Plough with symmetrical bodies and mould boards and shares comprising a coupler (1) provided with a pivot (3) about which a main frame (4) may oscillate freely and receive a pivot about which oscillates the foot of a hydraulic cylinder (17) actuating alone, a beam (8) oscillating about a pivot (7) belonging to said frame as well as the elements supported by said beam, regularly spaced along its length, body carrier assemblies which may include each a security system and receiving a mould board, a share, a set of two right and left skimmers or a single skimmer, or a single deflector per body, and a rudder fixed to the rear part thereof, characterized by the frame (4) which oscillates on its pivot (3) when passing from one working direction to the other, without guiding system or any other driving means forcing it to oscillate, by a single power source such as a hydraulic cylinder (17) causing at least the displacement of five elements namely the frame, the body-carrier beam, the bodies, the skimmer, the rudder, and also characterized by a symmetrical mould board (11) presenting a horizontally (46) and vertically (47) hollow concave working surface, as well as each lateral extremity, taken in a frontal position, receding from bottom to top backwardly, by a share (12) comprised of two symmetrical pieces (50) separated between each other by at least a third piece (49), by a single deflector (45) comprised at least of three umbrella-shaped elements of which the two extreme elements are symmetrical, by a single rudder blade (21) for both working directions, by two right and left elements, each including the surfaces (72 and 73) which are alternatingly retractable in order to occupy the position and perform the work, one on the mould board side and the other one on the skimmer side, or by a single skimmer element of which the support (88) performs a double motion of pivoting on itself and side displacement, by a stay of which one portion (78) has a shape of a rail acting as a guiding path for an element (79) connected to the sole (36) supporting the working parts, the share and the mould board.
A PLOW WITH SYMMETRICAL BODIES

The present invention relates to a plow with one or more bodies each having a share and a mold-board of a special symmetrical shape, with variable working width and angle and intended to be connected to a tractor provided with a hitch for a trailed tool or with a two or three point linkage for a mounted or a semi-mounted tool.

In the past, changing the working direction as required by so-called "flat" plowing has been done by rotating the body-carrying frame which is fitted with "righthand" bodies and with "lefthand" bodies, thereby increasing the number of parts, and increasing the weight of the plow to the detriment of plow price and tractor performance. Each body is provided with a side piece called a "landside" bearing against the wall of the furrow and intended to prevent the plow from skidding sideways by virtue of the force exerted on the mold-board by the earth, with the mold-board being at an angle of attack $\alpha$ to the line of advance. The presence of the landsides further increases length, since the strip of earth to be turned over can do so freely only after each landside fixed on the preceding body has gone past.

With conventional reversible plows, the body-supporting frame pivots about a horizontal axis fixed to the hitch with the working position of the bodies parallel to the ground being obtained by limiting the end of the stroke of the rotary motion. The principle is known of a plow having symmetrical bodies and a vertically oriented pivot about which the body-carrying beam swivels while being driven or guided by an adjustable system fixed to the hitch, enabling it to move progressively in its stroke so as to reach a position in which the bodies are placed parallel to the ground.

The principle of symmetrical bodies is known, but their mold-boards constituted by elements which are cylindrical or semi-helical in shape and of excess length at the top both behind and in front, suffer from a lack of vertical trailing angle going backwards and downwards, thereby giving rise to front end clogging leading to insufficient penetration and to
irregular burying of organic matter. Further, the junction between the outside side face of the plow share and the front, spur-shaped base of the mold-board constitutes an angle in whose hollow ground roots are retained, causing clogging to take place more quickly on entry into the ground when the same side face of the mold-board is used the next time.

A plow share is known constituted by two elements so that the forward portion, which opens the furrow and which wears more quickly, can be changed prior to changing the rear portion.

