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(54) HAYMAKING MACHINE

(71) We, MASCHINENFABRIK FAHR AKTIENGESELLSCHAFT GOTTMADINGEN, a German Company of 7702 Gottmadingen, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the followng statement:-

The invention relates to a hay-making machine of the kind having a machine frame, at least one tine spinner as hereinafter defined, a supporting wheel for supporting the tine spinner(s) at an adjustable height above the ground or soil, the tine spinner(s) preferably being supportable at an adjustable height above the ground by a hydraulic cylinder mounted on a supporting wheel, a tow bar adapted to secure the machine to the linkage draw bar of a tractor and swivellable relative to the machine frame about a shaft extending transversely of the direction of travel of the machine.

By "tine spinner" we mean a device for rotating at least one tine mounted on a support arm about a substantially vertical axis.

With one known hay-making machine of this type (German Offenlegungsschrift 2,206,125), a factor which we find inconvenient is that, with the height adjustment of the tine spinner as hereinbefore defined with the aid of the hydraulic cylinder of the supporting wheel, the said spinner reaches an inclined position in which the tines of the said spinner which at the time are at the front in the direction of travel show a smaller distance from the ground than the rear tines which are opposite the said front tines. Consequently, in order to increase the ground clearance, an alteration in the slope of the machine frame becomes necessary, while also the tow bar is swung relatively to the machine frame and secured in position. A threaded spindle is usually employed for this purpose. This adjustment of the tow bar is not always convenient and may prove to be complicating and time-wasting. We have found this to be disadvantageous especially when turning operations are carried out at the end of the field. It is our experience that it is just in these circumstances that the operator does in fact have to actuate the hydraulic cylinder of the supporting wheel each time and thereafter to adjust the tow bar *via* the threaded spindle.

Such a swinging and securing of the tow bar in relation to the machine frame we find to be necessary when the hay-making machine is to be connected to tractors having heights of the linkage draw bars which are different from one another, and also when it is necessary to compensate for different conditions of the soil.

The invention has for its object so to further develop and improve the hay-making machine of the kind referred to in the opening paragraph so that not only the height adjustment of the tine spinner, but also the swivelling and securing of the tow bar relatively to the machine frame, are possible quickly and conveniently and in a very simple manner.

According to the invention there is provided a hay-making machine having a machine frame, at least one tine spinner as hereinbefore defined, a supporting wheel for supporting the tine spinner(s) at an adjustable height above the ground or soil, a tow bar adapted to secure the machine to the linkage draw bar of a tractor and swivellable relative to the machine frame about a shaft extending transversely of the direction of travel of the machine, wherein a hydraulic cylinder (A) enabling swivelling and securing the position of the tow bar to be effected is connected between the tow bar and machine frame. Preferably the tine spinner(s) is/are supportable at an adjustable height above the ground or soil by a

hydraulic cylinder (B) mounted on a supporting wheel.

With a machine constructed in this preferred way, it is possible by a few manipulations not only for the tine spinner(s) to be hydraulically adjusted in height relatively to the ground or soil *via* the supporting wheel associated with it, but it is also possible for an inclination of the machine resulting therefrom to be compensated for by changing the position of the tow bar relatively to the machine frame by a convenient control of the tow bar hydraulic cylinder serving to swivel and fix the said bar. With the assistance of this tow bar hydraulic cylinder, it is in addition possible for the machine to be adapted very simply to tractors with different heights of the linkage draw bar. Finally, it is also possible conveniently to compensate for different soil or ground conditions.

In a further advantageous development, a preferred feature which has proved to be extremely advantageous as regards simplifying the operation of the preferred form of hay-making machine according to the invention is that the tow bar hydraulic cylinder is connected to the supporting wheel hydraulic cylinder *via* a pressure medium conduit common to both hydraulic cylinders and permitting simultaneous admission of pressure to the cylinders in order to set the spacing from the ground of tines associated with a said tine spinner, the said conduit being connected *via* a valve to a source of pressurised medium. With such an embodiment of the machine, it is possible by simply actuating the valve for pressure to be admitted simultaneously to both the supporting wheel hydraulic cylinder and the tow bar hydraulic cylinder, which leads to an extremely rapid changing over of the machine from the operating position to the transporting position, and *vice versa*.

