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MATERIAL HANDLING DEVICE

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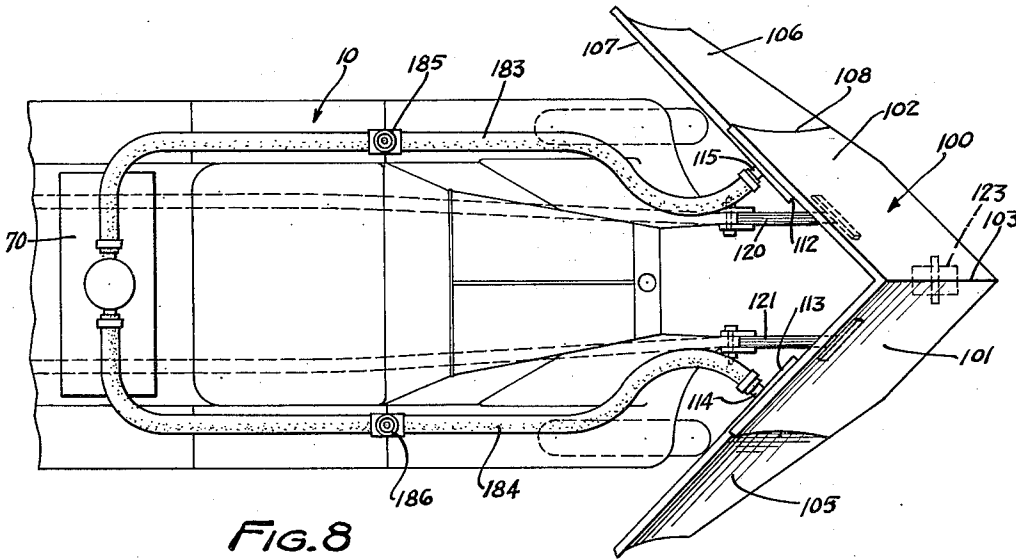


Fig. 8

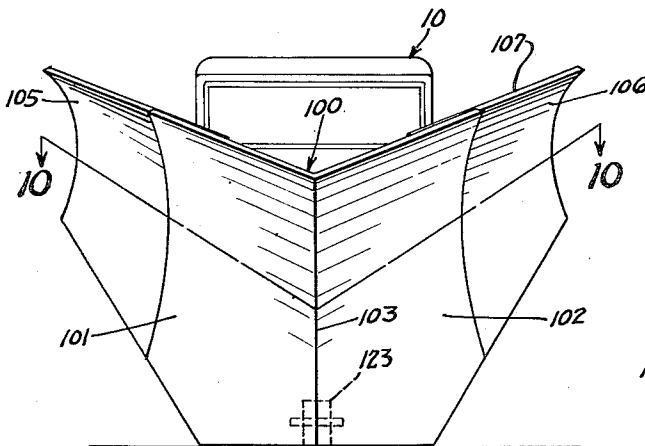


Fig. 9

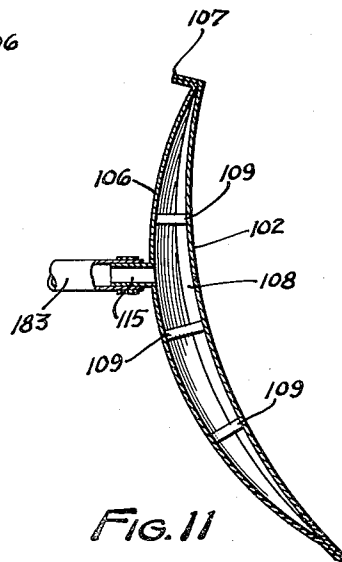


Fig. 11

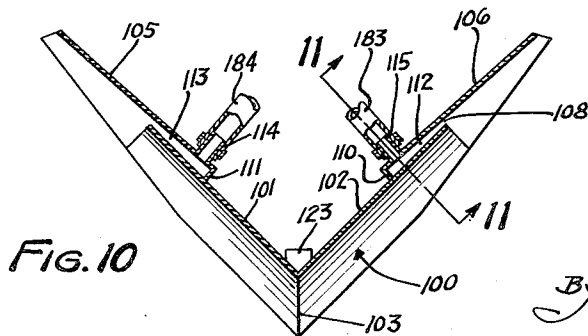


Fig. 10

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MATERIAL HANDLING DEVICE

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12 Claims. (Cl. 37—42)

