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(54) **Harvester**

(57) A harvester has a reaper knife drive in which bell crank levers (11) connected to the reaper knives (24) are drivable via crank pins (9) and articulated connecting rods (10) from both ends of a drive shaft (3) disposed behind a cutting mechanism trough (2). The levers (11) are disposed beneath the trough (2) and between mounting plates fixed to a frame of the cutting mechanism. The ends of the levers projecting outwards transversely to the travel direction through openings (12) in side walls (7) are connected with the rods (10), and the ends of the levers projecting forwards through apertures (22) in the trough (2) are connected inside the side walls (7) with knife head plates (25) fixed to the knives (24).

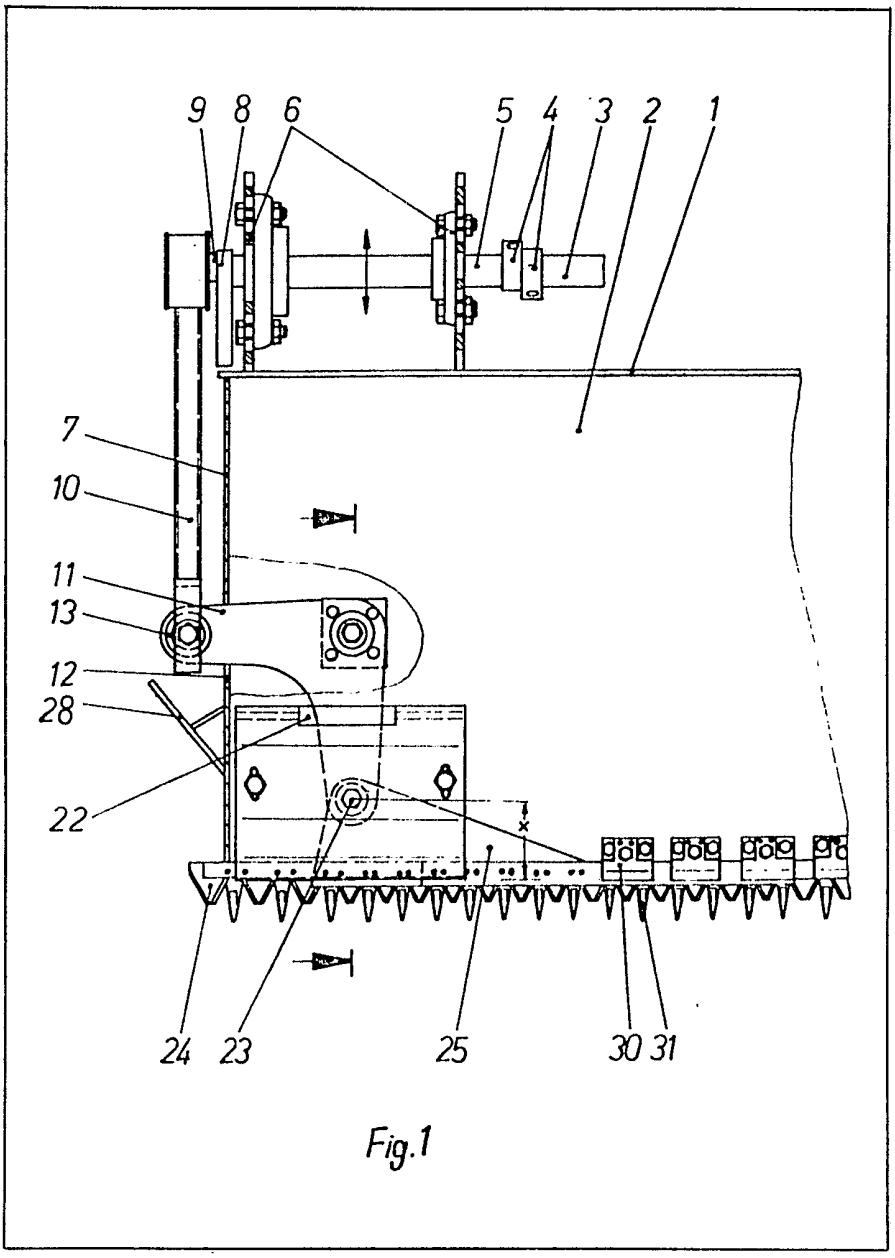

Fig.1

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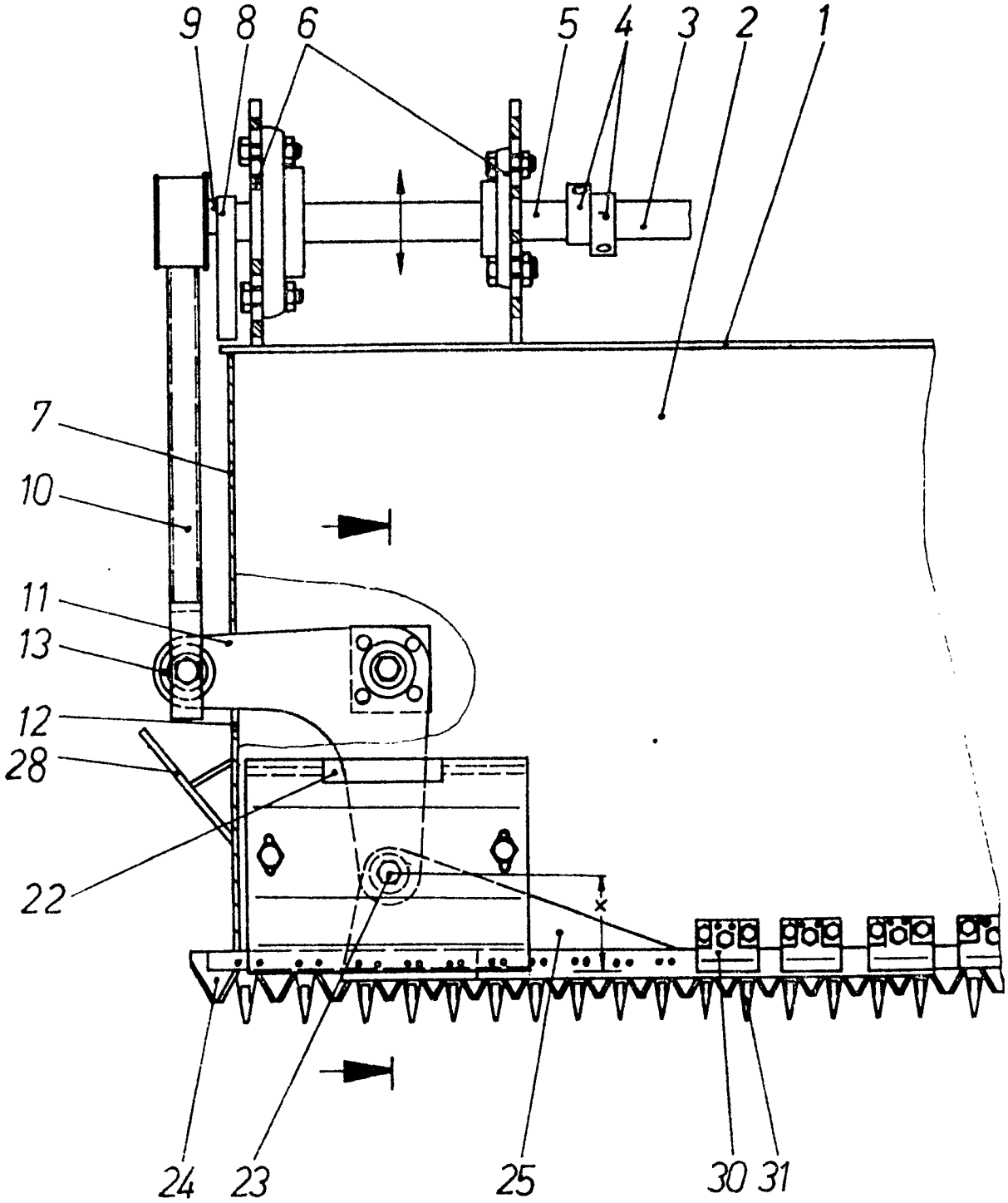