With conventional bodies, two principal types of equipment are known for projecting surface debris at the front of the body towards the furrow dug by the preceding body: a deflector in the form of a curved member disposed in front of the top portion of the mold-board; and a skimmer placed in front of the foremost portion of the mold-board; with both of these equipments serving solely to sweep the outer top portion of the strip to be plowed over less than one half of its width. When using a symmetrical body with two of such conventional units, current plows do not make it possible to work without clogging caused by the units situated at the rear of the mold-boards. Obstruction occurs between the two deflectors. Using skimmers, the skimmer situated facing the rear must retract in order to keep out of the way of the stream of earth arriving from the front of the mold-board.

At present, in order to satisfy conditions due to various types of earth, it is necessary to use mold-boards of different shapes, in particular at their rear ends, thereby requiring the manufacturer to store a variety of bodies. However a given user cannot change bodies as a function of conditions encountered on his farm since that would be too expensive and would take too long. In addition, on current plows, the user cannot vary the angle of the bodies.

Finally, plow body safety systems are known enabling the edge of the plow share to rise in a horizontal plane which moves vertically more or less parallel to the ground, with it being possible to retract the share whose tip pivots about an axis, however these two operations do not take place simulta-
neously and each of them presents its own drawback, with the first drawback being that the body takes up the selected depth over too long a distance, and the second being a mold-board which is vertically directed and which does not turn over the earth, with this second drawback occurring on all other systems having a share which pivots about a single direction about a pivot or an infinity of directions about a point.

In the past, so-called "flat" plowing has been possible using only one ground-working element only by using plows of a different category having disks that rotate, however this differently designed tool does not give satisfaction required by a very large number of users since there is no friction between the ground and a fixed portion of the plow.

The present invention seeks to provide possible ways of satisfying the above-mentioned drawbacks and insufficiencies and to provide solutions which are more effective and/or less expensive by proposing:

1. A main frame supporting the body-carrying beam and positioned relative to the hitch frame so as to make alternating contact with leveling abutments by pivoting thereon, without requiring guidance or drive means between said two frames, and a hitch frame whose locking to the main frame is unlocked by the beam itself.

2. A special shape of symmetrical mold-board and share that plow properly in both working directions.

3. A system for adjusting the angle of the bodies independently of the width over which each body works.

4. A rudder principle guiding the plow and replacing all of the landsides.

5. A single deflector system for both working directions, serving to bury surface plant residues properly.

6. A system using two skimmers operating alternatively as a skimmer and as a portion of the mold-board, or a system having a single skimmer for both working directions.

7. A single safety system for both working directions.

The various portions of the invention will be better understood from reading the following description and from
examining the accompanying drawings which show several embodiments of the various elements used in the invention by way of non-limiting example.

In the drawings:

Figure 1 is a plan view of a plow in accordance with the invention at work turning earth over to the right, said view omitting: the deflector, the skimmers, and the body safety means which are mentioned below. Detail A shows the front pivot control, and detail B shows the control for the rear pivots 55.

Figure 2 shows the same assembly in longitudinal section with the body-carrying beam in its middle position.

Figure 3 shows a locking system between the hitch frame and the main frame (with the front end of the beam moving from left to right as shown by its wheel 6), with the main frame supporting the body-carrying beam which releases said frames by pivoting: this view is a perspective view on aa' (Figure 2).

Figure 4 shows the shape of a conventional body.

Figure 5 shows the shape of a body, mold-boards, and share in accordance with the invention.

Figure 6 shows a rear rudder positioned on the rear body or controlled by the system for pivoting the bodies on the beam.

Figure 7 shows a body deflector which is adjustable relative to the mold-board, thereby improving the work performed by the body.

Figure 8 shows an alternating skimmer system where the skimmers also act as portions of the mold-board.

Figure 9 is a profile view of a multi-direction safety system.

Figure 10 is a rear half view of the same assembly.

Figure 11 is a detailed perspective view of the running path of the safety system.

Figure 12 is a perspective view of a system having a single skimmer which is controlled by pivoting the body support.
Figures 13, 14, and 15 are diagrams showing the skimmer respectively in its right position, its middle position, and its left position.

