CERTAIN-TEED PRODUCTS CORPORATION

Ardmore | January 10, 1956 | Paoli Eng.

Mr. O. F. Grieve

RE: AGENDA
1956 PLANT MANAGERS MEETING

BY: H. C. Johnson - jc

CC: Mr. P. E. Fischer, V.P. - Ardmore
Mr. H. J. Zelms - Acme
Mr. H. F. Debo - Akron
Mr. K. W. Brown - Blue Rapids
Mr. Myron Read - Fort Dodge
Mr. A. H. Ten Elshof - Grand Rapids
Mr. E. L. Flinn - Sigurd
Mr. J. E. Hart - Pryor
Mr. M. M. Powers - Akron
Mr. P. W. Codwise - Thorold
Mr. W. G. Will - Paoli
Mr. H. C. Puckett - Fort Dodge
Mr. G. A. Hoggatt - Paoli
Mr. M. F. Fink - Ardmore
Mr. C. G. Shuttleworth - Paoli Lab.

In compliance with instructions in your letter of December 12, 1955, I have prepared a paper on assigned Topic No. 14, "Automation and Gypsum Processes" and am sending each of those addressed a copy.

AUTOMATION & GYPSUM PROCESSES

BY

H. C. JOHNSON

TOPIC NO. 14, GYPSUM PLANT MANAGERS MEETING JANUARY 16, 1956

INTRODUCTION

During the past few years Automation has become a by-word and a catch phrase used indiscrimately in technical articles, magazines, periodicals and even in newspaper reporting. Headlines such as these have become part of our daily reading:

" Automation is sure to make money for some companies."

" Automation is in the best interests of all."

" Automation is key in the 13 week strike of Westinghouse. Workers balk at 5 year contract as they envisage speed up and replacement of men by machines."

" Machines (or automatic processes) can't buy cars or pay union dues, but within a few years they'll replace nearly half the workers in this country. No matter who you are or where you work your future way of life is going to be revolutionized."

" G.E. executive says ' Automation evolution will double industry's maintenance job."

Automation and automation thinking has developed so rapidly that it has tended to blind a common sense approach to its proper application. Although Automation implies an industrial utopia, management is understandably reluctant to invest large sums in something which is surrounded by an aura of mysticism and could lead to increased labor resentment and strife. Will it actually reduce costs or will increased investment capital and maintenance costs change utopia, the island of perfection, into a distant mirage?

A. W. J. Dyck, editorial writer for Paper Industry, has these comments on the subject:

" While human imagination has run wild - giving us at times a greatly distorted picture of automation - a few elementary lessons soon convince us that such terms as "electronic brain", "central thinking robots", etc., are highly misleading. Electronic computers or control instruments do not actually think. What they do is respond to an impulse thousands of times more quickly than a human being can ever hope to do. They can never do anything else but respond according to prescribed patterns along preset and precise channels. They do not have a choice in their approach to the problem nor in the method of solving it."

" There is great need for education and dissemination of information on the subject of automation. Labor must be acquainted with the "job enlargement" concept of automation, so that the term will not be used as a "psychological weapon" to retard progress under the guise that automation would create permanent mass unemployment. We must also strip automation of any implication that it is too complicated for people to understand, that we may be creating a Frankenstein, or that people will become subservient to it."

Henry Ford the II sums it up in 34 words " The term automation itself has become a catchword with dubious implications. Actually, it is nothing more than a handy means of describing something industry has been doing for years - improving the methods of production."

AUTOMATION TERMINOLOGY

To understand automation thinking let's review the more common terminology and see what they mean and how they could be applied to our process.

1. ANALOG COMPUTER An electronic calculating machine which solves problems by translating conditions like flow, temperature, or pressure into electrical quantities.

   APPLICATION: Used principally in design work or in a mechanical brain.

2. AUTOMATIC CONTROLLER A device or instrument which is capable of measuring and regulating anything from color to chemical make-up.

   APPLICATION: Now used to regulate heat input to dryer zones. Could be used at wet end in board plants or paper mill to control a continuous process.

3. CYBERNETICS A new field of science which attempts to relate the operation of automatic devices to the automatic functioning of the human body's nervous system. Once accomplished, it hopes to evolve a theory blanketing the field of control and communication — both in machines and men. Or in other words a system which will respond to "situations".

   APPLICATION: At some future date perhaps but not now.

4. DATA HANDLING OR REDUCTION SYSTEM - Automatically operated equipment engineered to simplify the use and interpretation of the bewildering mass of data gathered by modern instrument installations. Can, for example, automatically handle information fed to it from thousands of widely scattered points in a plant.

   APPLICATION: Not for our plants as yet.

5. DIGITAL COMPUTER A calculation machine which counts numbers rather than quantities as do analog machines. Performs basic arithmetic at speeds in millionths of a second. It can remember the result of one calculation and employ it later to come up with a complete answer.

