Fig. 1

The abstract of the patent states:

A coulter arrangement of a sowing machine, in which a coulter (1) comprises a frame (2), a disc arrangement (3A, 3B) for opening a seeder furrow (F) and an arrangement for setting the seeding depth, is characterised in that the arrangement for setting the seeding depth comprises at the side of the disc (3A) or only one disc (3A) of the two discs a side wheel (4) positioned so that its axis (G) is in the driving direction (E) of the sowing machine forward from the bearing point (D) of the discs (3 A, 3B), wherein the coulters (1) may be positioned by means of a small alternation (T) in the longitudinal direction laterally at a small seeding distance (W) from each other keeping at the same time space between the coulters for avoiding blockages. The side wheel (4) is formed advantageously so that it includes a plate-like central part and a periphery extending towards the disc, whereby its suspension arm may go through the opening between the disc and the periphery of the side wheel into the space between them.
COULTER ARRANGEMENT FOR SOWING MACHINE

FIELD OF THE INVENTION

The invention concerns a coulter arrangement of a sowing machine, especially a direct sowing machine.

BACKGROUND OF THE INVENTION

In the coulters of direct sowing machines seeding to an accurate depth, normally a side wheels are used for adjusting the seeding depth which wheels are positioned rearwards of the bearing point of the disc coulter, so that the point of the side wheel which is in touch with the soil surface is close to the point to which the seed falls. In this way the best control of the seeding depth is obtained but a disadvantage is, for example with a double disc coulter, that positioning of the coulters side by side at a distance of 12 to 15 centimeters from each other becomes impossible as the coulter is the widest in the rear part of it and the side wheel in connection with it increases further the width.

If there is not enough empty space between the coulters, blockages are easily achieved there hampering and retarding the seeding process. Therefore, the coulters must be positioned at wider distances from each other which is not a good solution in view of productiveness and control of weed. On the other hand, keeping the normal distance between the rows is possible by positioning the coulters totally separate from each other in the longitudinal direction of a machine, but then the length of the machine is increased disadvantageously and the machine must be made also higher so that the seed is brought to flow to the coulters along the pipes.

WO 2007050185 presents a solution for achieving a compact coulter arrangement. The side wheels setting the seeding depth are overlapping the discs of double disc coulters so that their axis is forward from the axes of the discs, and on the other hand, packer wheels are overlapping the discs so that their axis is rearwards from the axes of the discs. In this way, a longitudinally compact coulter is achieved but for obtaining the coulters laterally close enough to each other, they must surely be positioned totally separate from each other in the longitudinal direction.

SUMMARY OF THE INVENTION

An object of the invention is to present a compact coulter arrangement in which the coulters may be positioned by means of a small longitudinal alternation at a normal distance of seeding rows from each other laterally.
To achieve this, a coulter arrangement of a sowing machine, in which a coulter
comprises a frame, a disc arrangement for opening a seeding furrow and an arrangement for
setting the seeding depth, is characterised in that the arrangement for setting the seeding
depth comprises at the side of the disc or only one disc of the two discs a side wheel
positioned so that its axis is in the driving direction of the sowing machine forward from the
bearing point of the discs, wherein the coulters may be positioned by means of a small
alternation in the longitudinal direction laterally at a small seeding distance from each other
keeping at the same time space between the coulters for avoiding blockages.

In an embodiment of the invention, the side wheel is formed so that it includes a plate-
like central part to which the hub of the wheel is attached and a periphery extending towards
the disc, whereby the suspension arm of the side wheel is positioned so that it goes through
the opening between the disc and the periphery of the side wheel into the space between the
side wheel and the disc where it is connected to the hub of the side wheel.

The suspension arm may be curved so that it at the opening between said disc and the
periphery of the side wheel is directed towards the opening.

The suspension arm may further be positioned and curved so that a space is remained
between it and the inner side of the side wheel for preventing blockages from being formed
there.

In one embodiment of the invention the coulter arrangement is a double disc
arrangement.

The coulter arrangement may further comprise means for packing the seeding furrow
positioned essentially on the seeding line rearwards and separate from the disc arrangement.
The packing means may include a packing wheel.

As the side wheel is positioned forward from the bearing point of the disc or discs of
the coulter, it is at the narrower part of the wedge-shaped structure of the coulter. Then, a
large enough space is remained between the coulters and the wheel adjusting the depth when
the distance between the rows and the longitudinal alteration are normal. This advantage is
remarkable especially in a double disc structure which is widening significantly in the
rearwards direction.

