Jan. 27, 1931. R. W. McLEAN 1,790,106

CUTTER

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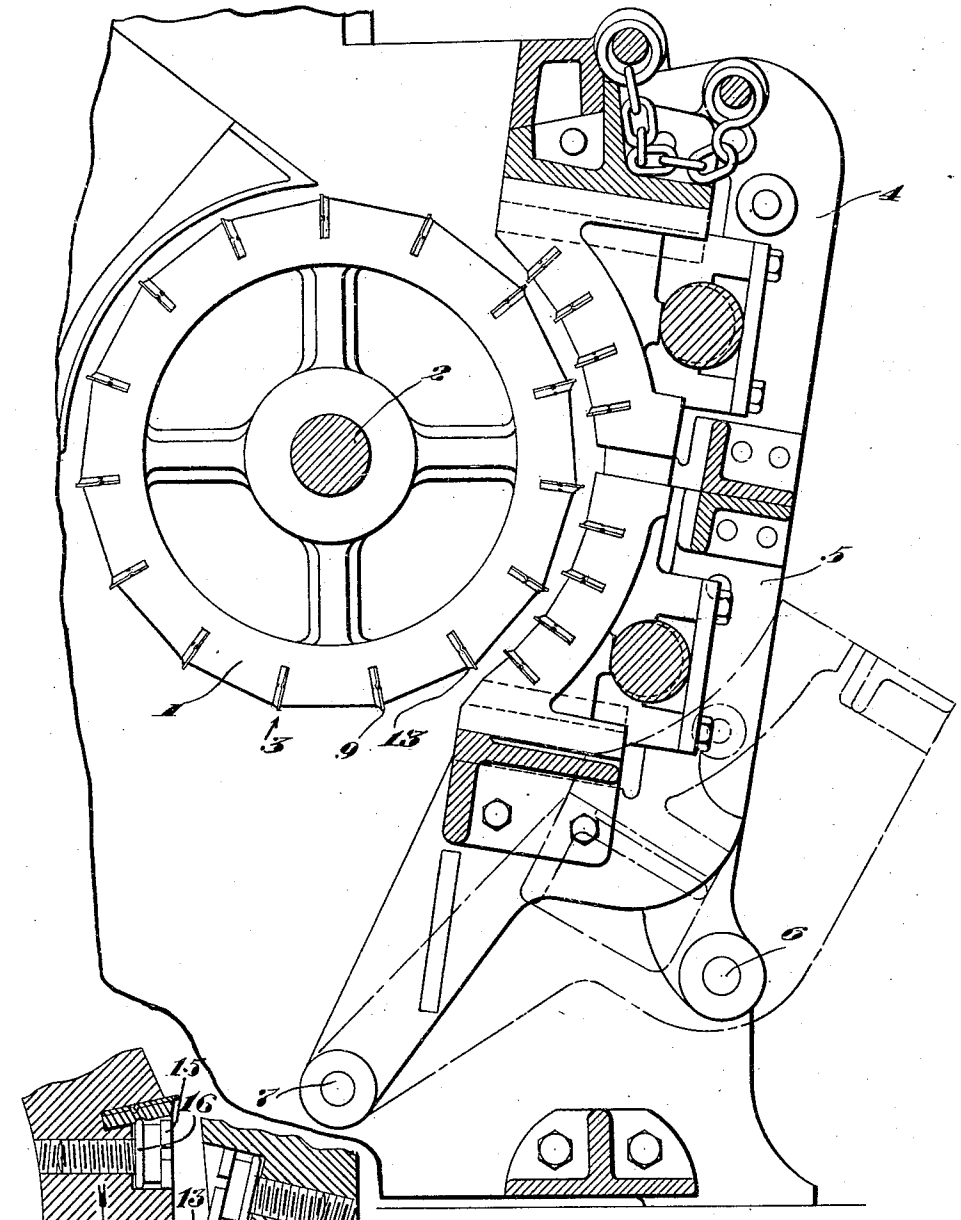

Fig. 1

Fig. 2

Inventor
Robert W. McLean
by Roberts Cushman & Woodbury,
Attys.

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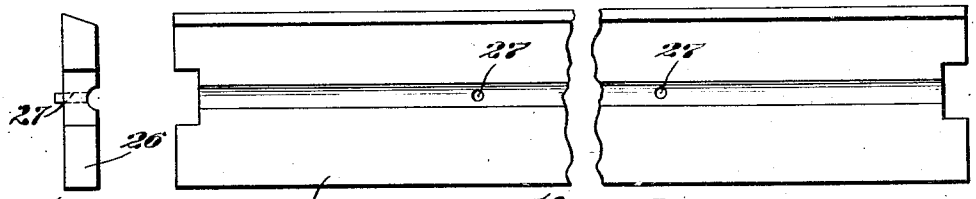