APPLICATION: Non forseeable in our plants. Used in design work.

6. LOGGER Not a woodsman but an instrument which automatically scans conditions (temp., press., humidity) and records or logs findings on a chart. Can come equipped with lights or alarms to signal danger points.

APPLICATION: Part of any automatic system for checking errors.

7. OPTIMALIZATION The approach to economically perfect plant operations accomplished primarily by analytical rather than hit or miss methods.

APPLICATION: Something for all of us to conjure with.

8. PROGRAM CONTROL A control system which automatically holds or changes its target value on the basis of time to follow a prescribed "Program" for the process.

APPLICATION: IBM has a controller which programs 40 functions and as many as 10 at a time. Start up production lines, turn on heat, lights ovens etc.

9. SERVO-MECHANISM A type of closed loop control system in which mechanical position is the controlled variable. (anti aircraft gun positioning is a servomechanism).

APPLICATION: None that we know of, as long as the Russians behave.

10. TRANSDUCER An element which converts one form of energy into another. Usually refers to an element creating a signal in relation to a condition being measured, like a thermocouple or strain gage.

APPLICATION: Specialized control.

(NOTE: Indebted to Minneapolis - Honeywell Regulator Co. for above definitions.)

All these sound intriguing but actually only a few would find application in our business. Automation for us, at least now, must be simply a realistic grouping of elementary controls, and equipment additions and revisions.

AUTOMATION IN OUR PLANTS

Now how do we apply this technique to our business? Certainly there are many places in our process where automatic controls will improve quality, reduce raw material cost, and reduce man power. But will the initial expenditure and maintenance cost offset these to the point where operating costs actually increase? There is no point in making a process automatic just to have it automatic.

To show you what is involved we have set up a more or less hypothetical automation layout based on the Akron plant production of plaster. It could apply however, with minor changes, to any of our plants. Although we have done some painstaking work time did not permit a rigorous engineering study to develop cost, detail equipment specification, or savings to be realized. Since this is

not a finalized layout, please bear with me if you detect errors in our preliminary thinking. Much of this work was done by one of our new engineers, a Mr. Norman Robinson, who until 2 weeks ago knew nothing about plaster packing. On the other hand, he is not inhibited by pre conceived ideas and something good can always be obtained from a fresh approach.

At Akron two men are involved on the raw material floor, a mixer man and a raw material procurer. We want to eliminate the mixer man.

To begin this study the plant prepared a six month plaster production recap by formula numbers. From this information (neglecting Kalite production) Norm prepared the following charts. Chart #1 is simply a listing of the 25 ingredients involved. Chart #2 is a formulation of the types of plaster produced, batch size, ingredients by code number and amount per batch.

Chart #3 was developed to determine the storage layout and weighing range required for a one ton packer.

Chart #4 was devised from previous charts to show the batch factors or number of separate weighing operations for each ingredient. Note that the total number of weighs is better than 400,000/yr.

At this point we decided to investigate the possibilities of using a larger packer to reduce the batching cycles. Thus Chart #5 reveals the packing cycles and storage facilities required for a 2 ton mixer and packer. After studying the batch factors required for each ingredient it was decided to drop the idea of complete plaster packing automation, and to use only one large automatic packer and use 2 small manual machines for the odd formulas.

CHART 1

INGREDIENTS

(1) Stucco - Land plaster AK - 20

(2) Stucco - Land plaster AK - 21

(3) Stucco - Tubed Stucco AK - 50

(4) Soda Ash

(5) Retarder

(6) Manila Fibre

(7) Stucco AK - 31

(8) Cotton Wood Defibrator Fibre

(9) Stucco - AK - 35

(10) Hydrated lime

(11) Sand - 100% thru 14 mesh

(12) Gum Arabic - Powdered

(13) Accel.- AK - 95 & 99

(14) Dried plastering sand

(15) Expand perlite 8 lb./ft.^{3}

(16) Air dried regular wood fibre

(17) Shavings - Hammer Mill ground

(18) Molding Plaster BR - 230

(19) Old Hickory Clay (Air Float Grade A)

(20) Globe Dextrine #150 - Powdered or Amidex

(21) Peruvian Ochre

(22) Stucco - AK - 38

(23) Moldene (fibrous talc)

(24) Stucco BR-38 (Sunflower Molding)

(25) Litharge #10 Pure.

