are provided on the plurality of number wheels (3 - 12), respectively, and rotate integrally with the number wheels (3 - 12);

a first frame (2a) and a second frame (2b) which are arranged at a predetermined interval in an axial direction of the plurality of number wheels (3 - 12) and partition a periphery of the plurality of driven gears (3a - 12a) into a first space (SP1) that stores the plurality of driven gears and a second space (SP2) outside the first space;

a third frame (2c) arranged between the first frame (2a) and the second frame (2b);

a plurality of first driving shafts (25) each including one end rotatably supported by the first frame (2a), and the other end rotatably supported by the third frame (2c);

a plurality of first driving gears (26) which are fixed to the plurality of first driving shafts (25), respectively, and mesh with a plurality of first driven gears (4a - 6a) included in the driven gears (3a - 12a), respectively;

a plurality of first motors (21) which are connected to the one end sides of the plurality of first driving shafts (25), respectively, and arranged in the second space (SP2), and drive the plurality of first driving shafts (25), respectively;

a plurality of second driving shafts (27) located on the same axes as the plurality of first driving shafts (25), respectively, each of the plurality of second driving shafts (27) including one end rotatably supported by the third frame (2c), and the other end rotatably supported by the second frame (2b);

a plurality of second driving gears (28) which are fixed to the plurality of second driving shafts (27), respectively, and mesh with a plurality of second driven gears (10a - 12a) included in the driven gears (3a - 12a), respectively;

a plurality of intermediate shafts (29) which are arranged on an outer side of the plurality of second driving shafts (27) in a radial direction of the plurality of number wheels (3 - 12) and extend in parallel to the plurality of second driving shafts (27), and are connected to the plurality of second driving shafts (27) by gear coupling, respectively, each of the plurality of intermediate shafts (29) including one end rotatably supported by the first frame (2a), and the other end rotatably supported by the second frame (2b); and

a plurality of second motors (23) which are connected to the one end sides of the plurality of intermediate shafts (29), respectively, and arranged in the second space (SP2), and drive the plurality of intermediate shafts (29), respectively.

[0008] According to another aspect of the present invention, the device (1) further comprises:

a plurality of third driving shafts (34) each including one end rotatably supported by the first frame (2a), and the other end rotatably supported by the second frame (2b);
a plurality of third driving gears (35) which are fixed to the plurality of third driving shafts (34), respectively, and mesh with a plurality of third driven gears (3a, 7a - 9a) included in the driven gears (3a - 12a), respectively; and
a plurality of third motors (33) which are connected to the one end sides of the plurality of third driving shafts (34), respectively, and arranged in the second space (SP2), and drive the plurality of third driving shafts (34), respectively,
wherein a plurality of multi-shaft driving mechanisms (13 - 15) are arranged on an opposite side of a printing position (50) of the plurality of number wheels (3 - 12) in the radial direction while being arranged in a circumferential direction of the plurality of number wheels (3 - 12), each of the plurality of multi-shaft driving mechanisms (13 - 15) includes a direct driving system (22) and an indirect driving system (24), the direct driving system (22) includes one of the plurality of first motors (21), one of the plurality of first driving shafts (25), and one of the plurality of first driving gears (26), and the indirect driving system (24) includes one of the plurality of second motors (23), one of the plurality of intermediate shafts (29), one of the plurality of second driving shafts (27), and one of the plurality of second driving gears (28), and
a plurality of single-shaft driving mechanisms (16 - 19) are arranged on a side of the printing position (50) with respect to the plurality of multi-shaft driving mechanisms (13 - 15) while being arranged in the circumferential direction, and each of the plurality of single-shaft driving mechanisms (16 - 19) includes one of the plurality of third motors (33), one of the plurality of third driving shafts (34), and one of the plurality of third driving gears (35).

[0009] According to still another aspect of the present invention, the device (41) further comprises:

a fourth frame (2d) that forms a boundary between the first space (SP1) and the second space (SP2) in cooperation with the first frame (2a);
a fifth frame (2e) that forms the boundary between the first space (SP1) and the second space (SP2) in cooperation with the second frame (2b);
a plurality of third driving shafts (34) each including one end rotatably supported by the fourth frame (2d), and the other end rotatably supported by the fifth frame (2e);
a plurality of third driving gears (35) which are fixed to the plurality of third driving shafts (34), respectively, and mesh with a plurality of third driven gears (3a - 6a) included in the driven gears (3a - 12a), respectively; and
a plurality of third motors (33) which are connected to the other end sides of the plurality of third driving shafts (34), respectively, and arranged in the second space (SP2), and drive the plurality of third driving shafts (34), respectively,
wherein the first frame (2a) and the fifth frame (2e) are arranged inside two ends of an assembly (42) including the plurality of number wheels (3 - 12) in the axial direction of the plurality of number wheels (3 - 12),
a plurality of multi-shaft driving mechanisms (13 - 15) are arranged on one side of a printing position (50) of the plurality of number wheels (3 - 12) in a circumferential direction of the plurality of number wheels (3 - 12) while being arranged in the circumferential direction, each of the plurality of multi-shaft driving mechanisms (13 - 15) includes a direct driving system (22) and an indirect driving system (24), the direct driving system (22) includes one of the plurality of first motors (21), one of the plurality of first driving shafts (25), and one of the plurality of first driving gears (26), and the indirect driving system (24) includes one of the plurality of second motors (23), one of the plurality of intermediate shafts (29), one of the plurality of second driving shafts (27), and one of the plurality of second driving gears (28), and
a plurality of single-shaft driving mechanisms (16 - 19) are arranged on the other side of the printing position (50) in the circumferential direction while being arranged in the circumferential direction, and each of the plurality of single-shaft driving mechanisms (16 - 19) includes one of the plurality of third motors (33), one of the plurality of third driving shafts (34), and one of the plurality of third driving gears (35).

[0010] According to yet another aspect of the present invention, in the device (1, 41), the plurality of second driven gears (10a - 12a) are driven gears of number wheels which print numbers in digit places higher than those of the plurality of first driven gears (4a - 6a).

[0011] In the present invention, the second driving shafts are located on the same axes as the first driving shafts, and the intermediate shafts are arranged on the outer side of the second driving shafts in the radial direction of the number wheels. Hence, the second motors connected to the intermediate shafts are arranged on the outer side of the first motors connected to the first driving shafts in the radial direction of the number wheels. For this reason, many motors can be provided without interference between these motors. It is therefore possible to increase the number of digits of a number to be printed.

