Values of beat-up force at various loom speeds And shed heights of the weaving machine

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Abstract:-

In this research the values of beating farce of a picanol loom is determined. Two parameters of the loom are in vestigated, namely, the speed and the shed heisht. The values of beating force are determined at Various loom speeds and shed heights. The experiments are performed an the picanol (president) loom. The model of warp mechanics of Salem[1] is used in this research for the predictions of warp tension. It was found by this research that the values of the beating force in creased with the speed of the loom. As well another interesting finding of this research is that the heatis force increased with the increase of the shed height at which the beaotion action took place.

الملـخــص:-

الطاقة الكهربائية الفعلية التي تستخدم لإنتاج القماش بواسطة ماكينة النسـيج قد تم تحديدها في هذا البحث. إستخدمت ماكينة البكانول لإجراء هذه التجارب.

الطاقة المفيدة المستخدمة بواسطة حركات الدف وفتح النفس والحدف في ماكينة النسيج قد تم حسابها وتحديدها في هذا البحث. تم إستخدام الجهاز المحوسـب لقيـاس الطاقة الكهربائية والمصمم بواسطة/ سالم كاتب هذا البحث لقياس الطاقـة الكهربائيـة المفيدة المستخدمة بواسطة الحركات الأساسية الثلاثة في ماكينة النسيج.

تمت دراسة أثر السرعة على الطاقة المفيدة المستخدمة لإنتاج القماش. أثبت هذا البحث أن 23% من الطاقة الكهربائية تستخدم في إنتاج القماش بينما هناك 77% مـن الطاقة الكلية تذهب هدراً في شكل فقدان ميكانيكي وحراري.

1-Introduction:-

The demand for electric power continues to increase for both domestic and industrial uses. The textile industry continues to be a major consumer of electric power particularly for motor drives.

The textile industry in general uses different energy sources[3] for different processes (i.e. , oil , coal , gas & electricity). A report prepared by the Shirley institute[4] for the department of industry stated that the textile industry (England) consumes about 5700 TJ (terajoules) of energy each year.

In Sudan the cost of electrical power receives a correspondingly small amount of attention from management. If the power consumption of the weaving machine only is considered ,then the cost of electricity would be the main production cost especially in weaving mills where greige fabric only is produced. The conservation of energy[5] is an essential step we should all work towards. There would by value then in directing attention to power consumption in weaving, especially these days where the demand and price of electricity is increasing rapidly.

In this work an attempt is made to show the exact useful power used in producing the fabric. The main three basic weaving mechanisms are investigated in this work, namely, Sley, shedding and picking mechanisms.

2. Materials & Methods:-

A series of experiments was conducted in this research, aimed at determining the actual power consumed in producing the fabric. For this work the computerized two – wattmeter designed by salem[2] was used to measure the electrical power consumed by the various mechanisms of the loom. The loom was run at several different speeds, firstly producing fabric at the specifications shown in Table (1.F) and secondly, after the warp yarns and cloth were removed and with no yarn in the shuttle. Loom speed was varied by the use of different sized motor pinions, ranging from 17 teeth to 22 teeth. Power consumption for different mechanisms was determined in this work, by running those mechanisms alone, i.e., by disconnecting all other mechanisms and maintaining only the basic drive and the drive to the mechanisms being investigated. This technique of investigation is identified in the results by the use of the subscript (0).

The power actually used in producing the fabric was calculated by subtracting the power consumed by the loom without material, from the power consumed by the loom with material.