Fig. 3

Fig. 5

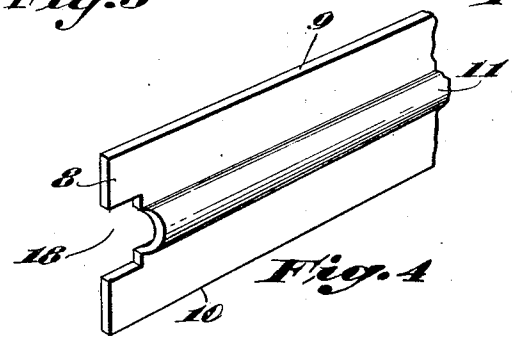

Fig. 4

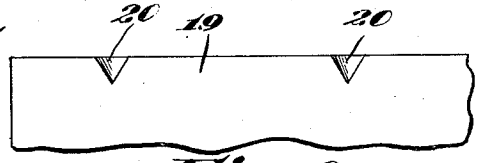

Fig. 6

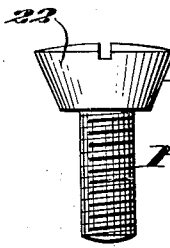

Fig. 7

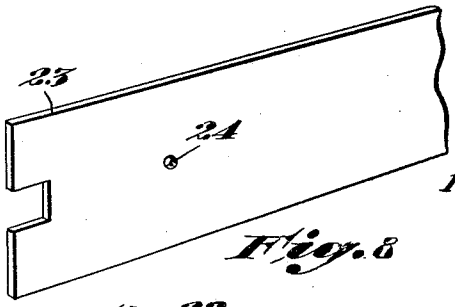

Fig. 8

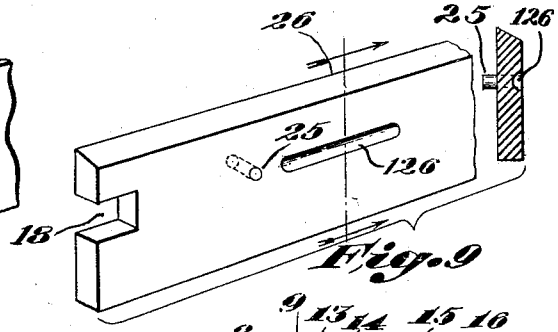

Fig. 9

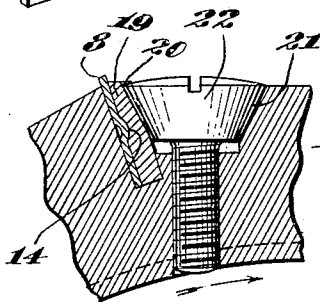

Fig. 10

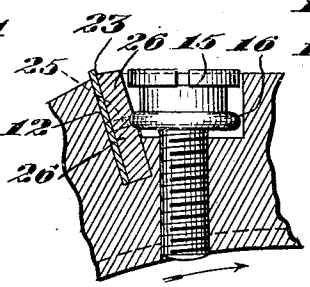

Fig. 11

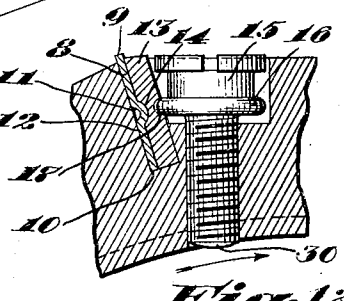

Fig. 12

Inventor
Robert W. McLean
by Roberts Cushman & Woodberry
Attys.