Fig.1

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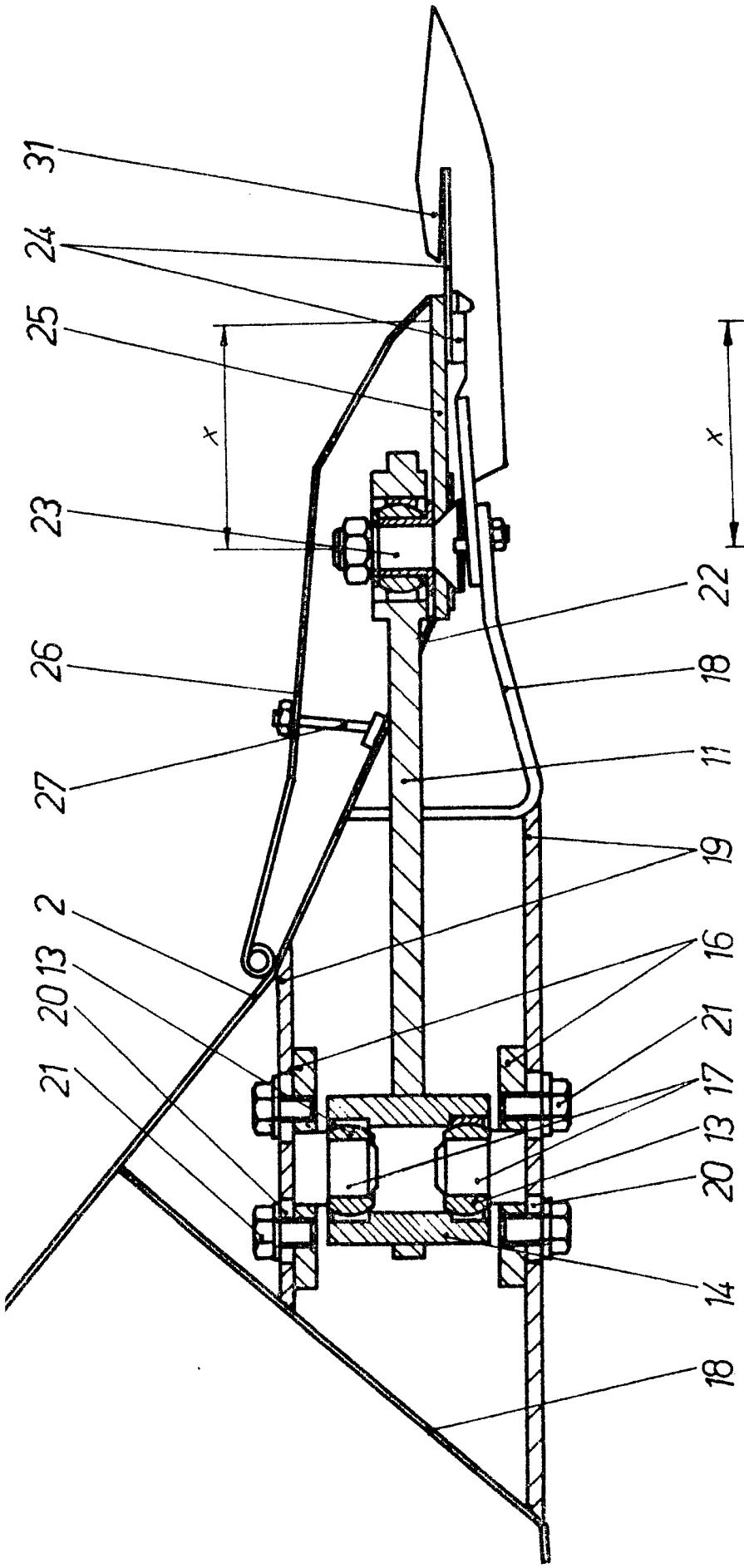