Table.(1.F): The Specifications of the fabric woven on picanol loom

Type	Specification
Type of material (warp)	Cotton
Type of material (weft)	Viscose rayon
Warp count (tex_1)	84 tex
Weft count (tex_2)	149 tex
Warp density (n_1)	12 (ends/ cm
Weft density (n_2)	8 (picks/ cm)
Total no. of ends	1860
No. of shafts	2
Reed sett	27 (dents/ inch)
Ends/ dent	1/1
Width of fabric	155 cms
Design	Plain weave ($^1/_1$)
Drawing – in	In series
Weight of empty shuttle	500. 74 (gms)
%warp crimp	3.95
% weft crimp	2.64

Table.(1.G): The power Consumption of Picanol loom (with material)

mechanisms	Power in Watts					
	Speed (revs/min)					
	161	170	180	189	199	208
Total	789.6754	840.0570	959.0190	1020.0456	1142.8008	1223.3997
$Sley_o$	281.1177	289.9413	301.8963	334.6038	378.4200	423.0765
$Picking_o$	485.5334	520.4102	579.9915	620.3861	715.0917	775.2709
$Shedding_o$	340.0797	347.9919	371.9136	388.4181	413.0457	437.0084

Table.(1.H): power Consumption of Picanol loom (without material)

mechanisms	Power in Watts					
	Speed (revs/min)					
	161	170	180	189	199	208
Total	623.1365	658.7019	738.7296	780.3954	860.0717	914.9756
$Sley_o$	186.7780	190.2864	195.4043	214.2830	238.5026	264.5715
$Picking_o$	480.3383	510.7272	577.9667	600.6057	710.7317	775.9929
$Shedding_o$	248.9100	251.1723	261.6869	269.4886	277.5189	291.6798

Table.(1.I): power Consumption of Picanol loom (used power)

mechanisms	Power in Watts					
	Speed (revs/min)					
	161	170	180	189	199	208
Total	166.5389	181.3551	220.2894	239.6502	282.7291	308.4241
$Sley_o$	94.3397	99.6549	106.4920	120.3208	139.9174	158.5050
$Picking_o$	91.1697	96.8196	110.2267	118.9295	135.5268	145.3286
$Shedding_o$	5.1957	9.6830	1.9480	19.7804	4.3600	0.7220

