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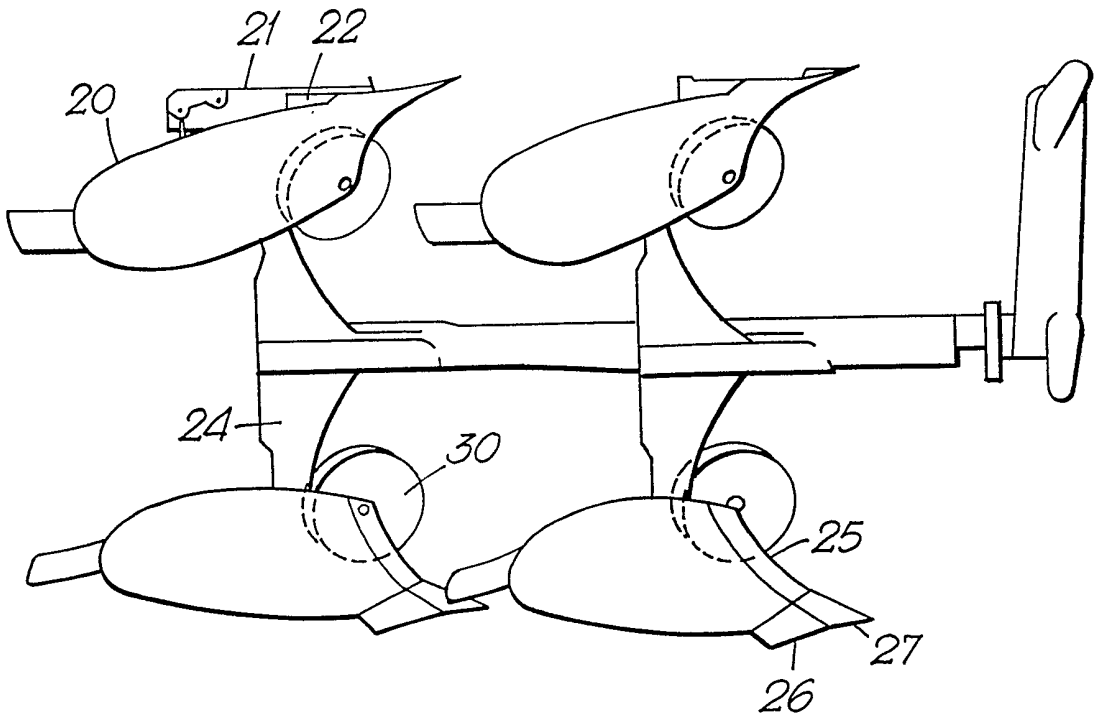
(54) An improved plough and method of ploughing using such plough

(57) A mouldboard or rotary tilling element type plough and a method of ploughing using such a plough comprises a wheel 30 which is pressed to the ground adjacent the leading edge 25 of the plough to nip the straw and other debris between the wheel and the ground as it is engaged by the leading edge of the plough to prevent the debris being gathered and bunched by the plough and to facilitate the inversion of soil from below to bury the debris thereunder in the formed furrow.

Fig.1.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.