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Fig. 13

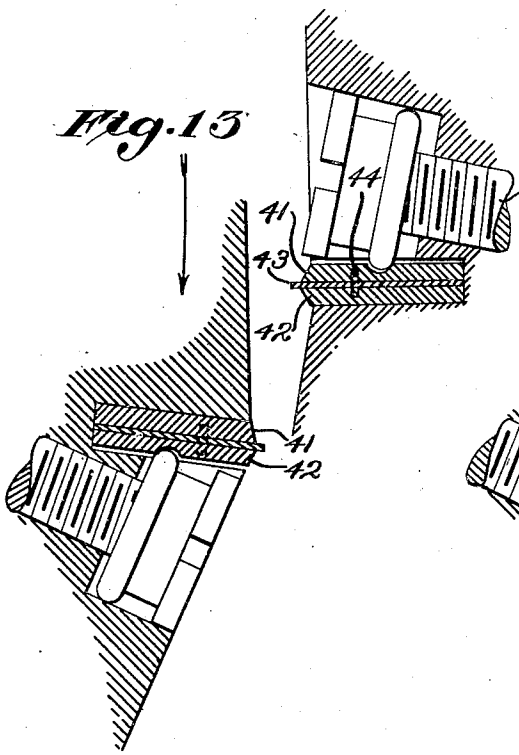


Fig. 14

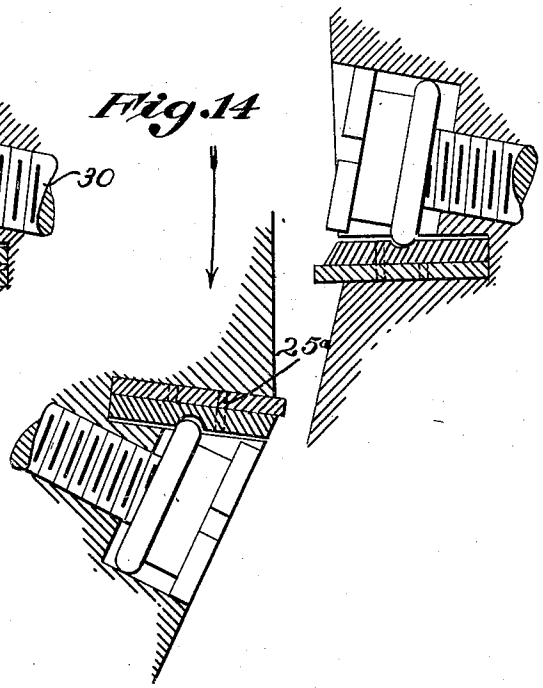


Fig. 15

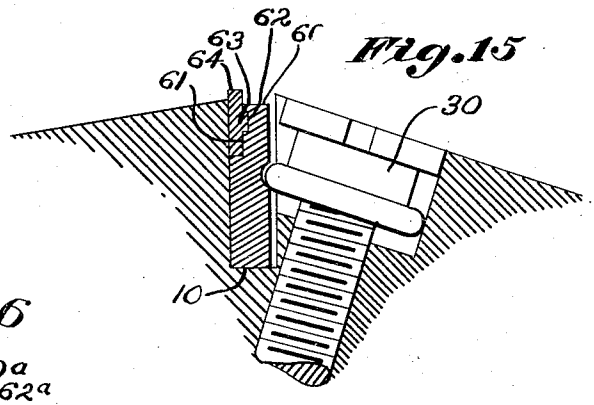
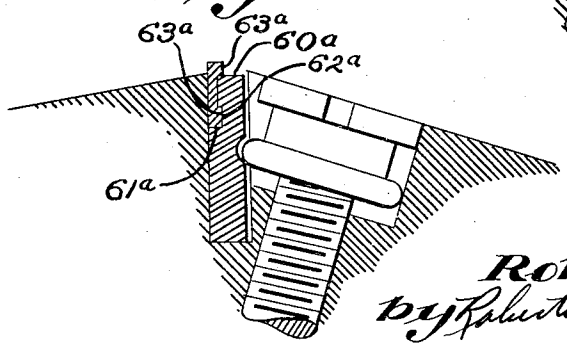


Fig. 16



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by Roberts, Cushman & Woodberry
Attys.