[0012] Additionally, all the motors are arranged outside the space to store the gears, and the first motors are spaced apart from the second motors in the radial direc-

tion of the number wheels. For this reason, the heat of the motors is readily dissipated, and other motors never impede when doing maintenance of the motors.

[0013] Hence, according to the present invention, it is possible to provide a numbering device capable of raising reliability and also easily performing maintenance while employing an arrangement capable of increasing the number of digits of a number to be printed.

Brief Description of the Drawings

[0014]

Fig. 1 is a front view showing the schematic arrangement of a numbering device according to the first embodiment of the present invention;

Fig. 2 is an exploded sectional view showing the driving mechanisms of the numbering device shown in Fig. 1, in which number wheels are also illustrated;

Fig. 3 is a front view of the schematic arrangement of a numbering device according to the second embodiment of the present invention; and

Fig. 4 is an exploded sectional view of the driving mechanisms of the numbering device shown in Fig. 3, in which number wheels are also illustrated.

Description of the Preferred Embodiments

(First Embodiment)

[0015] A numbering device according to the first embodiment of the present invention will now be described in detail with reference to Figs. 1 and 2.

[0016] A numbering device 1 shown in Fig. 1 prints a series of numbers on a sheet (not shown) to form securities, banknotes, or the like, and is used while being attached to the number cylinder of a number printing press (not shown). A plurality of numbering devices 1 are attached to the number cylinder of the number printing press in a state in which the numbering devices are arranged in the axial direction and the circumferential direction.

[0017] The numbering device 1 is formed by assembling constituent components to a frame 2. The constituent components assembled to the frame 2 are first to 10th number wheels 3 to 12 arranged in a direction (the axial direction of the number cylinder) orthogonal to the sheet surface of Fig. 1, and three multi-shaft driving mechanisms (first to third multi-shaft driving mechanisms 13 to 15) and four single-shaft driving mechanisms (first to fourth single-shaft driving mechanisms 16 to 19), which are configured to drive the number wheels 3 to 12.

[0018] Although details are not illustrated, each of the first to 10th number wheels 3 to 12 includes a printing unit with plates of characters such as numbers and alphabets formed on the outer peripheral portion. The first to 10th number wheels 3 to 12 are configured to be individually rotatable, arranged on the same axis, and supported on the frame 2 to be described later. The first to seventh number wheels 3 to 9 are configured to print a number such as a serial number, and the eighth to 10th number wheels 10 to 12 are configured to print alphabets. As shown in Fig. 1, the first to 10th number wheels 3 to 12 come into contact with a sheet at a printing position 50 projecting from the frame 2 and perform printing.

[0019] The first number wheel 3 prints the number in the one's place of a serial number having seven digits. The second number wheel 4 prints the number in the ten's place. The third number wheel 5 prints the number in the hundred's place. The fourth number wheel 6 prints the number in the thousand's place. The fifth number wheel 7 prints the number in the ten thousand's place. The sixth number wheel 8 prints the number in the hundred thousand's place. The seventh number wheel 9 prints the number in the million's place. Each of the eighth to 10th number wheels 10 to 12 prints an alphabet that means a number in a digit place higher than the seventh digit or an alphabet used for identification in addition to the serial number.

[0020] As shown in Fig. 2, driven gears 3a to 12a to which the first to third multi-shaft driving mechanisms 13 to 15 or the first to fourth single-shaft driving mechanisms 16 to 19 (to be described later) apply power are provided on the first to 10th number wheels 3 to 12, respectively, so as to integrally rotate.

[0021] As shown in Fig. 2, the frame 2 is formed by a first frame 2a and a second frame 2b, which are located on two end sides in the axial direction (in Fig. 2, at two ends in the vertical direction) of the first to 10th number wheels 3 to 12, and a third frame 2c arranged between the first frame 2a and the second frame 2b.

[0022] The first frame 2a and the second frame 2b are arranged at a predetermined interval in the axial direction of the first to 10th number wheels 3 to 12 and partition (the space of a part of) the periphery of all the driven gears 3a to 12a into a gear storage space SP1 and an external space SP2. The gear storage space SP1 is a space to store the driven gears 3a to 12a, which corresponds to "first space" in the present invention. The external space SP2 is a space outside the gear storage space SP1, which corresponds to "second space" in the present invention.

[0023] As shown in Fig. 1, the first to third multi-shaft driving mechanisms 13 to 15 are arranged on the opposite side (the lower side in Fig. 1) of the printing position 50 of the first to 10th number wheels 3 to 12 in the radial direction while being arranged in the circumferential direction of the first to 10th number wheels 3 to 12. The first to fourth single-shaft driving mechanisms 16 to 19 are disposed on the side of the printing position 50 of the first to 10th number wheels 3 to 12 with respect to the first to third multi-shaft driving mechanisms 13 to 15 while being distributed to both sides of the printing position 50 viewed from the axial direction of the first to 10th number wheels 3 to 12 and are disposed in a state in which they are arranged in the circumferential direction on both

sides.

[0024] The first to third multi-shaft driving mechanisms 13 to 15 employ the same arrangement, as shown in Fig. 2. Each of the first to third multi-shaft driving mechanisms 13 to 15 is formed by a direct driving system 22 using a first motor 21 as a power source, and an indirect driving system 24 using a second motor 23 as a power source. The direct driving system 22 is formed by the first motor 21, a first driving shaft 25 connected to the first motor 21, and a first driving gear 26 fixed to the first driving shaft 25.

[0025] The first driving shaft 25 includes one end rotatably supported by the first frame 2a, and the other end rotatably supported by the third frame 2c. The first motor 21 is fixed to the first frame 2a in a state in which the axis of the first motor 21 is parallel to an axis C of the first to 10th number wheels. The first motor 21 is located in the external space SP2. The first motor 21 is connected to the one end of the first driving shaft 25 and drives the first driving shaft 25. The first driving gear 26 meshes with a predetermined first driven gear of the plurality of driven gears 3a to 12a described above.

[0026] In this embodiment, the first driving gear 26 included in the first multi-shaft driving mechanism 13 meshes with the driven gear 6a of the fourth number wheel 6, the first driving gear 26 included in the second multi-shaft driving mechanism 14 meshes with the driven gear 5a of the third number wheel 5, and the first driving gear 26 included in the third multi-shaft driving mechanism 15 meshes with the driven gear 4a of the second number wheel 4. In this embodiment, the driven gear 6a of the fourth number wheel 6, the driven gear 5a of the third number wheel 5, and the driven gear 4a of the second number wheel 4 correspond to "first driven gear" in the present invention.