The assembly constituted by Figures 1, 2, and 6 bis comprises a hitch frame 1 having pins 2 which are hitched to the draw bars of the tractor, a pivot shaft 3 which connects it to the main frame 4 which pivots thereon, and an arm 5 whose other end is provided with a locking hook 28 for locking together said two frames and which is described below. The horizontal rear portion of the main frame 4 is provided with a vertical pivot 7 about which the beam 8 swivels from right to left and vice versa, said beam 8 being fitted with a plurality of pivots 9 which to which the elements for working the ground, i.e. the mold-boards 11 and the shares 12 are fixed via soles 36 and supports 10. Instead of a rigid strut 10, each pivot 9 may receive an optional safety system as described below between itself and its sole 36. Each pivot 9 has a crank 13 fixed thereon, with the cranks all being coupled to a link 14. One of the pivots 9 has an additional crank 15 provided with a terminal pin 16 which receives the piston rod of a hydraulic actuator 17 whose other end swivels about an axis 18 which is fixed to the main frame 4. Two sets of adjustable abutments 19 and 20 are fixed respectively on the beam 8 and on the frame 4 and serve respectively to limit the amplitude of the bodies relative to the beam delimiting the body attack angle, and the stroke of the beam delimiting the total working width of the bodies. A rudder 21 situated behind the last share is fixed to the bottom portion of a post 22 which pivots relative to the beam 8 and which is rigidly connected to a gear wheel 23 meshing with another gear wheel 24 fixed to the last pivot 9 or to any other link means between the post 22 and the pivot 9. The post 22 receives a yoke 25 with its right end connected to a cable 26 connected to the skimmer handles on that side of the beam 8, and with its left end connected to another cable 27 connected to the skimmer handles on the other side. When working width is altered, the position of the yoke may be angularly adjusted relative to the post 22 by means of two
slots without altering the body angle of attack, thereby maintaining the skimmers in proper position.

The assembly constituted by Figure 3 comprises an arm 5 fixed to the pivot shaft 3. The end of the arm 5 is hinged to a double-headed hook 28 about a pin 29. A sector 30 fixed to the frame 4 receives two adjustable abutments 31 which limit the stroke of the frame 4 by stopping it on contact between its abutments and the arm 5 while the corresponding hooked portion 32 of the hook 28 simultaneously engages in the abutment at 33 and is held in place by spring 34 pulling on the hook, with its other end 35 being fixed to the frame 4. The opposite other spring performs the same function by pulling likewise on the other end of the hook. The positions and the fixing of the springs at their ends and the position of the pin 29 are such that, when the double-headed hook pivots from right to left under thrust from the wheel 6 fixed at the end of the beam 8 (which is then being driven by force from the hydraulic actuator), which beam strikes alternately against bars 37 and 38, the lines of traction of the springs pass alternately to opposite sides of the pin 29. Thus, when the beam is in the working position, the hook is held in place at 33, and while the beam is pivoting the hook is in contact with the bar of abutment 31 until it engages at 33 with the frame pivoting and bearing against the abutment. The horizontal distance in a vertical plane between the pivot 3 and the axis 7 is selected so that a plow having three bodies or more in accordance with the invention, together with the various items received by the beam, is heavier behind the axis 7 than in front of it. Thus, after unlocking the two frames and as soon as it has passed through the plane of symmetry, said beam tilts together with the main frame 4 and without any guidance or other means so as to take up the appropriate level on the opposite side as determined by one of the abutments 31, with the resting surface 40 on which the wheel 6 rests not acting as a leveling slope, and indeed not being fixed to the hitch frame 1, but being fixed on the frame 4.
The assembly shown in Figure 4 comprises a conventional plow body having a mold-board 41 with all of its horizontal generator lines being straight or convex going rearwards, thereby requiring a long mold-board in order to turn over the strip of earth properly since otherwise the earth falls down behind it without being turned over sufficiently. The leading attack angle \( \alpha \) formed by a horizontal generator line and a line of advance parallel to the landside 42 is large enough to mean that the pressure on the mold-board requires a landside to extend over the entire length of the body in order to prevent the plow from skidding sideways. For a given angle \( \alpha \), the longer the mold-board, the more adherence to the ground requires additional traction power over and above that required by the lateral pressure of the landside 42 against the wall of the furrow against which it is pressed. The share is constituted by a single piece 43 optionally having a tip 44 at its leading end to facilitate penetration of the body into the earth by bursting, or else it comprises a maximum of two parts with the leading part having a tip and being replaceable more frequently.