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Fig. 17

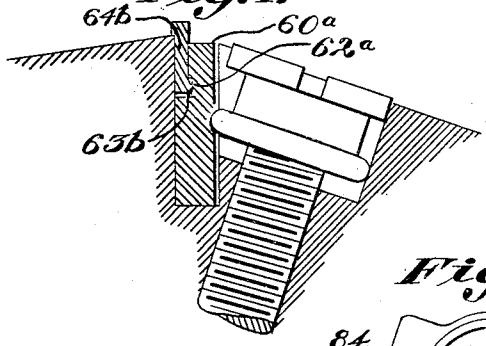


Fig. 18

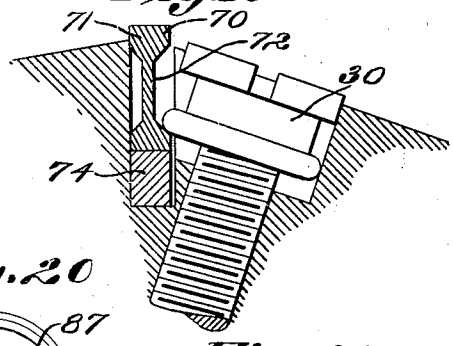


Fig. 20

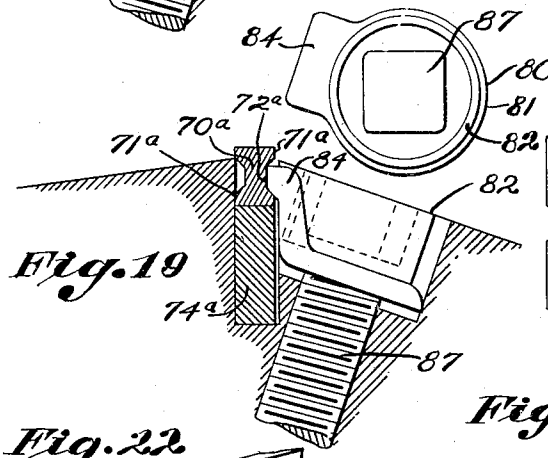


Fig. 19

Fig. 21

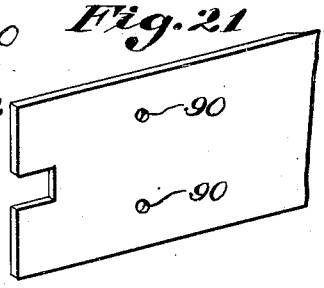


Fig. 22

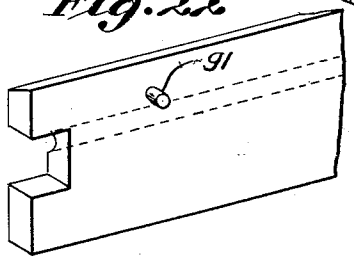


Fig. 23

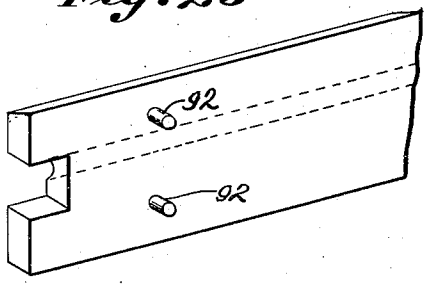
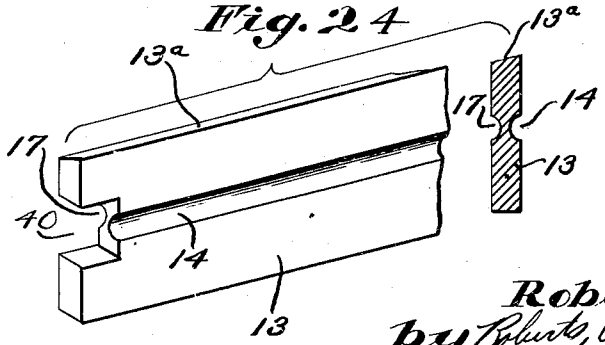


Fig. 24



Inventor:
Robert W. McLean
by Roberts, Cushman & Woodberry
Attys.

Patented Jan. 27, 1931 1,790,106

UNITED STATES PATENT OFFICE

ROBERT W. McLEAN, OF BRIDGEWATER, MASSACHUSETTS, ASSIGNOR TO CARVER COTTON GIN COMPANY, OF EAST BRIDGEWATER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

CUTTER

Application filed July 24, 1928. Serial No. 295,044.

This invention relates to knives, cutters, or like devices, and more particularly to knives or cutters for use in power driven machines running at high speed and in which the knives or cutters are subjected to hard and often abusive treatment necessitating their frequent replacement. While the improved knife or cutter forming the immediate subject of the present invention is of broad utility, I have herein chosen to illustrate and describe it as embodied in a cottonseed huller, wherein its peculiar characteristics are highly advantageous.

A cottonseed huller usually consists of a rotary drum or cylinder carrying knives spaced circumferentially about its periphery, which are adapted to cooperate with similar knives mounted in one or more concave members arranged adjacent to the drum, such as is shown in my prior Patent No. 1,590,305, issued June 29, 1926, the seeds to be crushed or hulled being fed between the drum or cylinder and the stationary concave members and being subjected to the crushing or cutting action of the two sets of knives.

Machines of this character, and particularly the cutting elements thereof, are ordinarily subjected to heavy shocks and severe usage. Consequently the knives quickly become dulled and are often broken. Frequently metal parts find their way into the machine and destroy one or more of the cutting elements before they can be ejected or removed, as described in my above-identified prior patent. Heretofore knives for this purpose have generally been cast or forged, and then have received suitable hardening and sharpening treatments. Due to the comparatively heavy loads and shocks to which cutting elements of this character are exposed, they are made comparatively heavy (for example $\frac{5}{16}$ of an inch thick), and they are accordingly expensive and difficult to manufacture, and the necessity of frequent renewal or replacement of these comparatively expensive knives adds very substantially to the operating expenses of machines of this general character.

In the preferred embodiment of this invention, the cutting elements comprise strips of sheet metal which have marginal portions extending slightly beyond the edges of supporting plates, the narrow width of the unsupported edges permitting them satisfactorily to withstand the shocks to which they are subjected. Due to the thinness of the effective cutting edge thus provided, the hulls of the seeds are cut or broken much more effectively, even after the blade has worn somewhat, than is the case with the ordinary blades which have a comparatively thick cutting edge. As the thick blades wear, their corners are rounded away upon a relatively large radius, and thus the cottonseeds engage the same with a wedging action and are crushed, rather than having their shells cracked or cleanly severed. On the other hand, the thin blade can never wear to an edge of large radius, and cracks or cuts, rather than crushes, no matter how badly it may be worn. In the former case a large portion of the oil (when the thick blades are very dull, as much as 60%) is absorbed into the shells and the efficiency of the oil removing process is thereby greatly reduced. Thus, the present invention not only provides blades which are originally comparatively inexpensive and which may be reversible to provide interchangeable cutting edges, but also provides cutting elements which are much more satisfactory and efficient than usual blades for the intended purposes.

According to the present invention the knives or cutting elements proper are formed of metal strips which are lighter and consequently are more easily worked, and are much less expensive than the conventional knives which have previously been utilized for cottonseed hullers or the like. In order to retain the edges of these blades in position, I provide blades supporting plates which cooperate therewith and which ordinarily do not have to be renewed during the life of the machine. Thus, the blades themselves may be formed of light metal strips, for example of sheet metal, which may be rolled out in the form of elongate strips of the desired cross-sectional dimensions and merely cut off to the desired lengths to provide the finished blades. Either before, during, or after the cutting operation,

suitable means for interfitting with the blade supports may be made by appropriate punching or rolling operations, and the appropriate heat treating and hardening operations may be performed.

The metal strips thus employed have a cost which is but a fraction of that of the knives that were previously used, but their dimensions are wholly inadequate, unless supported, to permit them to withstand without bending, the severe shocks or usage to which cutting elements of this character are ordinarily subjected. Accordingly, the blade supports are arranged to extend within a fraction of an inch of the outer edge of the cutting elements so that the unsupported portion of the same has a comparatively narrow extent which is appropriate to the thin gauge or lightness of the blade itself.

