The Control of Output and Operating Efficiency which must Precede the Reorganization of the Production of a Weaving Mill

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If we are placed in a weaving mill with the object of increasing the output, our attention will first of all be directed to investigating the quantity of goods produced. Only when this has been done are we in a position to say why the production is merely fair and what must be done to remedy this state of affairs.

The following lines are intended to show the way to getting a clear idea of the yardage of a cretonne weaving mill with 500 power looms.

In the first place the quantities produced during each payday period (of one week, or a fortnight) for the whole year must be calculated as an average uniform number of picks per centimetre, so as to make them comparable. Then this yardage is converted to a percentage of the production.

The percentage of the output of a payday period can easily be found by multiplying the production, which has been converted into the average number of picks, by 100 and dividing the result by the theoretical production similarly reduced to terms of the number of picks.

$$\text{percentage of production} = \frac{\text{actual output in unit metres} \times 100.}{\text{theoretical output in unit metres.}}$$

In order to arrive at the theoretical output, the speed of a large number of looms of each type must be measured during several days at different hours. The average speed of the loom can be calculated from these figures as follows.

Suppose that the speeds given below have been found for four types of looms —

150 looms Type A with 210 picks per minute
$150 \times 210 =$ 31,500 picks per min.
100 looms Type B with 200 picks per minute
$100 \times 200 =$ 20,000 picks per min.
100 looms Type C with 195 picks per minute
$100 \times 195 =$ 19,500 picks per min.
150 looms Type D with 190 picks per minute
$150 \times 190 =$ 28,500 picks per min.
500 looms would weave 99,500 picks per min.

without any interval, that is to say, the average loom speed is 99,500 : 500 = 199 picks per minute.

Let us assume that the standard number of picks is 25 per centimetre.

The theoretical output of 500 looms during a payday period of 90 working hours can be calculated from the formula given below:

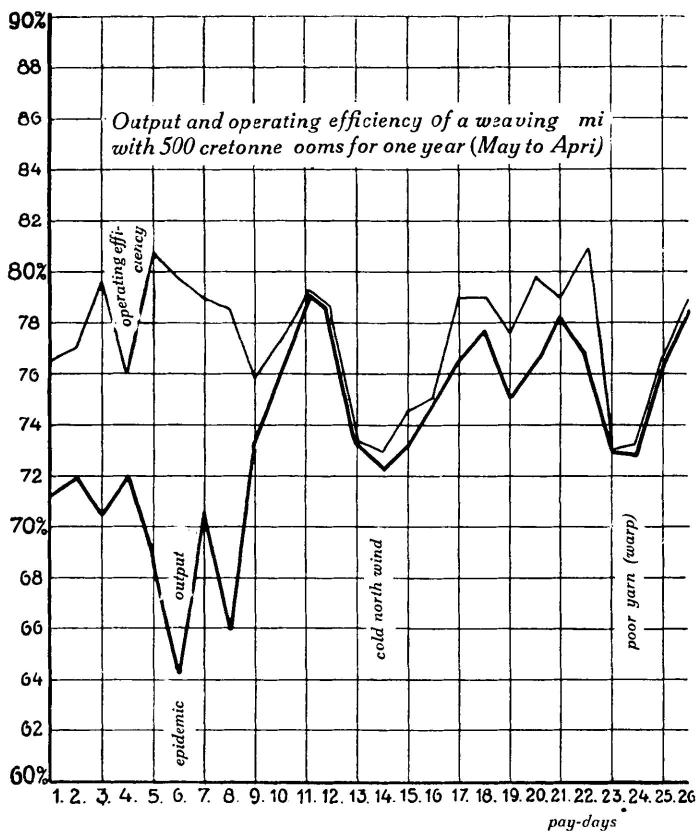
$$Pr_{th} = \frac{\overset{\text{picks/min.}}{199} \times \overset{\text{minutes}}{60} \times \overset{\text{working hours}}{90} \times \overset{\text{looms}}{500}}{\underset{\text{picks centimetre}}{25} \times \underset{\text{centimetres per metre}}{100}}$$

$Pr_{th} =$ 214,920 metres with 25 picks per centimetre.

Owing to holidays the number of the working hours varies, so that the theoretical output for all conceivable payday periods should be tabulated.

In 75	working hours the loom	179,100	metres
„ 80	has a theoretical	191,040	„
„ 85	output of	202,980	„
„ 90		214,920	„
„ 95		226,860	„
„ 100		238,800	„
„ 105		250,740	„
„ 110		262,680	„

Having calculated the percentage production for the paydays of the year past, these figures are tabulated, which will be of assistance in plotting a graph of the production.



Example: During the first payday period of 100 hours the mill produced 170,253 unit metres, then on this assumption the percentage

$$\text{of output} = \frac{170{,}253 \times 100}{238{,}800} = 71.3\%.$$

The table of production already gives us a certain view of the course of the business under review, but we do not know whether every loom is working properly, because the figures give no information upon the idle looms during the year just past. In many such cases the production may appear to be very low owing to lack of labour, although the looms at work have almost reached their maximum output.