Fig.2

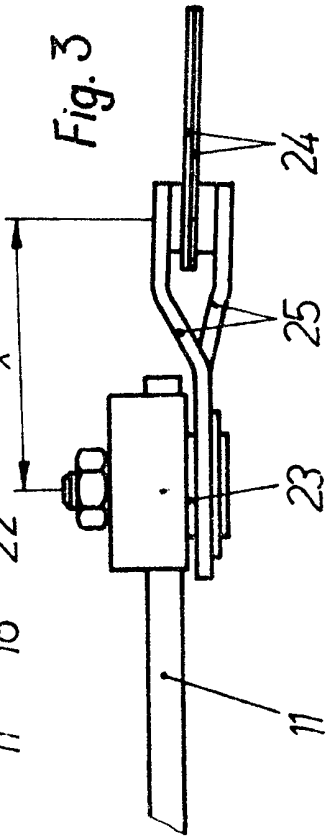

Fig.3

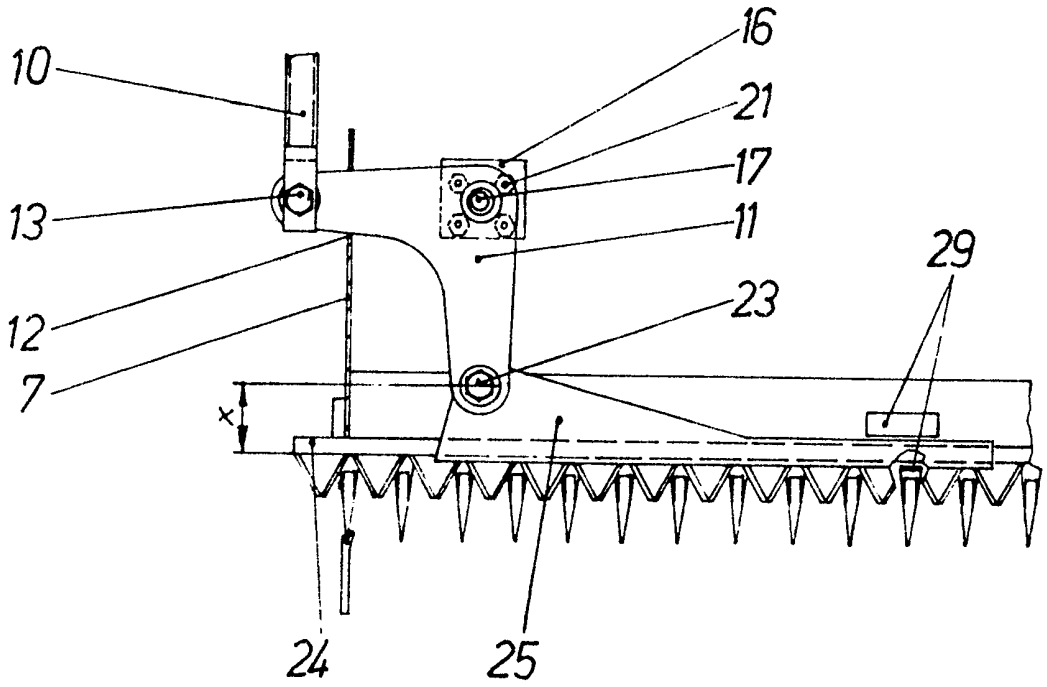

Fig.4

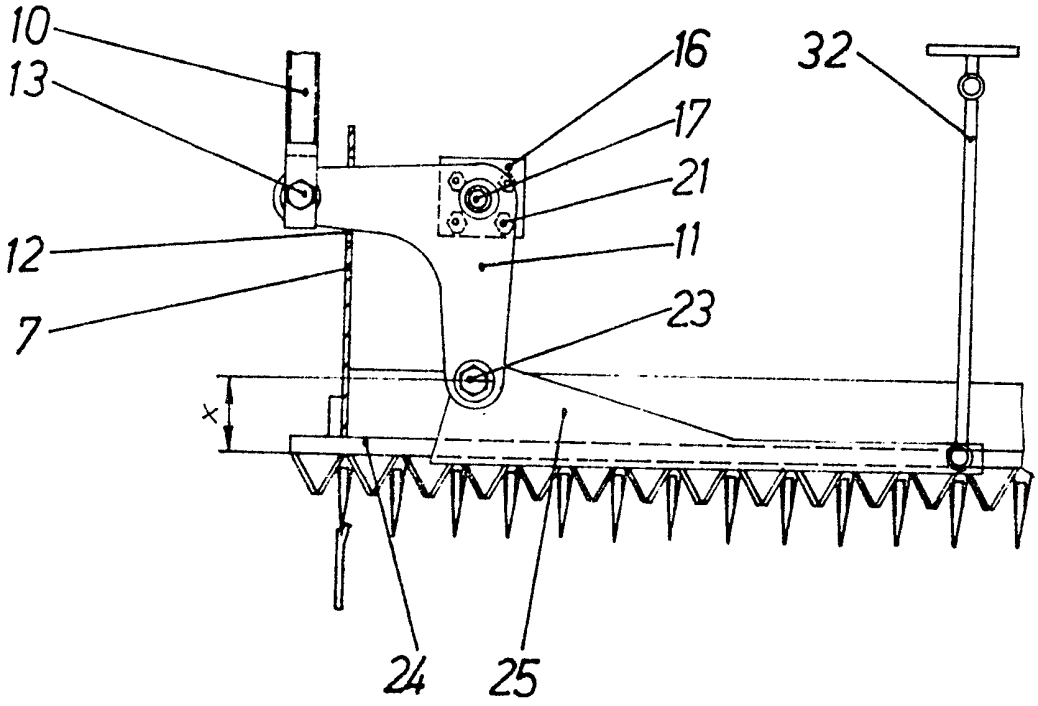

Fig.5

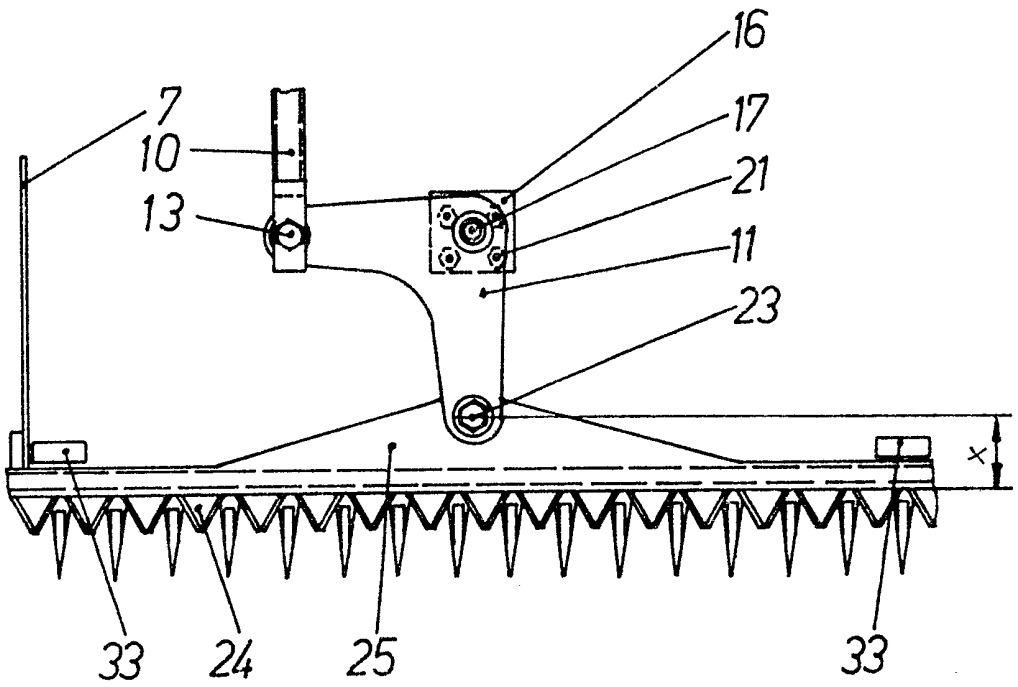

Fig. 6

SPECIFICATION
Harvester

The present invention relates to a harvester and has particular reference to a drive for a cutting mechanism of large working width on a self-propelled reaping and chaff cutting machine or a harvester-thresher.