[0027] The indirect driving system 24 is formed by a second driving shaft 27 located on the same axis as the above-described first driving shaft 25, a second driving gear 28 fixed to the second driving shaft 27, an intermediate shaft 29 arranged on the outer side of the second driving shaft 27 in the radial direction of the number wheels, and the second motor 23 connected to one end of the intermediate shaft 29.

[0028] The second driving shaft 27 includes one end rotatably supported by the third frame 2c, and the other end rotatably supported by the second frame 2b. The one end of the second driving shaft 27 is located to be adjacent to the other end of the first driving shaft 25. The other end of the second driving shaft 27 projects from the second frame 2b to the side of the external space SP2. A driven-side pinion 31 is attached to the projecting portion. The second driving gear 28 meshes with a predetermined second driven gear of the plurality of driven gears 3a to 12a described above, which is different from the above-described first driven gear.

[0029] In this embodiment, the second driving gear 28 included in the first multi-shaft driving mechanism 13 meshes with the driven gear 12a of the 10th number wheel 12, the second driving gear 28 included in the second multi-shaft driving mechanism 14 meshes with the driven gear 11a of the ninth number wheel 11, and the second driving gear 28 included in the third multi-shaft driving mechanism 15 meshes with the driven gear 10a of the eighth number wheel 10. In this embodiment, the driven gear 12a of the 10th number wheel 12, the driven gear 11a of the ninth number wheel 11, and the driven gear 10a of the eighth number wheel 10 correspond to "second driven gear" in the present invention.

[0030] The intermediate shaft 29 is arranged on the outer side of the second driving shaft 27 in the radial direction of the number wheels, and extends in parallel to the second driving shaft 27. One end of the intermediate shaft 29 is rotatably supported by the first frame 2a, and the other end of the intermediate shaft 29 is rotatably supported by the second frame 2b. The other end of the intermediate shaft 29 extends through the second frame 2b and projects to the side of the external space SP2. A driving-side pinion 32 is attached to the projecting portion. The driving-side pinion 32 meshes with the above-described driven-side pinion 31. The other end of the intermediate shaft 29 is thus connected to the second driving shaft 27 by gear coupling.

[0031] The second motor 23 is fixed to the first frame 2a in a state in which the axis of the second motor 23 is parallel to an axis of the first to 10th number wheels 3 to 12. The second motor 23 is located in the external space SP2. The second motor 23 is connected to the one end of the intermediate shaft 29 and drives the intermediate shaft 29.

[0032] As shown in Fig. 2, the first to fourth single-shaft driving mechanisms 16 to 19 employ the same arrangement. Each of the first to fourth single-shaft driving mechanisms 16 to 19 is formed by a third motor 33, a third driving shaft 34 connected to the third motor 33, and a third driving gear 35 fixed to the third driving shaft 34.

[0033] The third driving shaft 34 includes one end rotatably supported by the first frame 2a, and the other end rotatably supported by the second frame 2b. The third motor 33 is fixed to the first frame 2a in a state in which the axis of the third motor 33 is parallel to the axis of the first to 10th number wheels 3 to 12. The third motor 33 is located in the external space SP2. The third motor 33 is connected to the one end of the third driving shaft 34 and drives the third driving shaft 34. The third driving gear 35 meshes with a predetermined third driven gear of the plurality of driven gears 3a to 12a described above, which is different from the above-described first and second driven gears.

[0034] In this embodiment, the third driving gear 35 included in the first single-shaft driving mechanism 16 meshes with the driven gear 8a of the sixth number wheel 8, and the third driving gear 35 included in the second single-shaft driving mechanism 17 meshes with the driven gear 7a of the fifth number wheel 7. In addition, the third driving gear 35 included in the third single-shaft driving mechanism 18 meshes with the driven gear 3a of the first number wheel 3, and the third driving gear 35 includ-

ed in the fourth single-shaft driving mechanism 19 meshes with the driven gear 9a of the seventh number wheel 9. In this embodiment, the driven gear 3a of the first number wheel 3, the driven gear 7a of the fifth number wheel 7, the driven gear 8a of the sixth number wheel 8, and the driven gear 9a of the seventh number wheel 9 correspond to "third driven gear" in the present invention.

[0035] In the thus configured numbering device 1, the second motors 23 of the first to third multi-shaft driving mechanisms 13 to 15 are arranged on the outer side of the first motors 21 in the radial direction of the first to 10th number wheels 3 to 12. In other words, the motors are arranged at two points in the radial direction of the number wheels. When an arrangement in which the plurality of first motors 21 and the plurality of second motors 23 are arranged in the circumferential direction of the first to 10th number wheels 3 to 12 is employed, the plurality of motors can be arranged in lines in the inner and outer sides in the radial direction. Since it is therefore possible to provide many motors without interference between these motors, the number of digits of a number to be printed can be increased.

[0036] Additionally, all the motors are arranged outside the gear storage space SP1 (in the external space SP2), and the first motors 21 are spaced apart from the second motors 23 in the radial direction of the first to 10th number wheels 3 to 12. For this reason, the heat of the first and second motors 21 and 23 is readily dissipated, and other motors never impede when doing maintenance.

[0037] Hence, according to this embodiment, it is possible to provide the numbering device 1 capable of suppressing an increase in the motor temperature and raising reliability and also easily performing maintenance while employing an arrangement capable of increasing the number of digits of a number to be printed.

[0038] In the numbering device 1 according to this embodiment, the first to third motors 21, 23, and 33 are arranged at the same end in the axial direction of the first to 10th number wheels 3 to 12. In addition, the first to third multi-shaft driving mechanisms 13 to 15 are arranged on the opposite side of the printing position 50 of the first to 10th number wheels 3 to 12 in the radial direction while being arranged in the circumferential direction of the first to 10th number wheels 3 to 12. Furthermore, the first to fourth single-shaft driving mechanisms 16 to 19 are arranged on the side of the printing position 50 with respect to the first to third multi-shaft driving mechanisms 13 to 15 while being arranged in the circumferential direction of the first to 10th number wheels 3 to 12. Hence, since the first to third multi-shaft driving mechanisms 13 to 15 which increase the size in the radial direction of the first to 10th number wheels 3 to 12 are arranged on the axis side of the number cylinder with respect to the first to 10th number wheels 3 to 12, it is possible to provide the numbering device 1 that is compact in the conveyance direction of a sheet to print a number. The numbering device 1 having this arrangement is suitable in a case in which the longitudinal direction of a rectangular sheet is parallel to the axial direction of the number cylinder, that is, in a case in which a character string in the horizontal direction is printed at an end of the sheet in the widthwise direction.

