A crop header for a harvesting machine includes a frame, a lower cutter (28) supported by the frame, an upper cutter (32) supported by the frame forward and above the lower cutter, and a reel (26) supported by the frame rearward and above the upper cutter and at least partially forward the lower cutter. The upper cutter and the lower cutter are preferably vertically adjustable relative to one another.
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COMBINE HEADER FOR BOTH CORN AND GRAIN

FIELD OF THE INVENTION

The present invention relates to crop harvesting machines. In particular, the present invention relates to a crop header for a harvesting machine configured for harvesting both corn and grain.

BACKGROUND OF THE INVENTION

A typical midwestern farmer of today may attach a corn header to his combine to harvest corn for part of the day. The corn header being used to gather only the corn ears from the corn plants. The farmer then must remove the corn header and replace it with a grain header or another row crop header and harvest soybeans (which may or may not be grown in rows) or cereal crops for the remainder of the day. This alternate header would be used to cut the crop below the seed and gather the seed and upper part of the plant into the combine header.

Changing from the corn header to the cereal crop header can be time and labor intensive, thus taking up large amounts of the farmer's valuable harvesting time.

In addition, buying and maintaining two separate headers is expensive and more storage space needed for the headers and replacement parts.

The problems identified above are not intended to be exhaustive but are among the many that reduce the
effectiveness of current solutions to the problem of harvesting multiple types of crops in a single day. Other problems may also exist; however, those presented above should be sufficient to demonstrate that currently known solutions are amenable to worthwhile improvement.

**SUMMARY OF THE INVENTION**

A crop header for a harvesting machine includes a frame, a lower cutter supported by the frame, an upper cutter supported by the frame above the lower cutter, and a reel supported by the frame rearward and above the upper cutter and at least partially forward the lower cutter. The upper cutter and the lower cutter are preferably vertically adjustable relative to one another.

In one preferred embodiment, the crop header includes a reel arm coupled to the frame for supporting the reel and an upper cutter arm assembly pivotally supporting the upper cutter forward the reel. The upper cutter arm assembly preferably pivots between a first crop engaged position and a second crop disengaged position. In the second crop disengaged position, the upper cutter is preferably supported substantially above the reel. The arm assembly preferably comprises a four-bar linkage for vertically adjusting the upper cutter relative to the lower cutter while maintaining the substantially horizontal orientation of the upper cutter.

The crop header also preferably includes a power train for transmitting power to the upper cutter supported forward and above the lower cutter. The power train includes a plurality of pulleys and belts for transmitting power from the harvesting machine to the upper cutter. The power train further includes at least one spring biased idler arm in engagement with said at least one belt to reliably transmit power to the upper cutter independent of a vertical adjustment of the upper cutter relative to the
lower cutter.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side elevational view of a harvesting machine including a crop header.

Fig. 2 is a top elevational view of the header.

Fig. 3 is an enlarged side elevational view of the header illustrating the header harvesting corn plants.

Fig. 4 is a side elevational view of a first alternative embodiment of the header of Fig. 3.

Fig. 5 is a fragmentary top elevational view of a second alternative embodiment of the header of Figs. 1-3.

Fig. 6 is a sectional view of the header of Fig. 5 taken along lines 6--6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1 and 2 illustrate harvesting machine 10 including crop header 12. Fig. 1 is a side elevational view of harvesting machine 10 including crop header 12. Fig. 2 is a top elevational view of header 12. As shown by Fig. 1, harvesting machine 10 preferably comprises a conventionally known combine having a forward end 14 configured for supporting crop header 12. As is well known, harvesting machine 10 includes a threshing mechanism for separating the grain or seeds from the remaining straw or chaff. Harvesting machine 10 receives crops cut and gathered by crop header 12 and further threshes the crop to separate the grain from the plant.

