board (F) by means of a block (Y) of suitable length. By varying the length of the block the angle of the face of the thrust block may be varied. (Fig. 1.)

Chamberlin and Shepard produced arcuate mountains by applying pressure over a limited portion of the free side of a block.[1]

By means of this machine, with the face of the thrust block at an angle of 45° to the direction of thrust, arcuate mountains were repeatedly produced. Fig. 2 shows the results of one of a number of experiments in which such mountains were obtained. The curvature of the fold may be explained by the force resultant of the forces active in its production. This indicates that arcuate mountains can be produced by more than one method.

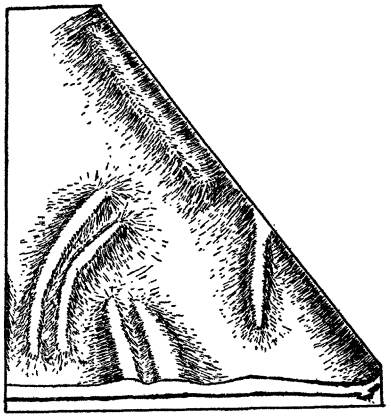


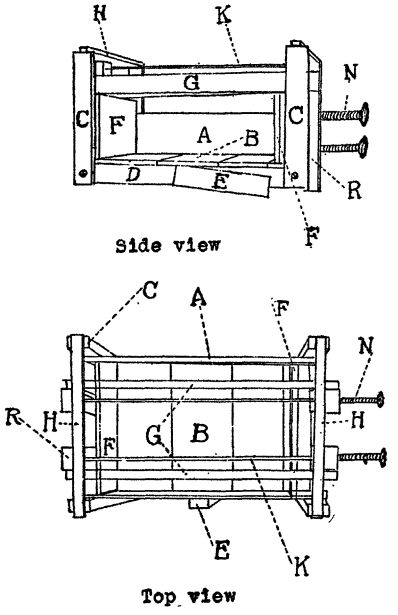
FIG. 2

R. H. MITCHELL

A MACHINE FOR THE INVESTIGATION OF STRUCTURE

IN laboratory experiments carried on for the purpose of investigating mountain structure it has seemed desirable to devise an apparatus that will overcome the difficulties of the narrow machines usually used. Such an apparatus is here described. The machine is simply a box, the ends of which may be freely approached towards each other, making it possible to compress layers of material placed between them in the box. This machine has worked very satisfactorily and has been found quite capable of withstanding a great pressure.

The inside dimensions of the box are: length, about 31 in.; width, 22¾ in. The floor (B) and the side boards (A) are of one inch pine material nailed securely to a base of oak two by fours (D). The corner posts (C) are also oak two by fours and are two feet high. At each end of the box these uprights are fastened together by one inch pine strips (H). The movable end boards (F) are of oak. (Two end boards are used at the end upon which the pressure



is applied, the outside one being protected by iron strips from the ends of the screws (N). Short oak two by fours (E) are bolted to the base and are turned to a vertical position to support the side boards when pressure is applied. The pressure is produced by means of four vice screws (N) set in four 4 x 4 oak posts (R), two of which are at each end of the box. These are fastened together by four iron rods (K) 11/16 in. in diameter running lengthwise across the box, two fastening the tops and two the bottoms of the posts. The end boards are kept from creeping upward by pine two by fours (G) which serve as a track.

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SPECIAL ARTICLES

THE RELATION OF TOTAL NITROGEN TO REGENERATION IN THE WILLOW

A CORRELATION between the carbohydrate-nitrogen relationship and growth has been shown by Kraus and Kraybill[1] and Murneek[2] for the tomato plant, Harvey[3] for the apple and Reid[4] for wheat and

[1] R. T. Chamberlin and F. P. Shepard, *Journal of Geology*, vol. 31, 1923.

[1] *Ore. Agr. Exp. Sta. Bull.* 149, 1918.
[2] *Plant Physiol.*, 1: 3–55, 1926.
[3] *Ore. Agr. Exp. Sta. Bull.* 200, 1923.
[4] *Amer. J. Bot.*, 26: 770–779, 1929; 27: 272–289, 1930.

