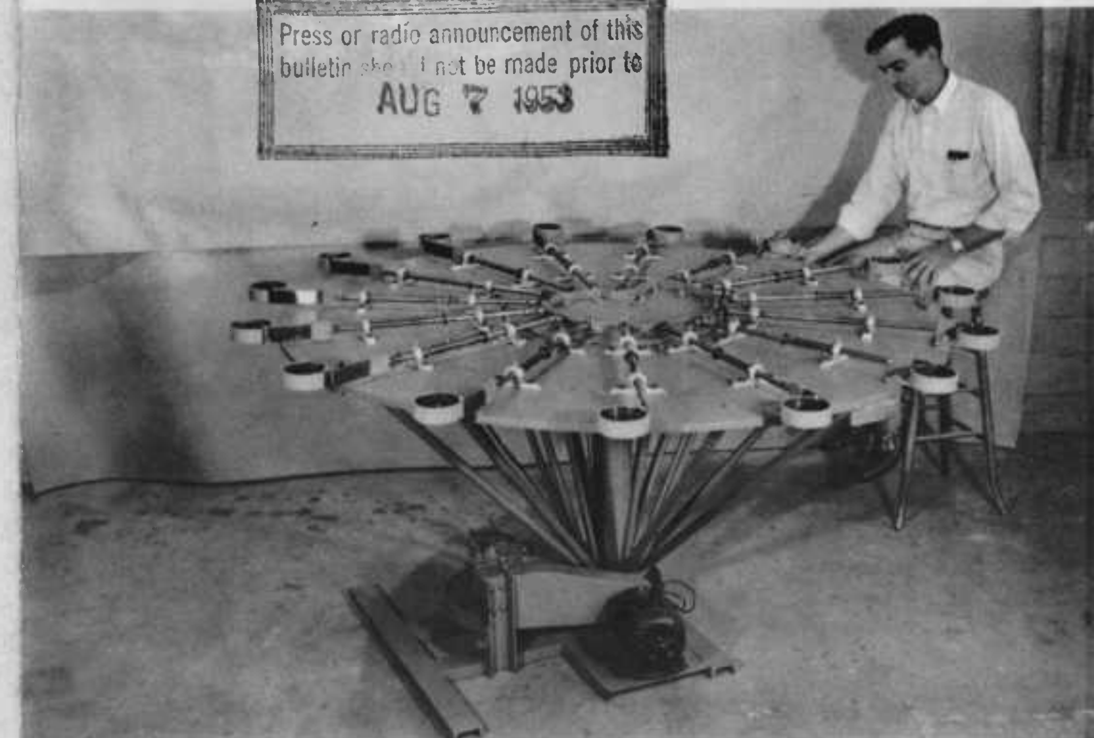
# A Croft Lily Bulb Grader

J. B. Rodgers

Circular of Information 531

July 1953





Agricultural Experiment Station
Oregon State College, Corvallis

# A Croft Lily Bulb Grader

J. B. Rodgers, Agricultural Engineer
*Oregon Agricultural Experiment Station*

## The Need for a Grader

The Croft lily bulb industry in Oregon is of considerable economic importance and many growers are engaged in their production. In the past, the grading of the bulbs has been a slow and tedious hand process in which the circumference of each bulb is determined either with a tape, by approximation, using the thumb and forefinger method, or some other manual means of determining circumference--the grader occasionally checking his accuracy with a tape. The output per individual grader, on one grower's farm, averaged approximately 225 bulbs per hour. The need for a more rapid method of grading in order to lower the cost, therefore, is quite apparent. The Oregon grading standards for Croft lily bulbs states that circumference shall be taken at the greatest diameter of the bulb at right angles to a line from the top to the base of the bulb. Commercial grades of Croft lily bulbs are specified by numbers, as for example numbers 7, 8, 9 and 10, the number indicating the circumference of the bulb in inches.

## Construction of the Grader

The functional element of the machine responsible for sizing the bulbs is an expanding and contracting clock spring steel band (blue clock spring steel 0.012 x 1 1/2 inches) held in the form of a loop as indicated on Figure 1. Fifteen of these elements are carried on the revolving 72" plywood table. The spring expands and contracts in a bulb cell. Expansion is positive and is accomplished by the cam follower engaging a lobe on the stationary cam. The cam is fastened to the stationary center section of the table. Contraction of the band and the holding of the bulb is accomplished by means of a coil spring. The size of the bulb held in the loop determines how far the bulb will be carried around by the bulb cell before the cam follower engages a lobe of the cam, corresponding to the proper grade, and releases the bulb. The larger the bulb the farther it is carried around by the table before it is released. The stationary cam is designed so that each lobe corresponds to one size (circumference) or grade.