The objects of this invention are, therefore, to provide simple, cheap and effective knives or cutters for cottonseed hulling and crushing machines and the like, such knives being applicable to existing machines without modification of the latter and being adapted to perform all the duties of the previously used knives, but which cost much less to manufacture; which perform the cutting operation more effectively and with less loss of oil through absorption; to provide suitable methods and means for holding such knives in the machines in which they are used while permitting the ready replacement or reversing of the knives; and in general to effect improvements in machines of this character.

Fig. 1 is a vertical cross-sectional view of a cottonseed huller showing the cylinder and portions of the concaves in end elevation;

Fig. 2 is a sectional detail of a portion of the cylinder and an adjoining part of a concave showing the arrangement of cutting elements in the same in accordance with the present invention;

Fig. 3 is an end elevation of one form of blade support;

Fig. 4 is a fragmentary perspective detail of one type of blade;

Fig. 5 is a fragmentary elevation of the support shown in Fig. 3;

Fig. 6 is a fragmentary elevational detail of another form of plate support;

Fig. 7 is a view showing a fastening element adapted to cooperate with the type of support shown in Fig. 5;

Fig. 8 is a fragmentary perspective view of a type of blade which may be used in conjunction with the support shown in Figs. 3 and 5;

Fig. 9 is a perspective view and sectional detail of another form of blade support;

Fig. 10 is a sectional detail showing the blade support of Fig. 6 and the fastening element of Fig. 7 assembled to hold the blade in a retaining slot;

Figs. 11 and 12 are similar views showing holders such as illustrated in Figs. 5 and 9, respectively;

Fig. 13 is a section through a small portion of a cylinder and an adjoining part of the concave illustrating other means for holding the cutting elements mounted therein;

Fig. 14 is a similar view showing slightly different types of cutting elements;

Fig. 15 is a sectional detail of a portion of a cylinder showing another type of cutter with the retaining means therefor;

Figs. 16, 17, 18 and 19 are similar views showing further variations of the invention;

Fig. 20 is a top view of a retaining nut and dog shown in Fig. 19;

Fig. 21 is a perspective view of an end of another form of blade;

Fig. 22 is a perspective view of an end of a support adapted to receive the type of blade shown in Fig. 21;

Fig. 23 is a similar view of a slightly different form of support; and

Fig. 24 is a perspective view and sectional detail of one end of a blade support particularly adapted for use with the blade of Fig. 4.

Referring to Fig. 1, the machine as a whole comprises a rotary cylinder or drum 1 mounted upon a shaft 2 and provided with a series of circumferential cutter elements 3. Cooperating with the cylinder 1 is a concave, here shown as made up of two parts 4 and 5, each part being pivotally mounted adjacent to the bottom thereof, the part 4 being pivoted at 6 and the part 5 at 7, substantially as in my prior patent, above referred to. These parts may swing away from the drum 1 by breaking one or more frangible links (not shown) in the event that any hard substance, such as a stone or piece of metal, should get between the teeth of cutting edges, so that too great damage will be avoided, the resulting backward position of part 5 being shown in dotted lines. The peripheral surface of the drum or cylinder 1 and the inner surfaces of the concaves are furnished with substantially radial blade receiving slots of the usual character and dimensions, which are adapted, if desired, to hold the usual thick and rigid, forged or cast blades or cutters of substantially rectangular transverse section. One side wall of the blade receiving slot constitutes an abutment element against which the cutter is firmly held, as hereafter more fully described. Inasmuch as this entire construction and its operation is described in my prior patent, and as it enters into this invention only as furnishing an appropriate environment for the use of the knives forming the main subject matter thereof, no further description thereof will be given here.

According to the present invention, as shown in Figs. 2, 12 and 24, for example, I provide substantially radially disposed blade supports or plates 13 preferably of substantially rectangular transverse section and hav-

ing substantially opposed grooves 17 and 14 in their opposite faces. The corresponding blade 8 (Fig. 4) is also preferably of substantially rectangular transverse section such as may be made by severing the blade from an elongate strip of sheet metal of appropriate width, and is provided with opposite cutting edges 9 and 10, preferably disposed in the same plane with the major portion of the blade, the latter having an intermediate bead 11 fitting within the groove 14 of the supporting plate 13, as shown in Fig. 12. Preferably the groove 14 is arranged somewhat nearer the outer, beveled edge thereof, while the bead 11 upon the blade may be centrally located so that the blade is reversible in relation to the blade support, i. e. after the edge designated 9 has become worn or nicked, the blade and supporting plate may be removed from the retaining slot and may be assembled in reverse relation so that the edge 10 becomes an effective cutting edge.

The blade and blade supporting or holding plate are so dimensioned that when assembled they are collectively of substantially the same size as the usual thick blade so that they are adapted to fit in and fill the slots in the cylinder and concaves of existing machines. The outer edge of the blade support preferably is slightly beyond the outer portion of the drum whereby the exposed portion of the rear edge of the blade (as the same is moving during operation of the machine) will be somewhat greater than the exposed front edge which is reinforced by the plate. The support 13 is accordingly provided with an outer edge 13ª inclining upwardly toward the blade. Furthermore, the elimination of an acute angle or right angled recess at this point tends to prevent the pocketing or encrusting of cottonseed portions adjoining the blade which would eventually lessen the effectiveness of same.

