United States Patent

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[33] **Germany**
[31] **M69954**

[54] **PIVOT ASSEMBLY FOR HAYMAKING MACHINES AND THE LIKE**
9 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **56/370**
[51] **Int. Cl.** **A01d 79/00**
[50] **Field of Search** 56/370, 365, 366, 6, 25.4

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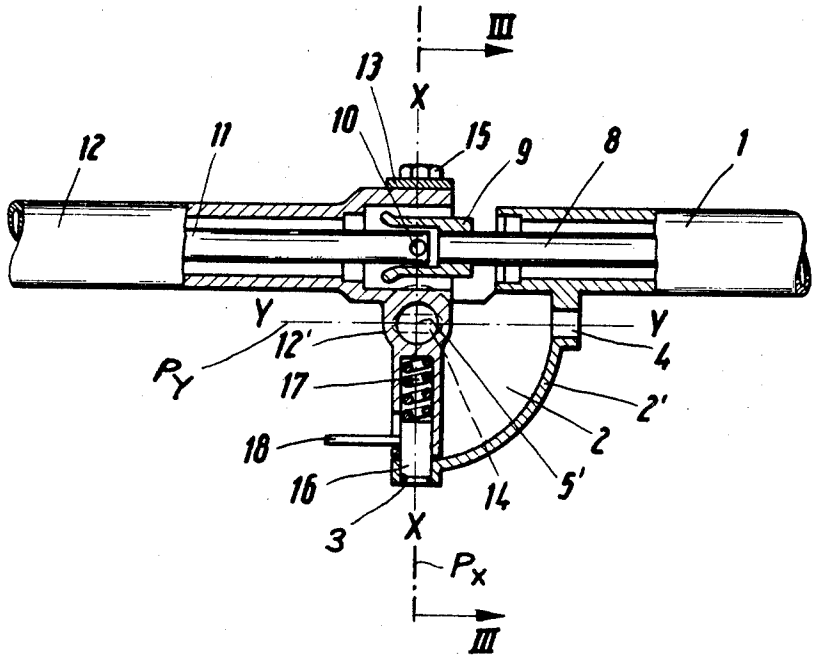
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Primary Examiner—Russell R. Kinsey
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ABSTRACT: A pivot assembly for the inwardly swingable outrigger beam of a rotary-rake haymaking inplement having a pair of hollow beam sections relatively swingable to include an angle of **90°** between them in one position thereof and axially aligned in another position thereof, a shaft extending through the beam sections and axially subdivided into a pair of interconnectable shaft sections disengaged from one another in said one position and mutually interconnected in said other position of the beam sections, and a ball joint interconnecting said beam sections for relative pivotal movement thereof between these positions about a vertical axis, laterally offset from the shaft in said other position and perpendicular to the axis thereof, and a horizontal axis generally parallel to one of the shaft sections, the axes intersecting one another.