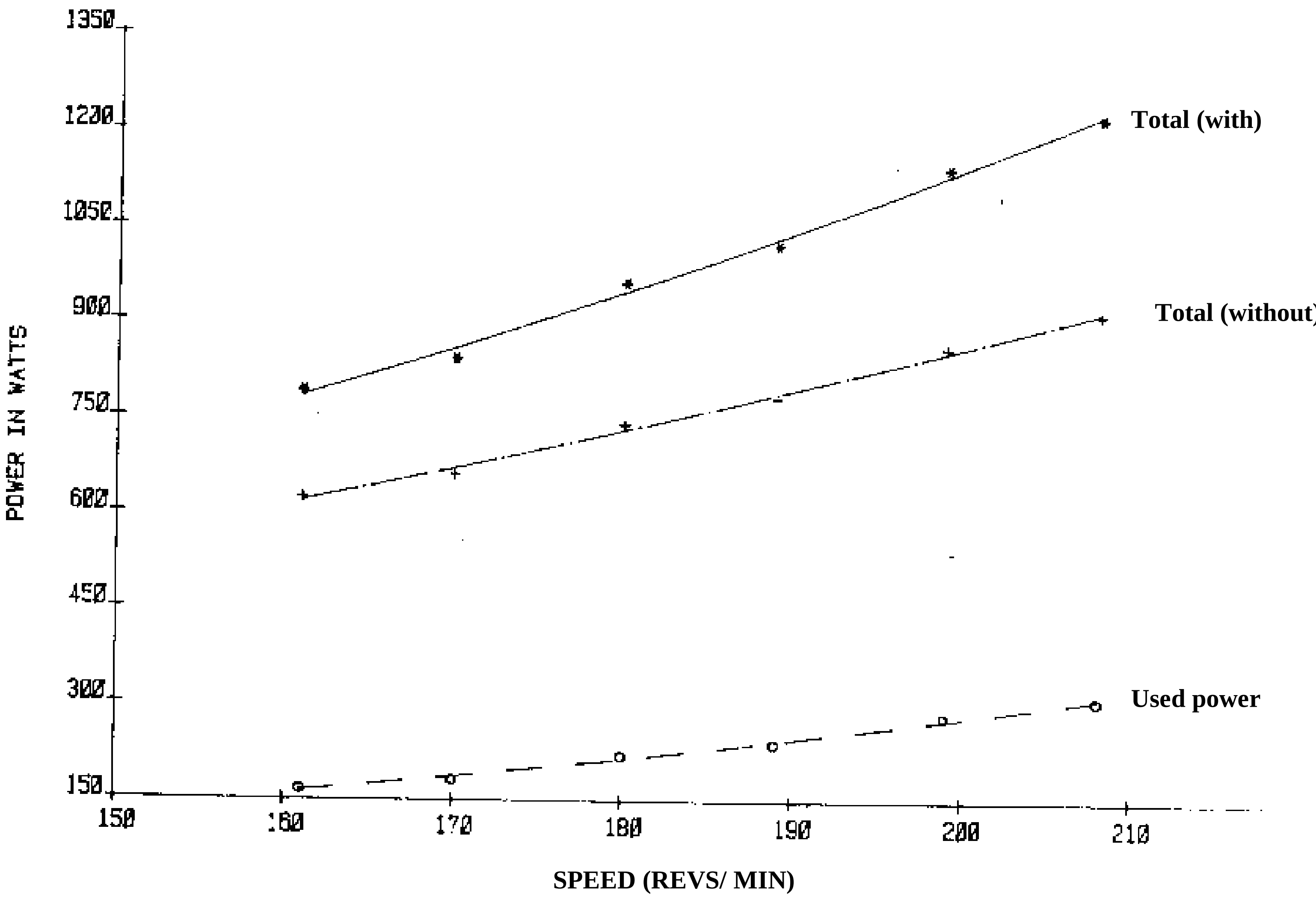


Fig. (1): The relationships between the power consumed by all mechanisms (Total) with & without material, power actually used in producing the fabric & the speed of the picanol loom

The Tables 1.G, 1.H and 1.I show the power consumed by the Picanol loom with material, without material and the actual power used in producing the fabric at different loom speeds, respectively.

3. Results & Discussion:-

3.1 All mechanisms (TOTAL)

It was found that the power consumed by all the loom mechanisms (total) with material, without material and actual power used in producing the fabric increased with the speed of the loom. The results obtained were plotted in Figure (1).