In DD-WP 79 137 there is disclosed a cutting mechanism drive for a cutting mechanism of large working width, in which a main drive shaft extending across the width of a trough of the cutting mechanism possesses, at its two ends, wobble journals cranked in the same direction. Drive rockers, movable by wobble discs and fork pieces, are connected at both ends outside side walls of the trough with knife heads fixed to the ends of the reaper knife blades. This reaper knife drive has the disadvantage that the drive assembly requires a broad construction of the side walls at the outer faces of the side walls. The knife head situated low down at the end of the reaper knife blades produces a worn trail outside the wide wall on the standing crop side. The crop is flattened and cannot be picked up by the reaper knife at the next cut. The part of the reaper blade outside the side wall moving over the boundary of the standing crop and the drive rocker articulated to the end of the knife head press the crop onto the ground and considerable harvesting losses result.

DE-OS 24 11 232 discloses a reaper knife drive for a double cutting mechanism, in which two reaper knife beams are each driven at their opposed outer ends at the knife heads of symmetrically disposed, oscillating angle elements by means of crank rods. Eccentric discs are fixed on the two ends of a drive shaft, moving the crank rods.

This angle lever drive does indeed avoid the need for a broad construction of the side walls, but the disadvantage of producing a worn trail in the region of the standing crop boundary still results from the externally mounted knife head plates. Further disadvantages arise from the eccentric disc drive and the construction of the crank rods. The eccentric discs and the crank rods are made in such a robust and thus material-intensive form of construction that this form of drive is not usable for cutting mechanism drives of large working width having a high knife speed, due to the masses that have to be moved.

There is accordingly a need for a knife drive which makes possible a slender construction of the side walls for cutting mechanisms of large working width and which does not give rise to worn trails on the standing crop side resulting in loss of harvest.

According to the present invention there is provided a harvester comprising a cutting mechanism supported by frame means and comprising a plurality of reaper knives fastened to reciprocating head plate means, a trough associated with the cutting mechanism and bounded by two side walls, and cutting mechanism reciprocating drive means comprising a crank drive disposed behind the trough with respect to the forward direction of travel of the harvester and a plurality of bell crank levers which are pivotably mounted below the trough between mounting members secured to the frame means and which comprise first arms projecting laterally with respect to said direction and connected by connecting rods to the crank drive and second arms projecting in said direction through openings in the trough and connected between said side walls with the head plate means.

In a preferred embodiment, the bell crank levers are disposed at both sides beneath the cutting mechanism trough and between mounting plates fixed in the cutting mechanism frame. Ends of the levers are conducted outwards transversely to the direction of travel through slit-shaped openings in the side walls and are connected in articulated bearings with driving rods. The driving rods are articulated on crank pins, which are disposed on crank discs of crankshafts held in clamping pieces behind the cutting mechanism trough on both sides. For regulating the degree of overlap of the reaper blades, the crankshafts are preferably adjustably mounted in bearing plates at both rear ends of the side walls.

The bell crank or angle levers disposed beneath the trough preferably possess bearing bushings projecting outwardly at both sides. Bearing pins fixed to plates are inserted into the bushings from above and from below. The levers can then be fixed to the mounting plates by bolted connections passing through elongated holes of these plates, so that the levers are adjustable at any time in a seating perpendicular to the plane of the reaper blades.

The forwardly pointing ends of the levers are preferably conducted through apertures of the trough to ball ends of the knife head plates and connected thereto by ball cups. To prevent blockage of the oscillating ends of the levers projecting through the apertures and twisting of the reciprocating knife head plates, outer knife pressers are fixed to the trough to be adjustable by means of adjusting screws and arranged to form a cover extending all around the movable components.

The head plates are preferably fixed to the knives at positions set back inwardly at least three knife stroke lengths from the outer edges. Due to the fact that the knife heads are always situated inside the side walls, worn trails do not occur at the boundary of the standing crop and the previously resulting crop losses are eliminated.

For the optional use of double knife cutting mechanisms, it is desirable to locate the connecting points, for example ball joints, of the head plates offset towards the rear at a distance from the centre of gravity line of the knives. The bending moments resulting from this rearward offsetting of the force transmission point can be accepted by bearing plates disposed at the inner ends of the two knife head plates.