Crop header 12 is supported at front end 14 of harvesting machine 10 and generally includes frame 18, divider wings 20, bottom shields 22, reel support arms 24, reel 26, lower cutter 28, upper cutter arm assembly 30 and
upper cutter 32. Frame 18 is fixedly mounted to front end 14 of harvesting machine 10 and provides a general framework for supporting the remaining components of header 12. As can be appreciated, frame 18 may have a variety of alternative sizes, shapes and configurations depending upon the size and configuration of harvesting machine 10 and header 12 as well as the particular type of crop being harvested.

Divider wings 20 are generally triangular in shape having tips supported forwardly of header 12 and reel 26. Divider wings 20 extend from header 12 on opposite lateral sides of header 12 so as to direct crops into header 12 and onto bottom shields 22.

Bottom shields 22 are conventionally known and generally consist of a plurality of individual shields coupled to one another so as to form a laterally extending platform below auger 23. The platform formed by bottom shields 22 capture and support the crop above the ground surface while auger 23 conveys a crop to a central intake 36 of harvesting machine 10.

Auger 23 is rotatably supported by frame 18 above bottom shields 22 and includes oppositely wound vanes for conveying crops cut by lower cutter 28 and carried onto bottom shields 22 by reel 26 towards central intake 36. Auger 23 is rotatably driven by a conventionally known auger drive mechanism.

Reel support arms 24 are generally elongate L-shaped support members projecting forward and upward from frame 18 for rotatably supporting reel 26 forward lower cutter 28 and above lower cutter 28 and bottom shields 22. Reel support arms 24 extend from frame 18 on opposite lateral sides of header 12 proximate divider wings 20. In the preferred embodiment illustrated, reel support arms 24 each
include a hydraulic linear actuator (not shown) for selectively raising and lowering reel 26 relative to frame 18. In the preferred embodiment illustrated, reel support arms 24 additionally include hydraulic linear actuators (not shown) for selectively moving reel 26 forward and rearward relative to frame 18.

Reel 26 is an elongate beater transversely extending between reel support arms 24 forward and above bottom shields 22 and lower cutter 28. Reel 26 further extends rearward and above upper cutter 32 and at least partially forward lower cutter 28. Reel 26 is rotatably supported by reel support arms 24 and is rotatably driven by a conventionally known reel drive (not shown). Upon being rotatably driven, reel 26 performs two functions. First, reel 26 engages top portions of crops cut by upper cutter 32 to propel the cut top portions of the crops forward of bottom shields 22 onto the ground. Second, reel 26 engages and conveys lowermost portions of the crops rearwardly towards lower cutter 28 and onto bottom shields 22.

Lower cutter 28 generally comprises an elongate cutting member transversely extending forward bottom shields 22 between divider wings 20. Lower cutter 28 is configured for cutting the lower portions of crops below the grain producing portion of each crop plant. In the preferred embodiment illustrated, lower cutter 28 comprises a conventionally known cutter bar having a plurality of sickles or knives secured to a bar that is transversely reciprocated in a well known manner. Lower cutter 28 is reciprocatively driven by a conventional knife drive box supported by frame 18 adjacent an end of lower cutter 28. Lower cutter 28 cuts and separates each crop plant from its associated roots to enable the removed plant portion to be conveyed towards central intake 36 by auger 23.
Upper cutter arm assembly 30 is a generally elongate forwardly extending support member fixedly secured to frame 18 for supporting upper cutter 32 forward and above lower cutter 28. Upper cutter arm assembly 30 additionally supports an upper cutter drive 38 (shown in Fig. 3) for reciprocatively driving upper cutter 32. As shown by Fig. 1, upper cutter arm assembly 30 includes shields 40 for substantially surrounding and enclosing upper cutter drive 38.

