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(71) Applicant: **M.E.P. MACCHINE ELETTRONICHE PIEGATRICI S.P.A.** [IT/IT]; Via Leonardo da Vinci, 20, 33010 REANA DEL ROJALE (IT).

(72) Inventor: **DEL FABRO, Giorgio**; Via Zanon, 18/10, 33100 UDINE (IT).

(74) Agent: **PETRAZ, Davide Luigi** et al.; GLP SRL, Viale Europa Unita, 171, 33100 UDINE (IT).

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(54) **Title:** DRAWING UNIT AND CORRESPONDING METHOD FOR METAL PRODUCTS

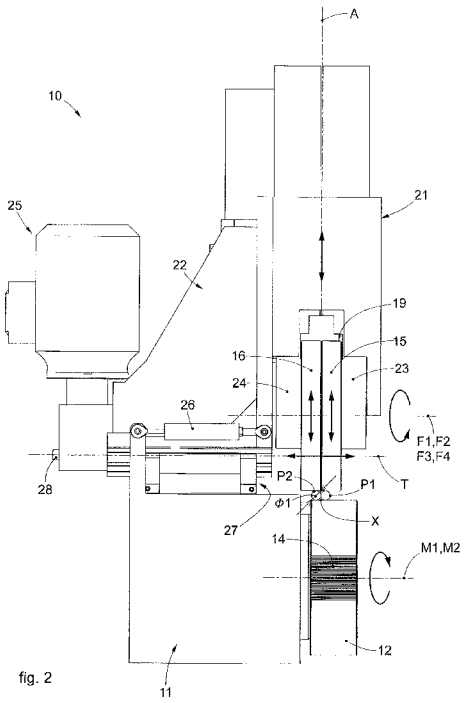

fig. 2

(57) **Abstract:** Unit (10) for drawing metal products comprising at least one motorized roller (12, 13) configured to support and move at least one oblong metal product (PI, P2) along an axis of feed (X), and at least two contrast rollers (15, 16; 17, 18) configured to rotate idly about respective axes of rotation (FI, F2; F3, F4) and disposed opposite said at least one motorized roller (12, 13). The present invention also concerns a method to draw oblong metal products (PI, P2).

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"DRAWING UNIT AND CORRESPONDING METHOD FOR METAL PRODUCTS"

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FIELD OF THE INVENTION

The present invention concerns a drawing unit to feed a machine for working oblong metal products, for example of the type usable for the production of reinforcements for the building trade.

In particular, the drawing unit according to the present invention is applied, preferably but not restrictively, to machines that simultaneously work at least two bars, round pieces or metal wires at a time, carrying out a substantially uniform, coordinated and simultaneous feed.

BACKGROUND OF THE INVENTION

Work machines are known, which are fed with oblong metal products, such as roll wires, round pieces, or pre-cut bars, to create, by way of example but not restrictively, reinforcement brackets for the building trade.

These machines can be bending/shaping machines, also called stirrup-making machines, and are generally fed with two or more metal products at a time, in order to optimize their productivity.

It is also known that a drawing unit is positioned upstream of the work machines in order to feed the metal products to be worked.

The drawing units known in the state of the art consist of a plurality of rollers, opposite each other with respect to the axis of feed of the metal products, in order to draw them. Normally one or more rollers of these rollers are motorized, while the others can be disposed in a position opposite to the metal products, acting as contrast rollers.

In some cases, a pair of contrast rollers, facing each other and not constrained to each other, can be positioned opposite one motorized roller, where each of them exerts a certain pressure on a metal product in the direction of the motorized roller.

This contrasting action is intended to ensure sufficient friction, between the metal product and the motorized roller, to obtain a uniform drawing action.

One disadvantage of known drawing units is that in some cases the compression action of the contrast rollers may fail, causing problems of slippage

of the metal product or products being worked, thus generating waste or other inefficiencies. For example, in the case where two metal products are drawn, it may happen that one of them interferes with both the contrast rollers opposite to one of the motorized rollers, thus limiting the friction necessary for the coordinated drawing of both metal products.

It should be noted that this problem is particularly frequent since the metal products are generally obtained at the end of a hot rolling cycle and have a plurality of ribs on the outside. Since the metal products are made by rolling, together with the presence of the ribs, this makes the section of the metal products not perfectly circular, giving them an oval section characterized by a bigger axis, in correspondence with the ribs, and a smaller axis angularly offset by about 90° from the bigger axis, and reduced by a few millimeters. The disposition of the metal products during drawing can therefore accentuate this interference. For example, a first metal product disposed with the bigger axis oriented perpendicular to the axis of feed and the axes of rotation of the rollers can interfere with both the contrast rollers, limiting the pressure applied to a second metal product, for example oriented offset by about 90° with respect to the first.

Another disadvantage is that known drawing units do not always guarantee the correct positioning of the metal product with respect to the contrast roller and/or the motorized roller. In particular, in some cases the metal product can position itself near the lateral edge of the contrast roller and/or the motorized roller. This can cause considerable bending of the contrast roller and/or the motorized roller, promoting the slippage of the metal product. This problem is particularly frequent in the case of rollers with a flat lateral profile.

For this type of rollers, the optimal alignment is that which provides the metal product in the center of the lateral profile of the contrast roller.