The grader consists of a base constructed of a 3" channel welded together as indicated on Figure 2. A 2" extra strong pipe column screwed into a standard 2" pipe coupling secured to the base plate and base channels, as indicated on Figure 2, holds the center or stationary section of the table. The outer or revolving section of the table carrying the 15 bulb cells is constructed of 3/4" exterior type plywood. Thin wall tubing is used to support the revolving

Acknowledgments: The project of developing a successful Croft lily bulb grader was a joint undertaking of the Agricultural Engineering Research Foundation and the Oregon Agricultural Experiment Station through its Department of Agricultural Engineering. The problem of designing and building the grader was assigned to Mr. John A. McMullen, a graduate student in the Department of Agricultural Engineering, during the winter and spring quarters of 1951. The completed machine and its designer and builder are shown on the cover. Since Mr. McMullen did not return to Oregon State College for the fall term the problem of making changes and refinements, indicated by the first season's operation, was assigned to Professor Ralph Lunde. He was responsible for making several modifications and improvements including the brake which was installed to smooth up the operation of the rotating table.

table in the manner indicated on Figures 1 and 2. A detail of the cam used for the Croft lily bulbs is shown on Figure 1. The revolving table is driven by a 1/4-horsepower electric motor through a suitable reduction gear unit. The cam follower and push rod which expands and contracts the clock spring steel band is supported by means of two self-aligning, bronze-bushed, pillow-block bearings for each functional element. Figures 1 and 2 are working drawings of the Croft lily bulb grader as actually constructed. If this grader were being built today, it would probably be built somewhat differently. It must be remembered that this machine was built during the early part of 1951 when anything made of metal was very difficult to obtain. For this reason it was necessary to use materials and parts which were available. Many different gear reduction units could be adapted for driving the table. It will be noted that the chain and sprocket is a No. 60. This is larger than needed for the light duty of the chain, but the No. 60 chain was available at the time the grader was built. See Figure 3.

The first season's operation showed that the table operated with a jerky motion, making it difficult for the operator to feed bulbs into the bulb cells. As the cam follower came off the high lobe of the cam it had a tendency to upset the smooth rotation of the outer table. This condition was remedied by adding the brake, shown on Figures 1 and 2, and more clearly on Figure 3. The brake is considered a necessity for the best operation of the grader. The grader was operated during the 1952 season without any mechanical difficulties.

## Operation of the Grader

In operation, the grader should be set up in a suitable location with plenty of room around the table for boxes or crates to catch the various grades of bulbs as they are released from the cells. Some means should be provided for bringing the ungraded bulbs quickly and easily to the operator. The machine operator will stand on the side of the table next to the high side of the cam. In this position the bands are fully expanded and are ready to receive the ungraded bulb. The bulbs are fed to the cells from the underside and are held by hand until the bulb is gripped by the band. As the table rotates, the bulb will be carried around until the follower engages the lobe of the cam corresponding to the circumference of the bulb in the cell. Here it will be released.

In operation, it has been found that the bulb grader is very accurate and all bulbs were sized well within the tolerance established for the respective grades. The grader handled the bulbs gently and caused no injury.

The speed of the outer table can be varied. There are four steps on the cone pulley, see Figure 4. Table speeds of 1.6, 2.04, 2.62, 3.24 revolutions per minute are possible with the 4-step pulley.

In training the operator, it is well to reduce the table speed to the minimum until the operator has become adept at feeding the bulbs into the individual bulb cells. The speed of the table can then be increased. During the past two seasons the bulb grader was operated, after a period of operator training, on the third step of the cone pulley corresponding to a speed of 2.62 revolutions per minute. At this rate, the table will grade 39 bulbs per minute in contrast to three or four bulbs per minute graded by hand. The machine is not difficult to construct. It is simple to operate and requires little maintenance.

This grader could be used for the sizing of other bulbs that are graded on the basis of circumference. The only change would be to substitute a cam suitable for the bulbs to be graded. The cam shown on Figure 1 was designed only for Croft lily bulbs and would not be satisfactory for any other kind of bulbs unless the grading standards happened to compare exactly with those for the Croft lily.