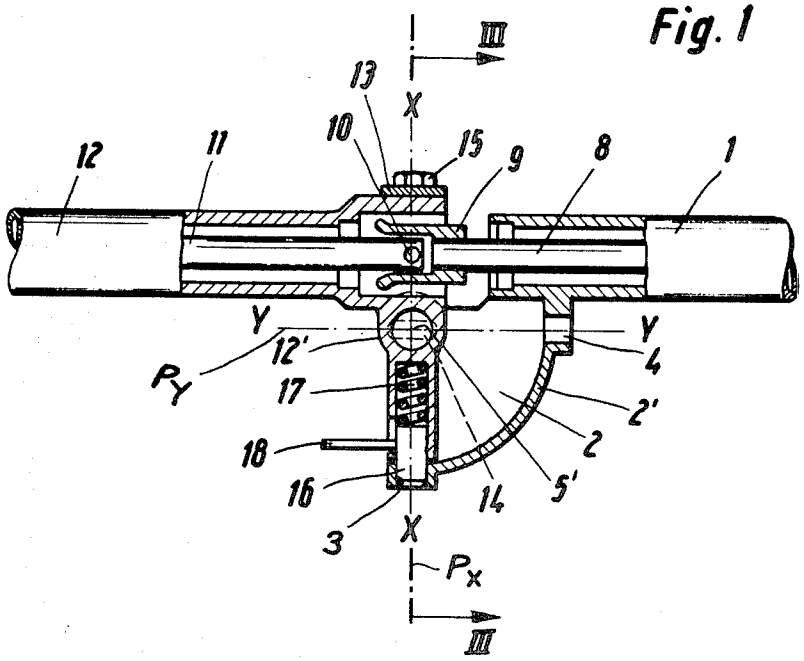


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Fig. 1



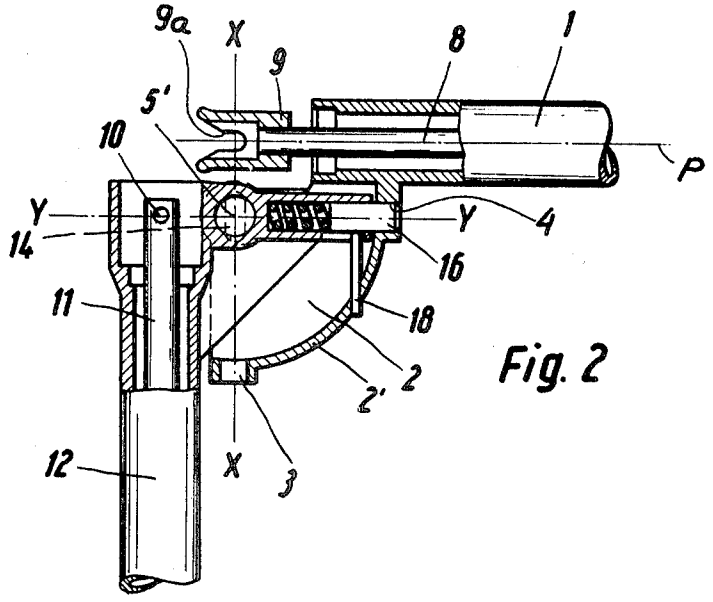


Fig. 2

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Fig. 3

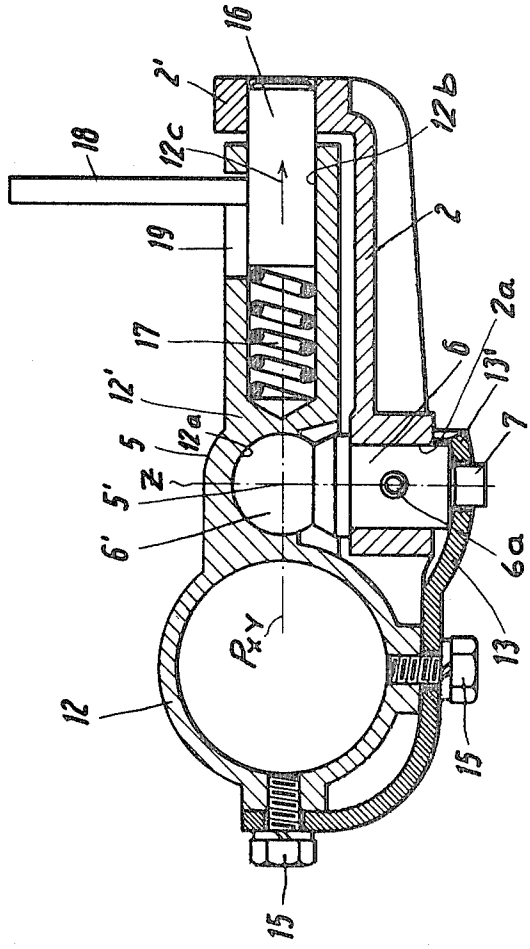
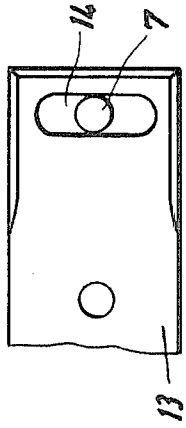