Upper cutter 32 is a generally elongate cutting member transversely supported by upper cutter arm assembly 30 forward and above lower cutter 28. Upper cutter 32 is supported and configured for cutting and separating topmost portions of crop plants above the grain carrying portion of the crop plant so as to reduce the overall amount of the crop plant and associated biomass that must be conveyed and processed by header 12 and harvesting machine 10. In the preferred embodiment illustrated, upper cutter 32 comprises a conventionally known cutter bar having a plurality of sickles or knives which are reciprocatively driven in a transverse or lateral direction forward of header 12. Upper cutter 32 is preferably reciprocatively driven by a conventionally known knife drive box 80 (shown in Fig. 3). As can be appreciated, upper cutter 32 may be reciprocatively driven by other well known reciprocating actuation mechanisms.

Fig. 3 is an enlarged side elevational view of header 12 illustrating header 12 harvesting corn plants 44. For ease of illustration, portions of header 12 have been omitted. As best shown by Fig. 3, header 12 includes lower cutter drive 46 and upper cutter drive 48. Lower cutter drive 46 is generally supported by frame 18 adjacent bottom shields 22 and generally includes drive pulley 50, driven pulley 52, drive belt 54 and idlers 56 and 57. Drive pulley 50 is rotatably supported by frame 18 and is
rotatably driven in a conventionally known manner by harvesting machine 10. Drive pulley 50 is preferably mounted on a conventional header drive jack shaft. Drive pulley 50 drives drive belt 54 to drive driven pulley 52.

Driven pulley 52 is supported by frame 18 adjacent to knife drive box 58. Driven pulley 52 drives knife drive box 58 to reciprocatively drive the knives of lower cutter 28. Idlers 56 and 57 are supported by frame 18 in engagement with drive belt 54. Idler 56 is preferably spring loaded while idler 57 is generally fixed. Idlers 56 and 57 maintain drive belt 54 at a proper tension independent of vertical movement of frame 18.

Upper cutter drive 48 is generally supported along upper cutter arm assembly 30 and includes driven pulleys 60, 62, and 64, drive belts 66, 68, 70, idlers 72, 74, 76 and 78 and knife drive box 80. Driven pulleys 60, 62 and 64 are rotatably supported at various points along upper cutter arm assembly 30. In particular driven pulley 60 is rotatably supported by frame 18 proximate drive pulley 50. Driven pulley 62 is rotatably supported at an intermediate point along upper cutter arm assembly 30. Driven pulley 64 is rotatably supported by upper cutter arm assembly 30 adjacent knife drive box 80. Drive belt 66 interconnects drive pulley 50 and driven pulley 60. Drive belt 68 interconnects driven pulley 60 and driven pulley 62. Drive belt 70 interconnects driven pulley 62 and driven pulley 64. As a result, power is transferred from drive pulley 50 along upper cutter arm assembly 30 to driven pulley 64 which drives knife drive box 80 to reciprocatively drive the knives of upper cutter 32.

Idlers 72, 74, 76 and 78 maintain drive belts 66, 68 and 70 at proper tensions independent of vertical adjustment of upper cutter arm assembly 30. In particular, idler 72 is preferably spring loaded for maintaining drive
belt 66 at a proper tension. Idler 72 preferably includes a release handle 82 for pinning idler 72 in a disengaged position relative to drive belt 66 for removal of drive belt 66. Idlers 74 and 76 cooperate to maintain drive belt 68 at a proper tension. Idler 76 is generally fixed while idler 74 is preferably spring loaded into engagement with drive belt 68. Lastly, idler 78 is preferably spring loaded into engagement with drive belt 70 to maintain drive belt 70 at a proper tension.

As further shown by Fig. 3, upper cutter arm assembly 30 generally includes rear arm 86, forward arm 88 and actuator 90. Rear arm 86 is a generally elongate slightly V-shaped extension member preferably having a rear end 92 pivotally coupled to frame 18 about pivot 94 and a forward end 96 pivotally coupled to forward arm 88 about pivot 98. Rear arm 86 pivots relative to frame 18 independent of reel 26 and reel support arm 24 (shown in Figs. 1 and 2). Alternatively, rear arm 86 and reel support arm 24 may be replaced with a single support structure configured for supporting both reel 26 and forward arm 88. The single support structure would preferably be pivotally coupled to frame 18. However, although less desirable, the single support structure could be fixedly coupled to frame 18. Upper cutter arm assembly 30 pivotally supports forward arm 88 and upper cutter 32 relative to frame 18 and lower cutter 28.