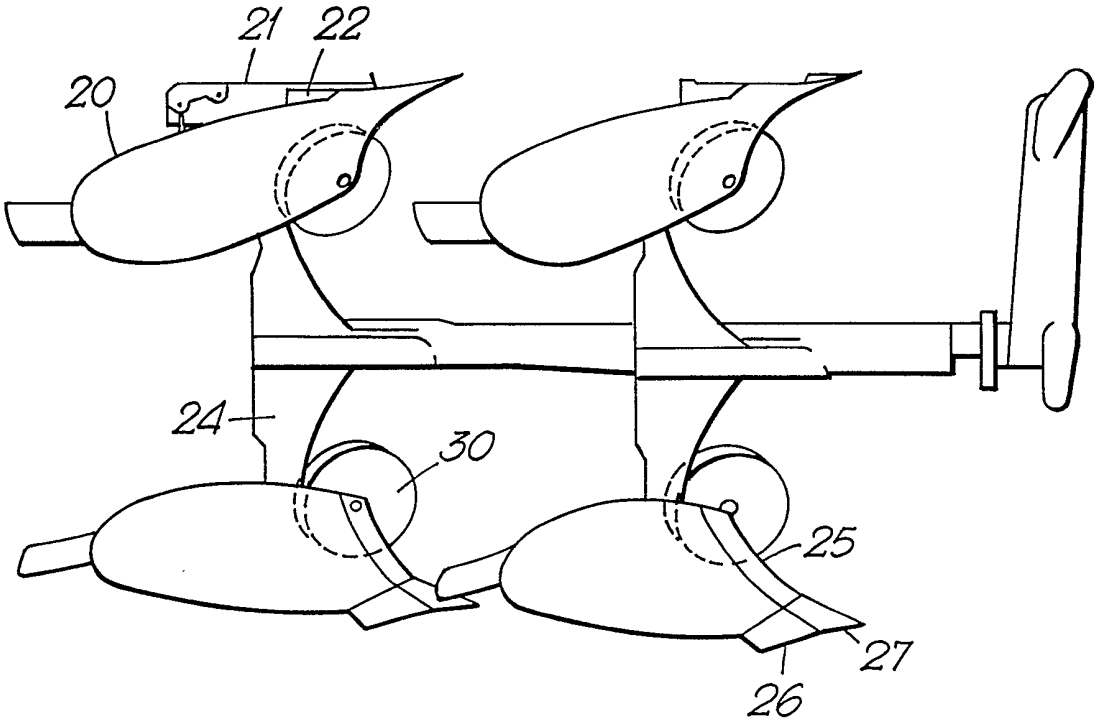


Fig.3.

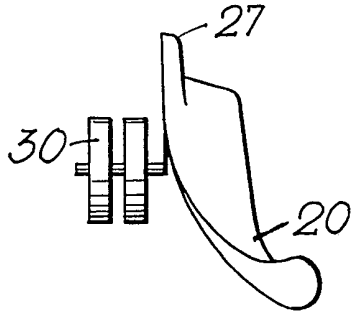


Fig. 2.