CHART II

FORMULATION AND INGREDIENTS BY NUMBER

FORMULA	BATCH SIZE	INGREDIENTS NO.	LBS./BATCH
35	2000	1	99.91 %
38	2000	2	99.911%
90	2014	3	2000
		13	6
		5	8
91	2015	3	2000
		13	6
		6	2
		5	7
92	2015.5	3	2000
		13	6
		6	2.5
		5	7
93	Now	AK-92	
100	2013	7	1400
		3	600
		8	10
		5	3
116	2016	3	500
		7	900
		10	40
		11	558
		8	5
		13	6
		5	7
128	1504.29	3	525
		14	975
		13	1.35
		6	0.75
		5	2.19
130	1327.125	3	1160
		15	160
		13	2.875
		6	0.500
		5	3.750
132	1166.6	3	1000
		15	160
		13	2.9
		6	0.5
		5	3.2

FORMULA	BATCH SIZE	INGREDIENTS NO.	LBS./ BATCH
133	1166.1	3	1000
		15	160
		13	2.9
		5	3.2
137	1246.4	3	1000
		15	240
		13	2.9
		5	3.5
151	1002.25	9	1000
		5	2.25
180	2004.75	3	1900
		16	25
		10	75
		5	5.75
187	1503.25	3	900
		7	480
		17	120
		13	3.25
190	1207.16	18	1000
		19	180
		20	24
		5	0.60
		21	2.56
200	Same as	22-50	
205	2000	22	100%
231	2000	22	100%
237	1000	22	800
		23	200
238	1000	24	800
		23	200
311	1498.5	3	858
		9	572
		25	37
		12	27
		20	3
		4	1.5

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CHART III
STORAGE PROBLEM AND WEIGHING RANGE

NO.	TYPE	FORMULA NO.	NAME	SPECS.	LARGEST LB/BATCH	STORAGE	SMALLEST LB/BATCH
1	STUCCO	AK-20	Land Plaster		2000	stable	2000
2		AK-21	Land Plaster		2000	"	2000
3		AK-50	Tubed Stucco	from #30 Stucco	2000	"	500
7		AK-31	Stucco	coarse grind	975	"	480
9		AK-35	Stucco	Treated	1000	24 hrs.	572
18		BR-230	Molding Plaster		1000	stable	1000
22		AK-38	Stucco	Fine Grind Treated	2000	24 hrs.	800
24		BR-38	Sunflower Molding		800	stable	800
6	FIBRE		Manila Fibre		2.5	stable	0.5
8			Cotton Wood Defibrator Fibre		10	"	5
16			Regular Wood Fibre	Air Dried	25	"	25
17			Shavings	Hammer Mill Ground	120	"	120
11	SAND		Sand	100% thru 14 mesh	558	"	558
14			Sand	Dried Plastering	975	"	975
4	MISC.		Soda Ash		1.5	stable	1.5
5			Retarder		8	stable	0.6
10			Lime	Hydrated	75	one wk.	40
13		AK-99	Accel.		6	24 hrs.	1.35
15			Perlite	8 lb/ft.^{3}	240	stable	160
19			Old Hickory Clay	Air Float Grade A	180	stable	180
20			Globe Dextrine	#150 Powdered	24	stable	3
21			Peruvian Ochre		2.56	stable	2.56
23			Moldene	Fibrous Talc	200	stable	200
25			Litharge	#10 Pure	37	stable	37
26			Gum Arabic	Powdered	27	stable	27
20			Dextrine Amidex	#150 Powdered	24	stable	3

CHART IV

Development of Batch Factors

6 Months

No.	Ingredients: Total Use Lbs.	Ingredients: Total Use Tons	No. of Batches for each ingredient
1		209	209
2		77	77
3		31,277	47,792
4	1.5		11
5	472*	97.4	47,849
6	58*	14.5	21,100
7		482.1	1,180
8	129*	2.2	445
9	48*	431.6	806
10	255	0.7	30
11		7.2	26
12	288*	0.144	11
13	286*	84.0	47,357
14		37.6	77
15		2,900.1	36,298
16	85		4
17		44.2	735
18		3.3	7
19		0.6	7
20		0.1	18
21	17		7
22		211.8	339
23		26.0	260
24		39.2	98
25		0.2	11

TOTALS	
Tons	Batch Factors
35,946 per 6 mos.	204,755 per 6 mos.
72,000 per year approx.	410,000 per year approx.