squash seedlings. They find that increased nitrogen results in increased shoot development and increased carbohydrates stimulate root development. Hicks[5] has applied this relationship to explain polarity in regeneration in the willow (*Salix viminalis*). She states that prior to development, nitrogen is translocated to the apex and carbon flows to the base. Shoots develop in the area (apex) of lowest C/N ratio, and roots appear in the area (base) of highest C/N ratio. The writer, working with *Salix nigra,* found that Hicks's results hold for cuttings having a normal gradient of total nitrogen (from morphological apex to the morphological base), in a normal position, and with a well-developed shoot and root polarity. Under such conditions, shoots develop in the area (apex) of highest total nitrogen per gram dry weight of cutting, and roots appear in the area (base) of lowest total nitrogen per gram dry weight of the cutting. Inverted cuttings, however, show different results. *A,* Fig. 1, shows an inverted cutting

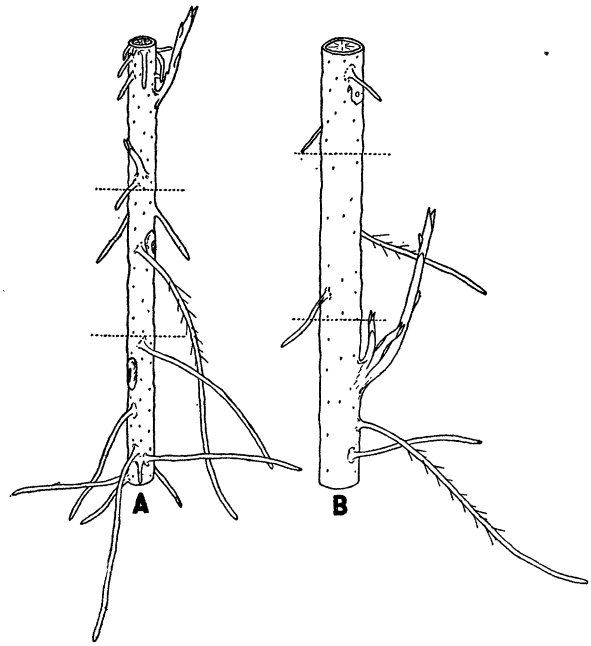

FIG. 1. *A,* an inverted cutting in which the gradient of total nitrogen is from the morphological base to the apex. *B,* an inverted cutting in which the gradient of total nitrogen is from the morphological apex to the base. The parts above and below the dotted lines were used for total nitrogen analyses.

in which the gradient of total nitrogen was from the morphological base to the apex, rather than from the morphological apex to the base, as is found in normal cuttings. The total nitrogen analyses (Table I) show that shoots develop in the area (morphological base) of highest total nitrogen per gram dry weight of the cutting, while roots regenerate along the entire cutting and are not confined to the area (morphological apex) of lowest total nitrogen per gram dry weight of cutting. *B,* Fig. 1, shows an inverted cutting with a normal gradient of total nitrogen from the morphological apex to the base. Total nitrogen analyses (Table II) show that shoots develop in the area (morphological apex) of highest total nitrogen per gram dry weight of the cutting and roots appear (as in cutting *A*) along the entire cutting.

TABLE I

TOTAL NITROGEN ANALYSES OF CUTTING A

The total nitrogen of the bark and wood is shown in milligrams of nitrogen per gram dry weight of the material. The total nitrogen of the roots and shoots was adjusted to the dry weight of the bark.

Part used for nitrogen determination	mgs N per gm dry weight			
	bark	shoots	roots	wood
Morphological apex	17.3259		0.1359	2.3316
Morphological base	16.9161	1.0304	0.0453	2.0299

TABLE II

TOTAL NITROGEN ANALYSES OF CUTTING B

The total nitrogen of the bark and wood is shown in milligrams of nitrogen per gram dry weight of the material. The total nitrogen of the roots and shoots was adjusted to the dry weight of the bark.

Part used for nitrogen determination	mgs N per gm dry weight			
	bark	shoots	roots	wood
Morphological apex	15.3337	1.1389	0.0765	2.3609
Morphological base	15.4889		0.0201	2.6144

The data indicate that regardless of the position of the nitrogen gradient and the position of the cutting, shoots develop in the area of highest total nitrogen per gram dry weight, while roots are not confined solely to the area of lowest total nitrogen per gram dry weight, but may appear along the entire cutting.

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EFFECT OF FREEZING AND THAWING ON THE EXTRACTABILITY OF THE ALLEGED CHICKEN SARCOMA AGENT[1]

THE assumed cell-free transmission of chicken sarcomas has given rise to many speculations as to the possible nature of the transmitting agent. We purposely avoid discussing relative merits of various

[5] *Bot. Gaz.,* 86: 193–209, 1928.

[1] Based on a paper read before the National Medical Congress of Japan, Osaka, April 4, 1930.