Fig. 4



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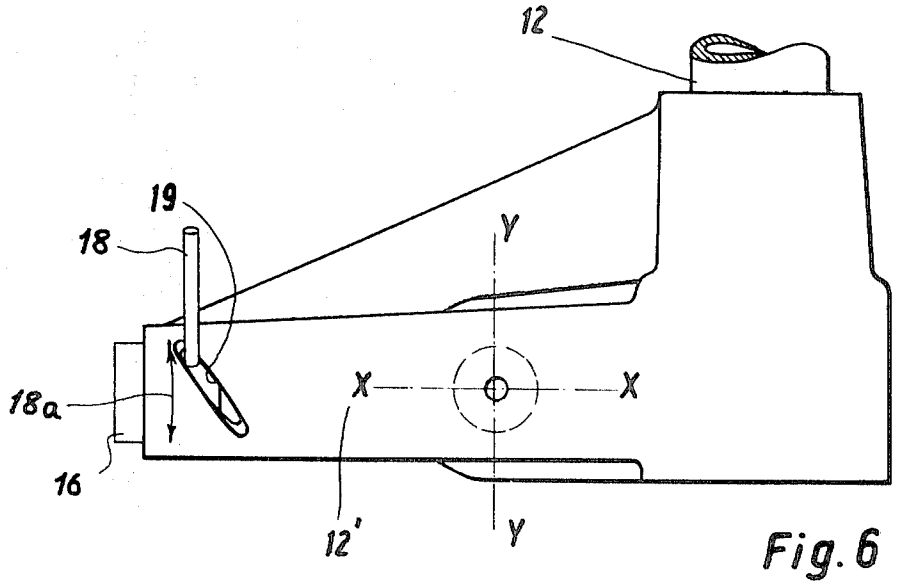