[0039] In this embodiment, the second driven gears are driven gears driven by the second driving gears 28 of the first to third multi-shaft driving mechanisms 13 to 15. In other words, the second driven gears are driven gears to which power is transmitted via a power transmission path including the gear coupling portion formed from the driven-side pinion 31 and the driving-side pinion 32. The second driven gears are the driven gears 10a to 12a of the eighth to 10th number wheels 10 to 12 that print numbers in digit places relatively higher than those of the first driven gears in a number having a plurality of digits printed by the plurality of number wheels 3 to 12. For this reason, a number wheel in a higher digit place rotates less frequently as compared to a number wheel in a lower digit place, and the use frequency of the gear coupling portion is relatively low. In the multi-shaft type, the number of gear coupling portions is larger than in the single-shaft type. However, according to this embodiment, the reliability is high.

(Second Embodiment)

[0040] A numbering device according to the second embodiment of the present invention will be described next with reference to Figs. 3 and 4. The same reference numerals as in Figs. 1 and 2 denote the same or similar members in Figs. 3 and 4, and a detailed description thereof will appropriately be omitted.

[0041] In a numbering device 41 shown in Fig. 3, first to third multi-shaft driving mechanisms 13 to 15 are arranged on one side (the left side in Fig. 3) of first to 10th number wheels 3 to 12 in the circumferential direction with respect to a printing position 50 of the first to 10th number wheels 3 to 12 while being arranged in the circumferential direction of the first to 10th number wheels 3 to 12. In addition, first to fourth single-shaft driving mechanisms 16 to 19 are arranged on the other side (the right side in Fig. 3) of the first to 10th number wheels 3 to 12 in the circumferential direction with respect to the printing position 50 of the first to 10th number wheels 3 to 12 while being arranged in the circumferential direction of the first to 10th number wheels 3 to 12.

[0042] As shown in Fig. 4, a frame 2 according to this embodiment is formed by first and second frames 2a and 2b extending to one side of the first to 10th number wheels 3 to 12 when viewed from a direction facing the printing position 50 of the first to 10th number wheels 3 to 12, a third frame 2c located between the first frame 2a and the second frame 2b, and fourth and fifth frames 2d and 2e extending to the other side.

[0043] The fourth frame 2d forms the boundary between a gear storage space SP1 and an external space SP2 in cooperation with the first frame 2a on one side (the lower side in Fig. 4) in the axial direction of the first

to 10th number wheels 3 to 12. The fifth frame 2e forms the boundary between the gear storage space SP1 and the external space SP2 in cooperation with the second frame 2b on the other side (the upper side in Fig. 4) in the axial direction of the first to 10th number wheels 3 to 12. The fifth frame 2e and the first frame 2a are arranged inside the two ends of a number wheel assembly 42 formed from the first to 10th number wheels 3 to 12 in the axial direction of the first to 10th number wheels 3 to 12.

[0044] More specifically, the first frame 2a is arranged at a position on the side of the 10th number wheel 12 with respect to the first number wheel 3 in the axial direction of the number wheel assembly 42. For this reason, certain portions of first and second motors 21 and 23 of the first to third multi-shaft driving mechanisms 13 to 15 overlap one end of the above-described number wheel assembly 42 in the axial direction. Three first driving gears 26 of the first to third multi-shaft driving mechanisms 13 to 15 according to this embodiment mesh with driven gears 7a to 9a of the fifth to seventh number wheels 7 to 9.

[0045] On the other hand, the fifth frame 2e is arranged at a position on the side of the first number wheel 3 with respect to the 10th number wheel 12 in the above-described axial direction. The first to fourth single-shaft driving mechanisms 16 to 19 according to this embodiment are supported by the fifth frame 2e and the fourth frame 2d. That is, each of third driving shafts 34 of the first to fourth single-shaft driving mechanisms 16 to 19 includes one end rotatably supported by the fourth frame 2d, and the other end rotatably supported by the fifth frame 2e.

[0046] Third motors 33 of the first to fourth single-shaft driving mechanisms 16 to 19 extend from the fifth frame 2e to the opposite side of the fourth frame 2d in the external space SP2. For this reason, the third motors 33 are arranged at positions to overlap the other end of the above-described number wheel assembly 42 in the axial direction. Each third motor 33 is connected to the other end of the third driving shaft 34 and drives the third driving shaft 34. Four third driving gears 35 of the first to fourth single-shaft driving mechanisms 16 to 19 are fixed to the third driving shafts 34 and mesh with driven gears 3a to 6a of the first to fourth number wheels 3 to 6.

[0047] In the numbering device 41 according to this embodiment as well, second motors 23 of the first to third multi-shaft driving mechanisms 13 to 15 are arranged on the outer side of first motors 21 in the radial direction of the first to 10th number wheels 3 to 12. It is therefore possible to provide many motors without interference between the motors and increase the number of digits of a number to be printed, as in the first embodiment.

[0048] Additionally, all the motors are arranged outside the gear storage space SP1, and the first motors 21 and the second motors 23 are spaced apart in the radial direction of the first to 10th number wheels 3 to 12. For this reason, the heat of the motors is readily dissipated, and other motors never impede when doing maintenance. Hence, in this embodiment as well, it is possible to provide the numbering device capable of suppressing an increase in the motor temperature and raising reliability and also easily performing maintenance while employing an arrangement capable of increasing the number of digits of a number to be printed.

[0049] In the numbering device 41 according to this embodiment as well, the second driven gears driven by the first to third multi-shaft driving mechanisms 13 to 15 are driven gears 10a to 12a of the eighth to 10th number wheels 10 to 12 that print numbers in digit places relatively higher than those of the first driven gears in a number having a plurality of digits printed by the plurality of number wheels. For this reason, the use frequency of the gear coupling portion is relatively low, and the reliability becomes high, as in the first embodiment.