* Moved into ton column

CHART V

PACKING CYCLES AND BIN VOLUME REQUIRED FOR 2 - TON PACKER

INGREDIENTS								
NO.	NAME	LARGEST LB/BATCH	SMALLEST LB/BATCH	BATCH FACTORS PER WK.	USE(TONS) PER WK.	APPROX. LB/FT^3	BIN VOLUME FOR 1 WK	1 DAY
								6 day v
5	Retarder	16.00	1.20	920	3.74	70	110	
3	Tubed Stucco AK-50	4000. 00	1000.00	910	1200.00	60		6660
13	Accel. AK-99	12.00	2.70	910	3.24	60	110	
15	Perlite	480.00	320.00	700	112.00	8		4700
6	Manila Fibre	5.00	1.00	405	0.54	20	54	
7	Stucco AK-31	1950.00	960.00	23	18.50	60	620	
9	Stucco AK-35	2000.00	1144.00	16	16.50	60	550	
17	Shavings	240.00	240.00	15	17.00	20		290
8	Defibrator Fibre	20.00	10.00	9	170 lbs.	20	9	
22	Stucco AK-38	4000.00	1600.00	7	9.25	60	310	
23	Moldene	400.00	400.00	5	1.00	45	45	
1	Land PlasterAK-20	4000.00	4000.00	4	8.00	60	270	
24	Stucco BR-38	1600.00	1600.00	2	1.51	60	50	
2	Land PlasterAK-21	4000.00	4000.00	2	2.96	60	100	
14	Plastering Sand	1950.00	1950.00	2	1.44	100	29	
10	Hydrated Lime	150.00	80.00	1	54 lbs.	50	1.1	
11	Sand(14 mesh)	1116.00	1116.00	1	552 lbs.	90	6.2	
20	Amidex	48.00	6.00	1	7.6 lbs.	40	0.2	
4	Soda Ash					40	0.04	
12	Gum Arabic	54.00	54.00	1	12 lbs.	50	0.3	
25	Litharge	74.00	74.00	1	16 lbs.	300	0.06	
18	Molding Plaster BR-230	2000.00	2000.00	1	254 lbs.	60	4.3	
19	Old Hickory Clay	360.00	360.00	1	46 lbs.	65	0.8	
21	Peruvian Ochre	5.12	5.12	1	0.7 lbs.	70	0.01	
16	Regular WoodFibre	50.00	50.00	1	3.28 lbs.	20	0.2	

Our next step was to group as many formulas as possible which contained the largest batch factors and those which were compatible for packing on the automatic machine. This is shown in Chart #6.

Chart #7 itemizes the production and ingredients used in the formulas to be produced on the 2 small manual packers.

The end results of all this manipulation is shown in Chart #8 where you will note the decrease in number of batches and that the number of separate manual weighing operations was reduced from 410,000 to 12,000 or a decrease of 97%.

To give you our version of what an automatic packer setup might look like we have prepared this drawing, and would like to review some of the problems involved.

As mentioned before this preliminary study is somewhat hypothetical. Do you think it merits further study? Have you suggestions as to a different approach? Are there installations in your particular plant or operation that would justify automation? Your comments and suggestions will be appreciated.

CHART VI

Production and ingredients for new 2 ton automatic packer.

Packer No.	Formula No.	6 Mos. Prod.	Batches Per 6 Mos.	Batch Factors*	Ingredients*** (Code Nos.)										
	AK-90	8	4	12	3	13	5								
	-91	4251	2109	8436	3	13	5	6							
	-92	6041	2997	11,988	3	13	5	6							
2	-100	422	209	836	3		5		8	7					
	-116	26	13	91	3	13	5		8	7	10	11			
New	-130	4551	3429	17,145	3	13	5	6					15		
4000 lb.	-132	2300	1975	9,775	3	13	5	6					15		
	-133	14,864	12,740	50,960	3	13	5						15		
replaces	-137	6	5	20	3	13	5						15		
old #2	-180	4	2	8	3		5				10			16	
and 3	TOTALS	32,473	23,483	99,271**											

* Weighing operations
** This figure was 198,542 for the 2000 lb. packer
*** The 10 ingredients, out of a total number of 25, used in above formulas represent 95% of total tonnage produced.

CHART VII

PRODUCTION & INGREDIENTS FOR THE 2 ONE TON MANUAL PACKERS

PACKER NO.	FORMULA NO.	6 MOS. PROD.	BATCHES PER 6MOS.	BATCH * FACTORS	INGREDIENTS (CODE NOS.)
	AK-35	209	209	209	1
	-38	77	77	154	2
1	-151	398	796	1592	5 8
	-190	4	7	35	5 18 19 20 21
old	-205	152	152	152	22
2000 lb.	-231	25	25	25	22
	-237	81	162	324	22 23
	-238	49	98	196	23 24
	-311	8	11	66	9 20 31 22 25 4
	TOTALS	1003	1537	2753	
3	Ak-128	58	77	385	5 3 14 13 6
old 2000 lb.	-187	553	735	2940	3 13 7 17
	TOTALS	611	812	3325	

* WEIGHING OPERATIONS

#5 - 13 - 3 - 6 - 7 also are used in new packer.

CHART VIII

Per year	Batches	% Reduction	Manual Batch Factors	% Reduction
Using 4 - 2000 lb. packers	98,630	—	409,240	
Using 2 - 2000 lb. manual & 1 - 4000 lb. packer with automatic feed	51,664	47.6	12,156	97.0

NOTE: The 4000 lb. packer will handle 99.5% of the total output (32,473 tons from total of 34,087 tons).