The disadvantage just described limits the dimensional range of the metal products that can be drawn by the drawing unit, in practice reducing the flexibility of use thereof.

Document EP0065736A2 is also known, which describes a drawing device for metal bars comprising a group of first rollers and a group of second rollers, in which each first roller is individually opposite to a corresponding second roller.

The group of first rollers and the group of second rollers are mobile in diverging directions to regulate the passage channel that is created between a first roller and a second roller that are opposite each other.

Document US3447730A is also known, which describes an apparatus for feeding wire for arc welding machines.

There is therefore a need to perfect a drawing unit for metal products and the corresponding drawing method which can overcome at least one of the disadvantages of the state of the art.

In particular, one purpose of the present invention is to provide such a drawing unit which can limit the slippage of the metal products that it has to draw.

Another purpose of the present invention is to provide a drawing unit able to guarantee adequate pressure on the metal products, even when their diameter varies.

Another purpose is to provide a drawing unit which allows correct positioning of the metal products with respect to the motorized rollers and the contrast rollers.

The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

The present invention is set forth and characterized in the independent claims. The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

In accordance with the above purposes, a unit for drawing metal products is described which overcomes the limits of the state of the art and eliminates the defects present therein.

The drawing unit comprises at least one motorized roller configured to move at least one metal product along an axis of feed, and at least two contrast rollers configured to rotate idly about respective axes of rotation and disposed opposite the at least one motorized roller.

According to one aspect of the invention, the at least one motorized roller and the contrast rollers are selectively mobile, with respect to each other, along an axis of transverse movement substantially parallel to the axes of rotation of the

contrast rollers.

According to another aspect of the present invention, the at least two contrast rollers are substantially facing each other and substantially coaxial.

According to another aspect of the present invention, the at least two contrast rollers are opposite the same motorized roller.

In preferred embodiments, the at least two contrast rollers are selectively mobile with respect to the at least one motorized roller along the axis of transverse movement.

Advantageously, this solution allows to adjust the reciprocal position between the contrast rollers and the at least one motorized roller, in the transverse direction. This adjustment can be carried out, for example, as a function of the nominal diameter of the metal products to be worked, in such a way as to achieve the correct alignment between the metal product and the respective contrast roller in every situation. This allows to prevent a same metal product from interfering with both the contrast rollers which form a pair opposite the at least one motorized roller.

In addition, the contrast rollers can be able to be selectively moved toward the at least one motorized roller along an axis of movement that is orthogonal to the axis of feed and to the axis of transverse movement.

The present invention also concerns a method to draw metal products which comprises a drawing step in which at least one oblong metal product is moved, that is, drawn, along an axis of feed. The drawing step as above occurs by means of at least one motorized roller to which there are opposed at least two contrast rollers rotating idly about respective axes of rotation.

According to one aspect of the invention, the method comprises at least one step of adjusting the reciprocal position between the contrast rollers and the at least one motorized roller along an axis of transverse movement that is parallel to the axes of rotation of the contrast rollers.

According to another aspect of the invention, in the drawing step as above at least two metal products are drawn simultaneously, and a first contrast roller of the at least two contrast rollers acts only on a first metal product and a second contrast roller of the at least two contrast rollers acts only on a second metal product different from the first metal product as above.

In some embodiments of the method, the adjustment step provides to move the contrast rollers with respect to the at least one motorized roller along the axis of transverse movement.

Preferred embodiments provide that the step of adjusting the reciprocal position between the contrast rollers and the at least one motorized roller along the axis of transverse movement occurs as a function of the nominal diameter of the metal products to be worked.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a front view of a unit for drawing metal products according to embodiments described here;
- figs. 2, 3 and 4 are lateral views of the drawing unit of fig. 1, in different conditions of use.

To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently be combined or incorporated into other embodiments without further clarifications.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

We will now refer in detail to the possible embodiments of the invention, of which one or more examples are shown in the attached drawings, by way of a non-limiting illustration. The phraseology and terminology used here is also for the purposes of providing non-limiting examples.

With reference to fig. 1, the number 10 indicates a drawing unit configured to feed a machine (not shown) for working oblong metal products P1, P2 such as bars, round pieces or roll wires having a diameter that can even reach a few tens of millimeters. In particular, the drawing unit 10 can be disposed upstream of the work machine and downstream of a feeding unit (also not shown) configured to supply, at entry, the metal products P1, P2 to the drawing unit 10.

In some cases, the work machine can be a bracket bending machine

preferentially used to produce reinforcement brackets for the building trade.

The drawing unit 10 can comprise a base 11 with which one or more motorized rollers 12, 13 can be operatively associated, the motorized rollers 12, 13 being made to rotate about respective axes of rotation M1, M2 by means of drive members of the known type.

During use, on the motorized rollers 12, 13 there can be disposed and supported the metal products P1, P2 to be drawn along an axis of feed X, which is tangential with respect to the motorized rollers 12, 13.

In this specific case, the drawing unit 10 can comprise two motorized rollers 12, 13 disposed in succession, adjacent along the axis of feed X and having the respective axes of rotation M1, M2 parallel.

The two motorized rollers 12, 13 are configured to rotate, during use, in a corresponding sense.

The drawing unit 10 can also comprise one or more contrast rollers 15, 16, 17, 18 opposite the motorized rollers 12, 13 with respect to the axis of feed X.