The positioning and formation of the side wheel so that the suspension arm may be
positioned between the side wheel and the disc make the structure of the coulter unit
essentially narrower and also otherwise better, so that the coulter units may be positioned
laterally close to each other and still reduce the blockage problem.

Positioning the side wheel forward from the bearing point of the discs moves the point
at which it is against the soil surface close to the point at which the discs or disc or cutting
tool or equivalent cut into the soil and makes also the straw-cutting ability better. The side
wheel is still close enough to the point to which the seed is falling so that the seeding depth is kept in accordance with the settings accurately enough.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The invention is described in further detail in the following with reference to the accompanying drawings, in which:

Fig. 1 presents schematically from below a realisation of the coulter arrangement of a sowing machine according to the invention;

Fig. 2 presents the realisation of Fig. 1 in side view, respectively;

Figs. 3 and 4 present, respectively, in side view and in plan view and partially in section along line FV-IV of Fig. 3 an advantageous embodiment of the coulter of the invention; and

Fig. 5 presents schematically from below another realisation of the coulter arrangement of a sowing machine according to the invention.

**DETAILED DESCRIPTION OF THE INVENTION**

Figs. 1 and 2 present schematically a largely simplified example of the coulter arrangement according to the invention. Each coulter 1 comprises a frame 2 which is connected at point 7 with a pivoted attachment to the frame of the sowing machine. It is not necessary to consider the suspension of the coulters and the adjustment of their position and pressure or other details more closely. Firstly, discs 3A and 3B of a double disc arrangement are attached with bearings to the frame 2. The bearing point or the position of their rotation axis is indicated by broken line D. The discs are positioned in relation to each other in a conventional way so that their cutting edges meet each other at the forward side in relation to the driving direction E of the sowing machine approximately at point C in which they cut into the soil, and so that their rear edges are at a further distance, which is approximately the width of the frame of the coulter, from each other. The discs may be also positioned so that there is a longitudinal step between them.

A side wheel 4, which sets the depth of the seeding furrow F according to the surface S of the soil, is positioned a little forward from the discs 3A and 3B so that its axis is at G. A side wheel is placed only at the side of the disc 3A. This solution makes the coulter significantly narrower than in the case where the side wheel is positioned further rearwards in relation to the disc. At the same time, the side wheel is, however, quite close to the point at which the seed fall into the furrow (see the inlets 10 and 12 for the feeding pipes in Fig. 2) so that the working depth is kept accurately enough in accordance with the settings. The front edge of the side wheel 4 extends clearly forward from the front edge of the disc 3A.
A further feature of the exemplary coulter arrangement is that it includes only one packing wheel 6 which is positioned essentially on the feeding line L behind the discs and separate from them. The suspension 6, 8, 9 or the adjustments of the packing wheel are not considered in further detail here, either, because they are not related to the invention. Instead of the packing wheel, some other packing device may be used.

The invention concerns primarily the combination of the disc arrangement, the side wheel and their suspensions. The solution according to the invention makes possible that the coulters may be positioned laterally at a normal distance W of 12 to 15 centimeters from each other, and with conventional dimensioning the longitudinal alternation T between the coulters may be within 20 to 25 centimeters.

Both the lateral distance and the longitudinal alternation may, of course, vary widely e.g. so that the first one is within 10 to 20 centimeters and the latter within 10 to 40 centimeters. A large enough space is then remained between the side wheel and the other disc 3B of the coulter so that the risk of blockage is low.

Figs. 3 and 4 present a suspension of the side wheel 4 which makes possible the compact positioning of the coulters in relation to each other so that no blockage problem due to too tight clearances between the coulters is caused. The structure of the side wheel 4 is such that there is a plate-like central part 17 to which the hub of the wheel is attached, and a supporting periphery 18 extending inwards towards the disc 3A and almost contacting it, the periphery being provided with a suitable coating 19, e.g. rubber ring. The side wheel is positioned so that a large enough opening 20 remains between its periphery 18 and the outer edge of the disc 3A. The suspension arm 12 is positioned inside the frame of the coulter and the side wheel and curved suitably so that it may be brought into the space between the coulter disc 3A and the side wheel 4. The suspension arm 12 is curved advantageously so that it is directed at the opening 20 between the disc 3A and the periphery 18 of the side wheel towards the opening. The angle of the curve of the suspension arm 12 in relation to the longitudinal direction E of the frame 2 and the coulter may be e.g. of the order of 30 to 50 degrees but it may also larger, even 90 degrees.