In another embodiment, the bending moments are relieved by the provision of oscillating levers.

The oscillating levers are articulated to the inner ends of the head plates and have a longer lever arm than the length of the distance from the pivot fulcrum of the bell crank levers to the points of connection of these levers to the head plates.

In a further embodiment with the connecting rods extending inside the side walls beneath the cutting mechanism trough to the bell crank levers, the head plates have their connections to the levers disposed at their centres. In this case, guide surfaces can be provided at the rear sides of the head plates at both ends thereof.

In the case of a harvester embodying the present invention, the now free ends of the reaper knives cannot cause worn trails at the standing crop boundary and thus crop losses are avoided. The bearing or guide surfaces or plates for relieving the bending moments that arise can be disposed within the required knife pressers and in the fixed finger, respectively, so that no additional components are required. The setting of the degree of overlap of the reaper blades can be effected by adjusting the crankshafts in their bearing plates. The connecting rods connected at the ends of the crankshafts to the crank pins can thus be made from bent material in lightweight construction.

Embodiments of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of one end of a knife drive, disposed at both ends, of a cutting mechanism of a harvester according to a first embodiment of the invention;

Fig. 2 is a section, to an enlarged scale, on the section line of Fig. 1;

Fig. 3 is a detail view, corresponding to part of Fig. 2, of a modified knife head plate with a double knife cutting mechanism;

Fig. 4 is a plan view of part of the drive of Fig. 1, showing the arrangement of knife head plates of the cutting mechanism;

Fig. 5 is a view similar to Fig. 4, but of the drive in a harvester according to a second embodiment of the invention; and

Fig. 6 is a view similar to Fig. 4, but of the drive in a harvester according to a third embodiment of the invention.

Referring now to the drawings, there is shown in Figs. 1, 2 and 4 the cutting mechanism region of a harvester in which a drive 3 is rotatably mounted behind the rear wall 1 of a cutting mechanism trough 2. Two crankshafts 5 are connected by clamping members 4 one at each end of the drive shaft 3. The crankshafts 5 are rotatably mounted in displaceable bearing plates 6 at side walls 7 of the cutting mechanism trough 2 and terminate in crank pins 9 fixed in crank discs 8 projecting beyond the side walls 7. Connecting rods 10, extending closely alongside the external faces of the side walls 7, are pivotably connected to the crank pins 9.

Arranged beneath the trough 2 are angle levers 11 which have laterally outwardly pointing ends guided through slit-shaped openings 12 in the side walls 7 and connected by articulated bearings 13 with the rods 10. The levers 11 possess, at their pivot fulcrums, bearing bushings 14 which project at both sides and in which pivot bearings 15 are seated at the top and bottom. Bearing pins 17, fixed to plates 16, can be pushed into the bearings 15. The levers 11, together with the upper and lower plates 16, are adjustable in elongated holes 20 underneath the trough 2 between mounting plates 19 disposed in the cutting mechanism frame 18 and are locked by bolted connections 21.

The forwardly projecting ends of the levers 11 extend through apertures 22 in the trough 2 and are connected in articulated manner by ball end pins 23 with knife head plates 25 fixed to the reaper knives 24. The mounting of the levers 11 must be carried out perpendicularly to the plane of the reaper knives 24. For setting this necessary perpendicular position, the angle levers 11, together with their pivot mountings as already described, are displaceable in the holes 20 of the mounting plates 19 and can be fixed by the bolted connections 21 at the plates 16. To prevent jamming, knife pressers 26, constructed as an all-round cover and mounted on the trough 2, are provided over the oscillating ends of the levers 11 projecting out from the apertures 22 and over the ball end pins 23 of the head plates 25. The setting of the required application pressure on the knives 24 is effected by adjustment screws 27 mounted in knife holders 26.

The ends of the levers 11 projecting laterally out through the openings 12 and the connecting rods 10 moving outside the side walls 7 are protected by deflector plates 28 mounted on both side walls.