The one or more contrast rollers 15, 16 and 17, 18 are configured to rotate, during use, in a sense that does not correspond to the motorized rollers 12, 13.

The contrast rollers 15, 16, 17, 18 can be hinged to the drawing unit 10 in an idle manner, in order to rotate freely about respective axes of rotation F1, F2, F3, F4.

The contrast rollers 15, 16, 17, 18 are configured to apply a pressure on the metal products P1, P2 in the direction of the motorized rollers 12, 13 in order to guarantee the correct friction between the motorized roller 12, 13 and the metal product P1, P2, required to draw the latter.

In preferred embodiments, both the contrast rollers 15, 16, 17, 18 as well as the motorized rollers 12, 13 have a lateral profile of contact with the metal products P1, P2 which is substantially smooth. In some cases, the lateral profile of the motorized rollers 12, 13 can have gripping zones 14 configured to increase the friction with the metal products P1, P2, see figs. 2-4.

The contrast rollers 15, 16, 17, 18 can be associated with a first support 21 of the drawing unit 10, mobile in the direction of the motorized rollers 12, 13 along a first axis of movement A orthogonal with respect to the axes of rotation F1, F2, F3, F4 of the contrast rollers 15, 16, 17, 18.

The first support 21 can be connected, by means of a sliding slider, to a second support 22 of the drawing unit 10, operatively associated with the base 11, and it can be moved along the slider by means of movement means of the known type.

In some embodiments, to one or more motorized rollers 12, 13 there can be opposed at least one pair 19, 20 of contrast rollers 15, 16 and 17, 18 substantially facing each other, unconstrained from each other and independent of each other.

In particular, to each motorized roller 12, 13 there can be opposed, with respect to the axis of feed X, a respective pair 19, 20 of contrast rollers 15, 16 and 17, 18. Each pair 19, 20 of contrast rollers 15, 16 and 17, 18 comprises two contrast rollers 15, 16 and 17, 18 substantially facing each other, substantially coaxial, unconstrained from each other and independent of each other. In particular, two contrast rollers 15, 16 and 17, 18 of the same pair 19, 20 are disposed in succession in a direction substantially parallel to their axes of rotation F1, F2 and F3, F4. Furthermore, by substantially facing each other and substantially coaxial we mean that between the axes of rotation F1, F2, and F3, F4 of the contrast rollers 15, 16 and 17, 18 of the same pair 19, 20 a play is allowed which can be even of a few centimeters.

In this specific case, the drawing unit 10 comprises two pairs 19, 20 of contrast rollers 15, 16 and 17, 18, each pair being opposite a respective motorized roller 12, 13. This configuration is particularly suitable in the event the work machine downstream has to operate on two metal products P1, P2 at a time.

The two pairs 19, 20 of contrast rollers 15, 16 and 17, 18 are disposed adjacent to each other in a direction parallel to the axis of feed X.

According to some embodiments, with reference to fig. 1, two homologous contrast rollers 15, 17 and 16, 18 of different pairs 19, 20 can be hinged to a single contrast support 23, 24 which is operatively associated with the first support 21. In this specific case, the drawing unit 10 can comprise two contrast supports 23, 24 to which respectively two contrast rollers 15, 17 and 16, 18 are hinged, adjacent in succession along the axis of feed X. Furthermore, the two contrast supports 23, 24 can be disposed substantially facing each other so as to form the pairs 19, 20 of contrast rollers 15, 16 and 17, 18 between them.

In some embodiments, the contrast rollers 15, 16, 17, 18 can be selectively mobile with respect to the first support 21 in directions substantially parallel to

the first axis of movement A. This movement can be independent for each contrast roller 15, 16, 17, 18.

In other embodiments, it is the contrast supports 23, 24 that can be selectively moved with respect to the first support 21 in directions substantially parallel to the first axis of movement A. For example, the contrast rollers 15, 16 and 17, 18 which respectively form the pairs 19, 20 can be moved in directions that are substantially parallel to the first axis of movement A and independently of each other.

This configuration allows to carry out a first movement that takes the contrast rollers 15, 16, 17, 18 close to each other by moving the first support 21, and a second adjustment movement by independently moving each contrast roller 15, 16, 17, 18 or each contrast support 23, 24 with respect to the first support 21. This configuration is particularly advantageous if two metal products P1, P2 are drawn. In fact, a respective contrast roller 15, 16, 17, 18 of a pair 19, 20 can be dedicated to each metal product P1, P2.

According to one aspect of the invention, the motorized rollers 12, 13 and the contrast rollers 15, 16, 17, 18 can be selectively mobile with respect to each other along an axis of transverse movement T substantially parallel to the axes of rotation F1, F2, F3, F4 of the contrast rollers 15, 16, 17, 18.

Advantageously, in this way it is possible to adjust, along the axis of transverse movement T, the relative position between the contrast rollers 15, 16, 17, 18 and the motorized rollers 12, 13.

