DIAGNOSES OF THE CAUSES OF THE YARN FAULTS IN THE EGYPTIAN SPINNING MILLS

M.A. EL Messiry
Textile Department, Faculty of Engineering, Alexandria University,
Alexandria Egypt.

ABSTRACT

It is very important to analyze the causes of the presence of yarn faults and their frequency since it affects both the yarn quality and the winding machine efficiency. The object of this work is to investigate the causes of yarn faults in a sample of Egyptian spinning mills. A software package is developed to help the quality control department to detect the causes of the different yarn faults knowing the results of the classimate test.

1. INTRODUCTION

The analysis of the yarn imperfection in the Egyptian mills indicate that, in spite of the high yarn quality produced on the modern spinning machines, the classimate values of these yarns are rather unacceptable. From the study of the Shirley institute [1] it was interesting to notice that the cost reduction resulting from fabrics which were downgraded due to spinning faults was 15.4% for shirt fabric and 22.4% for rain coat fabric. This figures show how important it is to control the yarn faults during the spinning process. The presence of the yarn faults in the spinning makes it unsuitable to be used directly without winding. However, the use of the electronic clear will make it possible to eliminate a certain type of the yarn faults. In the mean time, the increase of the number of cutting will reduce winding efficiency of the winding machine increasing the winding cost[2]. More over, poorer quality and faulty yarn can't be made into good yarn by means of an increased degree of clearing. Locher [3] indicates the necessity for quality control procedures in order to reduce the faults in the produced yarns. This associated with the faulty places in the finished fabric due to yarn faults. The analysis of the origin of yarn faults in the spinning mill divided the yarn faults into three main groups [4]:

- short periodic
- relatively frequent imperfection
- relatively seldom occurring long yarn faults.

The purpose of the article is to give a diagnosis software that will use the results of the classimate analysis to detect the cause of yarn fault and to investigate the causes of yarn faults in some Egyptian mills.

2. CLASSIFICATION OF YARN FAULTS

In the work of Peter [5] the origin and frequency of thick places in the yarn was studied in the several cotton ring spinning mills. The yarn faults are classified as following:

I. Faults due to raw material

M1 - foreign matter. This kind of fault often involves non-textile matter already present in the bales or picked up during the course of spinning process

M2 - felting. This is encountered above all in yarns containing manmade fibres. It consists of felted fibres appearing frequently in association with accumulations of spin finish. These groups may grow into very big thick places

M3 - manmade fibre bits. These faults are traceable to gummed individual fibres and particles of fibre material.

II. Faults due to processing

P1 - piecings. These results from spinning preparation as a rule, due to extreme variations in the cross section, though they may also be caused by other factors on the ring frame.

P3 - short "creepers". These faults arise chiefly through accumulations of short fibres, which remain undrafted in the roll draft systems and thus appear as thick places with little twist and therefore low breaking strength. This kind of fault may occur due to over-wide setting of the cradies on apron draft systems.

III. Faults due to spinning machine

S1 - fly spun in. Here wandering fibres drop into the draft system or cling to the roving behind it, and are twisted into the yarn over their entire length.

S2 - loose fly. This consists of fibres picked up by the yarn after the front roll and usually spun in at one end only.

S3 - long fly. This is felting on the aprons and rolls, which is picked up and taken along by the yarn sporadically.

S4 - "fishes" (corkscrews). This kind of fault is caused on the one hand by static charges, on the other hand by unsuitable aprons or bad apron surfaces.

S5 - holdbacks. These are individual fibres held back, usually at the traveller.

S6 - chains. Here faults S1, S2 and possibly S3 as well appear in combination and in rapid sequence.

S7 - yarn bursts. These result from overlength fibres which disturb drafting and briefly retard the draw-off of the yarn through the ring and traveller.

It is a common practice in all spinning mills to use the classimate in order to analyze the yarn faults after winding.The usage of the classimate will give yarn grades according to different classifications since it divides the faults into 16 classes: A1 to D4.