Adjoining the blade receiving slots are the usual recesses which receive the heads 15 of retaining screws 30. Each screw head 15 is preferably provided with an annular flange 16 that is adapted to fit in the recess 17 of the supporting plate 13, thus holding the plate and blade firmly in place in retaining slot. When the blade 8 and the plate 13 are to be assembled in the machine, the blade and support are first brought into interfitting engagement with each other and have their juxtaposed lower edges inserted in the upper portion of the receiving slot. The screw 30 may then be threaded part way into place, so that the flange 16 and recess 17 are brought into loose engagement with each other, it being understood that a plurality of these screws are similarly arranged along each of the slots. The screws may then be tightened, bringing the blades and blade supports downwardly into firm engagement with the bottom of the retaining slot. The ends of the blades and/or the supporting plates may each be provided with suitable notches designated 40 and 18, respectively, these notches facilitating the insertion of a tool to permit the separation of the plates and blades which become pressed into very firm engagement with each other due to the clamping action of the retaining screw.

Figs. 3, 6 and 11 show a slightly different form of the invention wherein the supporting plate 26 may be of the same general type as previously described, with the exception that the grooves 14 for interfittitng with the blades are omitted, and projecting nubs or pins 27 are substituted. The blade 23 (Fig. 8) which is adapted to cooperate with the support 26, has suitable openings 24 (one of which is shown) to engage these pins and to cooperate therewith in providing the interfitting engagement of the blade and support. Fig. 11 illustrates a blade and support of this character held in place by the same type of retaining means that is illustrated in Fig. 12.

Figs. 7 an 10 illustrate slightly different means for holding the supporting plates and blades in place. The support 19 in accordance with this form of the invention is provided with suitable recesses 20 adjoining its upper edge, while the retaining screw 21 is provided with a head of inverted frusto-conical form, the recesses 20 being adapted to interfit with heads of this type and to permit the same to press the plate support 19 downwardly and firmly against the blade.

Fig. 9 shows another form of blade support which possesses pins for engaging the blade similar to those shown in Fig. 3 and recesses for engaging the fastening screws. However, this type of support is characterized by having the recesses spaced so that the metal adjoining the pins is not weakened. Thus, Fig. 9 illustrates a plate characterized by aligned spaced grooves 126 upon one face of the plate and with pins 25 projecting from the other face of the same, these pins being inserted in portions of the support which are between ends of adjoining grooves.

Fig. 13 shows a further adaptation of the invention wherein two blade supports 41 and 42 are arranged at either side, respectively, of an intermediate blade 43. Preferably one of these supports carries projecting elements, such as pins 44, that are adapted to extend through openings in the plate into recesses in the opposite support. This type of cutter assembly may be secured in place by any suitable retaining means, such as one of those previously described, for example screws 30, such as illustrated in and described in connection with Fig. 12.

Fig. 14 illustrates a form of the invention wherein the blades and supporting plates are secured to each other by suitable dowels or pins, so that this embodiment of the inven-

tion quite closely resembles that shown in Fig. 11. In accordance with the embodiment of the invention, the pins 25ª may be arranged at one side of the mid-portion of the supporting plate, being adapted to engage suitable openings in the blade, the latter being provided with two sets of openings which are arranged to permit the blade to be readily reversible.

Fig. 15 illustrates a further embodiment of the invention which differs from those previously described in that the blade does not extend to the bottom of the retaining slot 10 but rather is engaged in a suitable recess in the upper corner of support 60. This support may be held in place with the retaining screws 30 of the character previously described in connection with Fig. 12, or by any other suitable retaining means illustrated herein or otherwise. The support 60 has a rabbet 61 adjoining one corner thereof. The vertical wall of this rabbet is provided with a suitable recess 62 which engages rib 63 upon the blade 64. Thus the blade is clamped in place between the plate and the wall of the retaining slot and is held in interfitting engagement with the former. If desired, the rib 63 and recess 62 may be so positioned that this blade is readily reversible.

Fig. 16 illustrates a form of the invention which resembles that shown in Fig. 15. However, the supporting plate 60ª of Fig. 16 has a rabbet 61ª with a recess 62ª at the bottom of the vertical wall, this recess interfitting with a suitable flange or rib 63ª at the lower edge of the blade. The upper edge of the blade may likewise have a suitable flange or rib 63ª, so that the plate and blade are very firmly interlocked with each other. If desired, the ribs 63ª may have similar dimensions so that the blade is readily reversible.

Fig. 17 illustrates a form of the invention resembling those shown in Figs. 15 and 16 and utilizing a supporting plate 60ª similar to that illustrated in the latter figure, the blade 64ᵇ fitting in a recess 62ª of the character previously described. In accordance with this form of the invention, the blade is provided with marginal ribs or flanges 63ᵇ, these ribs projecting from opposite faces of the blade so that the latter is more or less Z shaped. It is thus evident that when the ribs are similarly dimensioned that the blade may be reversible and that the outer rib may engage the peripheral surface of the holder in order to provide additional supporting means for the blade edge.

