

HULLER-CLEANERS

for Castor Bean Harvesters



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History and Purpose

The common practice of harvesting castor seed is to strip the seed from standing plants by machine or by hand. When this is done the seed remains in the hull. The hulls, along with other foreign material, must be removed from the seed in order to obtain maximum quality oil during the oil extraction process.

Castor beans are commonly hulled either by use of stationary or portable machines. When portable hullers are used castor beans are usually placed in piles on the ground in the field, and the huller is moved to the castor beans for the hulling operation. Stationary hullers are usually centrally located in the castor bean growing area along a railroad siding. Harvesting and hulling costs can be reduced considerably by combining them into one field operation, thereby, less equipment and labor will be required to harvest the crop. In addition the hulls are distributed directly from the huller back on the land for further utilization.

Considerable research and development have taken place on various types of hullers and hulling principles. This work was done by a number of state experiment stations and by industry. The machine described in this publication, however, is one of the first adaptations of mounting a huller-cleaner to castor harvesting machines. The picture on the cover shows one of these huller-cleaners assembled. It was the purpose in the development of this machine to make a compact, light-weight machine which could be easily mounted on castor bean harvesting equipment. It was designed to have a hulling capacity of three tons per hour while still maintaining a high hulling efficiency.

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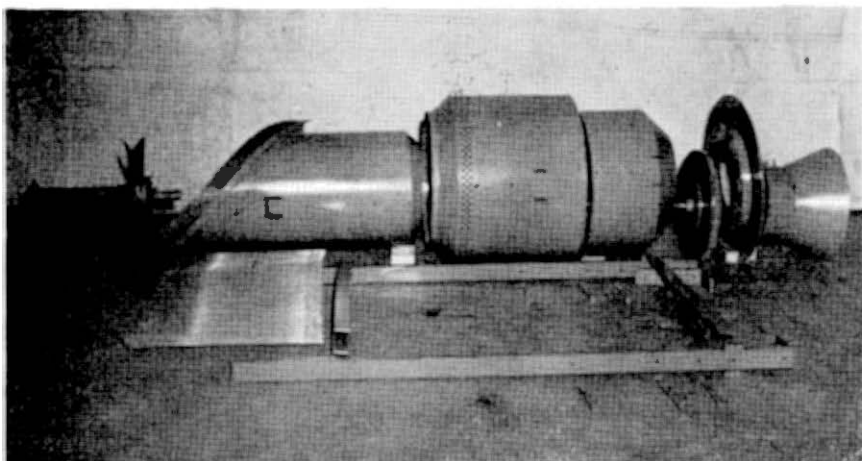
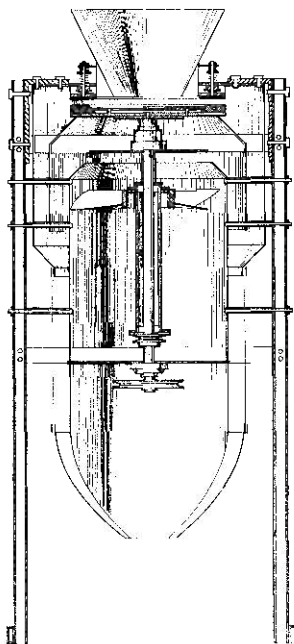


Fig. 1—Disassembly of huller-cleaner parts.

Description of Huller-Cleaner

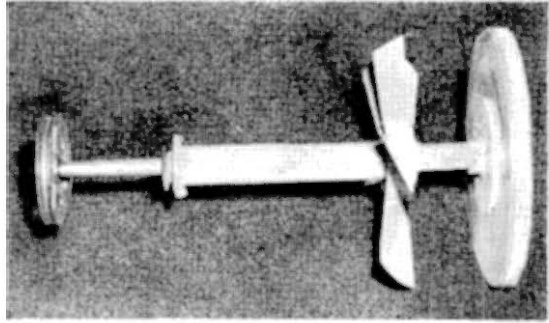
This machine consists essentially of hulling discs and a fan with cleaning chamber combined into one compact unit.



The figure on the cover of this bulletin shows the huller-cleaner assembled in operating condition. The machine measures 62 inches from the top of the feed hopper to the outlet for the cleaned seed. The outside diameter of the huller housing is 27 inches. The distance between the outside edges of the support posts is 32 inches and the weight of the machine is 285 pounds. An exploded view of the huller-cleaner showing various components of the machine as used for the assembled machine is shown in Fig. 1. The rotating hulling disc and fan mounted onto one shaft is shown in Fig. 3. The line drawing shows the various parts of the huller-cleaner in an assembled form (Fig. 2).

Fig. 2—Line drawing showing relative position of the various parts.

Fig. 3—Rotating hulling disc with axial flow fan mounted.