Horizontal :

Length class A shorter than 1 cm
Length class B 1 - 2 cm
Length class C 2 - 4 cm
Length class D 4 cm and longer

Vertical:

Cross section class 1 +100 to +150%
Cross section class 2 +150 to +250%
Cross section class 3 +250 to +400%
Cross section class 4 +400% and bigger

3. ALGORITHM FOR THE ANALYSIS OF YARN FAULTS

Then, in order to get the relation between the causes of the yarn faults and value obtained from the classimate analysis the following algorithm was developed to get the above mentioned relation.

$$M1 = A3 - A4$$
$$M2 = A4$$
$$M3 = B4$$
$$P1 = B2 - B3$$
$$P3 = (A2 - A4) + (B1 - B4) + C4$$
$$S1 = B4$$
$$S2 = D3 - D2$$
$$S3 = D4$$
$$S4 = (B2 - B4) + (C2 - C4)$$
$$S5 = A4$$
$$S6 = D1 - D2$$
$$S7 = A4 + B4$$

Hence, knowing the value of Ai to Di from the classimate analysis one can directly detect the causes of yarn faults.

4. EXPERIMENTAL WORK

Several mills were investigated to classify the type of yarn faults and their frequency. Bobbins from different spinning rooms were drawn. The whole investigation is based on Uster classimate grades. All faults were sorted out visually by their manifestation, forms, and various groups were expressed as percentages of the total of all objectionable faults. After this the different kinds of faults were investigated more closely, ascertaining where and under what circumstances and connections they are liable to occur. The chosen mills are producing different types of yarn of counts varied between Ne 20 to 80 from the various types of Egyptian cotton.

4.1 Analysis of the yarn faults in some spinning mills

From the analysis of the yarn faults in the different mills which are given in Table (1), it is clear that the yarn faults differ from one mill the other depending on the level of technology, type of machine, speed, etc.. However, fibre contamination dominated in some mills while the faults resulting from the presence of fly were most frequent in the all investigated mills.

Table 1. Analysis of the different yarn faults in some Egyptian mills.

Type of faults	Percentage of faults						
	Mill 1	Mill 2	Mill 3	Mill 4	Mill 5	Mill 6	Mill 7
M1	9	5.56	16.89	10.93	47	36.5	13.8
M2	0	0	0	0	2.25	0	0
M3	0	0	2.6	0	0	0	0
P1	5	6.94	4.79	0.1	0.76	7.9	16.2
P3	0	2.89	13.97	4.1	1.12	4.1	13.2
S1	31.64	10.7	10.14	7.3	11.2	9.36	3.03
S2	16.05	15.24	23.6	19.4	16.89	21.8	36.8
S3	9.13	8.49	3.2	9.57	0	1.04	3.08
S4	11.78	27.1	15.6	18.77	12.38	11.45	4.7
S5	6.72	21.8	6.78	16.74	1.12	3.12	9.1
S6	7.45	0.92	1.5	3.79	0	0	0
S7	3.12	9.2	1.3	4.14	1.12	0.2	0

Table 2. Percentage of the yarn faults due to the fly.

Mill No.	% of yarn faults
1	69.5
2	43
3	27
4	14.9
5	29.27
6	25.97
7	49.53

4.2. *Effect of air circulation on the number of the yarn faults to the fly*

In the spinning mills two types of the air ventilation systems are generally used, central and local. The efficiency of these systems affects the percentage of yarn faults due to the fly. The analysis of results obtained from the mills show that the percentage of spinning faults, especially that due to the fly (S2, S3, S5), their shapes are given in Figure (1), varied from one mill to another. Table (2) gives the percentage of yarn faults due to the fly. The value of the fly in the spinning room can be calculated by the following equation:

$$F = \left(\frac{A x n s x z x K x 10^3}{Ne^{1.5} x \alpha x V x N} \right) \text{mg/mt}^3$$

where:

ns spindle speed r.p.m.
z Total No. of spindle
α twist factor
Ne average yarn count
V volume of the spinning room mt^3
N number of air cycles per hour
A 0.9