The machine may have a threaded spindle to enable the tow bar to be adjusted relative to the machine frame, and in such a case it is very expedient if the threaded spindle is connected between the tow bar and one of the arms of a pivotally mounted bell-crank lever, the other arm of which being engaged by the tow bar hydraulic cylinder enables swivelling and securing the position of the tow bar to be effected. It becomes possible to select the basic setting of the hay-making position in its working position by means of the threaded spindle; starting from this basic position, the simple and simultaneous actuation of the hydraulic cylinders of the supporting wheel and of the tow bar is sufficient for transferring the machine into the transporting position and respectively back into the pre-established working position.

A hay-making machine which constructionally is particularly simple has a driving shaft connected to gearing for the tine spinner(s), two machine frame plates which extend from the said gearing substantially parallel to one another towards the front end of the machine, the two machine frame plates containing between them the driving shaft mounted in a protective tube and carrying the shaft extending transversely of the direction of travel, on which shaft are pivotally mounted the tow bar and the bell-crank lever.

It has been found to be extremely satisfactory in this connection if the pressure medium pipe lead from the valve, is guided along the protective tube of the driving shaft and through the tine spinner(s) gearing to the hydraulic cylinder of the supporting wheel, the pressure medium conduit being provided in the region of the protective tube of the driving shaft with a branch line leading to the hydraulic cylinder of the tow bar.

In the accompanying drawings, a preferred form of the invention is illustrated as an example by means of a side elevation of a hay-making machine.

As will be apparent from the drawing, and as regards the hay-making machine which is illustrated, what is concerned is a machine having at least one tine-spinner (as hereinbefore defined) 1, which comprises radially extending support arms 2 carrying tines 3. In a manner which is not clearly illustrated, the support arms 2, as they revolve, are respectively swivellable about their own axes around the approximately vertical tine spinner axis 4. It is always only a partial region of their rotational path that the tines 3 sweep with their tips over the ground or soil, so that they pick up the harvested material, carry it along and, because of the swivelling of the tines, are able to deposit said material, with formation of swaths of windrows.

The hay-making machine comprises a machine frame 5, on which is mounted the tine-spinner 1, for the driving of which is provided a gearing 6 positioned above the tine spinner and a driving shaft 7 leading to the said gearing and arranged in a protective tube 8. The machine frame 5 comprises two frame plates 9, of which only one plate is to be seen in the drawing. Starting from the tine-spinner gear 6, these machine frame plates 9 extend substantially parallel to one another towards the front end of the machine and contain between them the protective tube 8 with the driving shaft 7. Provided on the outer end of the driving shaft 7 is a plug-in coupling 10 for the connection of a cardan shaft 11 extending to the take-off shaft of the tractor. On a lower trapezoidal extension, the machine frame plates 9 carry a shaft 12 (horizontally disposed when in use) which extends tranverse-

ly of the direction of travel. Swivellably mounted on this shaft 12 is a tow bar 13, which is capable of being connected to the linkage draw bar 14 on bottom guide members 15 of a tractor which is not shown in greater detail. A bell-crank lever 16 is also swivellably mounted on the shaft 12. A hydraulic cylinder 17 (hydraulic cylinder (A)) for the tow bar and serving to establish the swivelling movement of said bar and for securing the position thereof engages on one arm of the said bell-crank lever, the said cylinder 17 being pivotally mounted on the machine frame. Connected between the other arm of the bell-crank lever 16 and the tow bar 13 is a threaded spindle 18 having a crank lever 19. By turning the crank lever 19, it is possible to adjust the relative position of the bell-crank lever 16 in relation to the tow bar 13. When pressure is admitted to the hydraulic cylinder 17 of the tow bar, the bell-crank lever 16 and, with it, through the threaded spindle 18, the tow bar 13 is swung relatively to the machine frame 5 about the shaft 12 and is fixed in the respective swivelled position.