Fig. 6

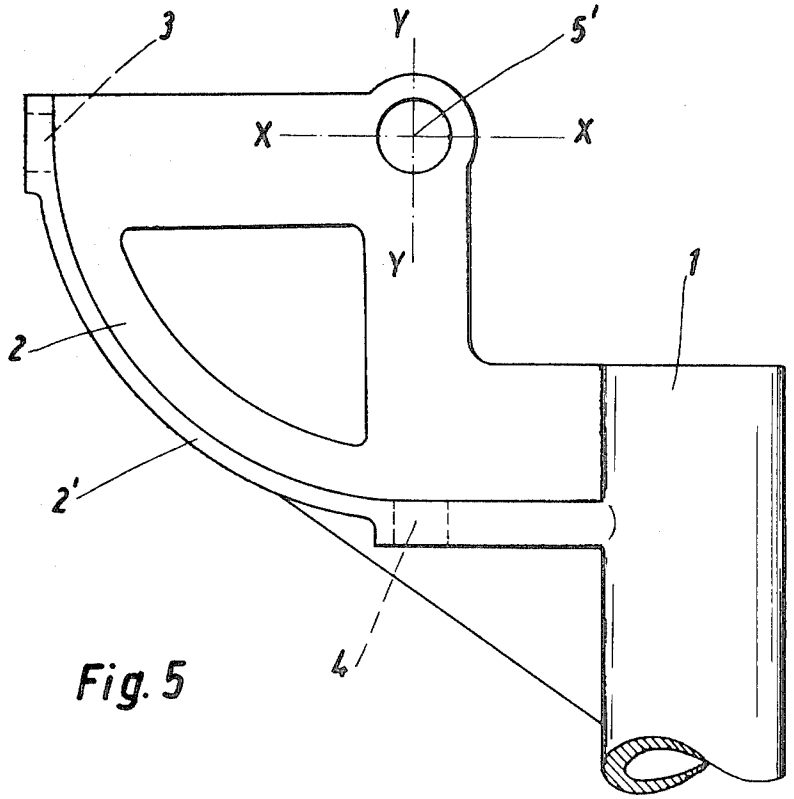


Fig. 5

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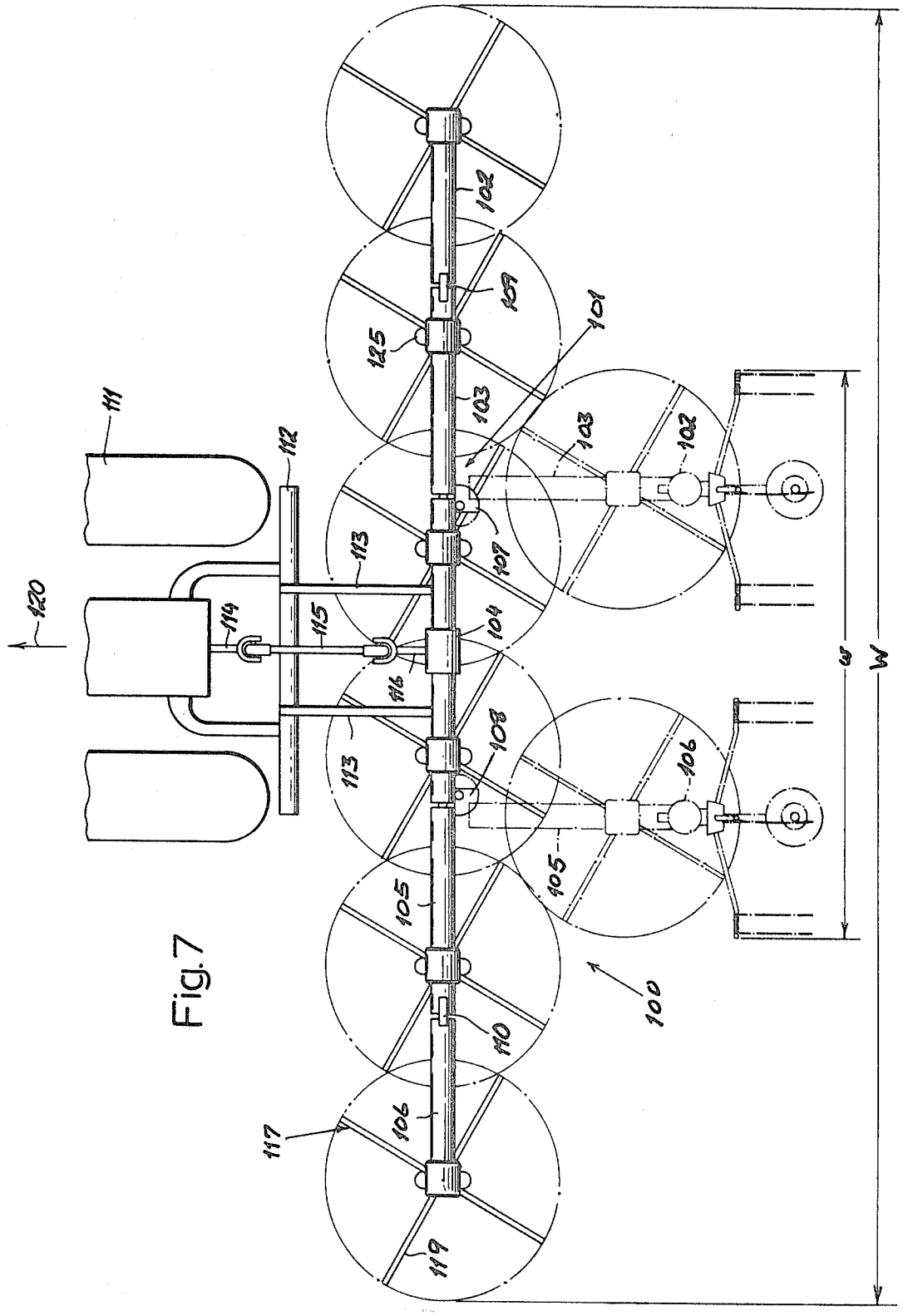

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125
102
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110
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119
143
102
106
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P
W
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100

Fig. 7

PIVOT ASSEMBLY FOR HAYMAKING MACHINES AND THE LIKE

This application is a division of application Ser. No. 647,065 now Pat. 3,509,707 filed 19 June 1967.

My present invention relates to a pivot assembly for haymaking machines and, more particularly, to a haymaking machine having a support beam for a plurality of rotary rakes which is subdivided longitudinally into a plurality of beam sections, and to the pivot means for interconnecting these sections.

In the commonly assigned copending application Ser. No. 577,335, filed 6 Sept. 1966 and entitled "HAYMAKING MACHINE AND METHOD OF OPERATING SAME" (now Pat. No. 3,509,707), there is described and claimed a haymaking machine adapted to be drawn by a towing vehicle, e.g. an agricultural tractor and to be driven by the power-takeoff shaft thereof. This rake, turner or tedder comprises a generally horizontal beam which is subdivided longitudinally into a plurality of beam sections, hingedly interconnected for swinging movement to enable the rotary rakes carried by these sections to be horizontally spaced-apart transversely to the direction of movement of the implement during haymaking operations or to be disposed one behind another when the implement is to be transported over narrow roads. Each beam section may be provided with respective support wheels upon which the beam rides and a plurality of rake heads forming housings for bevel gearing adapted to transmit the motive force from a shaft extending through and along the beam to the individual rakes. The latter have hubs rotatable generally about upright axes and radial arms carrying at their extremities spring fingers for engagement with the ground crop. It will be recognized that several problems are involved in the pivot systems by which the beam sections are hingedly interconnected since in the extended position of the beam, the drive shaft must be capable of transmitting power to the outermost rakes. In spite of the requirement for positive coupling of the beam sections, it is desirable that the outermost sections pivot about substantially vertical axes to permit the outer sections to swing inwardly and reduce the span of the machines. When the drive shaft passes through the beam sections, the difficulties increase. Moreover, the pivots are subject to considerable stress from ground drive, etc.