[0050] In this embodiment, the first to third multi-shaft driving mechanisms 13 to 15 are arranged on one side of the printing position 50 of the first to 10th number wheels 3 to 12 in the circumferential direction of the number wheels while being arranged in the circumferential direction. In addition, the first to fourth single-shaft driving mechanisms 16 to 19 are arranged on the other side of the printing position 50 in the circumferential direction while being arranged in the circumferential direction. Hence, since the first to third multi-shaft driving mechanisms 13 to 15 which increase the size in the radial direction of the first to 10th number wheels 3 to 12 are arranged on one side of the first to 10th number wheels 3 to 12 when viewed from a direction opposite to the printing position 50, it is possible to provide the numbering device 41 that is compact in the conveyance direction of a sheet to print a number.

[0051] The first frame 2a and the fifth frame 2e according to this embodiment are located inside the two ends of the number wheel assembly 42 in the axial direction of the first to 10th number wheels 3 to 12. For this reason, all the motors overlap the number wheel assembly 42 in the axial direction, and the numbering device 41 that is compact in the axial direction can be provided. The numbering device 41 is appropriate in a case in which the longitudinal direction of a rectangular sheet is orthogonal to the axial direction of the number cylinder, that is, in a case in which a character string long in the vertical direction is printed at an end of a sheet in the longitudinal direction.

[0052] In the above embodiments, the numbering devices 1 and 41 each including the first to third multi-shaft driving mechanisms 13 to 15 and the first to fourth single-shaft driving mechanisms 16 to 19 have been described. However, the present invention is not limited to this. That is, it is possible to employ an arrangement that drives all number wheels by only the multi-shaft driving mechanisms. Additionally, in each embodiment, the first frame 2a and the second frame 2b may replace each other.

Claims

1. A numbering device (1, 41) **characterized by** comprising:

a plurality of number wheels (3 - 12) which are individually rotatable and are arranged on the same axis;
a plurality of driven gears (3a - 12a) which are provided on the plurality of number wheels (3 - 12), respectively, and rotate integrally with the number wheels (3 - 12);
a first frame (2a) and a second frame (2b) which are arranged at a predetermined interval in an axial direction of the plurality of number wheels (3 - 12) and partition a periphery of the plurality of driven gears (3a - 12a) into a first space (SP1) that stores the plurality of driven gears and a second space (SP2) outside the first space;
a third frame (2c) arranged between the first frame (2a) and the second frame (2b);
a plurality of first driving shafts (25) each including one end rotatably supported by the first frame (2a), and the other end rotatably supported by the third frame (2c);
a plurality of first driving gears (26) which are fixed to the plurality of first driving shafts (25), respectively, and mesh with a plurality of first driven gears (4a - 6a) included in the driven gears (3a - 12a), respectively;
a plurality of first motors (21) which are connected to the one end sides of the plurality of first driving shafts (25), respectively, and arranged in the second space (SP2), and drive the plurality of first driving shafts (25), respectively;
a plurality of second driving shafts (27) located on the same axes as the plurality of first driving shafts (25), respectively, each of the plurality of second driving shafts (27) including one end rotatably supported by the third frame (2c), and the other end rotatably supported by the second frame (2b);
a plurality of second driving gears (28) which are fixed to the plurality of second driving shafts (27), respectively, and mesh with a plurality of second driven gears (10a - 12a) included in the driven gears (3a - 12a), respectively;
a plurality of intermediate shafts (29) which are arranged on an outer side of the plurality of second driving shafts (27) in a radial direction of the plurality of number wheels (3 - 12) and extend in parallel to the plurality of second driving shafts (27), and are connected to the plurality of second driving shafts (27) by gear coupling, respectively, each of the plurality of intermediate shafts (29) including one end rotatably supported by the first frame (2a), and the other end rotatably supported by the second frame (2b); and
a plurality of second motors (23) which are connected to the one end sides of the plurality of intermediate shafts (29), respectively, and arranged in the second space (SP2), and drive the plurality of intermediate shafts (29), respectively.

2. The device (1) according to claim 1, further comprising:

a plurality of third driving shafts (34) each including one end rotatably supported by the first frame (2a), and the other end rotatably supported by the second frame (2b);
a plurality of third driving gears (35) which are fixed to the plurality of third driving shafts (34), respectively, and mesh with a plurality of third driven gears (3a, 7a - 9a) included in the driven gears (3a - 12a), respectively; and
a plurality of third motors (33) which are connected to the one end sides of the plurality of third driving shafts (34), respectively, and arranged in the second space (SP2), and drive the plurality of third driving shafts (34), respectively,
wherein a plurality of multi-shaft driving mechanisms (13 - 15) are arranged on an opposite side of a printing position (50) of the plurality of number wheels (3 - 12) in the radial direction while being arranged in a circumferential direction of the plurality of number wheels (3 - 12), each of the plurality of multi-shaft driving mechanisms (13 - 15) includes a direct driving system (22) and an indirect driving system (24), the direct driving system (22) includes one of the plurality of first motors (21), one of the plurality of first driving shafts (25), and one of the plurality of first driving gears (26), and the indirect driving system (24) includes one of the plurality of second motors (23), one of the plurality of intermediate shafts (29), one of the plurality of second driving shafts (27), and one of the plurality of second driving gears (28), and
a plurality of single-shaft driving mechanisms (16 - 19) are arranged on a side of the printing position (50) with respect to the plurality of multi-shaft driving mechanisms (13 - 15) while being arranged in the circumferential direction, and each of the plurality of single-shaft driving mechanisms (16 - 19) includes one of the plurality of third motors (33), one of the plurality of third driving shafts (34), and one of the plurality of third driving gears (35).

3. The device (41) according to claim 1, further comprising:

a fourth frame (2d) that forms a boundary between the first space (SP1) and the second

space (SP2) in cooperation with the first frame (2a);
a fifth frame (2e) that forms the boundary between the first space (SP1) and the second space (SP2) in cooperation with the second frame (2b);
a plurality of third driving shafts (34) each including one end rotatably supported by the fourth frame (2d), and the other end rotatably supported by the fifth frame (2e);
a plurality of third driving gears (35) which are fixed to the plurality of third driving shafts (34), respectively, and mesh with a plurality of third driven gears (3a - 6a) included in the driven gears (3a - 12a), respectively; and
a plurality of third motors (33) which are connected to the other end sides of the plurality of third driving shafts (34), respectively, and arranged in the second space (SP2), and drive the plurality of third driving shafts (34), respectively,
wherein the first frame (2a) and the fifth frame (2e) are arranged inside two ends of an assembly (42) including the plurality of number wheels (3 - 12) in the axial direction of the plurality of number wheels (3 - 12),
a plurality of multi-shaft driving mechanisms (13 - 15) are arranged on one side of a printing position (50) of the plurality of number wheels (3 - 12) in a circumferential direction of the plurality of number wheels (3 - 12) while being arranged in the circumferential direction, each of the plurality of multi-shaft driving mechanisms (13 - 15) includes a direct driving system (22) and an indirect driving system (24), the direct driving system (22) includes one of the plurality of first motors (21), one of the plurality of first driving shafts (25), and one of the plurality of first driving gears (26), and the indirect driving system (24) includes one of the plurality of second motors (23), one of the plurality of intermediate shafts (29), one of the plurality of second driving shafts (27), and one of the plurality of second driving gears (28), and
a plurality of single-shaft driving mechanisms (16 - 19) are arranged on the other side of the printing position (50) in the circumferential direction while being arranged in the circumferential direction, and each of the plurality of single-shaft driving mechanisms (16 - 19) includes one of the plurality of third motors (33), one of the plurality of third driving shafts (34), and one of the plurality of third driving gears (35).