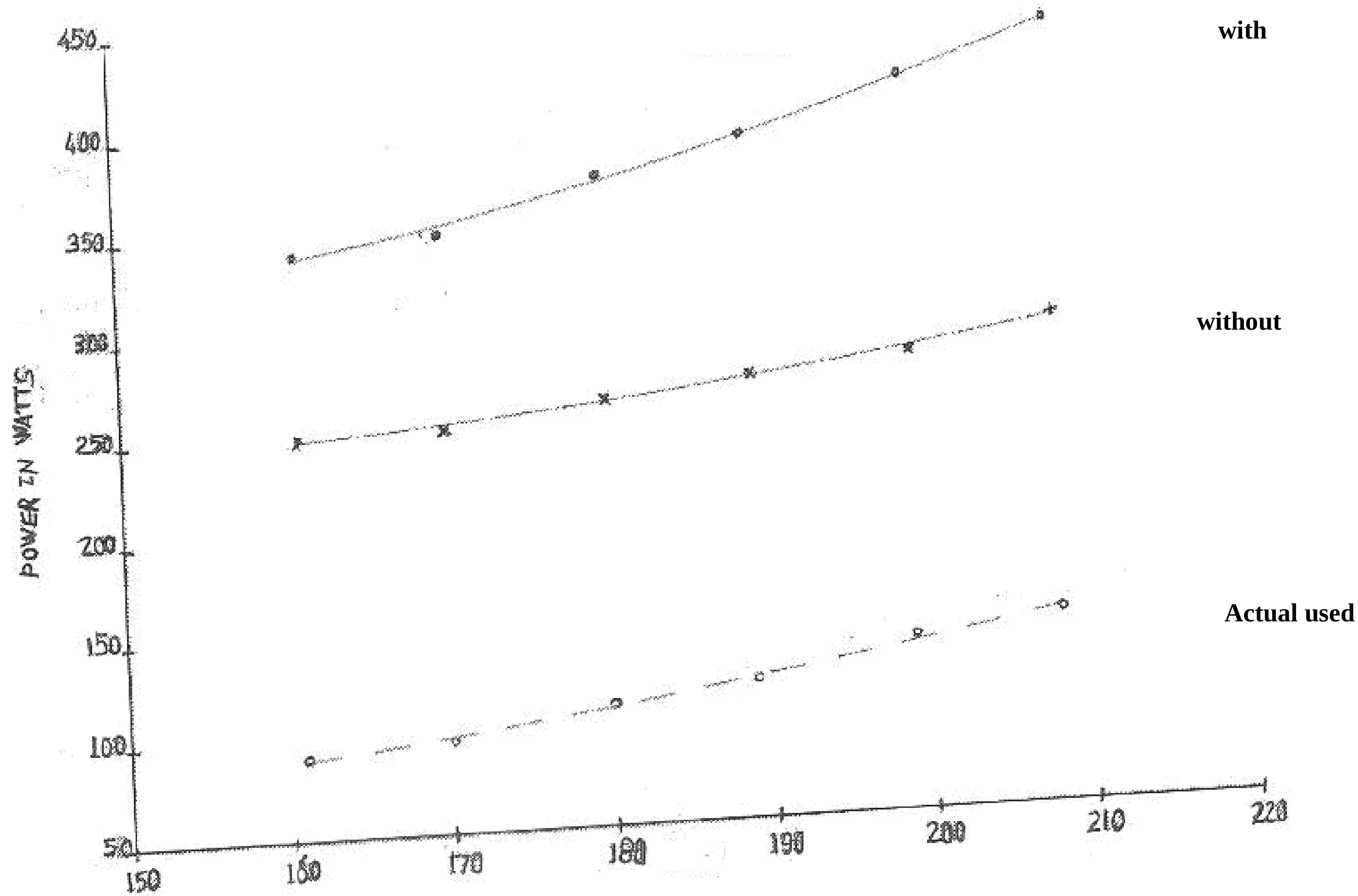
From Figure (1), the power required to weave the fabric is seen to be quite low in comparison with the power required to keep the loom running even without material. Further, the power required to weave the fabric is seen to increase significantly with loom speed. Over the speeds used, only approximately 23% of the total power consumption of the Picanol loom is used to produce the fabric while the rest of the power (77%) is dissipated as mechanical and heat losses. It is of great interest also to mention here that Min-Hao Michael [6] found an increase relation between the power consumption and the temperature rise.

3. 2. SLEY Mechanism:-

The power consumed by the sley mechanism with material, without material and the useful power used in producing the fabric, all increased with the speed of the loom. The results obtained were plotted in Figure (2). The actual power used by the sley in producing the fabric is seen to increase significantly with loom speed. This power is also quite low in comparison to the power required to keep the loom running even without material. Approximately 30% of the power consumed by the sley mechanism is used in producing the fabric while 70% of the power consumed is dissipated as heat and mechanical losses.

At lower loom speeds a gradual increase in net power consumed by the sley mechanism was noticed. At higher loom speeds a sharp increase was observed.

The results tabulated in Table (1.I) indicate that the sley action accounts for approximately half of the total power used to produce the fabric. This can only be an approximation, because the Figures derived by the technique used (which take the sley in isolation) cannot account for interferences between mechanisms that have been referred to earlier and which influence the absolute level of power consumption for individual mechanisms.