Forward arm 88 is an elongate support member pivotally coupled to forward end 96 of rear arm 86 for pivotally supporting upper cutter 32 forward and above lower cutter 28. As shown by Fig. 3, forward arm 88 supports upper cutter 32 above grain carrying portions 100 of corn plants 44. As a result, upper cutter arm assembly 30 cuts and separates topmost portions 102 above grain carrying portions 100 of each corn plant 44. Because reel 26 is rotatably driven rearward and above upper cutter 32 and
forward lower cutter 28, reel 26 engages the cut and separated topmost portion 102 of each corn plant 44 to propel the topmost portion 102 of each corn plant 44 to the ground in front of lower cutter 28 and bottom shields 22. As a result, header 12 harvests a smaller portion of each corn plant while still severing and gathering the most important portion of the corn plant, the grain bearing portion 100. Because header 12 severs and gathers only the grain bearing portion 100 of each corn plant 44, header 12 and harvesting machine 10 can more adequately accommodate the gathering and processing of the corn plants.

As further shown by Fig. 3, once upper cutter 32 severs the topmost portion 102 of each corn plant 44, reel 26 engages and conveys the remainder of each corn plant 44 towards lower cutter 28 and bottom shields 22. Lower cutter 28 severs grain bearing portions 100 of each corn plant from the lowermost portion 104 of each corn plant 44 below grain bearing portion 100. Reel 26 conveys the severed grain bearing portion 100 of each corn plant above and onto bottom shields 22 where auger 23 conveys the grain portion 100 of each corn plant to central intake 36 (shown in Fig. 2) for further threshing by harvesting machine 10.

Actuator 90 is coupled between rear arm 86 and forward arm 88 for selectively pivoting forward arm 88 about pivot 98. Actuator 90 further assists in maintaining forward arm 88 at a selected angle with respect to rear arm 86. Alternatively, other mechanical arrangements such as spaced detents and pins may be used for securing forward arm 188 at a selected angle with respect to rear arm 86 and frame 18.

In the preferred embodiment illustrated, actuator 90 comprises a hydraulic cylinder assembly pivotally mounted between rear arm 86 and forward arm 88. Actuator 90 may
alternatively comprise any one of a variety of alternative actuating mechanisms including pneumatic, electrical and mechanical actuators for pivoting forward arm 88 about pivot 98. Actuator 90 may also be omitted in favor of manual pivotal adjustment of forward arm 88 about pivot 98.

As shown in phantom in Fig. 3, upper cutter 32 is vertically adjustable relative to lower cutter 28. In particular, linear actuator 90 may be selectively actuated to pivot forward arm 88 and upper cutter 32 about pivot 98 between a first crop engaging position and a second crop disengaged position (shown in phantom). In the second crop disengaged position, upper cutter 32 is elevated to a height above auger 23 and substantially above reel 26 such that upper cutter 32 does not impair an operator's vision. As a result, header 12 may also be used for effectively gathering and harvesting non-corn crops such as beans, oats and the like, which have a relatively insignificant amounts of non-grain bearing portions.

At the same time, frame 18 of header 12 may be vertically raised and lowered in a conventionally known manner by harvesting machine 10 to raise and lower cutter 28. Because lower cutter 28 and upper cutter 32 may be selectively raised and lowered independent of one another, the vertical spacing between upper cutter 32 and lower cutter 28 may be optimized to sever the topmost portion 102 and the bottommost portion 104 of each corn plant 44 closest to the grain bearing portion 100 of each corn plant 44 without harvest loss. By minimizing the percentage of each corn plant 44 which must be gathered and threshed to yield the grain, header 12 and harvesting machine 10 more effectively harvest the corn crop at a higher rate and in less time.