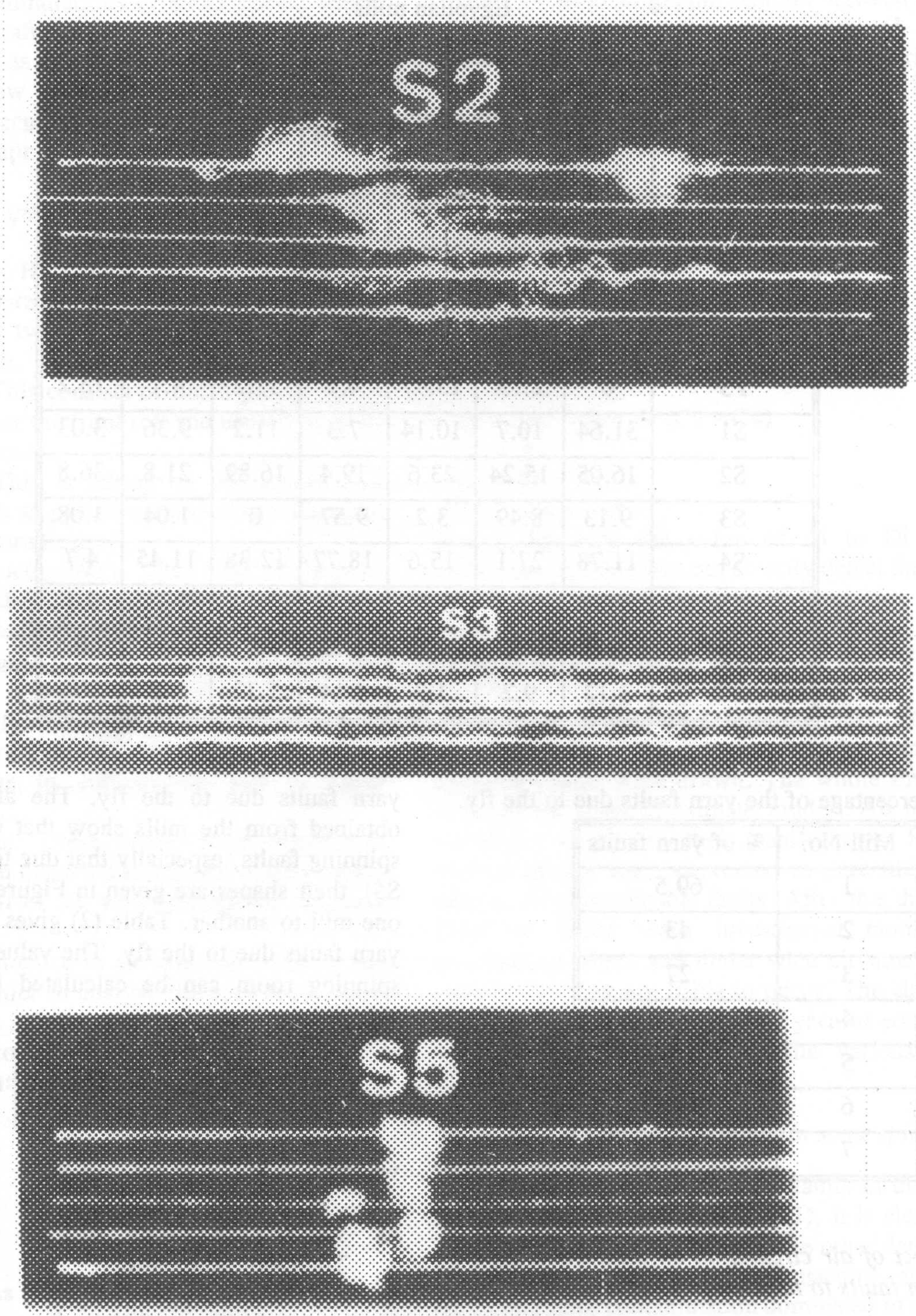
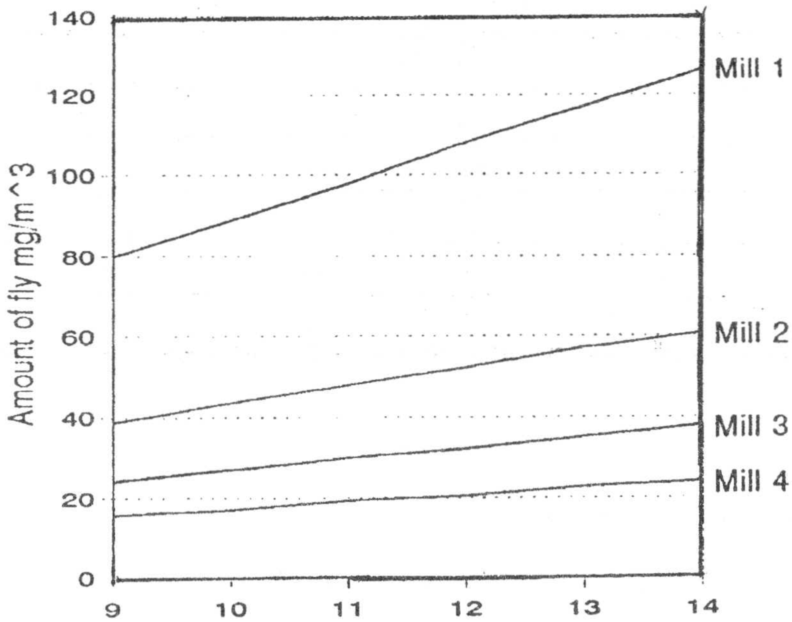


Figure 1.