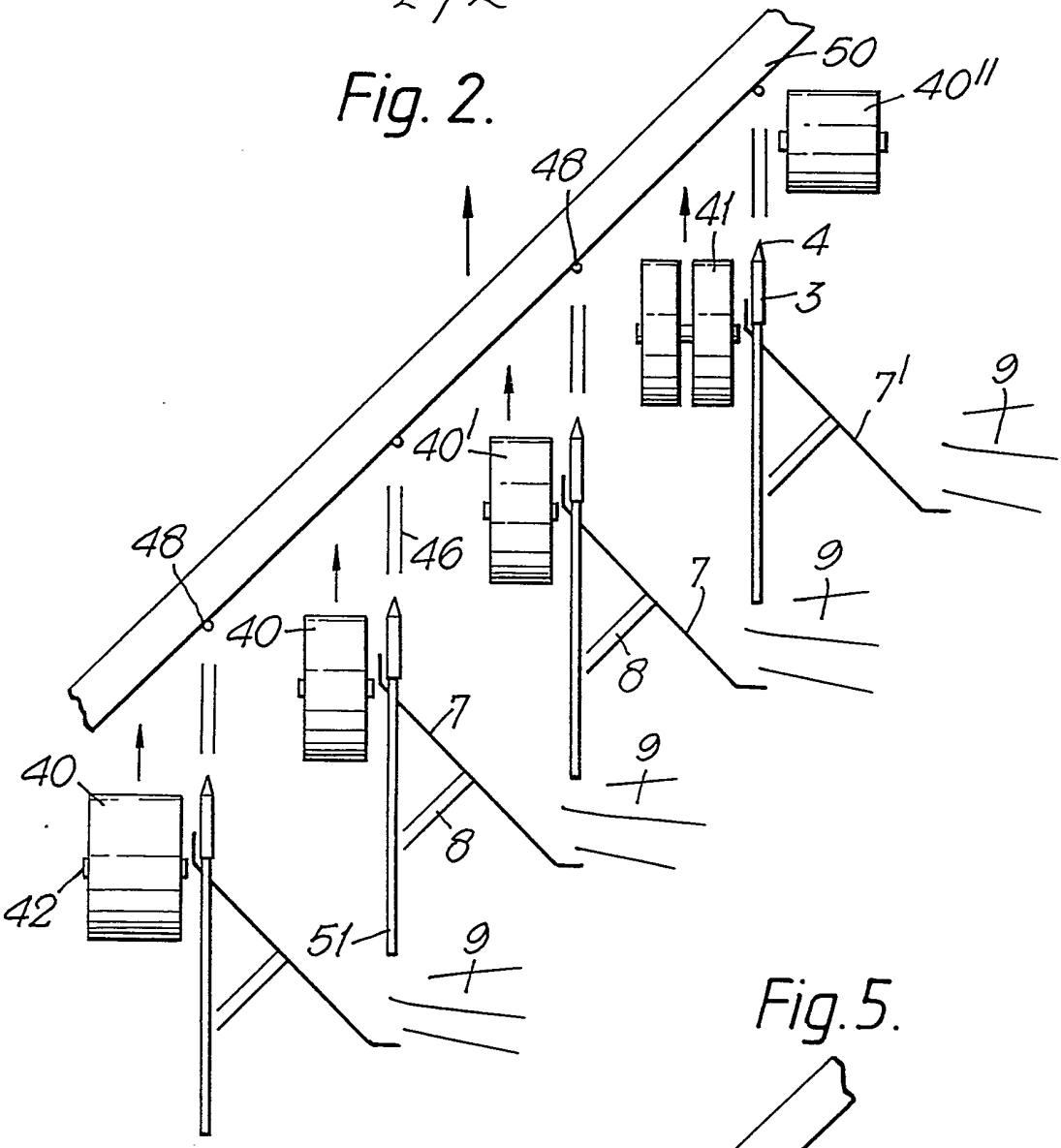


Fig. 4.

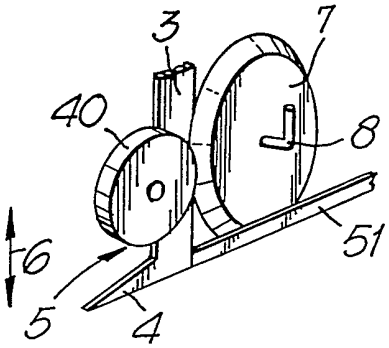
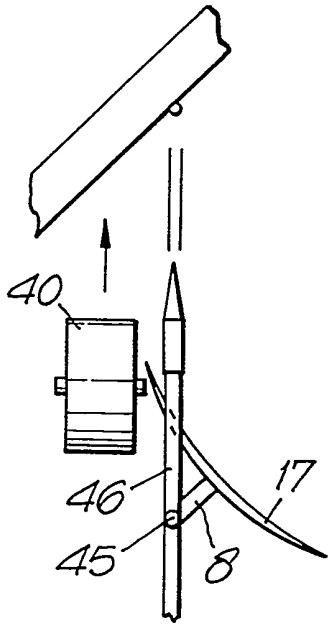


Fig. 5.



"AN IMPROVED PLOUGH AND METHOD OF PLOUGHING USING SUCH PLOUGH"

This invention relates to an improved method of ploughing and to an improved plough which can be used to carry out such method of ploughing.

There is a need for ground preparation equipment with an improved ploughing action to assist stubble incorporation, this becoming more important now that clearing the soil by stubble burning is being prevented.

Existing ground preparation equipment such as ploughs, during the process of incorporating straw or crop or other vegetable residues into the soil, can suffer from blockages being created within the apparatus. A method which has been proposed to try to prevent this problem is the disc coulter. This is a circular cutting disc which cuts into the soil and through waste residues directly in front of a plough body. This prevents blockage but in extremely wet or in dry conditions, it will either lack penetration or create blockage from the straw and waste residues.