It is, therefore, the principal object of the present invention to provide a pivot assembly for hollow beam sections of the character described wherein the beam sections can be swung through angles of about 90° relatively to one another and yet can have their respective drive shafts coupled in an extended position of the unit.

Still another object of this invention is to provide an improved retaining means for a pivot assembly for adjoining beam sections which is substantially unaffected by variations in the terrain.

I have found that the foregoing objects and others which will become apparent hereinafter can be attained in a relatively simple system for pivotally connecting the beam sections of an articulated support for a haymaking machine and especially a hollow horizontal support through which a rake-drive shaft extends, wherein a pivot is provided in the form of a ball joint between the articulated beam sections and is laterally offset from the axis of the shaft while affording pivoting movement about an axis (vertical) perpendicular thereto and at least limited pivoting movement about a horizontal axis parallel to one of the beam sections.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a plan view, partly in axial section, of the articulating or pivot assembly of a beam section for haymaking machines;

FIG. 2 is a view similar to FIG. 1 showing the assembly in its angular state corresponding to the transport position of the machine, as contrasted with the operating position shown in FIG. 1;

FIG. 3 is an enlarged cross-sectional view taken generally along the line III–III of FIG. 1;

FIG. 4 is a plan view of a portion of the device of FIG. 3;

FIGS. 5 and 6 are plan views of the interconnected parts of the pivot assembly; and

FIG. 7 is a plan view of a haymaking implement embodying the invention.

Referring first to FIG. 7, it can be seen that the implement **100** basically comprises a support beam **101** which is subdivided longitudinally into sections **102**, **103**, **!104**, **105** and **106** by a pair of pivots **107** and **108** having vertical axes and a pair of pivots **109** and **110** having horizontal axes. The tractor **111** has a drawbar **112** to which beam member **104** is attached by a linkage **113** and a power-takeoff shaft **114** to which the connecting shaft **115** is joined by universal couplings. The shaft **115** is connected to the input shaft **116** of the implement by another universal coupling and in the manner described in the commonly assigned copending application mentioned above. Motion is transmitted through a drive shaft in the hollow beam sections **102** through **106** to the rakes **117** whose overlapping patterns are represented in dot-dash lines. Each rake comprises a hub (not shown) driven by bevel gearing within the respective rake head of the beam from the throughgoing shaft and with angularly equispaced radial arms **119** which carry spring fingers at their extremities as illustrated in the aforementioned copending application. When the apparatus is used for the raking, tedding or turning of hay, grass or other field crops, the beam **101** is extended transversely to the direction of advance of the implement (arrow **120**) and treats a swath whose width W corresponds to the extended width of the assembly. For road transport, beam sections **103** and **105** are swung inwardly and rearwardly (dot-dash position) about their pivots **107** and **108**, while arms **102** and **106** are swung upwardly and inwardly (dot-dash position) so that the contracted width *w* of the entire assembly is only a fraction of the original swath width. The pivots **107** through **110** may be constituted as described in connection with FIGS. 1 through 6.

In FIGS. 1 through 6 of the drawing, I show a pair of beam sections **1** through **12** which are hingedly interconnected for swinging movement about a pivotal axis represented at **5'** and formed by the intersection of the vertical plane X-X and Y-Y, the axis **5'** being offset inwardly from the vertical axial plane P of the beam sections **1** and **12** in their extended state.

To this end, the support tube or beam section **1** is provided with a generally flat laterally extending flange **2** which, as indicated in FIGS. **3** and **5**, lies generally in a horizontal plane and is offset from the axial plane P of the shafts **8**, **11**; in this flange **2**, I provide an arcuate upstanding ridge **2'** which is transverse to the plane of the flange **2** and is provided at angularly offset locations with radial bores **3** and **4** (FIGS. **2** and **5**). The bore **4** lies generally in the vertical plane P_Y of the pivot axis Y-Y while the other bore (**3**) lies in the vertical plane P_X of the axis X-X. At the intersection of these planes and of the axes X-X and Y-Y (FIG. **3**), there is provided a ball joint which is described in greater detail below. This ball joint defines the vertical axis Z. The horizontal plane P_{XY} of this ball joint contains the axes X-X and Y-Y.