The present invention relates to a method and apparatus for removing snow and other material from roadways and involves the use of air under pressure to facilitate lateral movement and disposal of the snow or other material being handled. The method of the invention is carried out by means of an apparatus having a moldboard section disposed diagonally with respect to the centerline of a propulsion vehicle. In previous devices involving the use of a diagonally disposed moldboard the material being moved, whether snow or other road material, is engaged by the diagonally positioned moldboard and is given a sidewise component of motion, and is ultimately deposited in a ridge at one side of the path being cleared. Thus with the conventional snowplow, snow is heaped along the path being cleared and forms a wall of snow on both sides, from which it frequently redrifts into the cleared space.

In order to reduce the height of the roadside deposit, the ordinary snow plow is operated at high speeds so that the snow is tossed over a wide area on the roadside. However, this expedient is not successful where deep or wet snow is encountered, where the work is done on curves, on grades, or where roadside impediments are frequently encountered. This method of snow plowing is incapable under any circumstances of widely distributing the removed material.

As another expedient for distributing the snow over a wide roadside area, snowplows have been equipped with scarfing blades set at an elevation and usually behind the main moldboard. Scarfing blades do no more than to cut down the main roadside snow wall and being mounted alongside the vehicle, have the objection that they must be retracted frequently to clear roadside obstructions.

Various mechanical material moving expedients such as feed screws, moving blades, paddle wheels and the like have also been applied to the moldboard construction, but these are all objectionable for several reasons. Firstly, it is difficult and cumbersome to transmit mechanical movements from a power source on the vehicle to a movable element in an adjustable moldboard. Secondly, any screw, paddle or blade interposed on the snow engaging surface of the moldboard forms an obstruction which prevents normal movement of the snow across the moldboard, and hence, the mechanical adjunct becomes a hindrance unless positively operated. Stated another way, the moldboard having a

mechanical adjunct cannot be operated as a plain moldboard.

According to the present invention, a pneumatic blast device is used in conjunction with a usual moldboard, or especially contrived moldboard to impel snow or other material being removed toward the trailing edge of the moldboard. Due to the pneumatic blast, the snow or other material is given a lateral movement in the direction normally moved by the moldboard, with the combined result that the snow or other material is scattered over a wide roadside strip, rather than piled in a ridge along the roadway. The danger due to redrifts is thus reduced or entirely eliminated and snow removal greatly expedited.

It is, therefore, an object of the present invention to provide a method of material handling and a material handling device having a combined moldboard and pneumatic blast device for transferring materials such as snow.

More particularly, it is an object to provide a traction vehicle having a diagonal moldboard thereon and having air blast means positioned on the vehicle for providing an air blast along the material engaging face of the moldboard toward one end thereof.

It is also an object to provide an improved moldboard construction having a material engaging face and having one or more blast nozzle means formed therein or thereon, and to provide a traction vehicle for mounting and carrying the moldboard and nozzle means, a compressed air supply device, air conduit means and auxiliary appendages such as means for controlling the air supply.

The above and other inherent and implied objects will be more apparent from the description, drawings and claims. The specific embodiments hereinafter described and illustrated are merely illustrative of the inventions involved, and may be widely varied to satisfy specific design requirements.

Figure 1 is a schematic plan view of the forward end of a traction vehicle made in accordance with the present invention;

Figure 2 is a front elevation of the improved moldboard and air blast means;

Figure 3 is a horizontal section of the improved moldboard and air blast means taken along the line 3—3 of Figure 2;

Figures 4, 5, 6 and 7 are vertical sections of the moldboard taken along the lines 4—4, 5—5, 6—6 and 7—7, respectively, of Figure 3.

Figure 8 is a partial plan view showing the

front end of a modified form of the present invention in which the moldboard is constructed in V-shape;

Figure 9 is a front elevational view of the form of invention illustrated in Figure 8.

Figure 10 is a section of the V-shape moldboard on the line 10—10.

Figure 11 is a vertical sectional view taken along lines 11—11 of Figure 10.

The apparatus of the present invention illustrated in Figures 1 through 7 comprises a traction vehicle generally designated 10 having steerable front wheels 11 and rear drive wheels 12. This traction vehicle may be an ordinary motor truck which is augmented at certain seasons of the year by the attachment of parts so as to provide a material handling or snow removing apparatus.

