Division 6 - Lincoln Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: VISIT TO IBM, OCTOBER 23, 1953

To: David R. Brown

From: Francis E. Vinal

Date: October 28, 1953

Abstract: The Tube Laboratory at IBM under Mr. John Little has received the assignment of investigating ferrite memory core production. During the past summer, the study was initiated and although the project is not as yet fully staffed certain phases, primarily of a mechanical and materials handling nature, have already gotten under way. The work with binders for the powder compacts is well done and shows rapid progress. Ingenious ways of evaluating binder properties have enabled numbers to be used in evaluating the experimental work. Many phases are as yet untouched and no uniform core production can be anticipated in the immediate future.

The writer visited Mr. John Little, Mr. John Gibson and Mr. William Walker of the Tube Laboratory who have been assigned the problem of investigating ferrite core production. Mr. Gibson is an electrical engineer and Mr. Walker is a mechanical designer and as a result of their backgrounds considerable more progress has been made in the handling qualities of the ferrite mixtures, correlated by electrical tests, than in any other phase of core production. They have experimented with binders on a ferrite composition approximately equivalent to our DCL-3-48 and have settled upon a binder marketed by the Glyco Product Company in Brooklyn under the name of Acrawax C Atomized. They supplied me with a generous quantity of the material and the manufacturers directions for the use of this material. Also they supplied the following comments on its use as they have carried it out.

> "Ferrite Material has been calcined 1000°C."
>
> "To each 10 grams of dry ferrite material add 90 ml. of a 3% (by weight) solution of Acrawax and toluene."
>
> "Mill the mix for 4 hours in a ball mill and upon removing allow the toluene to evaporate by leaving at room temperature overnight."
>
> "Pulverize the material and screen."

The performance of this binder seems to be quite equivalent to the Flexalyn binder used at RCA. Green cores have high green strength, a shiny surface appearance and good dimensional tolerance. They have no automatic press facilities as yet and are using a single action die in a hand operated hydraulic press. They have another single action die designed and almost

completed and are considering the purchase of a Colton Rotary Press with 16 positions on the table. Mr. Walker, the mechanical designer, had studied the mechanisms of the Stokes Rotary and Colton Rotary Presses and believes that the design of the Colton is much to be preferred. It was not apparent to me what differences he based this decision on and however he seemed quite convinced that he was correct. They are planning to forward material to the Colton people for experiments with one of the rotary presses. The forming pressure used in the single action dies that they now have is usually 100,000 psi but is varied from somewhat less than that to 200,000 psi for test purposes. They take the dimensions of these test cores accurately by means of shadowgraph and test their green strength using a trip pan balance device which readily gives them a measure of the strength. This method is set up as follows. On one pan of the trip pan balance the test core is placed on its cylindrical side using a touch of stop-cock grease as an adhesive. The balance is mounted on a frame which has an upright post. The post carries an arm whose height is adjustable. The height is adjusted until it is just touching the top side test core. Granulated material, such as sand, is poured on the other pan of the trip pan balance until the core breaks. The quantity of sand is then weighed and the weight is taken as a measure of the green strength of the core. In this test it is necessary to normalize the results for cores of different height and for this reason the shadowgraph dimensions are necessary.

These people are using a very satisfactory means of evaluating the flow properties of a mix. The basis of this test is a standard ASTM test. A small conical steel cup is filled with the material and this cup is provided at the bottom of the cone with a two position slide. In one position the cone is closed for filling and in the other position the cone is free to empty through the slide. Using a stop watch, the time necessary for the cone to empty is a measure of the flow properties of a material. Materials which flow well in the die flow out of the cone in approximately three seconds. Materials a little less desirable in four seconds and for a longer time, trouble can be expected in filling the die cavity in the core presses. We tested the material supplied by RCA and found that in both flow tests and green strength tests it was fully comparable to the best composition prepared by IBM. They supplied me with a set of drawings for the flow test equipment and we are now having a similar piece made for our own use.

They have done firing tests but they have been somewhat limited by the availability of furnaces. Several furnaces have been ordered but none of the new equipment has yet been received. They stated that on the basis of the firing tests they believe that the only satisfactory way for determining the properties of a core were based on the time temperature integral of the firing cycle. Once a certain value of the integral is reached they quenched the cores somewhat in the manner of RCA. From this discussion arose the idea that an integrating device which sounds an alarm could be made to eliminate variations from one run to another in a batch firing process. Both IBM and our own group will consider the fabrication of such a device.

The group at IBM has made a good start on those phases of the problem discussed here. After the arrival of more equipment their progress

should be faster. I estimate at least one year will elapse before any sizeable production of uniform cores can be expected from IBM.

Signed FEVinal
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Approved DRB
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