4. The device (1, 41) according to any one of claims 1 to 3, wherein the plurality of second driven gears (10a - 12a) are driven gears of number wheels which print numbers in digit places higher than those of the plurality of first driven gears (4a - 6a).

FIG.1

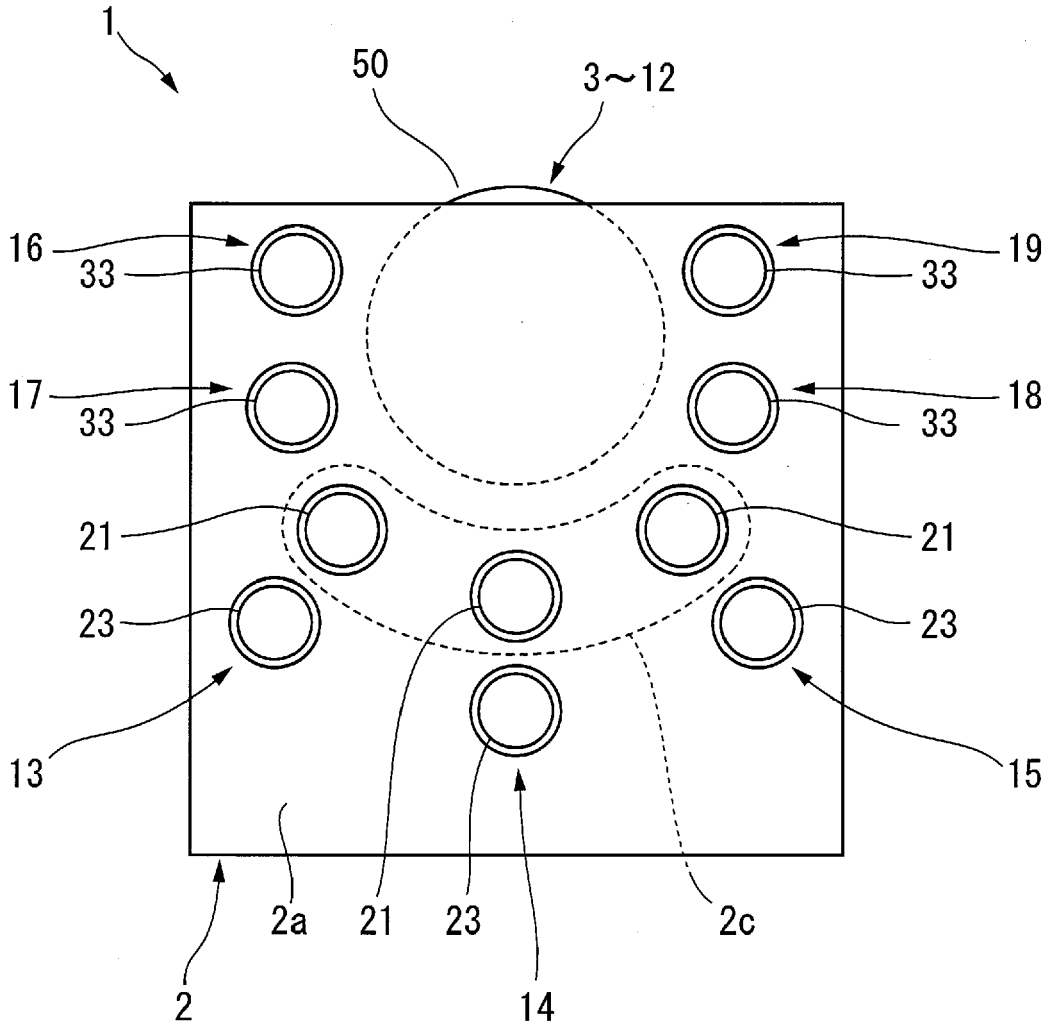