The material handling or snow removing apparatus carried by the traction vehicle comprises a moldboard generally designated 20, an air supply apparatus generally designated 70, and an air conduit arrangement generally designated 80 for conveying air from the apparatus 70 to the moldboard apparatus 20.

According to the present invention, the moldboard is preferably carried forwardly of the vehicle and diagonally with respect to the center line of the vehicle as shown in Figure 1. With the arrangement as the vehicle moves forwardly, the moldboard engages the material such as snow and imparts to the snow a component of motion parallel to the moldboard in the direction of the arrow 21. The material slides toward the trailing edge 22 of the moldboard and is deposited over a wide area along the side of the road. The component of motion in the direction of arrow 21 in the ordinary grader of snowplow arrangement is due entirely to the forward motion of the vehicle and is not sufficient ordinarily to throw the material or snow to any great distance beyond the trailing edge 22 of the moldboard.

According to the present invention, there is provided one or more blast nozzles either formed integral with the moldboard or mounted near the material engaging face of the moldboard so as to provide a blast of air along the material engaging surface in the direction of arrow 21.

In Figures 2 through 7, the moldboard 20 is shown as consisting of three curved plates 24, 25 and 26, which are positioned in overlapping relationship as shown in Figure 3. The plate 24 is curved as shown in Figures 6 and 7 so as to provide a vertical section 30 and an overhanging part 31 and has a length of about one-third the length of the moldboard structure.

Plate 25 is likewise curved as shown in Figures 5, 6 and 7 to provide a vertical portion 32 and an overhanging portion 33, and has a length of approximately two-thirds the length of the moldboard structure. Plate 25 is nested behind plate 24 as shown in Figure 3 and is held in spaced relationship thereto by being joined at the edges 34 and 35. Being thus held in spaced relationship, there is provided a narrow orifice 38 between the two plates as shown in Figure 6.

Plate 26 which has a length equal to the length of the moldboard arrangement is likewise curved so as to provide a vertical portion 40 and an overhanging portion 41, and is nested behind plates 24 and 25 and is joined thereto at the edges. Plates 25 and 26 are shaped so as to provide another narrow air blast orifice 42 where

plate 25 terminates in overlapping relationship against plate 26.

In some instances, it is desirable to provide spacing and strengthening ribs 43 between plates 24 and 25 and similar spacing ribs 44 between plates 25 and 26 so that the spacing between the plates will be maintained regardless of the pressure exerted against the front of the plates by the material being handled.

The edges 34 and 35 where plates 24, 25 and 26 are joined together are preferably made by welding the three plates into an integral unit, and at the right end of the moldboard structure as shown in Figure 3, there is provided an end wall 45, which is joined in airtight relationship to the edges of the three plates. In this way, there is provided a manifold at 50 between plates 24 and 25 and another manifold 51 between plates 25 and 26. The nipple 53 is provided for delivering air into the manifold 51 and another through nipple 55 is provided for delivering air into manifold 50. As illustrated in Figure 3, the spacing ribs 43 and 44 are interrupted at 46 so that manifolds 50 and 51 are not divided. In some instances, however, the vertically divided manifold is desirable, as explained below.

The moldboard structure is arranged to be carried forwardly of the vehicle by struts 60 and 61, which are attached to the moldboard structure by means of cap screw 62. If desired, the ground wheels may be provided for carrying the moldboard in closely spaced relationship to the surface of the roadway over which it travels. Since caster wheels of this type are commonly used in scarfing and moldboard arrangements, they are not illustrated here.

In Figure 1, strut 60 is illustrated as being of greater length than strut 61. Obviously, hoisting or elevating arrangements for the moldboard may be used if desired.

Upon the vehicle, there is provided an air compressor unit, generally designated 70, which may be driven from the motor of the traction vehicle, or by a separate motor. The air compressor unit is of any desired standard construction capable of producing a relatively large volume of air at a relatively low pressure such as a positive displacement rotary compressor.