The ball joint is formed by the spherical head **6'** of a ball member whose cylindrical shank **6** is located in the tubular boss **2***a* of flange **2** by a setscrew **6***a*. At the lowermost extremity of the cylindrical shaft **6**, there is provided a downwardly projected joint tongue **7** which projects into a longitudinal slot **14** at the free end of a spring member **13**. To receive the ball head **6'**, the lateral projection **12'** of the tube **12** is formed with a spherical seat **12***a* which is open downwardly. Radially outwardly of this seat **12***a* with respect to the axis Z, there is provided a radial bore **12***b* in which a cylindrical locking bolt **16** is urged radially outwardly (arrow **12***c*) by a compression spring **17**, the bolt **16** being dimensioned for engagement in the bores **3** and **4**. A handle **18** projects from the bolt **16** and passes through a slot **19** of the sleeve **12'** to enable the operator to withdraw the bolt and swing the beam sections **1** and **12** relatively about the axis Z.

The shaft sections **8** and **11**, which deliver motive power to the rakes, as described in the aforementioned copending application, are interconnected at the point of intersection of the planes P, P_X and P_{XY} by a coupling represented at **9**, **10**. This coupling can include a claw-shaped socket **9** whose axially open recesses **9***a* form notches which are engaged by the lateral pins **10** of the shaft **11**. Thus, when the shaft **12** is swung in the clockwise sense about the axis Z, the pins **10** are engaged in the socket **9***a*. The shaft **8** thus is able to drive the shaft **11**.

The assembly is resiliently held in place by locking strap **13** which is anchored by a bolt **15** to the beam **12** and underlies at its free end **13'** the ball member **6**, **6'**. Thus, the strap **13**, whose slot **14** receives the projection **7** of the ball member **6**, **6'**, bears upwardly against the ball member while drawing the section **12** downwardly. The handle **18** projects through the helicoidally extending camming slot **19** so that, as the lever **18** is rotated in the direction of arrow **18***a* (FIG. **6**), the bolt **16** is drawn inwardly.

In the operating position of the machine corresponding to the solid-line illustration in FIG. **7** and the position of the beam sections **1**, **12** of FIG. **1**, the pins **10** are received in the socket **9** and the shaft sections **8** and **11** are interengaged. Thus, when the power-takeoff shaft **114** is driven, rotary movement is delivered to shaft **116** and thence, by gearing of the type illustrated in the copending application mentioned earlier, to the shaft **8**, **11** for delivery to the rotors or rakes **117**. In this position of the beam sections **1** and **12**, the rakes span the maximum swath width W. It will be noted that the beam sections **102** through **106** are carried by respective support wheels **125**, e.g. as described in the copending application, so that unevenness of the ground during the operative movement of the vehicle and implement in the direction of arrow **120** often causes strain at the junction between the shaft sections. In the position of the device illustrated in FIG. **1**, the bolt **16** is received in bore **3**. Since the ball joint permits limited relative angular movement of beam sections **1** and **12** about the axis X-X, unevenness can be accommodated without difficulty. The ability of the ball member **6** thereof to swing in the slot **14** permits such movement about the axis X-X or Y-Y without straining the joint. In fact, the slot **14** is dimensioned to permit an arcuate movement of at least 20° on either side of its normal position.

When it is desired to transport the apparatus over roadways, the outermost arms **102**, **106** can be swung upwardly and the arms **103**, **105** inwardly to the dot-dash position illustrated in FIG. **7**. This swinging movement is permitted by withdrawing the bolt **16** of the respective pivot assembly and permitting it to be forced by spring **17** into the other bore **4** upon pivotal movement through 90° (FIG. **2**). This movement decouples the shaft sections **8** and **11** and affords compensation for road unevenness by permitting the members **1** and **12** to swing relatively through at least 20° on either side of the median position about the horizontal axis Y-Y.

The invention described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the invention except as otherwise limited in the appended claims.