Fig. 18 illustrates a further variation of the invention wherein the blade may have a width substantially equal to that of the support. For example, the blade 70 may have enlarged cutting edges 71 connected by a thinner web 72. The supporting plate in this form of the invention comprises a bar 74 which is arranged beneath the lower edge of the cutter 70. The thin intermediate web 72 provides suitable recesses at either side of the blade that are adapted to be engaged by the heads of the retaining screws 30, so that the lower portion of the blade may be held firmly upon the supporting plate or bar. Since this plate is symmetrical, it may be readily reversed, and thus provide two cutting edges.

Fig. 19 illustrates a form of blade and supporting plate assembly similar to that shown in Fig. 18, with the exception that the relative dimensions of the parts are varied, the blade 70ª having a comparatively shallow depth and the recesses provided by the thinner intermediate portion 72ª between the cutting portions 71ª accordingly being reduced in height while the supporting plate 74ª may be considerably deeper than the similar element shown in Fig. 18. While the blades of Figs. 18 and 19 do not possess all of the advantages of some of the other forms shown, they are cheaper, lighter and more easily manufactured than the usual type of blade.

Fig. 19 also shows a further variation of the retaining means which may be utilized to hold the blade assembly in place. For this purpose I may provide a retaining dog 80 having an annular flange 81 arranged about an upwardly extending cup-like portion 82. At one side of the dog the flange 81 is continued in an upwardly and outwardly extending lug or projection 84, the end of which is positioned and dimensioned to engage within one of the recesses at the side of the blade 70ª. A suitable square-headed screw 87 is received within the cup-like portion of the dog 82 and when tightened upon the same serves to press the projection 84 into firm engagement with the longitudinal recess in the blade.

Figs. 21 and 22 illustrate a cooperating blade and supporting plate which may be characterized by a plurality of openings 90 in the former, which are adapted to receive pins 91 in the latter, these pins and openings being arranged adjacent the edges of the respective elements rather than at their intermediate portions, while Fig. 23 illustrates a further form of supporting plate wherein projecting pins 92 are arranged adjacent to both edges of the supporting plate.

I claim:

1. In a machine of the class described having a curved holder provided with a plurality of substantially radial blade receiving slots of the shape and dimensions usually provided for use with thick and rigid forged blades, a supporting plate and a blade located in each slot, each blade and its associated plate having complemental interengaging elements.

2. In a machine of the class described having a curved holder provided with a plural-

ity of substantially radial slots of substantially rectangular transverse section adapted to receive the thick and rigid blades usually employed, a supporting plate and blade located in each slot, one of said latter parts having a recess and the other of said parts having a projection engaging said recess.

3. In a machine of the class described having a holder provided with a plurality of slots each of substantially rectangular transverse section, a blade and at least one supporting plate in each slot, and fastening means adjoining each slot, at least one plate associated with each blade having a recess in one of its wider faces, and the fastening means comprising a part engageable with said recess.

4. In a machine of the class described having a holder provided with a plurality of slots substantially rectangular in transverse section, and a supporting plate and blade in each slot, the plate and its associated blade having complemental interfitting elements, said supporting plate and blade being arranged so that the latter has a narrow margin projecting beyond the edge of the former, said supporting plate projecting beyond said holder along one side of the blade a distance sufficient substantially to fill the angular space included between the outer edge of the blade and the holder.

5. In a machine of the class described having a holder provided with a plurality of slots substantially rectangular in transverse section, a supporting plate and a single thin sheet metal blade in each slot, the plate and blade having interfitting engagement with each other, said supporting plate and blade being arranged so that the latter has a narrow margin projecting beyond the edge of the former, the outer edge of the plate being bevelled inclined outwardly toward the region of engagement with the blade, whereby the collecting of material in the angle between the projecting blade portion and the plate edge is avoided.

6. A cutter for use in cottonseed hullers of the kind employing a blade holder having slots of substantially rectangular transverse section adapted to receive thick rigid blades of substantially the same transverse section, said cutter comprising a supporting plate and a thin blade, said plate and blade having interfitting elements and being adapted when assembled to fit within the slot in the holder, said interfitting elements being arranged so that a margin of the blade extends beyond the edge of the plate, the opposite edge of the blade being disposed so that it does not project beyond the edge of the plate.

7. A cutter for use in power driven machines of the class described comprising a supporting plate and a blade, the plate and blade having interfitting elements, said elements being arranged so that a margin of the blade extends beyond the edge of the plate, the opposite edge of the blade and plate being substantially aligned, said interfitting elements being arranged so that the blade may be reversed in relation to the plate whereby either cutting edge may project beyond the plate edge and the other cutting edge may be protected by the corresponding plate edge.

8. A cutter for use in cottonseed hullers comprising a supporting plate and a blade, said blade and plate having interfitting elements, said elements being arranged so that a margin of the blade extends beyond the edge of the plate, the opposite edge of the blade being arranged so that it does not project beyond the edge of the plate, said interfitting elements being arranged so that the blade may be reversed in relation to the plate whereby either cutting edge may project beyond the plate edge and the other cutting edge may be protected by the corresponding plate edge.

9. In a cottonseed huller having a blade holder provided with a slot adapted to hold the usual rigid and thick forged blade of substantially rectangular transverse section, the combination with a sheet metal blade having a longitudinal cutting edge, the blade being substantially straight in a direction transversely of its cutting edge, of one wall of the slot constituting a rear support for said blade, a removable supporting plate, and means for holding the blade and plate in assembled relation within the slot.