How the Huller-Cleaner Operates

The unhulled material is fed by gravity into the machine at the top through a funnel to the center opening of a stationary rubber faced disc and on top at the center of a rotating disc (Fig. 5). Here the beans are thrown horizontally outward between the rubber covered discs. The rubbing action of the two discs remove the hulls from the castor seed. After passing through the discs the seed and the hulls drop downward between the outer huller housing and middle divider to a baffle which deflects the material into an upward moving airstream.

At this point the hulls and other light foreign material are lifted upward into a chamber between the outside of the fan housing and the inside of the middle divider into the fan. From this point the hulls and light material are blown downward inside the fan housing to the outside of the machine. The cleaned seed drops downward through the upward moving airstream on the outside of the fan housing and out of the machine.

A simple adjustment is provided for changing the disc spacing to obtain optimum hulling. A quick pressure release mechanism, as



Fig. 4—The quick pressure release mechanism shown at the top of the huller protects the hulling surfaces from rocks and debris.

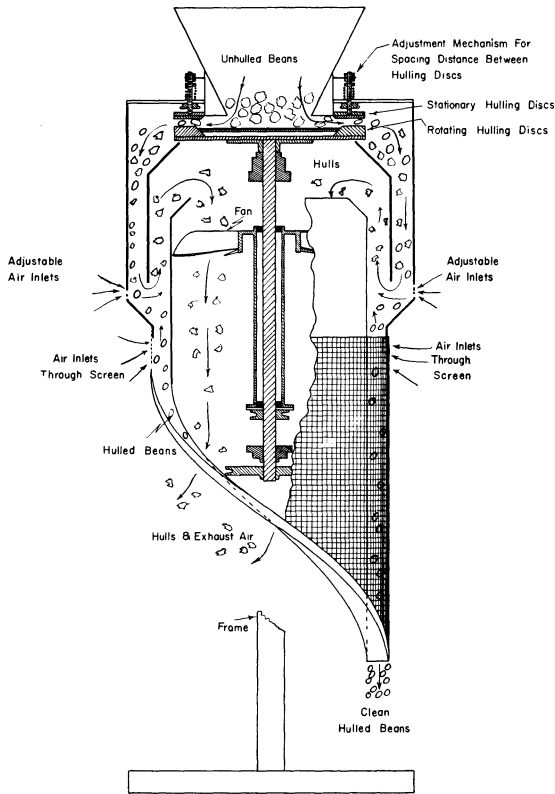


Fig. 5—Schematic diagram of huller-cleaner showing path of castor seed through the machine.

shown in Figure 4, can be provided to protect the hulling surfaces from rock and other foreign material damage.

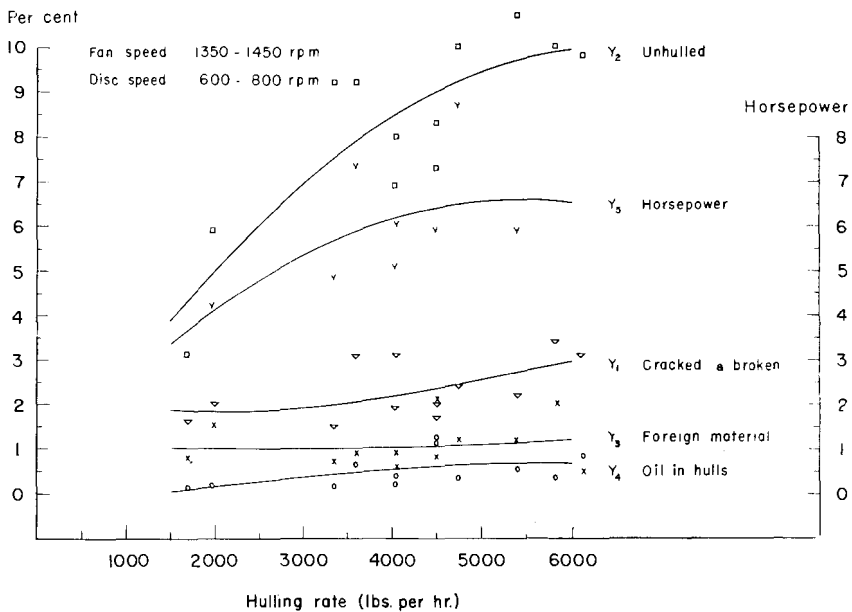
Tests on the Machine

Tests made on the huller-cleaner show the machine did an excellent job of hulling at low capacities up to approximately $11\frac{1}{2}$ tons per hour, and maintained a satisfactory performance up to a capacity of three tons per hour. Chart I shows the performance of the huller-cleaner while hulling well dried Cimarron castor beans which had a considerable number of small pieces of stalks in the harvested beans. The amount of oil bearing material that was carried out with the hulls from the huller-cleaner was relatively small for the high hulling rate and practically negligible at the low hulling rate, the range being 1.2 percent to .14 percent, respectively. Cracked and broken beans and unhulled beans and foreign

material with the hulled beans were considered minimum for the very dry, hard-to-hull castor beans and ranged from 1.6 percent to 3.4 percent. The performance of such hullers will vary depending upon the type and condition of castor seed.

