MR. N. K. JAIN

VERTICAL SIZE PRESS

Vertical Size Press is very much similar to the traditional through-wet press of a paper machine. The paper run for this kind of press is very simple. The paper is fed in the nip of the press without any wrinkles and as far as possible, it leaves the nip not tangential to the contact line of the nip. The side movements of the web causes marking in cross directions and some times even break.

This basic requirement for the satisfactory working of a vertical size press was also not known for quite some time and led to many unsuccessful installations. The normal procedure of driving only the bottom roll was also a cause of trouble for quite some time. It has now become a general practice either to give both the rolls separate main drives, or to give one roll main and the other roll helper drive.

After considering all the modernisation, nay, all the developments and improvements made, the vertical size press still has some basic limitations :



Sizing of Paper







Figure 1: VERTICAL SIZE PRESS. N. K. Jain Utkal Machinery Ltd., Kansbahal, Dist. Sundergarh, Orissa.

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- (a) The two-sidedness of paper originated at the time of formation of paper on wire, becomes much more prominent because of unequal sump of sizing solution on the two sides of web.
- (b) In this arrangement, the one side sump will have to be supported by the paper web, which causes breakage, especially in cases of thin papers and papers without high wet strength.
- (c) Speed Limitation

At high speed it becomes difficult to remove the surplus sizing solution in the trough which is installed below the bottom roll.

- (d) It is very difficult to keep the spray pipes clean of crust formation.
- (e) Depth of the sump is considerably low and hence it can be used only for sizing and light coating is not possible at all.

HORIZONTAL SIZE PRESS

Birth of Horizontal Size Press

The Horizontal size press did not come as a result of any particular research work, but it came out in the year 1953 when the frame of a vertical press in one of the paper mills of Mead Corporation of America gave way, and there was no alternative but to use the frame of an old horizontal roll coater to continue with the normal production. In a short time it was found that this emergency arrangement worked even better than the normal vertical press and there were less problems and breakages on the machine. Altogether the advantages of this arrangement over the vertical size press arrangement were so distinguished that thereafter almost all the new machines were made with horizontal size presses.



Figure 3 : HORIZONTAL SIZE PRESS

Horizontal Size Press in General

The paper enters the size press almost vertically. The sizing solution supplied from showers form a sump on either side between the paper sheet and press rolls. The roll ends are provided with overflow funnels and sealing plates. Excess of sizing matter can vary. Since the paper is not immersed in a size sump, stresses on the paper in the horizontal size press are reduced to the minimum. The nip pressure is unaffected by the roll's weight. Both press rolls have variable speed drive.

The maximum pick-up is 8 to 9 g/m^2 per side.

Paper Run

The paper run through the size press depends on the basis weight of paper

and roll arrangements of press. The

last dryer in general is always a top

dryer. The last paper roll before the

size press should be horizontally ad-

justable, but in no case it should be

spring loaded. As far as possible, this paper roll should be near to the press. In case of a sharp turning, a bigger diameter paper rool than the normal size paper roll is used. In case the size press is to be used for one side sizing of paper, this paper guide roll should have much more horizontal adjustment.

There are size presses with inclined rolls arrangement to avoid sharp 90° turning of heavier weight papers. Presses with this kind of arrangement are sometimes distinguished from horizontal size presses and are called Inclined Size Presses.

Experience has shown that a wrap angle of about 75° on the outgoing roll is quite an optimum angle as shown in Fig. 4.



Figure : 4

COVERING OF ROLLS

To decide on covering of the rolls, the following points are to be borne in mind:

- (a) Operating speed of the machine
- (b) Diameter of rolls
- (c) Nip pressure
- (d) Kind of sizing solution
- (e) Final Product
- (f) Dryness of paper before the size press.

It is common to have the rolls of different hardnesses ranging from 15 to 50 PI. PI. The harder roll should come in contact with the top side of the paper. In case of Board machine, it is common to use Micro Rock covering for the roll which comes in contact with the top side of the board. The other

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roll will have the hardness of 30 to 35 PI.PI. For thicker boards, this other roll might be still softer to avoid un-uniform sizing at the edges.