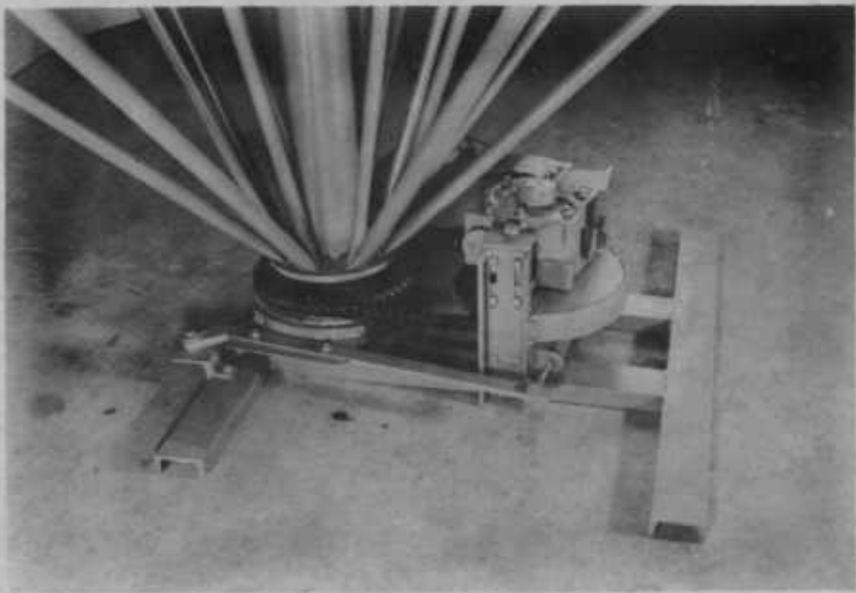


Figure 1. Base of the Croft Lily Bulb Grader showing the brake and the