Fig. 4 is an enlarged side elevational view of header 112, a first alternative embodiment of header 12. Header
112 is similar to header 12 of Figs. 1-3 except that header 112 includes upper cutter arm assembly 130 in lieu of upper cutter arm assembly 30. For ease of illustration, those remaining elements of header 112 which correspond to similar elements of header 12 are numbered similarly. Upper cutter arm assembly 130 supports upper cutter 32 forward and above lower cutter 28 and forward reel 26. Upper cutter arm assembly 130 generally comprises a four-bar linkage and includes rear arms 186 and 187, forward arm 188, and actuator 190. Rear arm 186 has a rearward most end 192 pivotally coupled to frame 18 about pivot 194 and a forward most end 196 pivotally supporting forward arm 188 about pivot 198. Similar to rear arm 86, rear arm 186 supports driven pulley 62 and idler assemblies 74 and 76.

Rear arm 187 extends between frame 18 and forward arm 188. Rear arm 187 includes a rearward most end 200 pivotally coupled to frame 18 about pivot 202 below pivot 194 and a forward most end 204 pivotally coupled to forward arm 188 about pivot 206 below pivot 198.

Forward arm 188 is a support member pivotally coupled to rear arms 186 and 187 about pivots 198 and 206. Forward arm 188 is configured for supporting upper cutter 32 on opposite transverse ends of header 112. Similar to forward arm 88, forward arm 188 supports driven pulley 64, idler 78 and knife drive box 80. As can be appreciated, forward arm 188 may have a variety of alternative sizes and configurations depending upon the configuration of upper cutter 32, upper cutter drive 48, rear arms 186 and 187 and the overall configuration of header 112.

As shown in phantom in Fig. 4, upper cutter 32 is vertically adjustable relative to lower cutter 28. In particular, upper cutter 32 pivots between a first crop engaging position and a second crop disengaged position (shown in phantom). In the second crop disengaged
position, upper cutter 32 is elevated to a height above auger 23 and substantially above reel 26 such that upper cutter 32 does not impair an operator's vision. As a result, header 112 may also be used for effectively gathering and harvesting non-corn crops such as beans, wheat, oats and the like, which have relatively insignificant amounts of non-grain bearing portions.

In addition to being raised and lowered to improve an operator's vision, upper cutter 32 may be selectively raised and lowered independent of lower cutter 28 to optimize the spacing between upper cutter 32 and lower cutter 28 for harvesting grain bearing portions of each corn plant without harvest loss. By minimizing the percentage of each corn plant which must be gathered and threshed to yield the corn, header 112 and harvesting machine 10 more effectively harvest the corn at a higher rate and in less time.

As shown by Fig. 4, during vertical adjustment of upper cutter arm assembly 130, rear arms 186 and 187 pivot in a first direction about pivots 194 and 202, respectively, relative to frame 18. At the same time, forward arm 188 pivots about pivots 198 and 206 in a second opposite direction. As a result, the horizontal, substantially level orientation of upper cutter 32 is maintained during vertical adjustment of upper cutter arm assembly 130. This insures that upper cutter 32 is maintained at a proper orientation for engaging the top most portions of the corn plants independent of the vertical spacing between upper cutter 32 and lower cutter 28.

To pivot rear arms 186 and 187, forward arm 188 and upper cutter 32, upper cutter arm assembly 130 includes actuator 190. Actuator 190 is coupled between frame 18 and rear arm 186. In the preferred embodiment illustrated,
actuator 190 comprises a hydraulic cylinder assembly pivotally coupled between frame 18 and rear arm 186. Actuation of actuator 190 pivots rear arm 186 about pivot 194. Because rear arm 186 is pivotally coupled to forward arm 188 and because forward arm 188 is pivotally coupled to rear arm 187, actuation of actuator 190 also pivots forward arm 188 about pivots 198 and 206 and pivots rear arm 187 about pivot 202. Actuator 190 further assists in maintaining upper cutter arm assembly 130 and upper cutter 32 at a selected height relative to frame 18. Alternatively, other mechanical arrangements such as spaced detents and pins may be used for securing upper cutter arm assembly 130 and upper cutter 32 in a selected vertical position.