In particular, in this specific case, the second support 22, with which the contrast rollers 15, 16, 17, 18 are operatively associated, can be selectively moved with respect to the base 11 along the axis of transverse movement T. More in particular, the second support 22 can be coupled to the base 11 by means of at least one sliding slider 27 and it can be selectively moved by means of movement means 25 of a known type. For example, the second support 22 can comprise a screw 28 connected to a motor, and a nut-thread element 29 configured to accommodate the screw 28 can be integrally connected to the base 11. It is therefore clear that a translation of the second support 22 along the slider 27 corresponds to a rotation of the screw 28. The sense of the rotation defines the sense of the translation. In some cases, the extent of the translation may depend

on the nominal diameter Φ_1, Φ_2, Φ_3 of the metal products P1, P2.

Advantageously, this configuration allows to adjust, along the axis of transverse movement T, the relative position between the contrast rollers 15, 16, 17, 18 and the motorized rollers 12, 13 in such a way as to always guarantee the optimal alignment between contrast rollers 15, 16, 17, 18, metal products P1, P2 and motorized rollers 12, 13. In this way, it is possible to prevent the interference between a metal product P1, P2 and both contrast rollers 15, 16, 17, 18 of a pair 19, 20.

For example, referring to fig. 2, the metal products P1, P2 have a first nominal diameter Φ_1 and the contrast rollers 15, 16 of the pair 19 are positioned along the axis of transverse movement T in such a way as to prevent one of the two metal products P1, P2 from interfering with both contrast rollers 15, 16. In this way, the correct alignment and drawing of the metal products P1, P2 is guaranteed. Subsequently, with reference to fig. 3, the type of metal products P1, P2 to be worked may be different, for example due to a format change, and may have a second diameter Φ_2, larger than the first diameter Φ_1. In this case, as shown, the drawing unit 10 of the present invention can move the contrast rollers 15, 16, 17, 18 along the axis of transverse movement T in such a way as to restore the correct alignment with the metal products P1, P2. In another condition of use, with reference to fig. 4, the drawing unit 10 can be fed with a metal product P1 that has a third diameter Φ_3 larger than the second diameter Φ_2. In this case, the contrast rollers 15, 16 can be moved once again along the axis of transverse movement T in order to align the contrast roller 15 with the metal product P1. It is therefore clear to see the advantages of the drawing unit 10 of the present invention, which allows the transverse alignment of the contrast rollers 15, 16, 17, 18 as a function of the diameter of the metal products P1, P2 that have to be drawn. This makes the drawing unit 10 very flexible to use.

In some embodiments, the drawing unit 10 can also comprise a transducer device 26 configured to monitor the translation, that is, the distance of the second support 22 with respect to the base 11. In fact, the transducer device 26 can be configured to generate an electrical signal that is proportional to the distance between the second support 22 and the base 11. This solution allows a better regulation of the reciprocal position of the contrast rollers 15, 16, 17, 18 with

respect to the motorized rollers 12, 13. In other words, the functioning of the movement means 25 can be adjusted as a function of the signal generated by the transducer device 26.

The present invention also concerns a method to draw metal products P1, P2 comprising a drawing step, in which oblong metal products P1, P2 are drawn, along an axis of feed X, by means of motorized rollers 12, 13 to which there are opposed, with respect to the axis of feed X, contrast rollers 15, 16, 17, 18. The contrast rollers 15, 16, 17, 18 are configured to rotate idly about respective axes of rotation F1, F2, F3, F4.

Preferably, in such drawing step at least two metal products P1, P2 are drawn at the same time and a first contrast roller 15 of a first pair 19 of contrast rollers 15, 16 acts only on a first metal product P1, and a second contrast roller 16 of the first pair 19 acts only on a second metal product P2. Furthermore, a first contrast roller 17 of a second pair 20 of contrast rollers 17, 18 acts only on the first metal product P1, and a second contrast roller 18 of the second pair 20 acts only on the second metal product P2.

According to one aspect, the method also comprises at least one adjustment step in which the reciprocal position between the contrast rollers 15, 16, 17, 18 and the motorized rollers 12, 13 is adjusted along an axis of transverse movement T substantially parallel to the axes of rotation F1, F2, F3, F4 of the contrast rollers 15, 16, 17, 18.

In accordance with some embodiments, the adjustment step provides to move the contrast rollers 15, 16, 17, 18 with respect to the motorized rollers 12, 13 along the axis of transverse movement T.

In preferred embodiments, the above adjustment of the reciprocal position between the motorized rollers 12, 13 and the contrast rollers 15, 16, 17, 18 occurs, on each occasion, as a function of the respective nominal diameters of the metal products P1, P2, as described previously by way of example.

Advantageously, in this way it is possible to guarantee, in all conditions, an adequate pressure on the metal products P1, P2, eliminating the problems of slippage that are typical of drawing units of the traditional type.

It is clear that modifications and/or additions of parts or steps may be made to the drawing unit 10 and to the method as described heretofore, without departing

from the field and scope of the present invention as defined by the claims.

In the following claims, the sole purpose of the references in brackets is to facilitate reading: they must not be considered as restrictive factors with regard to the field of protection claimed in the specific claims.

CLAIMS

1. Drawing unit (10) for moving at least one metal product (P1, P2) along an axis of feed (X), comprising at least two contrast rollers (15, 16; 17, 18) configured to rotate about respective axes of rotation (F1, F2; F3, F4) and disposed opposite at least one motorized roller (12, 13), with respect to said axis of feed (X), **characterized in that** said at least two contrast rollers (15, 16; 17, 18) are selectively mobile with respect to said at least one motorized roller (12, 13) along an axis of transverse movement (T) substantially parallel to said axes of rotation (F1, F2; F3, F4).