The suspension arm 12 is attached pivotally to the frame 2 of the coulter with an axle 13 on which the position of the arm may be adjusted by means of an adjustment mechanism formed by a lever 14 and an eccentric 15.

Despite of that that there will be no additional parts which could cause blockages between the coulters in this arrangement, the creation of blockages is avoided also between the side wheel and its suspension arm. Some soil, straw and other matter from the surface of the field get easily stuck to the periphery of the side wheel. If the suspension arm is positioned outside the side wheel, it must be positioned close to both the periphery and the
outer side of the wheel. Then, said blockages are easily created on the other hand between the suspension arm and the adjacent coulter and on the other hand between the side wheel and the suspension arm, whereby the side wheel stops rotating and the blockage and the harm caused by it become even worse. In the arrangement according to the invention, the periphery and the outer side of the side wheel are surrounded by an empty space and no blockages are created there.

In the coulter arrangement of Figs. 3 and 4, the suspension arm 12 is positioned and curved also so that a large enough space 22 remains between it and the inner edge 21 of the side wheel so that creation of blockages is prevented there. The inner side 21 of the side wheel loosens from the surface of the disc 3A soil and plant scrap which get jammed between the inner side and the suspension arm if the gap is too small.

Fig. 5 presents a solution corresponding to the coulter arrangement of Fig. 1 in which solution the other disc in the disc arrangement opening the furrow is replaced by a cutting tool or equivalent device 3C positioned at the side of the disc 3A so that it opens the seeding furrow together with the disc 3A. The cutting tool or equivalent device 3C is presented only schematically in Fig. 5. Otherwise the coulter arrangement of Fig. 5 is similar to the coulter device of Fig. 1.

The invention may vary within the scope of the accompanying claims.
CLAIMS

1. Coulter arrangement of a sowing machine, in which a coulter (1) comprises a frame (2), a
disc arrangement (3A, 3B; 3A, 3C) for opening a seeding furrow (F) and an arrangement for
setting the seeding depth, characterised in that the arrangement for setting the seeding
depth comprises at the side of the disc (3A) or only one disc (3A) of the two discs a side
wheel (4) positioned so that its axis (G) is in the driving direction (E) of the sowing machine
forward from the bearing point (D) of the discs (3A, 3B), wherein the coulters (1) may be
positioned by means of a small alternation (T) in the longitudinal direction laterally at a
small seeding distance (W) from each other keeping at the same time space between the
coulters for avoiding blockages.

2. Coulter arrangement according to claim 1, characterised in that the side wheel (4) is
formed so that it includes a plate-like central part (17) to which the hub (16) of the wheel is
attached and a periphery (18) extending towards the disc (3A), whereby the suspension arm
(12) of the side wheel is positioned so that it goes through the opening (20) between the disc
(3A) and the periphery (18) of the side wheel into the space between the side wheel (4) and
the disc (3A) where it is connected to the hub (16) of the side wheel.

3. Coulter arrangement according to claim 2, characterised in that said suspension arm (12)
is curved so that it at the opening (20) between said disc (3A) and the periphery (18) of the
side wheel is directed towards the opening.

4. Coulter arrangement according to claim 2, characterised in that said suspension arm (12)
is positioned and curved so that a space (22) is remained between it and the inner side (21)
of the side wheel (18) for preventing blockages from being formed there.

5. Coulter arrangement according to claim 1, characterised in that the coulter arrangement
is a double disc arrangement (3A, 3B).

6. Coulter arrangement according to claim 1, characterised in that it further comprises
means (5) for packing the seeding furrow positioned essentially on the seeding line (L)
rearwards and separate from the disc arrangement (3A, 3B; 3A, 3C).

7. Coulter arrangement according to claim 6, characterised in that the packing means
include a packing wheel (5).
INTERNATIONAL SEARCH REPORT

International application No
PCT/FI2010/050120

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: A01C

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

Fi, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 2008257238 A1 (FRIESEN DICK EDWARD) 23 October 2008 (23.10.2008) abstract; figures 1-3, 5, 6, 8, 10</td>
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