Associated with the tine spinner 1 is a supporting wheel 20, this wheel being mounted on an arm 21 which is swivellably mounted on a supporting plate 22. The said supporting plate 22 is fixed on a shaft 23 underneath the tine spinner. This shaft 23 also has swivellably mounted thereon a hydraulic cylinder 24 (hydraulic cylinder (B)) for the supporting wheel, the said cylinder engaging at the other end on the outer end of the arm 21 carrying the supporting wheel 20.

A pipe 25 for pressurised medium is guided through the tine-spinner gear 6 to the hydraulic cylinder 24 for the supporting wheel, said pipe being guided along the protective tube 8 of the driving shaft 7. In the region of the protective tube 8, the pipe 25 for the pressurised medium is provided with a branch line 26 to the hydraulic cylinder 17 of the tow bar. The pressurised medium pipe 25 starts from a valve 27 which is fixed on the forward end of the machine frame 5, it being possible for the said valve to be connected to a source of pressurised medium which is not shown and which is available on the tractor.

By operating the valve 27, it is possible for pressurised medium to be supplied simultaneously to both the hydraulic cylinder 17 of the tow bar and the hydraulic cylinder 24 of the supporting wheel, so as to produce simultaneously an adjustment in height of the tine spinner 1 and a swivelling of the tow bar 13. Obviously, it is also possible by means of the valve 27 to control the discharge from the hydraulic cylinders 17 and 24. In order to guarantee this discharge, a return spring (not shown in detail) is associated with the hydraulic cylinder of the tow bar. Such a spring is unnecessary as regards the hydraulic cylinder 24 of the supporting wheel, since the weight of the implement is sufficient to bring it into the initial position.

WHAT WE CLAIM IS:-

1. A hay-making machine having a machine frame, at least one tine spinner as hereinbefore defined, a supporting wheel for spporting the tine spinner(s) at an adjustable height above the ground or soil, a tow bar adapted to secure the machine to the linkage draw bar of a tractor and swivellable relative to the machine frame about a shaft extending transversely of the direction of travel of the machine, wherein a hydraulic cylinder (A) enabling swivelling and securing the position of the tow bar to be effected is connected between the tow bar and machine frame.

2. Hay-making machine according to Claim 1, wherein the tine spinner(s) is/are supportable at an adjustable height above the ground or soil by a hydraulic cylinder (B) mounted on a supporting wheel.

3. Hay-making mahine according to Claim 2, wherein the hydraulic cylinder (A) is connected to the hydraulic cylinder (B) *via* a pressure medium conduit common to both hydraulic cylinders and permitting simultaneous admission of pressure to the cylinders in order to set the spacing from the ground of tines associated with a said tine spinner, the said conduit being connected *via* a valve to source of pressurized medium.

4. Hay-making machine according to any preceding claim, having a threaded spindle to enable the tow bar to be adjusted relative to the machine frame, wherein the threaded spindle is connected between the tow bar and one arm of a pivotally mounted bell-crank lever, the other arm of the lever being engaged by the hydraulic cylinder (A) for swivelling the tow bar.

5. Hay-making machine according to Claim 4, having a driving shaft connected to gearing for the tine spinner(s), two machine frame plates which extend from the said gearing substantially parallel to one another towards the front edge of the machine, the two machine frame plates containing between them the driving shaft mounted in a protective tube and carrying the shaft extending transversely of the direction of travel, on which transversely extending shaft are pivotally mounted the tow bar and the bell-crank lever.

6. Hay-making machine according to Claims 3 and 5, wherein the pressure medium conduit leads from the valve, is guided along the protective tube of the driving shaft and through the tine spinner(s) gearing to the supporting wheel hydraulic cylinder, the pressure medium conduit

being provided in the region of the protective tube of the driving shaft with a branch line leading to the hydraulic cylinder (A).

7. A hay-making machine substantially as herein described with reference to and as shown in the accompanying drawing.

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1571462 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*