2. Drawing unit (10) as in claim 1, **characterized in that** said at least two contrast rollers (15, 16; 17, 18) are substantially facing each other and substantially coaxial.

3. Drawing unit (10) as in claim 1 or 2, **characterized in that** said at least two contrast rollers (15, 16; 17, 18) are opposite the same motorized roller (12, 13).

4. Drawing unit (10) as in any claim hereinbefore, **characterized in that** it comprises a base (11), with which said at least one motorized roller (12, 13) is operatively associated, and a second support (22) with which said contrast rollers (15, 16; 17, 18) are operatively associated, said second support (22) being able to be selectively moved with respect to said base (11) along said axis of transverse movement (T).

5. Drawing unit (10) as in claim 4, **characterized in that** said at least two contrast rollers (15, 16; 17, 18) are associated with a first support (21) which can be selectively moved with respect to said second support (22) and in the direction of said at least one motorized roller (12, 13) along a first axis of movement (A) orthogonal to said axis of feed (X).

6. Drawing unit (10) as in claim 4, **characterized in that** said at least two contrast rollers (15, 16; 17, 18) can be selectively moved with respect to said first support (21) in directions parallel to said first axis of movement (A), in an independent manner with respect to each other.

7. Drawing unit (10) as in claims 5 or 6, **characterized in that** it comprises at least two pairs (19, 20) of contrast rollers (15, 16; 17, 18) adjacent to each other in a direction substantially parallel to said axis of feed (X) and opposite, with respect to said axis of feed (X), respective motorized rollers (12, 13), **and in that**

homologous contrast rollers (15, 17; 16, 18) of different pairs (19, 20) are pivoted to respective contrast supports (23, 24) associated with said first support (21).

8. Drawing unit (10) as in any previous claim from 4 to 7, **characterized in that** it comprises a transducer device (26) configured to monitor the distance of said second support (22) with respect to said base (11).

9. Method to draw at least one metal product comprising a drawing step in which oblong metal products (P1, P2) are moved, along an axis of feed (X), by means of at least one motorized roller (12, 13) to which there are opposed, with respect to said axis of feed (X), at least two contrast rollers (15, 16; 17, 18) rotating about respective axes of rotation (F1, F2; F3, F4), **characterized in that** it comprises at least one adjustment step in which the reciprocal position between said at least two contrast rollers (15, 16; 17, 18) and said at least one motorized roller (12, 13) is adjusted along an axis of transverse movement (T) substantially parallel to said axes of rotation (F1, F2; F3, F4).

10. Method as in claim 9, **characterized in that** said at least two contrast rollers (15, 16; 17, 18) are substantially facing each other and substantially coaxial.

11. Method as in claim 9 or 10, **characterized in that** said at least two contrast rollers (15, 16; 17, 18) are opposite the same motorized roller (12, 13).

12. Method as in any claim from 9 to 11, **characterized in that** in said drawing step at least two metal products (P1, P2) are drawn at the same time, **and in that** a first contrast roller (15; 17) of said at least two contrast rollers (15, 16; 17, 18) acts only on a first metal product (P1) **and in that** a second contrast roller (16; 18) of said at least two contrast rollers (15, 16; 17, 18) acts only on a second metal product (P2) different from said first metal product (P1).

13. Method as in any claim from 9 to 12, **characterized in that** said adjustment step provides to move said at least two contrast rollers (15, 16; 17, 18) with respect to said at least one motorized roller (12, 13) along said axis of transverse movement (T).

14. Method as in any claim from 9 to 13, **characterized in that** said adjustment step occurs as a function of the nominal diameter (Φ_1, Φ_2, Φ_3) of said metal products (P1, P2).