FIG.2

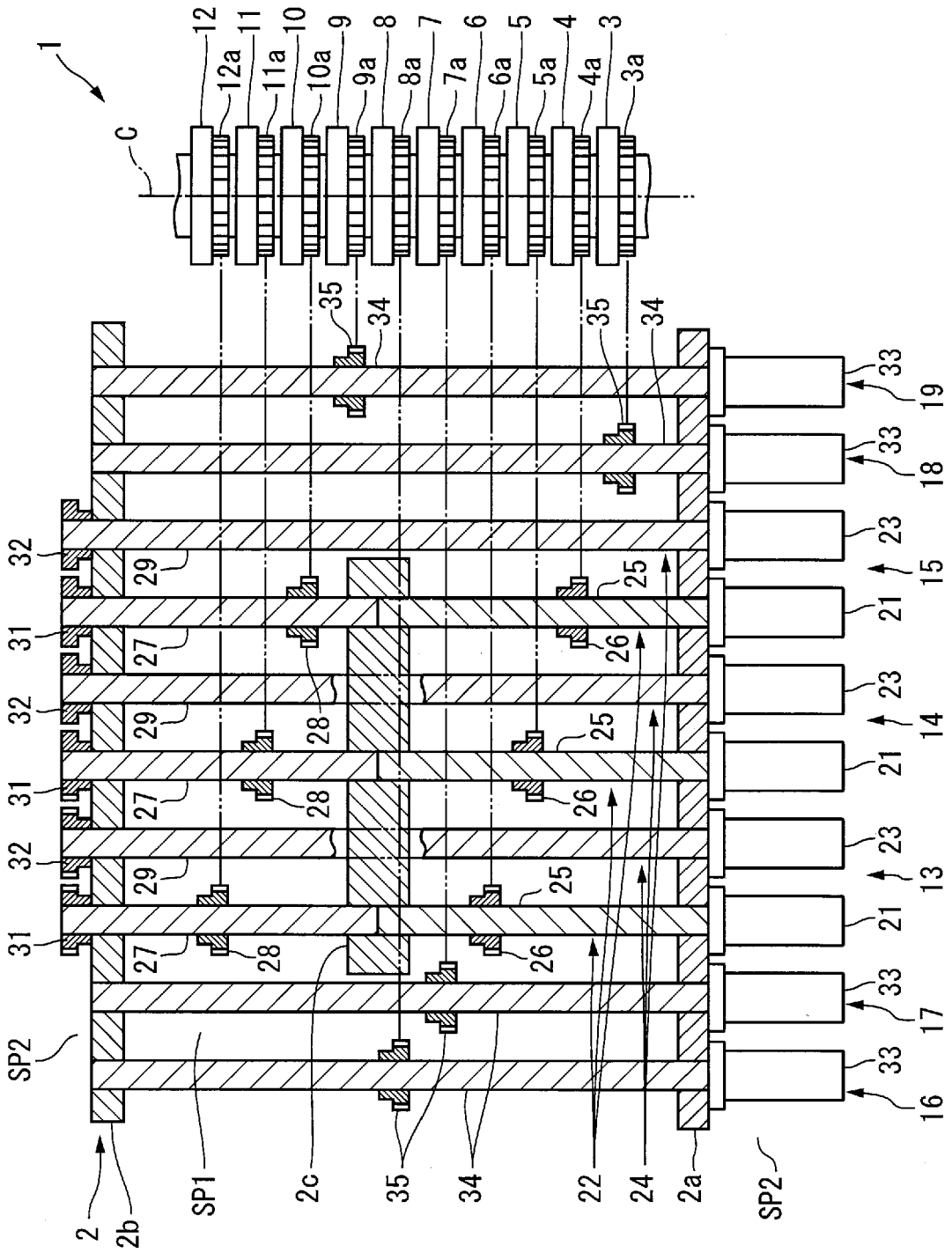

1
C
12
12a
11
11a
10
10a
9
9a
8
8a
7
7a
6
6a
5
5a
4
4a
3
3a
35
34
33
19
18
23
15
21
14
13
17
16
32
31
29
27
28
26
25
SP2
SP1
2
2b
2c
22
24
2a

FIG.3

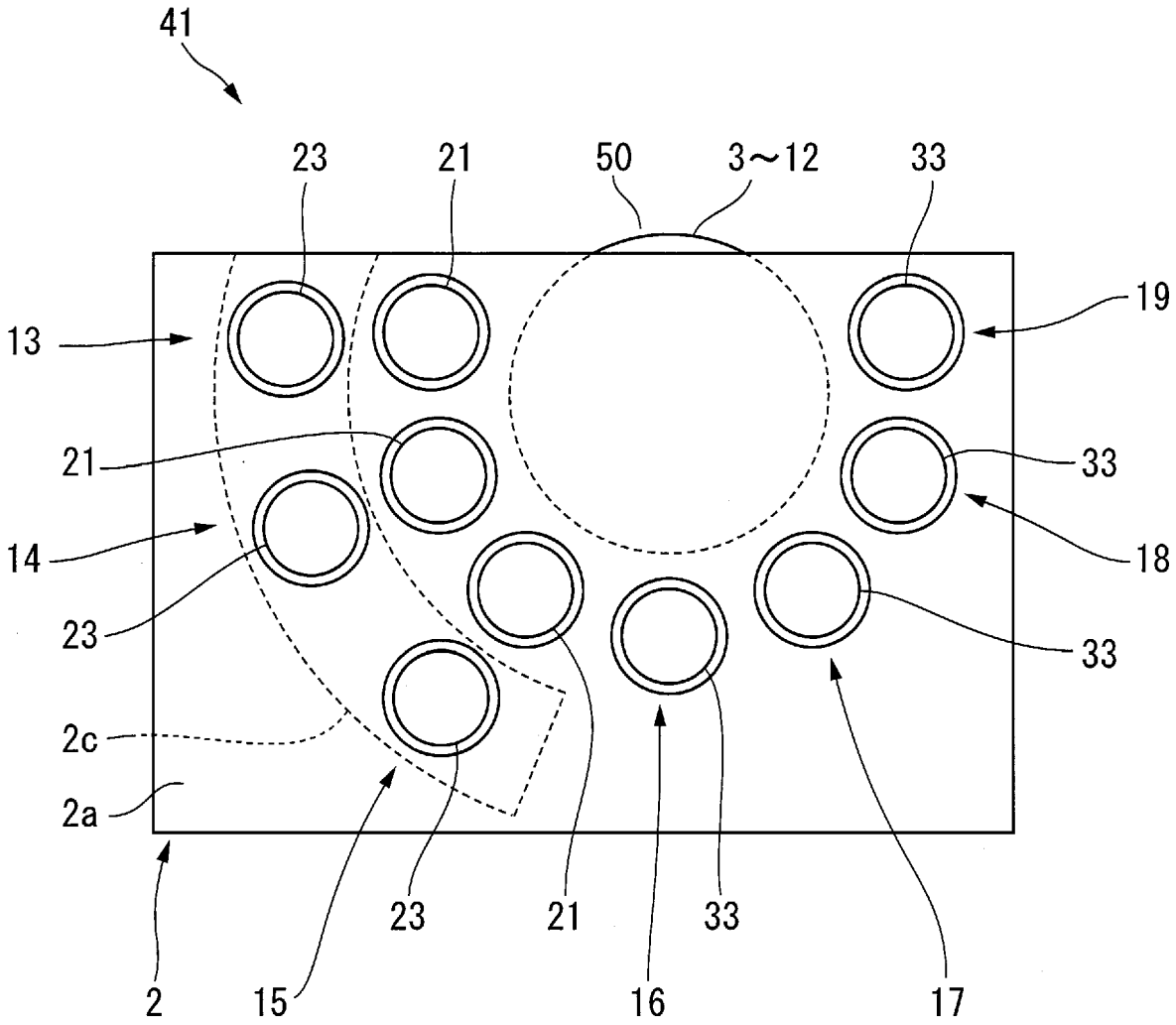
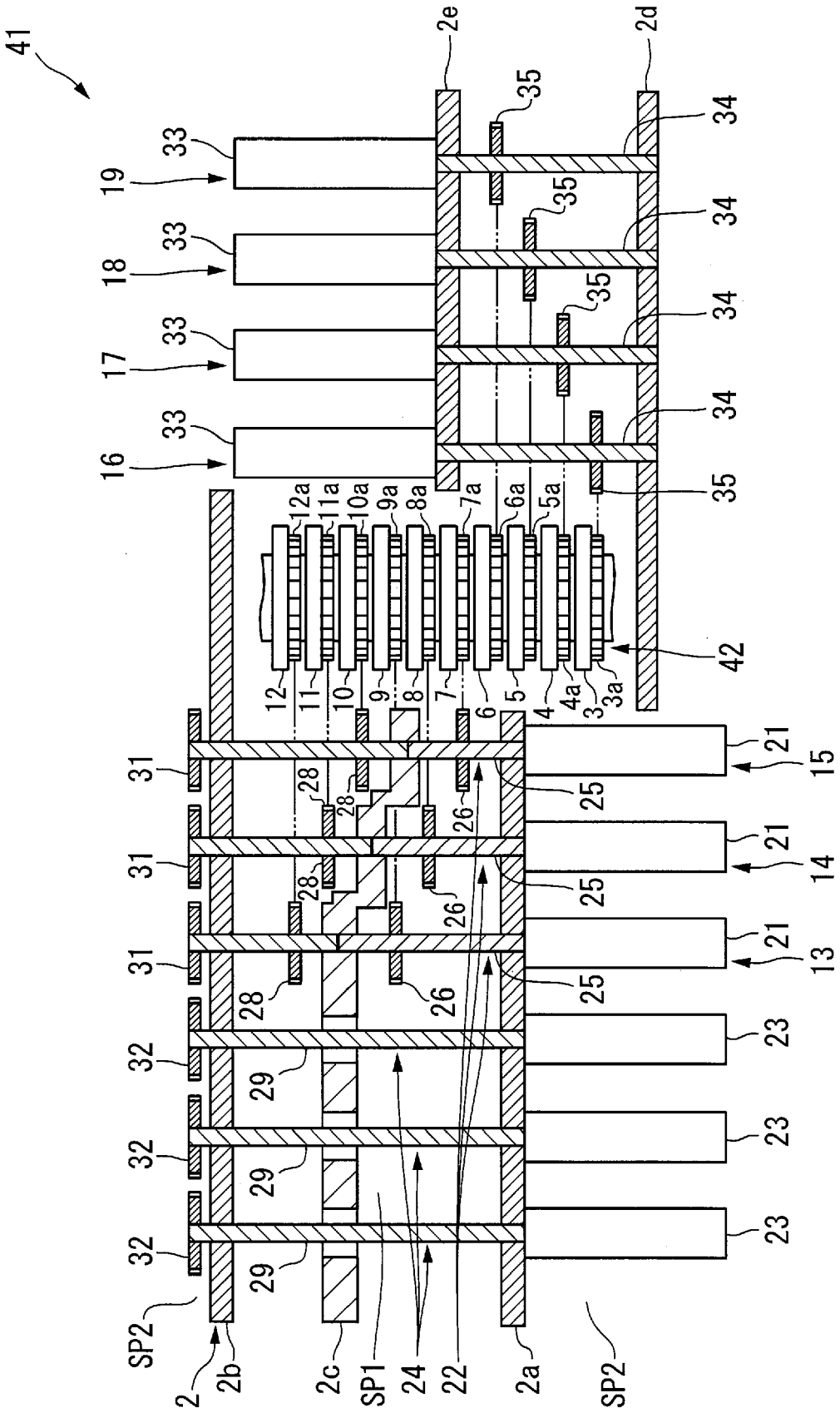