Spindle speed in thoused rpm

Figure 2.

Figure (2) shows the value of the fly for the different mills under investigation taken into consideration that K=1%. The results coincide with the measured values of the yarn faults due to the presence of the fly. It is obvious that the mill (1) which has a bad design of the air ventilation system gets the increase of the yarn faults, while the mill (4) has less trouble as it owns a better ventilation system.

4.3. *Effect of bobbin location on the percentage of yarn faults.*

The air velocity around a spinning machine significantly affects a path of the fly after its generation from the zone of drafting system. The rotation of a bobbin will create air draft from one side of machine to another. Consequently, the percentage of the yarn faults due to the fly will vary from one bobbin to another. The air velocity pattern also will change depending on a machine location in a spinning room. From the investigation of the distribution of yarn faults in the different bobbins sampled from different locations in the spinning room, it is clear that the location of the bobbin affects the percentage of the yarn faults due to the fly. This occurs because the distribution of the air stream inside the spinning room will affect the path of the fly emitted from the different production units. A typical example of the analysis of yarn faults in the different locations, at the ends and the middle of a spinning machine show that the value of the sum of the faults (S2, S3, S5) per 100 km is found to be 27.2 at the right end , 15 at the middle, and 9 at the left end. This significant difference is due to the direction of the air stream moving from the left to the right caring the fibres alongside with it. Further more, a machine location in spinning room also should be taking into consideration. For instance, in a spinning mill machine (1) is located near a door, so the strong air stream continuously moves the fly outside the spinning area reducing the quantity of the fly and the number of the spinning faults has been found to be 3.35 per 100 km, while machine (2) is located in the middle of a spinning room where the concentration of the fly is higher, thus the percentage of the yarn faults due to the presence of the fly is higher reaching a value of 21 per 100 km. These results indicate the importance of correct design for the air circulation inside the spinning room, especially when the spindle speeds are high and the yarn counts are coarse. In the most cases the installation of a new spinning equipment running at a higher production rates will emit high percentage of the fly. This will lead to increase of the yarn faults. Thus, the proper ventilation system should be designed to satisfy the required low value of the fly.

Table 3. Example of computer run.

Textile Co.							
Mill #:2				Date: 20/10/1993			
A1	30	B1	0	C1	0	D1	0
A2	58.3	B2	0	C2	16.25	D2	0
A3	92.1	B3	0	C3	16.25	D3	0
A4	258.3	B4	45.8	C4	16.25	D4	0

Yarn count : 40/1
M/c # : 101
Type of cotton G 70

DIAGNOSIS OF MILL CONDITION:

* Excess faults due to the accumulation of the fly caused by the traveller (Type S5)

5. COMPUTER SOFTWARE FOR DIAGNOSIS THE CAUSE OF THE YARN FAULTS

In order to analyze the causes of the yarn faults in a certain mill, a classimate analysis of ring spinning cops are usually carried out as a routine test. Using the above mentioned algorithm it is possible to identify the causes of such faults. However, the value of each class of the faults should be compared with the international standards to determine its deviation from the usual norms. A computer program was developed to make it easy to give the diagnoses of the causes of the yarn faults if it is higher than the international norms. The results of the application of the above technique are given in Table (3). The field investigation of some Egyptian mills shows an increase of the percentage of the fly/m3 in a spinning room which deteriorates the yarn quality, and this consequently resulted in that the most yarn faults in such mills were due to the presence of the fly.

6. CONCLUSION

The excess of the fly occures because of using of most of the yarn faults are due to the presence of the fly. The analysis of the results carried out at several egyptian mills indicate that unsuitable ventilation system. The relation between the classimate value and the causes of the yarn faults was concluded. diagnosis software was developed.

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