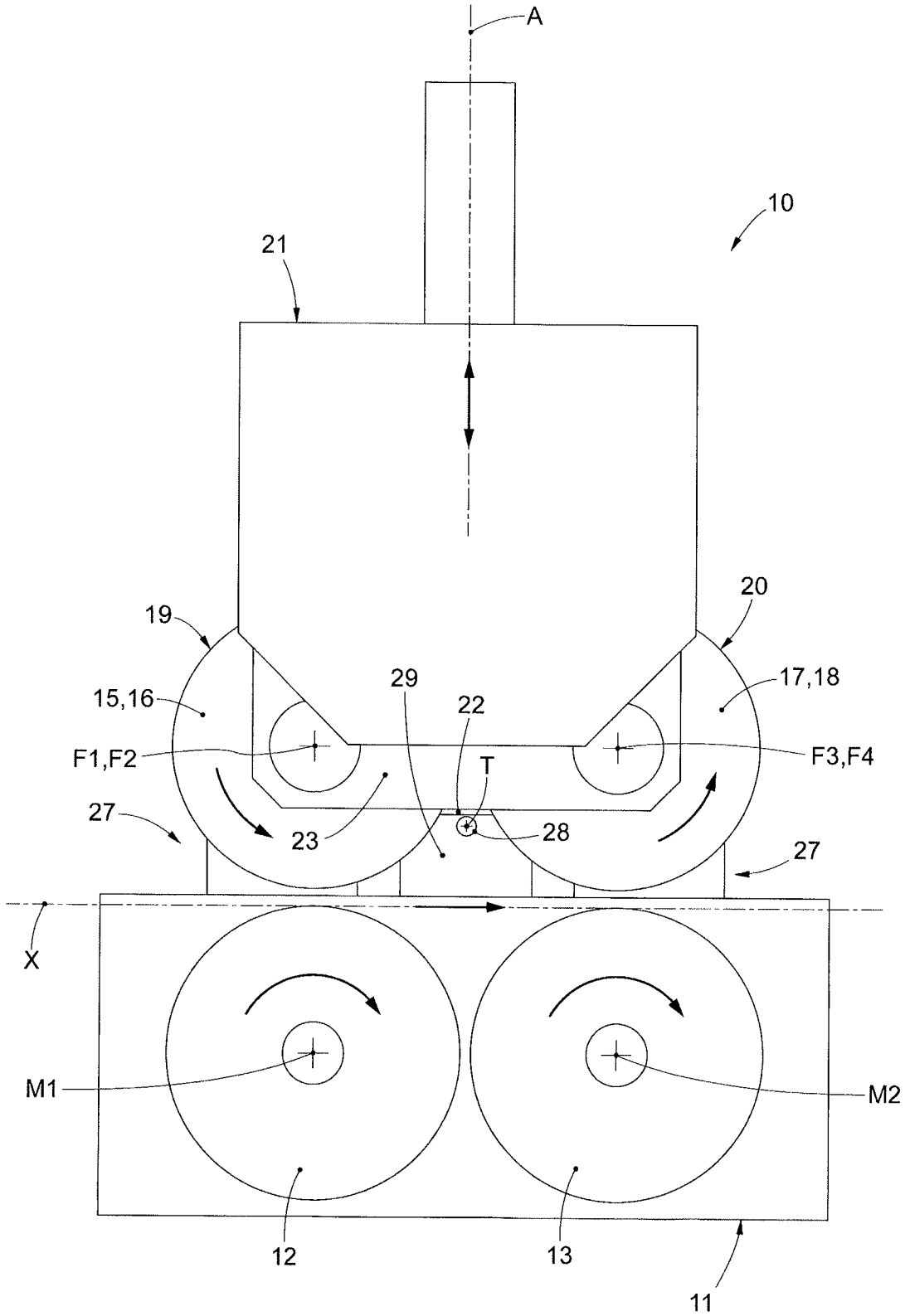
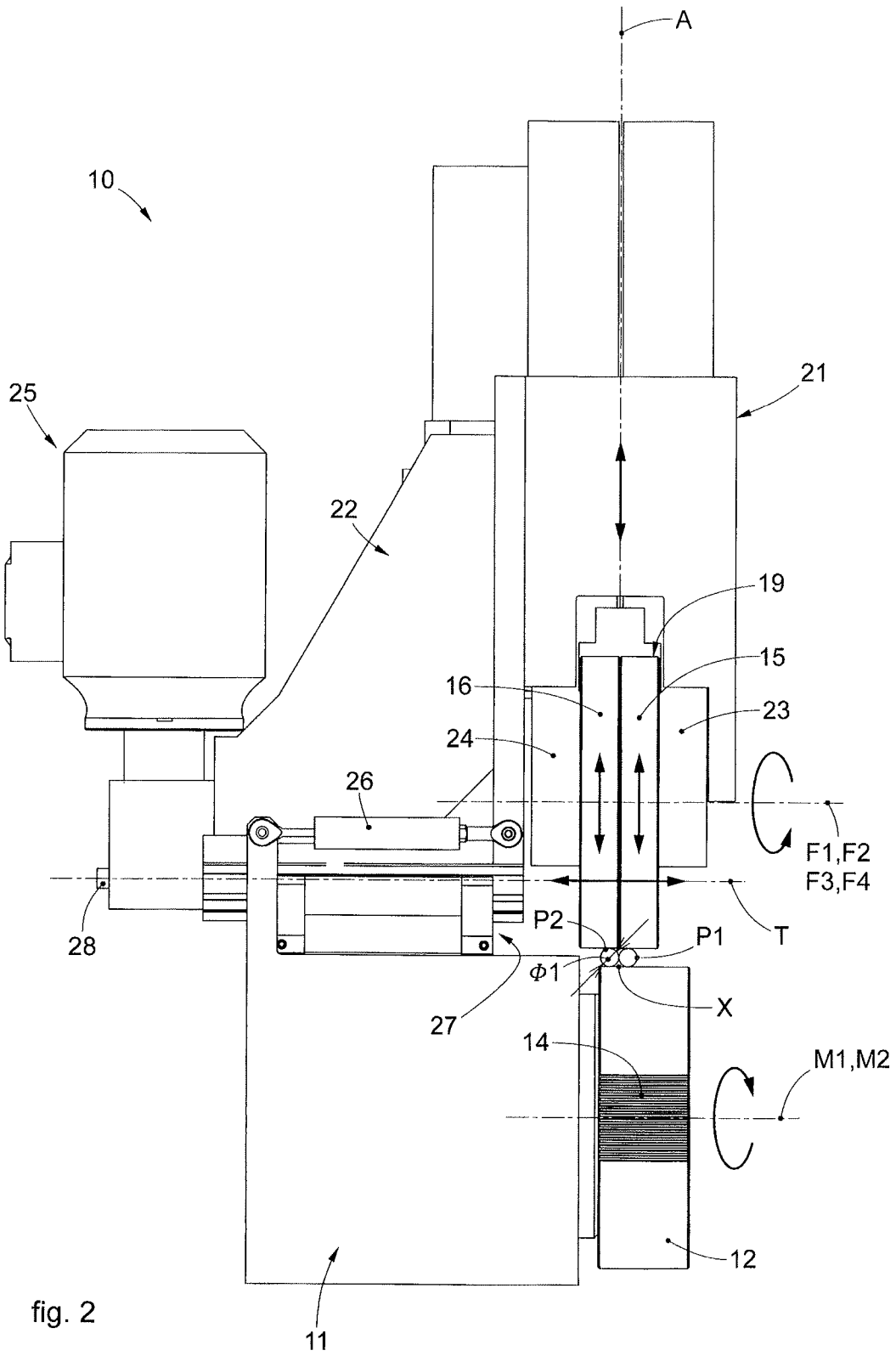