The compressed air delivered by compressor 70 is conveyed from the compressor unit to the moldboard structure 20 by the conduit and piping arrangement generally designated 80. In the illustrated form of the invention, a main delivery hose 81 extends from manifold 71 of the air compression unit to a Y-connection 82, at which point the air flow is divided and is carried by conduits 83 and 84. Adjacent the driver's seat, there is preferably provided regulating valves 85 and 86, by means of which the driver of the machine may regulate the amount of air delivered to each of the manifolds 50 and 51. The conduits 81, 83 and 84 are preferably of flexible rubber hose so as to facilitate mounting of the air compressor unit in the ordinary load carrying body of the traction vehicle and to facilitate carrying the air supply to the moldboard structure at the forward end of the vehicle. By thus providing flexible conduit means for conveying the air, the moldboard structure is left free to move vertically with respect to the vehicle and the entire arrangement may quickly be lifted on to an ordinary truck body and attached thereto with the result that an ordinary truck can be combined into an improved snowplow arrangement of the present invention in but

a few minutes' time. The position of the air compressor unit is not critical as the flexible hoses admit of easy rearrangement.

The range of pressures and amounts of air used in connection with the present invention may obviously be varied widely from but a few ounces pressure to approximately ten pounds pressure, and from a small volume to a large volume. For light fluffy and easily movable material, I prefer to use a relatively large volume of air at relatively low pressures. Thus, from 5 to 6 thousand cubic feet of free air per minute delivered at two pounds pressure to manifolds 50 and 51 gives good results with most snow conditions. For extremely wet and heavy snow, it is desirable to increase the pressure somewhat, and for light snow falls of dry impalpable snow particles, lesser pressures may be used. Under some conditions, it is desirable to use only one or the other of the blast nozzles depending upon the density and depth of snow fall, and under some conditions, unequal volumes of air may be delivered by the several blast nozzles.

In Figures 8 through 11, there is illustrated a plow consisting of two moldboards joined together in V-formation as shown in Figure 8. In this instance as before, the moldboard arrangement is mounted upon a traction vehicle generally designated 10, which carries an air compressor and supply arrangement generally designated 70. The V-type moldboard arrangement consists of a pair of relatively short moldboards 101 and 102 joined together along the line 103 as shown in Figure 10. These moldboards are curved as shown in Figure 11 and are provided with an upper stiffening flange 107. Behind the moldboards 101 and 102, there are nested moldboards 105 and 106, which are attached to moldboards 101 and 102 respectively by welding, riveting or bolting. The curvature of moldboard 106, for example, is as illustrated in Figure 11, and is such as to provide a narrow air blast nozzle space at 108. The inward ends of moldboards 105 and 106 are provided with enclosure plates 110 and 111 respectively so as to form closed manifolds 112 and 113 respectively. The moldboard 106 is provided with an air delivery nozzle 115 and moldboard 105 is provided with an air delivery nozzle 114. As in the previously described modification, it is desirable to provide stiffening ridges 109 between moldboards 101 and 105 and between moldboards 102 and 106. It will be noted that as illustrated, these ridges do not extend back to the air inlet tubes and accordingly do not separate the air chamber into sections.

The V-type moldboard arrangement 100 is attached to the traction vehicle by a pair of struts 120 and 121 and may be provided with a ground engaging wheel immediately behind the moldboard structure near the V-point thereof as illustrated at 123. Hoisting arrangement for elevating the V-type moldboard with respect to the vehicle may likewise be provided if desired.

In this modification of the invention, there is likewise provided an air delivery conduit 183 which extends from the air supply and compressor device 70 to manifold 112, and another air delivery conduit 184, which extends from the air compressor and supply apparatus to manifold 113. The air delivery conduits may, as in the previously described modification of the invention, be provided with regulating valves 185 and 186 respectively by which the air supply delivered to each of the

two V-type blades may be varied as desired by the operator of the vehicle.

In each of the modifications of the invention heretofore described, the air blast provided along the face of the moldboard and toward the trailing edges thereof serves to move the material being handled such as snow and to impart to the material an exceedingly great velocity which serves to distribute the material over a wide area beyond the trailing edge of the moldboard blade. In this respect, it differs from devices heretofore used. The air blast along the material and engaging surface of the moldboard is confined due to the pressure of the material against the moldboard and thus the velocity energy of the air blast is imparted to the particles of material being handled with little loss of energy. As a consequence, the power of the air compressor motor is efficiently delivered to the material and the material may thus be scattered over a wide area with relatively smaller horsepower requirements than in previous arrangements.

In the illustrated modification where from 7 to 8 thousand cubic feet of free air per minute is utilized at, for example, 2 pounds of pressure, the air compressor will require approximately 80 horsepower, and this power is delivered efficiently and with relatively little loss to the material being removed. The air blast along the face of the moldboard also assists the movement of the material by forming a thin film of air between the material and the moldboard itself which serves greatly to reduce the frictional loss due to impactment of material against the moldboard. Thus the energy imparted to the material being handled due to the forward movement of the traction vehicle alone is largely conserved and imparts to the material a greater sideways velocity than in apparatus where the air film separation of the material from the moldboard is not present. The use of the air blast principle of the present invention thus serves to enhance the material moving propensity of the ordinary moldboard arrangement.