The present invention proceeds from the appreciation that an alternative means can be provided to prevent blockage very efficiently with these alternative means giving additional advantages over the conventional plough. This invention stems from the idea of gripping the debris between a wheel and the ground so that it is held as the leading cutting edge of the plough passes that point so that the debris is split and divided by the leading of the plough and is not carried forward and bunched in front of the plough due to its being gripped between the wheel and the surface of the soil.

According to the present invention, there is provided a method of ploughing in which a wheel is pressed to the ground adjacent the leading edge of a plough to nip straw and other debris between the wheel and the ground as

it is engaged by the leading edge of the plough to prevent the debris being gathered and bunched by the plough and to facilitate the inversion of soil from below to bury the debris thereunder in the formed furrow.

A further aspect of the invention provides a plough comprising a tilling element and a soil conditioning wheel mounted adjacent the leading edge of the tilling element for close engagement with the ground beside the leading edge of the tilling element during ploughing to hold straw and other debris as it is engaged by the tilling element.

In the disc coulter, as referred to above, there are various disadvantages such that it cuts soil only directly in front of the plough leg and does not improve the inversion of long stubble, loose debris or straw into the furrow. In dry conditions it will not penetrate the ground and in wet conditions it will block. It takes up a lot of space within the plough, making the plough more cumbersome to use, and because it has to penetrate the ground, it creates extra draft. As compared therewith, the land conditioning wheel as used with the present invention prevent blockage of all materials around the plough leg in wet or dry conditions. It holds the soil firm between adjacent tilling elements of the plough, improving efficiency and predictability of the inversion of the plough furrow, this being very important where the tilling element is a soil inversion wheel or disc plough. The firm soil also helps the landslide to create stability of ploughing action whilst, as previously indicated, the wheel can lay long straw flat on the ground to provide a very efficient ploughing process and prevent loose straw from fluffing up to cause blockage.

An additional advantage is that it can be used to provide efficient depth control for each plough body across the machine, assisting the plough to follow the contours of the ground without any additional form of depth control

being necessary. As the land conditioning wheel does not penetrate the ground, it only rolls over the top of the ground to pinch the debris against the surface thereof, it only adds a very small amount of draft and causes little increase to the pulling force which needs to be exerted by the tractor. A consistent flow of loose debris, standing straw or other vegetable residues can be achieved through the plough so as to obtain a smooth and consistent operation.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a side elevational view of a mouldboard plough embodying the present invention;

Figure 2 is a diagrammatic partly broken away plan view of part of a plough using rotary inversion wheels as tillage elements embodying the invention;

Figure 3 is a detailed plan view showing the relationship between a soil conditioning wheel and a plough share as used in the plough of Figure 1;

Figure 4 is a perspective detailed view showing the arrangement of the soil conditioning wheel in connection with a tillage element as used in the plough of Figure 2; and

Figure 5 is a diagrammatic view of a detail of Figure 2 showing a single conventional disc instead of the soil inversion wheel.

Figure 1 illustrates a plough having a plurality of plough shares shown as comprising a mouldboard 20, a landslide 21, a frog 22, a supporting leg 24 for each such mouldboard, the plough share also being provided with a conventional shin 25, wing 26 and point 27. Associated with each plough share is a conditioning wheel 30 for a purpose to be explained.

During use of the plough, when ploughing in one

direction, the two lower plough shares shown in Figure 1 will be drawn through the earth to produce furrows and when working in the opposite direction across the field the plough shares will be rotated so that what are shown as the upper plough shares in Figure 1 will now be the working plough shares, the one set of plough shares operating in a right-hand mode and the other working in a left-hand mode so that parallel furrows can be obtained across the field with the plough working alternatingly in the opposite directions.

The wheel 30, which may be a single wheel or, as convenient, a plurality of coaxial side-by-side wheel elements is shown in Figure 3 as being mounted rigidly in connection with the mouldboard 20. The position of the wheel 30 is just behind the point 27 of the share on the point side of the share.

As the plough is drawn across the ground, the wheel 30 engages the top of the ground and has two functions. Firstly, it acts as a depth gauge to control the depth to which the point 27 will penetrate beneath the top level of the soil, and secondly, and very importantly, it acts to stop debris accumulating and jamming the proper action of the plough. This occurs since as the wheel runs over the ground it pinches between itself and the ground any straw and other debris to hold it firm as it passes the front edge of the plough. Because of this the plough is able to cut the debris such that it can readily be lifted and inverted by the action of the mouldboard 20 during ploughing.