10. A cutter for use in a holder having an elongate blade receiving slot of substantially rectangular transverse section, one wall of which constitutes an abutment element, said cutter comprising a sheet metal blade adapted to be received in the slot in the holder with one side engaging said abutment element, and an elongate clamping plate of substantially rectangular transverse section, engaging the opposite side of the blade to position and strengthen the latter, said blade and plate when assembled substantially filling said slot, said blade being substantially straight in a direction transversely of its cutting edge.

11. In a cottonseed huller, the combination with a thin sheet metal blade which is substantially straight in a direction transversely of its cutting edge, of a holder having an elongate slot of substantially rectangular transverse section and of a width adapted to hold a thick and rigid blade, and means for detachably holding said thin blade firmly in place within the slot.

12. In a cottonseed huller, the combination with a thin sheet metal blade which is substantially flat and straight between its cutting edge and the opposite rear edge thereof, of a holder comprising a member having an elongate slot therein of a width adapted to hold a thick and rigid blade of substantially

rectangular transverse section, a plate adapted to be received in said slot together with said thin blade and to impart rigidity to the blade edge, and wedge means for holding the blade and the plate rigidly within said slot.

13. In a cottonseed huller, the combination with a sheet metal blade, of a holder comprising a member having an elongate slot therein of greater width than the thickness of the blade, a plate adapted to be received in said slot with the blade, the blade and plate being provided with a hole and a pin respectively to position them relatively to one another, and means for holding the blade and the plate rigidly and detachably to said member.

14. A cutter for use in a holder having a blade receiving slot adapted to receive a thick and rigid blade of substantially rectangular transverse section, one wall of said slot constituting an abutment element, said cutter comprising a thin sheet metal blade adapted to be received in the slot in the holder with one side engaging said abutment element, the opposite surfaces of the blade being substantially straight from the effective cutting edge to the rear edge thereof, and a plate adapted to be received in said slot with the blade, said plate reinforcing the blade and enabling it to perform its cutting operation without bending.

15. In a cottonseed huller, the combination with a thin sheet metal blade of a holder comprising a relatively fixed member having an elongate slot adapted to receive a blade of substantially rectangular transverse section and of greater thickness than said sheet metal blade, a plate adapted to be received in said slot with the blade, a recess in said plate, and a screw for detachably holding the parts together, said screw having a head provided with a portion which is received in said recess.

16. In a cottonseed huller, the combination with a sheet metal blade of a holder comprising a member having an elongate slot therein of greater width than the thickness of the blade, a plate adapted to be received in said slot with the blade, the blade and the plate being provided with a recess and a complemental projection respectively for positioning them relatively to each other, and means for holding the blade and the plate detachably within said groove.

17. In a cottonseed huller, the combination with a sheet metal blade of a holder comprising a member having an elongate slot therein of greater width than the thickness of the blade, a plate adapted to be received in said slot with the blade, the blade and the plate being respectively provided with a hole and a pin for relatively positioning them with either lateral edge of the blade in cutting position, the plate having a groove therein in the side away from the blade, and a part which is receivable in the last-mentioned groove to clamp the blade and plate in the slot.

18. In a cotton seed huller comprising a concave and a huller drum, each having substantially radial blade-holding slots of substantially rectangular transverse section, and filling means disposed in said slots for reinforcing relatively thin, flexible blades, the combination of thin sheet metal blades disposed in the blade-holding slots, the side faces of each blade being substantially straight and parallel to a single plane which is also parallel to the direction of the slot in which the blade is disposed, the cutting edge of this blade being disposed in this plane, the blade being so thin that wear or chipping does not appreciably broaden the effective cutting edge thereof, whereby the tendency for worn or chipped blades to crush material passing through the huller is reduced.

19. A blade for use in a cotton seed huller comprising a huller drum and a concave, each provided with substantially radial blade-holding slots of substantially rectangular transverse section, and filling means disposed in each slot for reinforcing a relatively thin, flexible blade, said blade comprising a body having side faces which are substantially straight from that margin of the blade which has the cutting edge to the opposite margin thereof so that the body of the blade may be disposed within a blade-holding slot with one face in a plane substantially parallel to the direction of the slot and with the cutting edge of the blade also disposed in this plane, said blade also being so thin and flexible as to require the external support and reinforcement along its cutting edge provided by the filling means.

20. In a cotton seed huller comprising a cylinder provided with a slot of substantially restangular transverse section and of a width adapted to receive a thick, rigid cutter blade of substantially rectangular transverse section, the combination of a detachable cutter disposed in the slot, the cutter comprising a thin, flexible sheet metal blade having parallel side faces which are substantially straight from that margin which has the cutting edge to the opposite or rear margin of the blade, so that the margin having the cutting edge and the opposite rear margin of the blade may lie entirely between the planes defined by the opposite side walls of the slot, and a relatively thick and rigid supporting plate, said plate and blade being adapted collectively to be received in the slot in the cylinder.

Signed by me at Boston, Massachusetts this 20th day of July, 1928.

ROBERT W. McLEAN.