SPEED (REVS/MIN)

Fig. (2): The relationships between the power consumed by the sley mechanism with & without material, power actually used by the sley in producing the fabric & the speed of the picanol loom

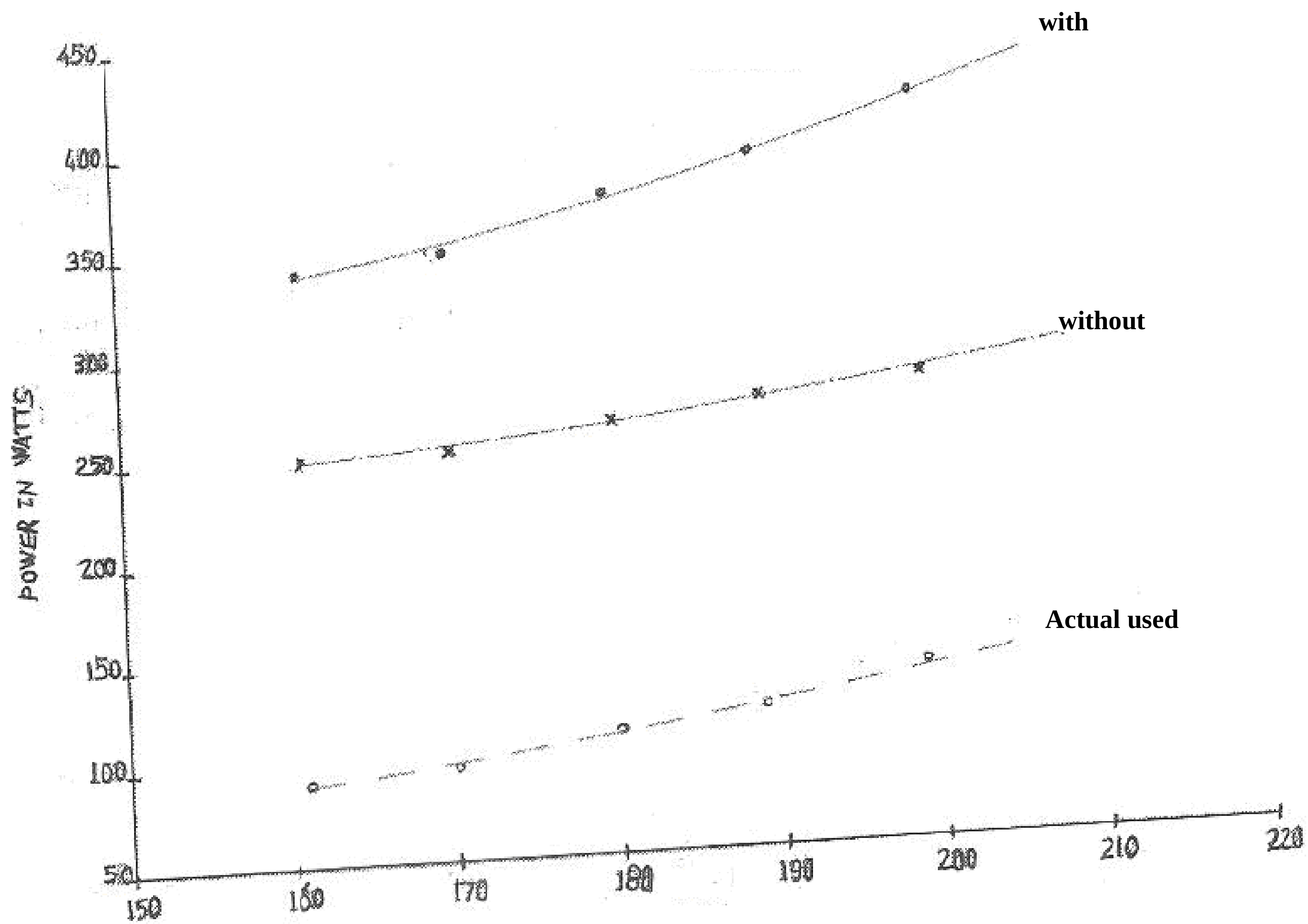


Fig. (3): The relationships between the power consumed by the shedding mechanism with & without material, power actually used by the shedding mechanism in producing the fabric & the speed of the picanol loom