It will be noted also that in the present invention the moldboard structure may be used without the air blast and without serious loss in the efficiency of the moldboard due to the fact that the vertical area presented to the material being moved is substantially the same smooth area as is found in the ordinary moldboard construction.

Many obvious variations may be made without departing from the spirit of the present invention illustrated, described and claimed herein, as follows:

I claim:

1. The combination comprising a moldboard shaped substantially like a partial cylinder and a fluid blast nozzle positioned adjacent said moldboard and directed to project a blast of fluid substantially parallel to the moldboard and along the face thereof.

2. The combination comprising a snowplow moldboard shaped substantially like a partial cylinder, a fluid blast nozzle mounted in juxtaposition to said moldboard in a position to direct a fluid blast substantially parallel to the face of the moldboard and in the direction of flow of snow along the snow engaging surface of said moldboard.

3. The combination comprising a snowplow moldboard, formed to include a plurality of fluid blast nozzles terminating substantially parallel

with the snow engaging surface of the moldboard and fluid supply manifold means for said nozzles.

4. The combination of a plurality of moldboards positioned in endwise overlapping relationship to each other, said moldboards being spaced from each other where they overlap to form fluid nozzle space at the overlap, and fluid manifold means for delivering fluid to the fluid nozzle space.

5. A moldboard comprising a plurality of transversely curved plates, said plates being positioned with their ends overlapping, spacing means between the overlapping ends for maintaining the overlapped ends in spaced relationship, and fluid manifold means behind the plates communicating with the space at the overlap.

6. The combination comprising a traction vehicle, a moldboard mounted diagonally on said vehicle in a position for scraping the surface over which the vehicle travels, and fluid nozzle means mounted on said vehicle, said nozzle means being oriented to direct a fluid blast along the surface of the moldboard substantially parallel thereto in the direction normally travelled by material being scraped thereby.

7. A snowplow comprising a traction vehicle, a snowplow moldboard mounted diagonally on said vehicle, an air blast nozzle mounted on said vehicle in a position to direct an air blast along and substantially parallel to the snow engaging surface of the moldboard in the direction in which the snow is normally propelled by engagement of said diagonally mounted moldboard with the snow.

8. A snowplow comprising a traction vehicle, a snowplow moldboard mounted diagonally of the vehicle, said moldboard being formed with a plurality of blast nozzles positioned for projecting air along and substantially parallel to the snow engaging surface of the moldboard and toward the trailing edge thereof, and air compressor and delivery means on said vehicle for supplying air under pressure to said nozzles.

9. A snowplow comprising a traction vehicle, a

plurality of moldboards attached together in V-formation to form a V-shaped plow, means for mounting said plow forwardly of the vehicle, and air blast nozzle means on said moldboards for projecting blasts of air substantially parallel to the face of the moldboard and along the snow engaging surfaces of said moldboards toward the trailing edges thereof, and means on the vehicle for supplying air under pressure to said nozzle means.

10. A snowplow comprising a traction vehicle, a snowplow moldboard mounted diagonally at the forward end of said vehicle, said snowplow moldboard being formed with a plurality of nozzle means at intervals along the snow engaging face thereof, said nozzle means being positioned for delivering air blasts substantially parallel to the moldboard along the snow engaging surface thereof toward the trailing edge of the moldboard, air compressor and delivery means on the vehicle for delivering air under pressure to the nozzle means, and operator controlled means for regulating the volume of air delivered to said individual nozzle means.

11. The method of removing material such as snow from a surface such as a roadway which comprises propelling a scraping blade along said surface to collect the material there against and projecting an air blast along the material engaging surface of the blade substantially parallel to the blade and in a direction transverse to direction of motion so as laterally to project the material collected against the blade.

12. The method of removing material such as snow from a surface such as a roadway which comprises propelling along said surface a moldboard section which is disposed diagonally with respect to the direction of propulsion to collect and laterally transfer the material being removed and projecting an air blast along the material engaging surface of said blade substantially parallel to the blade and in the direction of said lateral movement to enhance said movement.

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