Although illustrated as a hydraulic cylinder assembly, actuator 190 may alternatively comprise any one of a variety of well known actuating mechanisms such as other hydraulic, pneumatic, electric or mechanical actuation mechanisms. In lieu of being coupled between frame 18 and rear arm 186, actuator 190 may alternatively be coupled between frame 18 and rear arm 187. Moreover, actuator 190 may be alternatively omitted in favor of the manual raising and lowering of upper cutter arm assembly 130.

Figs. 5 and 6 illustrate header 212, a third alternative embodiment of header 12 shown in Figs. 1-3. Fig. 5 is a top elevational view of header 212. Fig. 6 is a sectional view of header 212 taken along lines 6--6 of Fig. 5. Header 212 is similar to header 12 except that header 212 includes grain draping mechanism 223 in lieu of auger 23. Although header 212 is illustrated as including upper cutter arm assembly 30, header 212 may alternatively include upper cutter arm assembly 130 (illustrated in Fig. 4). For ease of illustration, those remaining elements of header 212 which correspond to elements of header 12 are numbered similarly.
Grain draping mechanism 223 is a conventionally known lateral draper and is typically used in small grain headers for gathering and harvesting small grain crops such as wheat, barley, oats, canola, flax and the like. As is conventionally known, grain grain draping mechanism 223 includes a pair of oppositely driven webs 225 and 227 which carry grain to central intake 36. Webs 225 and 227 are driven in a conventionally known manner by conventionally known web driving devices.

Alternatively, header 212 may include a conventionally known longitudinal draper in lieu of the lateral draper illustrated. With this alternative, the longitudinal draper would carry the grain rearwardly towards auger 23. Auger 23 would then convey the grain to central intake 36.

Although header 212 is typically used for cereal grains such as wheat, barley, oats, canola and flax, upper cutter 32 of header 212 enables header 212 to harvest larger grain crops such as corn. As discussed above with respect to headers 12 and 112, because upper cutter 32 is vertically adjustable relative to lower cutter 28, upper cutter 32 may be elevated into a crop disengaged position substantially above reel 26 such that upper cutter 32 does not impair an operator's vision during harvesting of cereal grains such as wheat, barley, oats, canola and flax. At the same time, however, upper cutter 32 may be lowered into a crop engaged position for removing the topmost portions of larger crops such as corn to enable header 212 to gather and harvest only the grain bearing portions of the larger corn plants. Because reel 26 extends forward and above lower cutter 28, reel 26 engages the top most portions of the crops cut by upper cutter 32 to propel the cut top portions of the crops forward of grain draping mechanism 223 onto the ground. At the same time, reel 26 engages and conveys the lower most portions of the crops rearwardly
towards lower cutter 28 and onto webs 225 and 227 of draping mechanism 223. Furthermore, because header 212 enables the vertical spacing between upper cutter 32 and lower cutter 28 to be optimized depending upon harvesting conditions to harvest only the grain bearing portions with minimal harvest loss, header 212 effectively harvests larger grain crops such as corn at a higher rate and in less time.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.
What Is Claimed Is:

1. A crop header comprising:
   a frame;
   a lower cutter supported by the frame;
   an upper cutter supported by the frame forward
   and above the lower cutter; and
   a reel supported by the frame rearward and above
   the upper cutter and at least partially forward the lower
   cutter.

2. The crop header of claim 1 wherein the upper
   cutter and the lower cutter are vertically adjustable
   relative to one another.

3. The crop header of claim 2 including:
   a reel arm coupled to the frame for rotatably
   supporting the reel; and
   an upper cutter arm assembly supporting the upper
   cutter forward the reel.

4. The crop header of claim 3 wherein the upper
   cutter arm assembly is movable between a first crop engaged
   position and a second crop disengaged position.

5. The crop header of claim 3 wherein the upper
   cutter is positioned substantially above the reel in the
   second crop disengaged position.