Figure 5 shows an assembly constituting a body in accordance with the invention. In accordance with the invention, the working face of the mold-board 11 has a concave surface which may represent all or a portion of the surface of the mold-board, with horizontal generator lines 46 that are concave with their overall shape corresponding to a given type of earth to be plowed, and with the degree of concavity varying from bottom to top. The concavity is generally more marked at the top in order to accentuate turning over, thereby reducing the effective working length of the mold-board over which earth passes. The mold-board angle of attack \( \alpha \) is smaller, thereby avoiding the use of a landside on the body. Such a body which is hollow in two directions, i.e. horizontally 46 and vertically 47, gives rise to a mold-board which is shorter at the top and gives rise to reduced lateral force, thereby requiring less tractive power. In accordance with the invention, this reduction in length makes it possible to provide a front edge to the mold-board at its front end portion.
which is closest to the vertical when projected on a vertical plane parallel to the direction of advance which is a line generally close to a straight line forming a rearwardly trailing angle $\beta$ relative to the horizontal which is always less than 90°. In addition, in order to avoid a sharp angle that would slow down the flow over the share/mold-board junction of debris such as roots or plants, said junction has a curved portion 48 in accordance with the invention. The share 11 has the special feature, in accordance with the invention, of being built up from a plurality of elements, including two symmetrical parts 50 each optionally incorporating a tip, which two parts are separated from each other by at least one cutting element 49 of the share.

The assembly shown in Figure 6 comprises a vertically directed shaft 51 having a guide plate 21 at its bottom end with the bottom edge of the guide plate being situated substantially at the same level as the bottom of the share 12, said shaft pivoting in a sleeve 52 which is fixed to the strut 10 with the top end of the shaft being fitted with a stay 53 which comes into contact with one or other of two abutments 54, depending on the working direction, said abutments being adjustable depending on the angle of attack adopted for the body. Instead of being fixed to the strut 10, the sleeve 52 could be received in the beam 8, in which case the shaft 22 (see Figure 6 bis) would be connected to the control 14 for pivoting the bodies via a connection 52 for pivoting the rudders at the same time as the bodies are pivoted.

The assembly shown in Figure 7 has the general shape 45 of three sectors of an umbrella. The end two sectors are symmetrical whereas the middle sector, which may be of different area, has a vertical plane of symmetry which coincides with the vertical plane of symmetry of the body. The tip P is the top-most portion directed forwardly and the bottom periphery is in contact with the mold-board. The end sectors ABP and A'B'P act in respective plowing directions as surface debris deflectors, which debris therefore falls further forward so as to be buried, with the sector PBB' serving to direct earth towards
the rear of the mold-board. The assembly is connected to the strut 10 by a conventional rodding system enabling its height to be adjusted depending on the depth of plowing. Such a deflector in accordance with the invention is an improvement of the mold-board 11.

The assembly shown in Figure 8 comprises a group of two (left and right) skimmers. Each is constituted by a support 56 which is assembled to the strut 10, said support receiving a pin 57 about which a top handle 58 pivots, which handle is connected to a bottom handle 59 by a hinge 60, with motion being limited by a thrust plate 61 engaging an adjustable abutment 63 on the support 56 under the action of a spring 67 connected to the strut 10 by means of an arm 68. The bottom handle 59 receives a sleeve 69 which is adjustable thereon by means of a screw 70 which receives a shaped plate 71 on which a mold-board 72 and a share 73 are fixed. All of the handles of a given side are connected by a cable 26 connected at the rear to one of the ends of the yoke 25 connected to the post 22 of the rudder 21, with the other end of the yoke receiving the cable 27 interconnecting the handles 58 of the opposite skimmers.