Table. (1.J): The % Actual power used in producing the fabric by various mechanisms

mechanisms								
All mechanisms (TOTAL)			**Sley**		**Shedding**		**Picking**	
Speed reus/min	**% Used power**	**% Losses**	**% Used power**	**% Losses**	**% Used power**	**% Losses**	**% Used power**	**% Losses**
161	21.0895	78.9105	26.8083	73.1917	33.5588	66.4412	1.0701	98.9299
170	21.5884	78.4116	27.8224	72.1776	34.3707	65.6293	1.8606	98.1394
180	22.9703	77.0297	29.6377	70.3623	35.2744	64.7256	0.3359	99.6641
189	23.4941	76.5059	30.6189	69.3811	35.9592	64.0408	3.1884	96.8116
199	24.7400	75.2600	32.8116	67.1884	36.9741	63.0259	0.6097	99.3903
208	25.2104	74.7896	33.2553	66.7447	37.4646	62.5354	0.0000	100.0000
Mean %	23.18	76.82	30.16	69.84	35.60	64.40	1.1775	98.8225

3. 3. Shedding Mechanism:-

The power consumed by the shedding mechanism with material, without material and the useful power used in producing the fabric increased with the speed of the loom. The results obtained were plotted in Figure (3). Table (1.I) indicates that the shedding mechanism accounts for approximately half of the power used in fabric formation. This can only be an estimate for the reasons discussed earlier.

The actual power used by the shedding mechanism in producing the fabric was also quite low. As in Table (1.I), only 35.6% of the power consumed by the shedding mechanism was used in producing the fabric and 64.4% of the power dissipated as mechanical losses.

3. 4. PICKING Mechanism:-

Tables (1.G) and (1.H) show that at all speeds, picking (with and without material) has the highest consumption of power of all the individual mechanisms. Further, it can be seen that the energy required for picking increases with loom speed. Table (1.I), where the power consumed in forming the fabric is tabulated, shows that the power used in picking is very low in relation to other mechanisms and to the total power requirement. The Figures do not reveal a trend with respect to speed.

Due to the high mechanical losses experienced by this mechanism it is of interest to mention that this mechanism is an unbalanced mechanism. This finding comply also with Alexsurt[7].