method of driving the table.

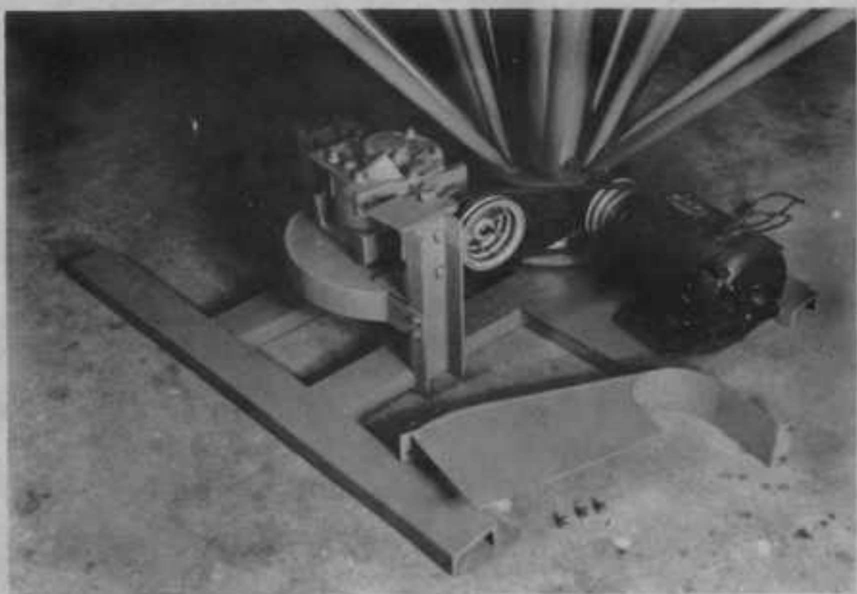
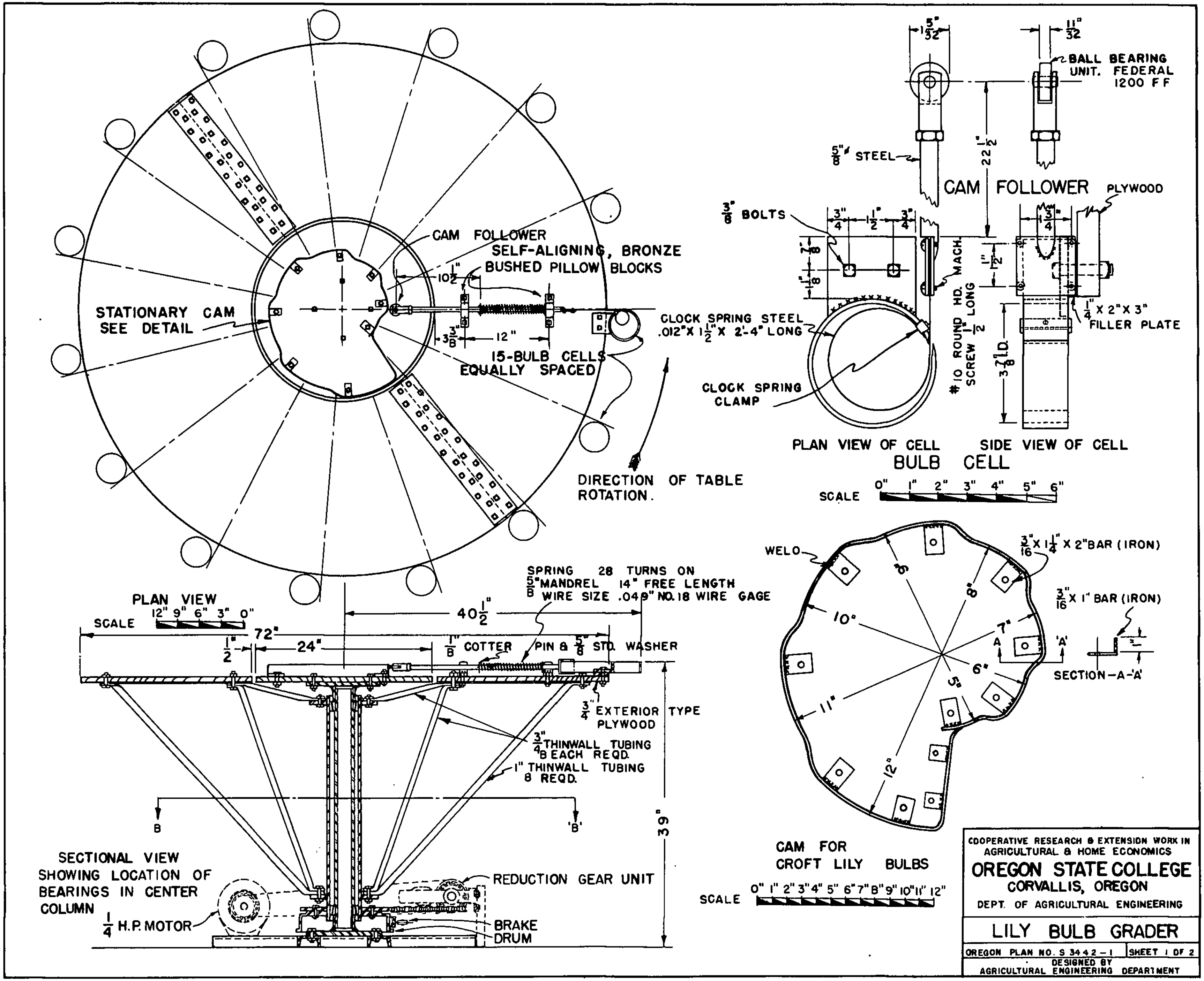