I claim:

1. A pivot assembly comprising a pair of hollow beam sections relatively swingable to include an angle of less than 180° between them in one position thereof and axially aligned in another position thereof; a shaft extending through said beam sections and axially subdivided into a pair of interconnectable shaft sections disengaged from one another in said one position and mutually interconnected in said other position of said beam sections; and pivot means interconnecting said beam sections for relative pivotal movement thereof between said positions about a first axis laterally offset from said shaft in said other position and perpendicular to the axis thereof, and a second axis generally parallel to one of said shaft sections in one of said positions, said second axis intersecting said first axis, said hollow beam sections forming part of an articulated beam for a haymaking machine towable by an agricultural tractor, said shaft being driven from said tractor, said beam being provided with a plurality of rotary rakes operatively connected to said shaft and spaced along said beam for raking a ground crop upon advance of the beam and said rakes thereover, said first axis being generally upright and said second axis being generally horizontal.

2. The pivot assembly defined in claim **1** wherein said pivot means includes a ball member mounted on one of said beam sections at a location laterally offset from said shaft, and a socket member formed on the other of said beam sections and receiving said ball member, said members forming a ball joint permitting at least limited pivotal movement of said beam sections in all relative angular positions thereof about a horizontal axis parallel to at least one of said beam sections.

3. The pivot assembly defined in claim **2**, further comprising a retaining strap fixed to said other beam section and underlying said ball member, said ball member and said strap being formed with mutually engaging formations permitting at least limited angular movement of said members about said horizontal axis and defining said limited angular movement.

4. The pivot assembly defined in claim **2**, further comprising slidable bolt means having an axis coplanar with said second axis and carried by said other section while cooperating with said one of said beam sections for locking the assembly in said positions.

5. A haymaking machine comprising a pair of hollow beam sections relatively swingable to include an angle of less than 180° between them in one position thereof and axially aligned in another position thereof; a shaft extending through said beam sections and axially subdivided into a pair of interconnectable shaft sections disengaged from one another in said one position and mutually interconnected in said other position of said beam sections; and pivot means interconnecting said beam sections for relative pivotal movement thereof between said positions about a first axis laterally offset from said shaft in said other position and perpendicular to the axis thereof, and a second axis generally parallel to one of said shaft sections in one of said positions, said second axis intersecting said first axis, said pivot means including a ball member mounted on one of said beam sections at a location laterally offset from said shaft, and a socket member formed on the other of said beam sections and receiving said ball member, said members forming a ball joint permitting at least limited pivotal movement of said beam sections in all relative angular positions thereof about a horizontal axis parallel to at least one of said beam sections; and a plurality of rotary rakes mounted on and driven by said shaft sections, wherein said other of said beam sections is formed with a lateral projection generally coplanar with the respective shaft section and formed with said socket member and with an outwardly extending sleeve having an axis coplanar with the respective shaft section and with said second axis of said socket member while extending radially therefrom, said one of said beam sections having a lateral flange lying generally in a horizontal plane and provided with an arcuate transverse rim having a pair of generally radial bores separated by an angle of approximately 90° about said first axis, one of said bores having an axis parallel to the shaft section of said one of said beam sections, the other of said bores having an axis parallel to said shaft section of said other of said beam sections, said other of said beam sections being further provided with a radially slidable cylindrical bolt received in said sleeve and fittable in said bores, and with a compression spring in said sleeve resiliently urging said bolt into the respective bore in the respective positions of said beam sections.

6. A haymaking machine as defined in claim **5** wherein said ball member has a cylindrical shank received in said flange and an axial projection extending therebelow, said other of said beam sections being formed with a retaining strap underlying said flange and provided with a longitudinal slot receiving said projection with freedom of relative angular movement

of said beam sections through limits determined by the extent of said slot.

7. A haymaking machine as defined in claim 6 wherein said sleeve is provided with a generally helicoidal camming slot, said bolt having a handle slidably received in said slot and enabling withdrawal of said bolt from the respective bore upon a rotary movement of said handle about said second axis in said slot.

8. A haymaking machine as defined in claim 7 wherein said shaft sections are provided with matingly interengageable formations automatically interfitting and releasing upon swinging movement of said beam sections about said first axis.

9. A haymaking machine as defined in claim 8, wherein said beam is provided with a multiplicity of spaced-apart rotary rakes driven by said shaft, at least some of said rakes being swingable beyond other of said rakes upon relative movement of said beam sections through an angle of 90° from one of said positions to the other of said positions.