In order to get to learn the proper run of the looms at work, the operating efficiency must be calculated. The efficiency operating of a weaving mill is the quotient of the actual yardage and the theoretical output of the looms at work. The theoretical production of the looms at work is found by calculating that worked out for 500 looms. To find the efficiency capacity we must first copy the figures from the book of the head foreman for a payday period, from which we see that during ten months of the year the working day was of 10 hours, and for two months 9 hours, as prescribed by law, apart from Saturdays.

These are the figures for the first fortnightly payday period:

First week:

Monday	10 hours		36 looms
Tuesday	10	„	32 „
Wednesday	10	„	32 „
Thursday	10	„	40 „
Friday	10	„	32 „
Saturday	5	„ 36/2=18	„
	in 55 hours		190 looms

Second week:

Monday	10 hours		52 looms
Tuesday	10	„	32 „
Wednesday	10	„	32 „
Thursday	0	„	holiday
Friday	10	„	24 „
Saturday	5	„ 24/2=12	„
	in 45 hours		152 looms

During 100 working hours 342 looms were idle, i. e. 34.2 per day of 10 hours.

The idle looms having been entered in a second column of the table mentioned above, we can now proceed to calculate the efficiency capacity.

In order to find the percentage of the efficiency capacity of a payday period, the actual output is multiplied by 100 and the product is divided by the theoretical output of the looms which were at work during the period in question.

Example: During the first payday period 34.2 looms were idle on an average and the mill had an output of 170,253 metres.

The theoretical production of 500 looms for

100 hours is 238,000 metres and for (500—34,2) = 465,8 looms amounts to 222,467 metres % of the operating efficiency =

$$= \frac{170{,}253 \times 100}{222{,}467} = 76.5\ \%.$$

The operating efficiency for the total number of paydays, say 26, is entered in a third column of the table which is reproduced below in extenso.

In order to arrive at an absolutely clear conception of the output and efficiency capacity, a graph is plotted (see figure), the abscissa of which shows the 26 paydays during the year and the ordinate the percentages for production and efficiency capacity from 60 to 90 per cent.

Payday	Hours	Actual production in metres at 25 picks per centimetre	Percentage of output %	Idle looms	Percentage of operating efficiency %
1	100	170,253	~71,3	34,2	~76,5
2	100	171,687	„ 71,9	32,4	„ 77
3	110	185,302	„ 70,5	56	„ 79,6
4	110	189,607	„ 72	23,5	„ 76
5	110	181,499	„ 69,2	71	„ 80,7
6	100	153,806	„ 64,4	98	„ 79,8
7	95	160,002	„ 70,5	53	„ 79
8	110	173,683	„ 66	79	„ 78,5
9	110	192,365	„ 73,5	16	„ 75,8
10	110	199,708	„ 76	6,4	„ 77,2
11	110	207,312	„ 79	—	„ 79
12	110	205,993	„ 78,5	—	„ 78,5
13	110	192,300	„ 73,2	—	„ 73,2
14	110	189,678	„ 72,2	4	„ 72,8
15	75	131,250	„ 73,2	8,8	„ 74,5
16	95	169,963	„ 75	—	„ 75
17	95	173,496	„ 76,5	15,5	„ 79
18	85	157,502	„ 77,6	9,2	„ 79
19	100	179,481	„ 75	14,1	„ 77,5
20	110	201,103	„ 76,5	19,9	„ 79,8
21	110	205,025	„ 78	6	„ 79
22	110	200,981	„ 76,5	25,5	„ 80,8
23	110	191,598	„ 73	—	„ 73
24	110	190,893	„ 72,8	4	„ 73,2
25	100	180,912	„ 75,8	2,9	„ 76,3
26	100	189,334	„ 78,5	—	„ 78,5

The diagram shows that the two curves unite several times at those points where all the looms are at work, that is to say, when production is equal to the efficiency capacity (the output has reached its maximum). The space between the two curves represents the idle looms. The black curve, which represents the output, keeps us at all times informed of the cost of manufacture, which is a function of the actual yardage.

The thin efficiency capacity curve indicates whether the looms are running normally, whenever it falls the manager must investigate the matter.

The figures were read off the slide rule and are thus accurate enough.

Besides all this the graph shows us also that the output is poor between ordinates 5 and 8, (owing to shortness of labour, an epidemic of influenza, and lack of substitutes).

For two thirds of the year the efficiency capacity is good, but is low between ordinates 13—16 and 23—24. Investigation showed that there was often a cold north wind between 13 and 16, so that the conditioning equipment is either working badly, or is insufficient. Between 23 and 24, two thirds of the looms were working on poor yarn.

From these lines and the diagram it can be seen that it is evidently quite possible to raise the output of this weaving mill by training the operatives and making working methods more efficient, for good hands working on ordinary power looms can attain an output of from 85 to 90%, or even, in the case of the best workers, as much as 95 per cent.

Every owner of a weaving mill who is not satisfied with the work done should carry out this little investigation when he has occasion to appoint a new manager, so that he can make his salary depend upon the progress in organization made by the mill.