FIG.4


41
2e
2d
35
34
33
19
18
17
16
12a
11a
10a
9a
8a
7a
6a
5a
12
11
10
9
8
7
6
5
4
4a
3
3a
42
31
28
26
25
21
15
14
13
32
29
23
SP2
2
2b
2c
SP1
24
22
2a

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 20 5330

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2007/148288 A2 (KBA GIORI SA [CH]; WUERSCH ALAIN [CH]; MERMINOD ANTOINE [CH]) 27 December 2007 (2007-12-27) * abstract * * pages 7-9 * * pages 11-13 * * pages 16-20 * * figures 1-16b * -----	1-4	INV. B41K3/10 B41K3/12 B41F13/00 B41F13/004 B41F13/008 B41F17/00
A	WO 2016/000741 A1 (PAUL LEIBINGER GMBH & CO KG NUMMERIER UND MARKIERUNGSSYSTEME [DE]) 7 January 2016 (2016-01-07) * abstract * * pages 1, 10 * * figure 1 * -----	1-4	
			TECHNICAL FIELDS SEARCHED (IPC)
			B41K B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 February 2018	Bellofiore, Vincenzo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 5330

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-02-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007148288 A2	27-12-2007	AT 495893 T	15-02-2011
		AU 2007262422 A1	27-12-2007
		BR PI0713517 A2	07-02-2012
		CA 2656732 A1	27-12-2007
		CA 2897069 A1	27-12-2007
		CN 101472743 A	01-07-2009
		DE 07789741 T1	09-12-2010
		DE 202007019477 U1	26-11-2012
		EP 2032364 A2	11-03-2009
		EP 2230087 A1	22-09-2010
		EP 2236295 A1	06-10-2010
		EP 2243629 A1	27-10-2010
		EP 2468522 A1	27-06-2012
		EP 2537676 A1	26-12-2012
		EP 2894040 A2	15-07-2015
		EP 2894041 A2	15-07-2015
		ES 2431822 T3	28-11-2013
		ES 2531550 T3	17-03-2015
		ES 2535095 T3	05-05-2015
		HK 1131942 A1	21-10-2011
		JP 5457175 B2	02-04-2014
		JP 6121979 B2	26-04-2017
		JP 2009541085 A	26-11-2009
		JP 2013226846 A	07-11-2013
		JP 2015071312 A	16-04-2015
		PT 2032364 E	17-03-2011
		PT 2230087 E	26-11-2013
		RU 2009101372 A	27-07-2010
		US 2009235832 A1	24-09-2009
		US 2014165862 A1	19-06-2014
		US 2016339686 A1	24-11-2016
		WO 2007148288 A2	27-12-2007
WO 2016000741 A1	07-01-2016	EP 3160748 A1	03-05-2017
		WO 2016000741 A1	07-01-2016

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 5457175 B **[0002]**