fig. 1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M1,M2
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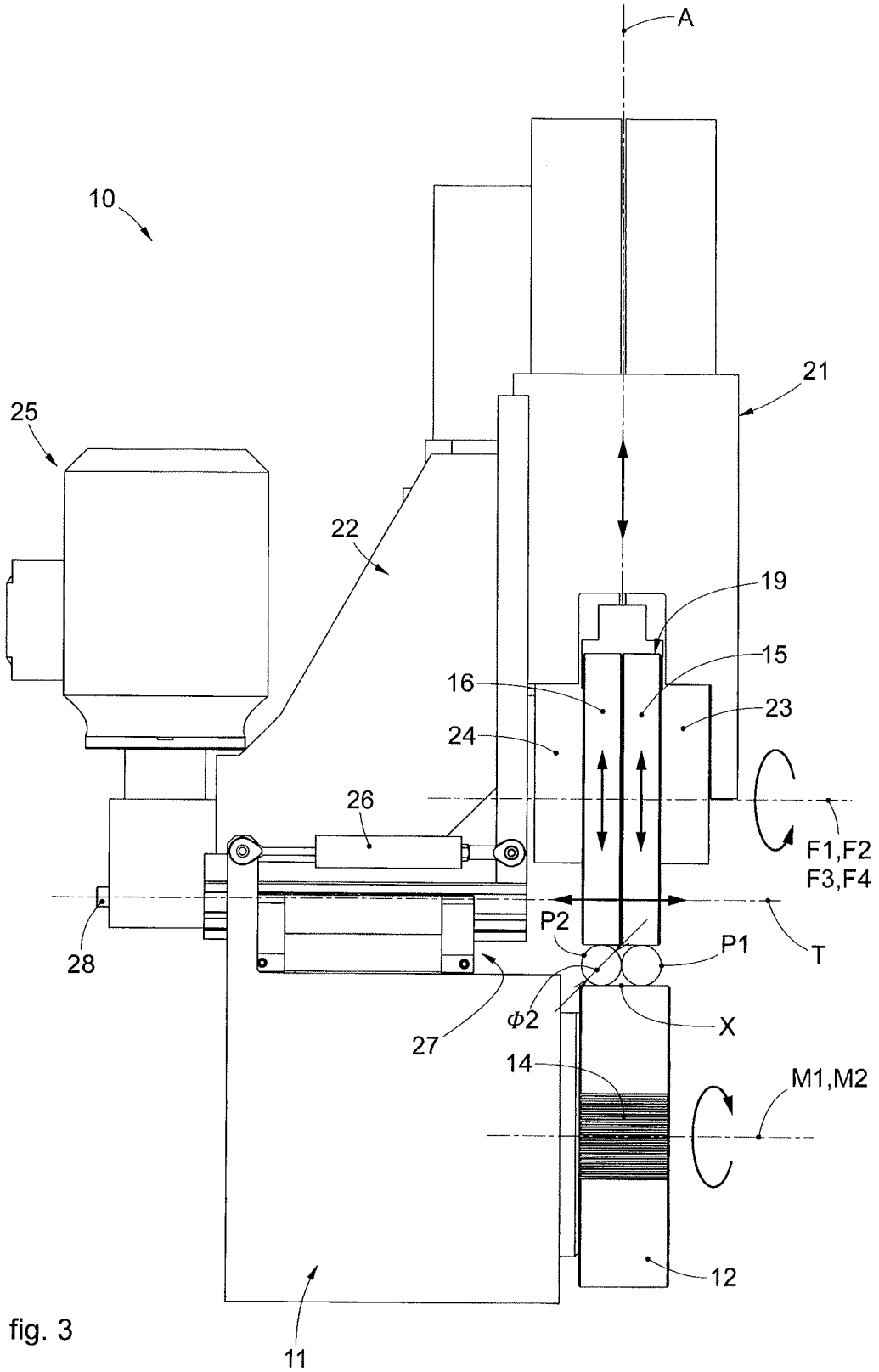
fig. 2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M1,M2
12
11