DANGER OF WRINKLES

The danger of wrinkles is just the same in a vertical size press as what it is in a horizontal size press. The removal of wrinkles after size press is dependent on the design of the paper roll just after the size press. It is always preferable to use a spreader roll after the size press, but in case it is not used, a roll of quite big diameter and without any deflection should be used. For example; if in a machine all the paper rolls are of 215 mm diameter, then the paper roll just after the size press should be either of 250 mm or sometimes even of 305 mm diameter to avoid wrinkles. The top surface of this roll should be perfectly smooth and spot free. A little unevenness on the top surface of the roll may cause wrinkles. All the new machines are generally equipped with spreader rolls after the size press, but in case of papers of higher gram weights, it is not absolutely necessary and an ordinary roll of a little bigger diameter than the normal paper roll will give trouble-free service. It is generally recommended to avoid dryer felts or fabric on the first two drying cylinders, or on at least one drying cylinder after the size press. The reason not to use felts is not only to avoid the removal of sizing by felts, but much more because of the risk of forming of wrinkles. It is practical experience that felts on dryers just after the size press are also reasons for form ing wrinkles. Drying cylinders without felts after size press not only avoid wrinkles, but also smooth away the wrinkles.

DANGER OF STICKING OF PAPER ON DRYING CYLINDERS AFTER SIZE PRESS

As we know, after the size press one or two drying cylinders are generally chrome-plated or covered with Teflon lining. Nowadays as the tendency is to construct wider and wider paper machines, chrome-plating or Teflon covering of the cylinders becomes more and more complicated. In Europe and other countries, alloyed cast iron drying cylin-







ders are being installed after size presses. After a detailed research on this subject, a special cast iron alloy has been developed for this specific use. Furthermore, a detailed study has proved that it is not only the top surface of the cylinder which is important, but that the temperature of the cylinder surface and efficient doctoring are equally important. The heating arrangement of these dryers should be such that their surface temperature could be varied in the range of 60 to 80°C depending on the composition of sizing solutions.

ONE-SIDE SIZING

It is not very common to use a horizontal size press for sizing of one side of paper, but, if required, it can be successfully used for this purpose. There are two ways of doing so:

(a) A small quantity of plain water is to be spread on one side of the paper web, and on the other side the sizing solution. The disadvantage of this method is that a little water will get mixed with the sizing solution and the density of the sizing solution will be varying.

(b) The other method of one side siz ing is that one roll which comes in contact with the not-to-be sized side of the paper is to be kept just moist by installing a very fine shower on the roll. It is very important that the roll which is not coming in contact with the sizing solution should be kept all the time moist because otherwise the heat generated at the nip will tend to deform the rubber-covered roll.

ONE SIDE PLAIN AND THE OTHER SIDE COLOURED SIZING

This could be achieved when one side of the sump of the web is supplied with a coloured sizing solution, and the other side with normal plain sizing solution. The only precaution which is to be observed is that the quantity

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CALCULATIONS FOR DRYNESS AFTER SIZE PRESS

Let us assume the following figures to calculate dryness after the size press :

Solid contents in sizing solution	:	8%
Basis weight of base paper	:	48 g/m ²
Dryness before size press	•	90 %
Final dryness after the after-dryer section	:	94%
Size pick-up	:	1 g/m ² on each side.

CALCULATIONS

CONSIDERING ONLY 1 M² OF THE WEB

Total water contents after size press

Total of solid contents and water

So

Bone dry contents in the paper before entering size press	$= 48 \times 0.9 = 43.2 \text{ gms}$
Therefore water content before size press	= 48 - 43.2 = 4.8 gms
Bone dry content in 2 gms of solution at 94% of final dryness	$= 2 \times 0.94 = 1.88 \text{ gms}$
As the solid contents in the sizing solution are 8%, we say	
For 8 gms of solid contents there are 92 gms	of water
Therefore for 1 gm of solid contents there are	92/8 gms of water
Therefore 1.88 gms of solid contents there are	92/8 $ imes$ 1.88 gms of water
	= 21.6 gms of water
Total bone dry content after sizing	= 43.2 + 1.88 gms = 45.08 gms

= 26.4 gms

= 45.08 + 26.40 gms = 71.48 gms

4.8 + 21.6 gms

Now when 71.48 gms is the total weight of solid contents and water, the weight of only solid contents is 45.00 gms.

71.48 gms total weight of solid contents and water	= 45.08 gms weight of only solid contents
Therefore 1 gm total weight of solid contents and water	= 45.08/71.48 gms weight of only solid contents
Therefore 100 gms total weight of solid contents and water	$= \frac{45.08}{71.48} \times 100 \text{ gms weight of}$ only solid contents
	= 63%
Hence the dryness after size press	= 63% approx.