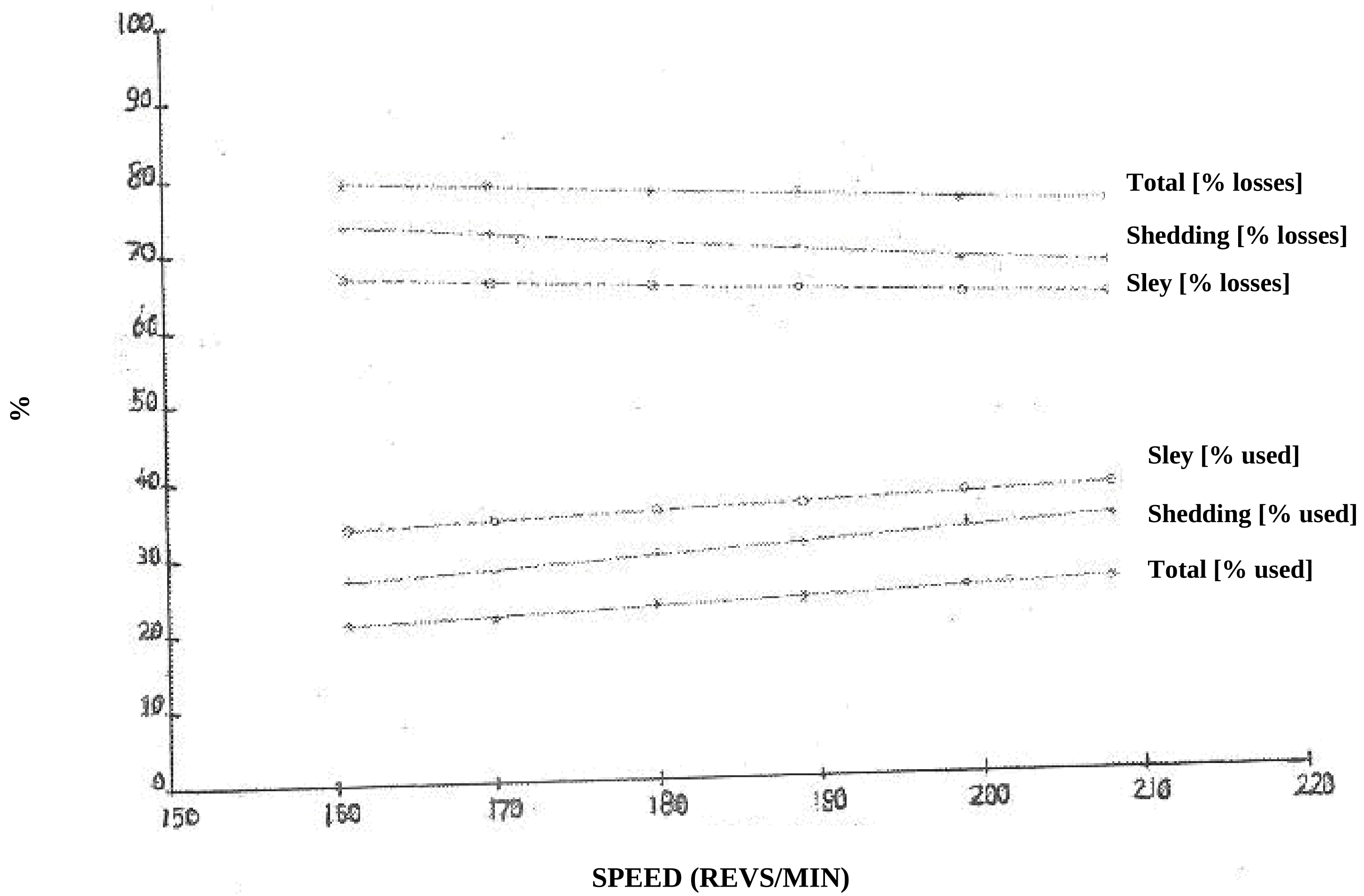


Fig. (4): The % Used and lost power of picanol loom

3. 5. MECHANICAL LOSSES:-

Table (1.J) shows the used power of the total, shedding, and the sley mechanisms at different speeds of the loom caluclated as a percentage of the net power consumed by the same mechanisms with material in the loom. The balance of power consumed is dissipated as mechanical and heat losses. These percentages are also tabulated. The mean % power used in producing the fabric and the mean percentage power losses of the total, sley and the shedding mechanisms are shown in Table (1.J). It is clear from these results that only small part of the power input to the motor was actually used in producing the fabric and the rest of the power dissipated. The results of Table (1.J) are plotted against the speed of the loom in Figure (4).

Figure (4) shows that the sley and the shedding (tappets) mechanisms of the picanol loom are inadequate from the power point of view. These mechanisms demand high power and actually use little power in producing the fabric. Most of the power consumed by these mechanisms is dissipated as mechanical and thermal losses. Inadequacy of the picking mechanism from the power point of view was not doubted. If the mean % power used in producing the fabric is considered as the power efficiency of the loom then the shuttle loom gave a very low result of 23.2% over the speed range used.

4. CONCLUSION :-

The power required to weave the fabric is found to be quite low in comparison to the power required to keep the loom running even without material. This power is found to increase significantly with the increase of speed. It was found by this research that only some 23% of the total power consumption is used to produce the fabric while 77% of the power is dissipated as mechanical & thermal losses.

The sley, the shedding and the picking mechanisms of the loom investigated were found inadequate from the power point of view. These mechanisms together consume the bulk of power required for operation of the loom. But the percentage of power for each mechanism actually used in producing fabric is only approximately 30%, 35% and 1% respectively.

The techniques described in this work allow for analysis of the energy intensity in conventional picking which may be applied in optimizing the use of this particular mechanism.

5- References:-

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