A statistical analysis using the method of least squares showed that the quadratic equations expressed data obtained from tests better than straight line, or quadratic equations.

The foreign material in the hulled seed ranged from 0.5 percent to 2.1 percent. The unhulled castor seed remaining after the hulling operation ranged from 3.1 percent for the low hulling rate to 10.7 percent for the high hulling rate. The power requirements for hulling (based on input to the electric motor) ranged from 2.0 hp. at no load to 10.0 hp. at maximum hulling rate.



Then $y_1 = 1.97 - .36x + .23x^2$
 $y_2 = -.37 + 6.38x - .98x^2$
 $y_3 = 1.17 - .17x + .07x^2$
 $y_4 = -.47 + .78x - .13x^2$
 $y_5 = .37 + 4.60x - .85x^2$

Where y_1 = percent cracked or broken beans

y_2 = Percent unhulled beans
 y_3 = Percent foreign material
 y_4 = Percent oil in hulls
 y_5 = Hp input to electric motor drive
 x = Rate of hulling in tons per hour

Typical Uses of Huller-Cleaner

Axial flow and centrifugal type fans have been adapted for use in this type huller-cleaner. When a centrifugal type fan is used the hulls are disposed of through an outlet on the side of the huller-cleaner while an axial flow type fan will blow the hulls downward out the center of the huller. Fig. 4 shows a huller-cleaner which uses the centrifugal type fan.

Fig. 6 shows an early model of the huller-cleaner used on a one-row experimental castor bean harvester in 1953. This huller-cleaner is of a size and capacity for use on a one-row machine. Use of this machine with the huller-cleaner during one harvesting season was shown to do satisfactory work. Fig. 8 shows the latest huller-cleaner mounted on a Massey-Harris combine. Fig. 10 shows the huller-cleaner being used as a portable machine.

Economic Value of Huller Cleaner

Field observations have shown that 20 percent or more of the harvesting time has been used to unload unhulled castor seed from har-



Fig. 6—Huller-cleaner (using centrifugal fan for cleaning) mounted on a USDA castor bean harvester.

vesters at the edge of a field near a stationary huller-cleaner. At least one-half of this time could be saved when a harvester, which hulls the seed, is used because less bulk is required to be handled. In addition, labor and much lost motion is eliminated when the castor seed is hulled as part of the field harvester operation. Only one man is required on a castor bean harvester which has a huller-cleaner as an integral part of the

Fig. 7—Huller-cleaner mounted on a two-wheel trailer for use as a portable huller.

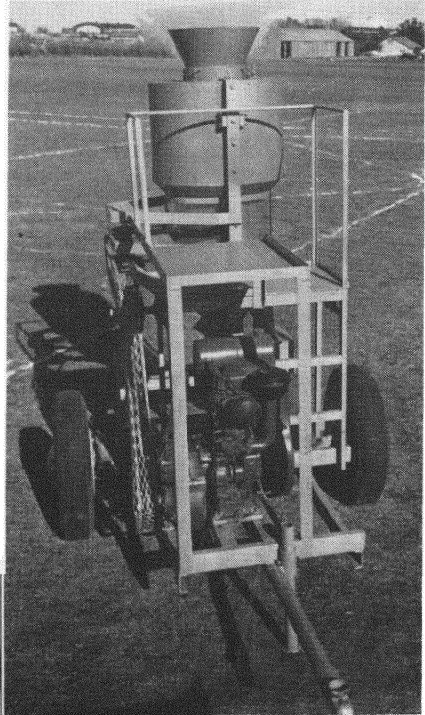


Fig. 8—Huller-cleaner mounted on a Massey-Harris castor bean combine.



harvester. At least one and perhaps two additional men are required for the hulling operation when a harvester is used that does not hull the castor seed. In addition, the hulls must be disposed of when a stationary field huller is used. The cost of a huller-cleaner constructed on a field harvester should not be more and may be less than a stationary huller.

Summary

A large capacity huller-cleaner adaptable for mounting onto castor bean harvesters was developed and several machines were built. The huller-cleaner will hull up to three tons of castor seeds per hour and is adaptable for mounting on harvesters which will harvest as much as four rows at a time. The huller-cleaner blows the hulls back onto the land and permits the utilization of their fertilizing and humus value without further handling. Less bin space is needed on the harvester and fewer stops required during harvesting operations because less bulk material is placed in the bin. One operator can satisfactorily operate a castor bean harvester which has an attached huller-cleaner as the huller requires very little attention. Less equipment and labor are required when harvesting and hulling are combined than when done by separate operations.

This huller-cleaner is not being manufactured at the present time. However, it can be constructed in a well-equipped machine and tin shop. The capacity of the huller-cleaner determines the physical dimensions of the hulling discs and component parts. Huller-cleaners have been developed to use axial flow as well as centrifugal fans.

Detailed plans for this huller-cleaner may be obtained by writing to the Oklahoma Agricultural Experiment Station.