Figure 2 illustrates a plough using rotary inversion wheels 7. These inversion wheels are tillage elements with a substantially flat centre portion and a peripheral flange angled thereto which are more fully described in the specification of my pending Application No 91 23079.8. Instead of having the preferred inversion

wheels 7 a conventional concavely curved plough disc 17 as shown in Figure 5, can be used instead. The inversion wheel 7 is shown mounted for rotation about an axle 8 with the end of the axle remote from the inversion wheel being carried for movement about a vertical pivot axis 45. The pivot axis 45 is carried by a frame member diagrammatically illustrated at 46 which extends at a height above that of the top of the inversion wheel to be connected at a pivot 48 carried by a support bar 50 mounted in a plough frame, not shown. The support bar 50 extends diagonally of the direction of movement of the plough so that during use of the plough, the frame member 46 will trail from the pivot 48 with the inversion wheels 7 forming adjacent furrows 9.

Also depending from the frame member 46 is a leg 3 which carries at its lower end a forwardly projecting point 4 and a rearwardly extending landslide 51. A soil conditioning wheel shown as a single wheel 40 or as a double wheel 41 with two coaxial side-by-side wheel elements is mounted beside the point 4 on the opposite side thereof from the furrow which is being formed. Whilst the wheel 40 or 41 can be mounted to the same support as the leg 3, or to leg 3, it is preferred that it be arranged to trail from a pivot connection, not shown, also provided on the support bar 50 between adjacent pivots 48. Arranged in this way, it is readily possible to change the plough from having a right-hand ploughing action to a left-hand ploughing action, simply by reversing the direction of inclination of the support bar 50 and swinging the axle 8 about the pivot 45 so that the soil inversion wheel 7 is inclined in the opposite direction to the direction of movement of the plough. With the pivotal connection of the wheels 40 or 41 to the bar 50, they also will swing so that the wheel 40' shown in Figure 2 as operating in conjunction with the point 4 immediately to the right thereof will, following the change from right- to left-hand ploughing

format, be correctly positioned to the left-hand side of the second point from the left shown in Figure 2. In order to achieve this function, there will be one more of the conditioning wheels 40 or 41 provided than there will be plough discs with associated points and landslides. The soil inversion wheel 40" shown in Figure 2 will, in the format shown, firm up the ground for efficient ploughing by the following inversion wheel 7'. When the format is changed by reversing the direction of inclination of the frame bar 50, the wheel 40" will be adjacent the point associated with the inversion wheel 7'.

The wheels 40 and 41 engage the ground surface during use of the plough to determine the depth to which the point 4 will penetrate beneath the surface and thus accurately control the depth of ploughing. The primary purpose of the wheel 40, however, is to prevent bunching of straw or other debris which may be on the surface of the ground. As the plough advances, straw or other debris is pinched between the surface of the ground and the wheel so as to be held firmly as the point 4 and leg 3 pass the debris such that the debris is cut and torn and does not bunch up in front of the leg 3. It then lays flat whilst being turned over by the next following inversion wheel 7 so as to buried in the formation of the furrow under soil brought up from the bottom by the rotating inversion wheel 7. Figure 4 shows how the depth 5 of ploughing is determined by the relative position of the conditioning wheel 41 and the plough point 4.