For the optional use of a double knife cutter mechanism, the ball end pins 23 situated in the head plates 25 are disposed offset by a distance X from the centre of gravity line of the knives 24. Due to this displacement of the force transmission point, a bending moment occurs at the knives 24. To accept this bending moment, bearing or guide surfaces 29, bearing on both sides of the comparatively long head plates 25 at the end, are disposed in knife plates 25 at the end, are disposed in knife plates 30 and in fixed fingers 31 situated in this region. Instead of these bearing surfaces 29, oscillating levers 32 (Fig. 5), articulated to the ends of the head plates 25, may be fitted for reducing the bending moment. The oscillating levers 32 must, however, have a lever arm longer than the distance from the pivot fulcrum of the levers 11 to the ball end pins 23 of the head plates 25. In the embodiment illustrated in Fig. 6, in which the connecting rods 10 extend inside the side walls 7 and underneath the trough 2 to the levers 11, the head plates 25 can be equipped with centrally located ball end pins 23. For accepting the bending moments, bearing or guide plates 33, bearing at both ends of the head plates 25 against the rear side thereof, and also capable of being fitted on the knife plates 30, are

sufficient.

In the embodiments hereinbefore described, the cutting mechanism drive means is particularly suitable for a crop harvesting machine of large working width, in that the articulation points for transmitting the drive force to the reaper knives are no longer outside the side walls and a high knife speed can be achieved with slender construction and low mass movement.

CLAIMS

1. A harvester comprising a cutting mechanism supported by frame means and comprising a plurality of reaper knives fastened to reciprocating head plate means, a trough associated with the cutting mechanism and bounded by two side walls, and cutting mechanism reciprocating drive means comprising a crank drive disposed behind the trough with respect to the forward direction of travel of the harvester and a plurality of bell crank levers which are pivotably mounted below the trough between mounting members secured to the frame means and which comprise first arms projecting laterally with respect to said direction and connected by connecting rods to the crank drive and second arms projecting in said direction through openings in the trough and connected between said side walls with the head plate means.

2. A harvester as claimed in claim 1, wherein the first arms of the levers project through openings in the side walls.

3. A harvester as claimed in either claim 1 or claim 2, wherein the crank drive comprises a drive shaft and two crankshafts each fastened to the drive shaft at a respective end thereof, the crankshafts being connected at crankpins thereof to the connecting rods and being mounted in bearing means to be adjustable for variation in the degree of overlap of the knives.

4. A harvester as claimed in any one of the preceding claims, wherein each of the levers is pivotably mounted at both sides thereof by means of universal bearing joints which are fastened to plates adjustably attached to the mounting members.

5. A harvester as claimed in any one of the preceding claims, comprising knife presser elements adjustably mounted on the trough to cover end portions of the first arms of the levers projecting through the trough openings and ball joints coupling said end portions to the head plate means.

6. A harvester as claimed in any one of the preceding claims, the head plate means being fastened to the knives inside the side walls and set back from the outer edges of the knives by an amount equal to at least three times the length of the knife stroke.

7. A harvester as claimed in any one of the preceding claims, wherein the levers are pivotally connected to the head plate means at a spacing from the centre of gravity line of the knives, the head plate means being guided between guide surfaces disposed at knife plates and fixed fingers associated with the knives.

8. A harvester as claimed in any one of claims 1 to 6, the head plate means comprising plates each guided by an oscillating arm pivotally connected to an end portion thereof.

9. A harvester as claimed in any one of claims 1 to 6, wherein the connecting rods are disposed between the side walls and below the trough and the levers are pivotally connected to the head plate means centrally thereof, the head plate means comprising plates guided by guide surfaces disposed at ends of the plates and at edges thereof facing rearwardly with respect to said direction.

10. A harvester substantially as hereinbefore described with reference to Figs. 1, 2 and 4 of the accompanying drawings.

11. A harvester as claimed in claim 10 and modified substantially as hereinbefore described with reference to Fig. 3 of the accompanying drawings.

12. A harvester substantially as hereinbefore described with reference to Fig. 5 of the accompanying drawings.

13. A harvester substantially as hereinbefore described with reference to Fig. 6 of the accompanying drawings.

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