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of plain sizing solution should be so proportioned that the overflow of the plain sizing solution is as less as possible so that after collecting the overflow of coloured and plain sizing solutions, it could be re-used just by addition of a small quantity of colour.

FACTORS AFFECTING THE SIZE PICK-UP

The size pick-up on a particular base paper is dependent on many factors. This has been very nicely illustrated by Mr. P. Howarth in Paper Technology — Issue No. 5 of 1968. I would like to quote the important results of the experiments which were made on a research size press of 535 mm width and 380 mm roll diameter.

The rubber hardness of the rolls was in the range of 11 to 35 PI.PI. The nip pressure was varying up to a maximum of 16 kg/cm. The maximum working speed achieved was 213 m/min. Solid contents of the sizing solution were varying from 5 to 18%.

i) EFFECT OF NIP PRESSURE

The size pick-up becomes less as soon as the nip pressure increases. However, the size pick-up for the same nip pressure is more in the case of a horizontal size press than what it is in the case of a vertical size press. (See graph No. 1).

ii) EFFECT OF OPERATING SPEED

A vertical size press shows little difference in size pick-up because of various speeds, whereas in the case of a horizontal size press, the size pick-up at 30 m/min. speed is almost double that of the vertical size press at the same speed. Upto 60 m/min. speed the size pick-up gets reduced, but after 120 m/min. speed it again rises as the speed increases. (See graph No. 2).

iii) EFFECT OF SUMP DEPTH

The horizontal size press gives quite a low difference in size pickup because of differnt depths of sump at 122 ,m/min. speed, whereas at 30 m/min. speed it gives quite a considerable difference. At 60

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Type of coater	Base paper substance g/m ²	Coating weight per side g/m ²	Coating solids content, per cent	Speed of coater, ft/min,	Coating weight control	Application	Metering	Smoothing
Airknife	74-82 88-120 120-150	10 15 22	40 50 50	1200	Air Pressure	Web surface contact	Excess removed by air jet	Air jet
Champion metering bar	80 (Paper) 0.018 (Caliper 0.055 board)	7.5-12 2.5 12	25-45 40 45	800 Paper 450 Board	Web tension	Web surface contact	Excess removed by contrarotating bar	Contrarotating bar or fixed fixed blade
Consolidated roll (Massey)	60-66 74-82 88-120	7.5 10.5 15	55 60 65	1000 ± 200	Metering and film spliting	Squeeze nip	Premetering at transfer nips	Shearing action of rolls
Blade	52-60 60-66 110-120	4.5 10 20	50 52 57	3000+	Blade Pressure, speed & web properties	Squeeze nip	Flexible blade metering	Flexible blade
Size Press	45.60 60-75 85	1.5 4 8-9	8 35 35	1100 precoat 350 final	Roll Pressure	Squeeze nip	Metering roll nip	Shearing action of rolls

m/min. speed it gives much more considerable difference in size pickup. (See graph No. 3).

iv) EFFECT OF WETNESS OF PAPER

4 to 8% wetness gives a size pickup as high as 8 to 9.5 g/m²; between 10 to 20% wetness, it reduces to about 5 g/m², but at 40% wetness, it again increased to 6 g/m², and at 60% wetness it again becomes 5 g/m². (See graph No. 4).

v) EFFECT OF TEMPERATURE AND SOLID CONTENTS

Between 25 to 80° C temperature and solid contents betwen 5 to 15%it gives quite low deviation in the speed range of 90 to 120 m/min. With reducing speed and higher temperature, a considerably high size pick-up could be achieved The high solid contents of sizing solution at 30 m/min. speed makes this tendency distinguishing. (See graph No. 5).

CONCLUSION

It can be said that because of comparatively small investment and simple working, size presses have become very common, especially for writing and printing papers.

However, with all the improvements and modernisation of the size press, it still cannot replace the coater. From the enclosed summary of characteristics it can be (seen that the horizontal size press can be) used for light coating of upto 8 to 9 g/m^2 per side, but for higher coating weights, modern coaters will have to be used. In Europe and other countries modified horizontal presses with proper instrumentation are working for LWC (light weight coated) papers on a machine width of 6 to 7 metres and speed of 700 to 800 m/min. Let us be sure that the day will not be far off when these will run in our country as well.

Presented by Mr. N. K. Jain at the IPPTA Annual General Meeting held at New Delhi on Nov. 8 & 9, 1971.

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SUMMARY OF CHARACTERISTICS

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