fig. 3

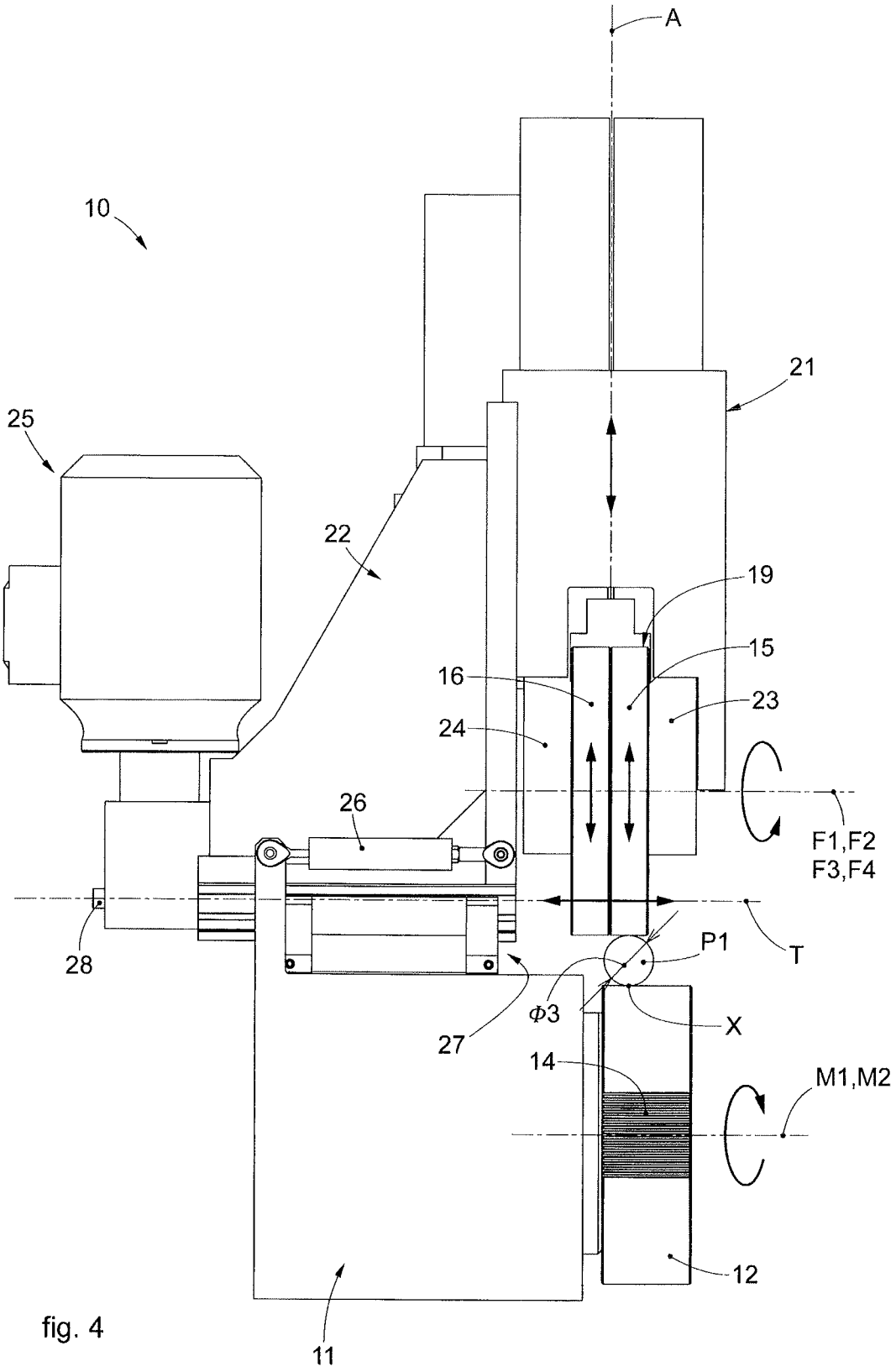

fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2021/050299

A. CLASSIFICATION OF SUBJECT MATTER
INV. B21D43/00 B21F23/00
ADD.

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 B21L B21F B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 065 736 A2 (BUCHER FRANZ) 1 December 1982 (1982-12-01) claims 1-8; figures 1-3	1,4,5,9, 12
X	US 3 447 730 A (JEANNETTE JOSEPH C) 3 June 1969 (1969-06-03) column 1 - column 4; claims 1,4; figures 1-7	9,14
Y	US 2019/337037 A1 (PEZZUTO PATRIZIA [IT]) 7 November 2019 (2019-11-07) paragraph [0112] - paragraph [0126]; claim 5; figures 1-5	1-3,6-8, 10-13
Y	US 2002/104353 A1 (HRESC STJEPAN [HR] ET AL) 8 August 2002 (2002-08-08) paragraph [0027] - paragraph [0027]; claim 1; figures 1-4	1-3,6-8, 10-13

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 January 2022	26/01/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Charvet, Pierre

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 9 555 465 B2 (DEL FABRO GIORGIO [IT]; M E P MACCH ELETTR PIEGATRICI SPA [IT]) 31 January 2017 (2017-01-31) claims 1,4; figures 1-5	1-3,6-8, 10-13
Y	WO 2013/104773 A1 (SCHNELL SPA [IT]) 18 July 2013 (2013-07-18) figures 1-9	12
Y	US 3 392 896 A (ROBERT ULLMAN) 16 July 1968 (1968-07-16) figures 3-5	12

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Information on patent family members

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