The assembly constituted by Figures 9, 10, and 11 comprises: the top portion 74 of the strut connected to the pivot 9 by a plate 75 and a hinge 76 whose oscillation is limited by a flexible abutment 77; and a rigid rail portion 78 on the top portion 74 in which at least one wheel 79 runs, said wheel being supported by a shaft fixed on the sole 36 which receives the mold-board 11 and the share 12 and also the ends 80 of a pair of flexible links 81, each of whose top ends oscillate about a respective pins 82 fixed to the plate 75.

The assembly shown in Figure 12 includes rigid arms 83 on the support strut 10 receiving the wheel 84 which is capable of moving along a slot 85 in the arm 86 which swivels about a pin 87 on the beam 8. The arm 86 receives the support 88 for the mold-board and the plow share, which support pivots on the arm at 89 and which has a crank 90 rigidly received therewith receiving a rigid or flexible connection 91 whose other end is connected at 92 to the beam 8.
Operation is as follows:

When the tractor arrives at the end of the field in order to return along the line left by the last body, e.g. by right-hand plowing, the plow is lifted off the ground, the hydraulic actuator 18 is actuated, the beam 8 leaves its right abutment 20, with its front wheel 6 tilting the hook 28 by thrust against the bar 37, thereby disconnecting 32 with 33 situated to the right and releasing both the hitch frame 1 and the main frame 4 to pivot relative to each other as far as the center of gravity situated behind the axis 7, under the action of the actuator, after passing through the vertical plane of symmetry passing through the axis 3, coming from the side opposite to said plane, with the left to right pivoting motion of the main frame 4 being stopped by contact with the opposite left abutment 31 on the arm 5, the wheel 6 locking the hook 28 at 33 with the hook being held in place under traction from the spring 34 whose line of traction has passed beneath the pin 29. The beam continues its stroke until its encounters the left abutment 20. If the crank 15 pulled by the hydraulic actuator rod does not move during pivoting, then after the beam 18 makes contact with the abutment 20, the actuator thrusts the crank 15 until contact is made with the left abutment 19 at the leading angle of attack selected for the bodies.

In its displacement, the control 14 linking the cranks and the pivots 9 also causes the rear rudder 21 to pivot from right to left. As it rotates, the post 22 also moves the cables 26 and 27, thereby changing the positions of the skimmers, and this action is assisted by the tension in the springs 67. The righthand skimmers leave their mold-board positions to take up skimmer positions while the opposite occurs with the lefthand skimmers. On pivoting at 69, the plowing shape is changed.

When the plow is fitted with a single assembly of single skimmers, when changing from one working direction to the other, the pivot 9 as driven by the control 14 causes the wheel 84 to pivot the arm 86 while moving in the slot 85 thereof. Simultaneously, the connection 91 causes the support 88 to
pivot. These movements together cause the skimmer to be moved correctly from one working position to the opposite working position as shown by Figures 13 and 15.

When the bodies are protected by a safety system, with the skimmers being controlled hydraulically and independently for each body in order to avoid untimely displacements thereof during movements of the safety system, and when the portion in the ground (the share or the mold-board) encounters an obstacle, then various different movements are possible: if the obstacle, e.g. a stone, is situated at the front, the body tilts about the wheel support axis 79 while the wheel runs along the rail 78, thereby compressing resilient systems which reposition the body after the obstacle has been passed; if the obstacle is situated towards the back or in the middle, the body rises as guided by the wheel in the rail 78 and may also cause the top portion 74 and the rail to pivot about the top axis 76. Finally, the three motions: tilting, running of the wheel, and pivoting about the top axis, may be provoked simultaneously under pressure from the resilient systems 81.