Figure 2. Speed reduction unit and the 4-step cone pulley drive.




COOPERATIVE RESEARCH & EXTENSION WORK IN AGRICULTURAL & HOME ECONOMICS

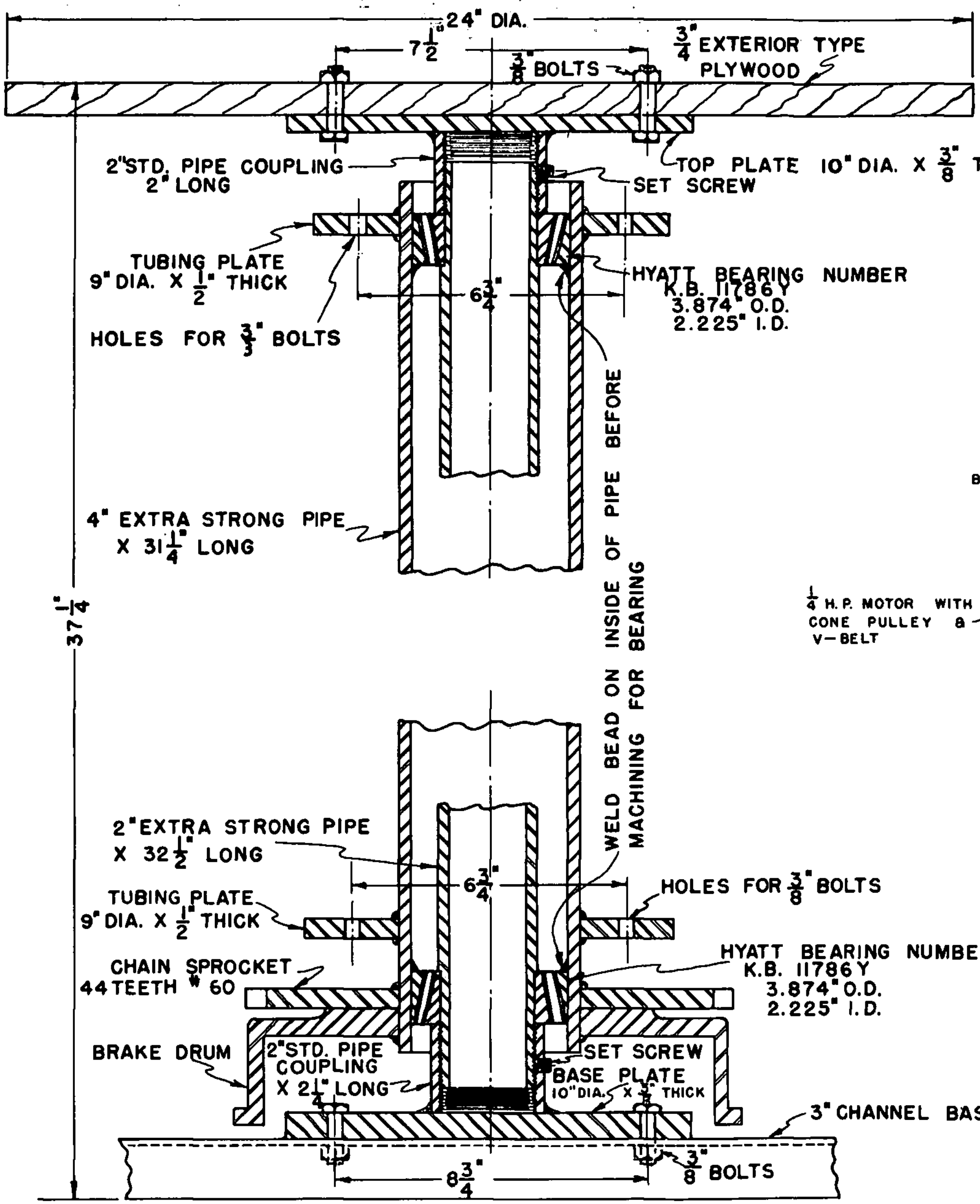
OREGON STATE COLLEGE
CORVALLIS, OREGON

DEPT. OF AGRICULTURAL ENGINEERING

LILY BULB GRADER

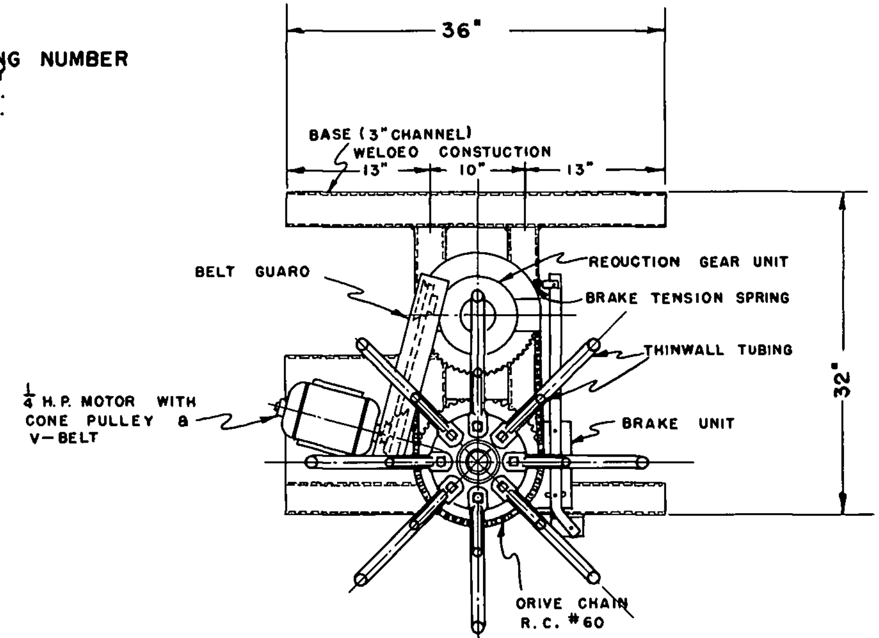
OREGON PLAN NO. S 3442-1 | SHEET 1 OF 2

DESIGNED BY AGRICULTURAL ENGINEERING DEPARTMENT




SECTIONAL VIEW OF CENTER COLUMN

SCALE 0" 1" 2" 3" 4" 5" 6"




SECTION B-'B'

SCALE 12" 9" 6" 3" 0" 1'

COOPERATIVE RESEARCH & EXTENSION WORK IN AGRICULTURAL & HOME ECONOMICS

OREGON STATE COLLEGE
CORVALLIS, OREGON
DEPT. OF AGRICULTURAL ENGINEERING

LILY BULB GRADER

| OREGON PLAN NO S 3442 - 1 | SHEET 2 OF 2 |
|---|---|

DESIGNED BY AGRICULTURAL ENGINEERING DEPARTMENT