During use of the plough, as it is pulled behind the tractor or the like, point 4 enters the soil to the depth 6 which is determined by the height of the wheel 41. The draft created by the ploughing motion and the inclined top of the point 4 creates downward pressure onto the soil by the wheel 41 at the position 5. The downward pressure creates a pinching motion between the base of the wheel 41

and the soil whereby straw and waste residues which are positioned between the wheel and the soil are held firmly in place by the rolling motion of the wheel preventing blocking near the point 4 or plough leg 3. The rolling motion of the wheel 41 also squeezes any loose straw or waste residue into position so as to prevent blockage and aid the inversion of the soil. Thus, the soil conditioning wheel firms down the soil to improve the efficiency of operation of the next following inversion wheel. This is similar to the effect which occurs when using the wheel conditioner in conjunction with a mouldboard plough as shown in Figures 1 and 3. Where long straw is left in the soil, it is laid flat to the ground by the wheel to provide a more efficient ploughing surface. Generally, with the plough using a disc or inversion wheel, the efficiency and predictability of the plough furrow is greatly enhanced because of the manner in which the soil is held firm by the wheel at the commencement of the ploughing action.

The preferred position of the land conditioning wheel has been found to lie within the range of a rearward position where the leading edge of the wheel is opposite the leading edge of the leg 3 or forward to a position where the axle of the wheel is level with, or slightly in advance of, the front edge of the leg 3. The land conditioning wheel 40' in Figure 2 is shown in the advanced position.

The dimensions of the land conditioning wheel can vary, depending upon the particular circumstances but generally the width of the wheel can lie within the range of 2.5 and 60 cm (1 in and 2 ft) and the height of the wheel can conveniently lie in the range of 25 cm and 90 cm (10 in and 3 ft).

While we have discussed the conditioning wheel as being dragged by a pivot from the support bar 50, in other embodiments it may be made rigid with the frame. In

general, the land conditioning wheel can expect to require the provision of a scraper.

The wheels are staggered with and alongside the plough legs. They can either be touching or up to 20 cm (8 in) away from the leg and in operation will be parallel, or at least nearly parallel, with the forward direction of movement of the plough.

C L A I M S

1. A method of ploughing in which a wheel is pressed to the ground adjacent the leading edge of a plough to nip straw and other debris between the wheel and the ground as it is engaged by the leading edge of the plough to prevent the debris being gathered and bunched by the plough and to facilitate the inversion of soil from below to bury the debris thereunder in the formed furrow.

2. A plough comprising a tilling element and a rotatable soil conditioning wheel mounted adjacent the leading edge of the tilling element for close engagement with the ground beside the leading edge of the tilling element during ploughing to hold straw and other debris as it is engaged by the tilling element.

3. A plough according to claim 1, wherein the wheel is vertically adjustable relative to the tilling element to control depth of ploughing.

4. A plough according to claim 2 or 3, wherein the soil conditioning wheel is located beside the tilling element on the side thereof opposite the side at which the furrow is formed by that tilling element during ploughing.

5. A plough according to any one of claims 2 to 4 wherein the tilling element is a mouldboard plough.

6. A plough according to any one of claims 2 to 4, wherein the tilling element is a rotary element in the form of a rotary disc or soil inversion wheel.

7. A plough according to any one of claims 2 to 6, in which the tilling element comprises a cultivating element having a rotary soil inversion wheel or disc associated therewith.

8. A plough according to claim 6 or 7, wherein the soil conditioning wheel is trailed by a pivot from the same support bar as the tilling element with which it is associated.

9. A plough according to any one of claims 2 to 8,

wherein the soil conditioning wheel is adjustably positionable in the fore and after direction of the plough.

10. A plough according to any one of claims 2 to 9, wherein the soil conditioning wheel is fixedly securable in relation to the tilling element.

11. A plough according to any one of claims 2 to 10, wherein a scraper is associated with the soil conditioning wheel.

12. A plough according to any one of claims 2 to 11, wherein a plurality of tilling elements and associated soil conditioning wheels are arranged in a staggered formation to provide for the formation of a plurality of side-by-side furrows.

13. A plough according to any one of claims 2 to 12, in which the or each soil conditioning wheel comprises a plurality of coaxial side-by-side wheel elements.

14. A plough constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

15. A method of ploughing substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
9117176.9

Relevant Technical fields

(i) UK Cl (Edition K) A1B

(ii) Int Cl (Edition 5) A01B

Search Examiner
K J KENNETT

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
25 NOVEMBER 1991

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 995686 (TROJAN) whole document	1,2,3 & 5
X	GB 932687 (HARVESTER) Figure 1	1,2 & 11

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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