In most cases, the body moves close to and parallel with the ground, thereby ensuring better protection of the plow overall from the point of view of mechanical strength and also providing greater continuity in the turning over of the earth.
CLAIMS

1/ A plow having symmetrical mold-boards and bodies, the plow comprising a hitch 1 connected in particular by means of a pivot 3 and a special unlocking system 28/33 to a main frame 4 which is provided with a pivot 18 receiving a hydraulic actuator 17 whose action causes a beam 8 to pivot about its axis 7 together with body carrier elements 10 provided with mold-boards 11, with a safety system 36/78 which are special, with deflectors 45, and with a single skimmer 88 or a pair of specially positioned and directed skimmers 59, together with a single rear rudder 21, characterized by the hook 28 being disconnected from the abutment 33 by means of the beam 8 being pivoted, by a symmetrical mold-board 11 having a concave working surface which is horizontally hollow 46 and vertically hollow 47, with each of its side ends taken in a front position tapering upwardly rearwardly, by a single deflector 45 for both working directions in the form of a sector of a melon, by a strut 10 constituted by a safety system including two elements 36 and 78 capable of moving longitudinally relative to each other, by a single skimmer system 88 or by a pair of right and left skimmers 59 including combined motion about two axes of rotation respectively 87/88 and 57/60 for each system, and by a rear rudder blade which pivots for the two working directions.

2/ A plow according to claim 1, more particularly characterized by the fact that the horizontal generator lines of the concave mold-board have a radius of curvature which varies from bottom to top of the mold-board.

3/ A plow according to claim 1, more particularly characterized by the fact that each side edge of the symmetrical mold-board taken in its front working position, forms a line in its portion closest to the vertical as projected on a vertical plane parallel to the line of advance, which line is generally close to a straight line tapering rearwardly upwardly such that the angle $\beta$ formed with its own projection of said tapering straight line on a horizontal plane is always less than 90°.
and having a connection at its bottom end with the share following a concave curve 48.

4/ A plow according to claim 1, more particularly characterized by the fact that the deflector 45 may be constituted by one or more sectors.

5/ A plow according to claim 1, more particularly characterized by the fact that the two elements of the safety system 37 and 78 are interconnected by a wheel 79 enabling the entire body to rotate.

6/ A plow according to claim 1, more particularly characterized by the fact that the pivoting and positioning of the single skimmer are obtained by a pivoting arm 86 itself including a shaft 89 going towards the skimmer.

7/ A plow according to claim 1, more particularly characterized by the fact that the pivoting and positioning of each of the skimmers in a pair of skimmers are obtained by a pivoting arm 58 itself including a shaft 60 going towards each skimmer.

8/ A plow according to claim 1, more particularly characterized by the fact that the blade pivots freely about an axis 51 or pivots rigidly with a shaft 22 controlled by the movement of the beam 8.

9/ A plow according to claim 1, more particularly characterized by the fact that one of the two skimmers acts as a retractable extension of the mold-board.

10/ A plow according to claim 9, more particularly characterized by the fact the retractable extension of the mold-board overlies the mold-board without the two portions, i.e. mold-board and its extension, having a common bearing surface.
ABSTRACT

A plow having symmetrical mold-boards and bodies, the plow comprising a hitch 1 connected in particular by means of a pivot 3 and a special unlocking system 28/33 to a main frame 4 which is provided with a pivot 18 receiving a hydraulic actuator 17 whose action causes a beam 8 to pivot about its axis 7 together with body carrier elements 10 provided with mold-boards 11, with a safety system 36/78 which are special, with deflectors 45, and with a single skimmer 88 or a pair of specially positioned and directed skimmers 59, together with a single rear rudder 21, characterized by the hook 28 being disconnected from the abutment 33 by means of the beam 8 being pivoted, by a symmetrical mold-board 11 having a concave working surface which is horizontally hollow 46 and vertically hollow 47, with each of its side ends taken in a front position tapering upwardly rearwardly, by a single deflector 45 for both working directions in the form of a sector of a melon, by a strut 10 constituted by a safety system including two elements 36 and 78 capable of moving longitudinally relative to each other, by a single skimmer system 88 or by a pair of right and left skimmers 59 including combined motion about two axes of rotation respectively 87/88 and 57/60 for each system, and by a rear rudder blade which pivots for the two working directions.