6. The crop header of claim 3 wherein the upper
   cutter arm assembly includes:
   a forward arm supporting the upper cutter;
   a first rear arm pivotally coupled at a first end
   to the frame and pivotally coupled at a second end to the
   forward arm; and
   a second rear arm pivotally coupled at a first
end to the frame and pivotally coupled at a second end to
the forward arm to form a four-bar linkage for vertically
raising and lowering the upper cutter relative to the lower
cutter while maintaining an orientation of the upper
cutter.

7. The crop header of claim 1 including:
an auger rotatably supported by the frame
rearward and above the lower cutter.

8. The crop header of claim 1 including:
a belt conveyor supported by the frame rearward
and above the lower cutter.

9. The crop header of claim 2 including:
an arm assembly for pivotally supporting the
upper cutter relative to the frame forward the reel;
a plurality of pulleys rotatably coupled to the
arm assembly;
at least one belt supported by the plurality of
pulleys for transmitting power along the arm assembly to
the upper cutter; and
at least one spring loaded idler supported by the
arm assembly in engagement with the belt.

10. The crop header of claim 1 wherein the upper
cutter and the lower cutter comprise elongate cutter bars
transversely extending along the crop header.

11. A crop header comprising:
a frame;
a reel supported by the frame;
a lower cutter supported by the frame; and
an upper cutter supported by the frame above the
lower cutter, wherein the upper cutter and the lower cutter
are vertically adjustable relative to one another.
12. The crop header of claim 11 wherein the frame supports the reel at least partially forward the lower cutter.

13. The crop header of claim 11 including:
   a reel arm coupled to the frame for rotatably supporting the reel; and
   an upper cutter arm assembly supporting the upper cutter forward the reel.

14. The crop header of claim 13 wherein the upper cutter arm assembly is movable between a first crop engaged position and a second crop disengaged position.

15. The crop header of claim 13 wherein the upper cutter is positioned substantially above the reel in the second crop disengaged position.

16. The crop header of claim 14 wherein the arm assembly includes:
   a lower arm supporting the upper cutter;
   a first rear arm pivotally coupled at a first end to the frame and pivotally coupled at a second end to the forward arm; and
   a second rear arm pivotally coupled at a first end to the frame and pivotally coupled at a second end to the forward arm to form a four-bar linkage for vertically raising and lowering the upper cutter relative to the lower cutter while maintaining an orientation of the upper cutter.

17. The crop header of claim 11 including:
   an auger rotatably supported by the frame rearward and above the lower cutter.

18. The crop header of claim 11 including:
   a belt conveyor supported by the frame rearward
19. The crop header of claim 11 including:
   an arm assembly for pivotally supporting the upper cutter forward the reel relative to the frame;
   a plurality of pulleys rotatably coupled to the arm assembly;
   at least one belt supported by the plurality of pulleys for transmitting power along the arm assembly to the upper cutter; and
   at least one spring loaded idler supported by the arm assembly in engagement with the belt.

20. The crop header of claim 11 wherein the upper cutter and the lower cutter comprise elongate cutter bars transversely extending along the crop header.

21. A crop header comprising:
   a frame;
   a lower cutter supported by the frame;
   an upper cutter supported by the frame above the lower cutter, wherein the upper cutter and the lower cutter are vertically adjustable relative to one another; and
   a reel supported by the frame rearward and above the upper cutter and at least partially forward the lower cutter.
## INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 6   A01D41/14

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 6   A01D

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

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

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>X</td>
<td>US 2 706 882 A (THORNTON) 26 April 1955</td>
<td>1-3, 7, 9-13, 17, 19-21</td>
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<td>US 3 596 448 A (BUSKIRK ERNEST MELVILLE VAN) 3 August 1971</td>
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<td>A</td>
<td>US 3 399 517 A (MAGEE KENNETH L) 3 September 1968</td>
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**Date of the actual compilation of the international search**

13 August 1998

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