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A Press for Producing Binderless Board from Agricultural Wastes

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The investigations carried out at the Central Building Research Institute, Roorkee, led to the design of a new press for producing binderless board from agricultural wastes. Straw and paper liner are the only raw materials required and the elimination of binder makes this technique unique and economical over the conventional process. Some of the salient design features of this press and uses of these boards are described. Utilization of these agro-industrial wastes in the production of particle board has been recommended to fill the gap created by the shortage of traditional wood used in the erection of various industrialized buildings on dry construction.

Several processes for converting wood and wood wastes into a variety of structural and decorative products have been developed from time to time. With the increasing demand for housing in the country, a stage has reached where in place of scarce and preferred woods, alternate varieties or reconstituted wood are needed for use in buildings. In this context there has always been felt a need to develop moulded articles from agro wastes.

With more food production and industrialization in India, large amounts of agricultural residues are available creating serious problems of disposal. These agro-wastes do not find any major use except as fuels or packing materials. Utilization of these wastes in the production of particle/hard board has often been recommended to fill the gap created by the shortage of traditional wood for putting up various structures, with advantages of thermal and acoustic insulation and fire resistance qualities.

The demolition of many old buildings in India and abroad has revealed the use of straw in cavities as a means of insulation. Almost without

exception, the straw has retained good colour and condition after many hundreds of years and demonstrates its durability. The current trend towards industrialized buildings on dry construction opens up an important field for the use of sheet materials including building boards preferably those which are made with little or no binder.

These boards/slabs are produced by (i) conventional pressing process and (ii) extrusion process.

Conventional process

In the conventional process for making particle boards, raw materials are prepared by an elaborate method of chipping, hammering, defibrization and impregnation with traditional costly synthetic resins like phenyl formaldehyde, urea formaldehyde, methyl formaldehyde, etc. The boards are normally formed by filling and pressing to suitable density. Flat platnen method is generally used for pressing. Hard boards also are normally made by such processes. The extrusion process, however, is not so common

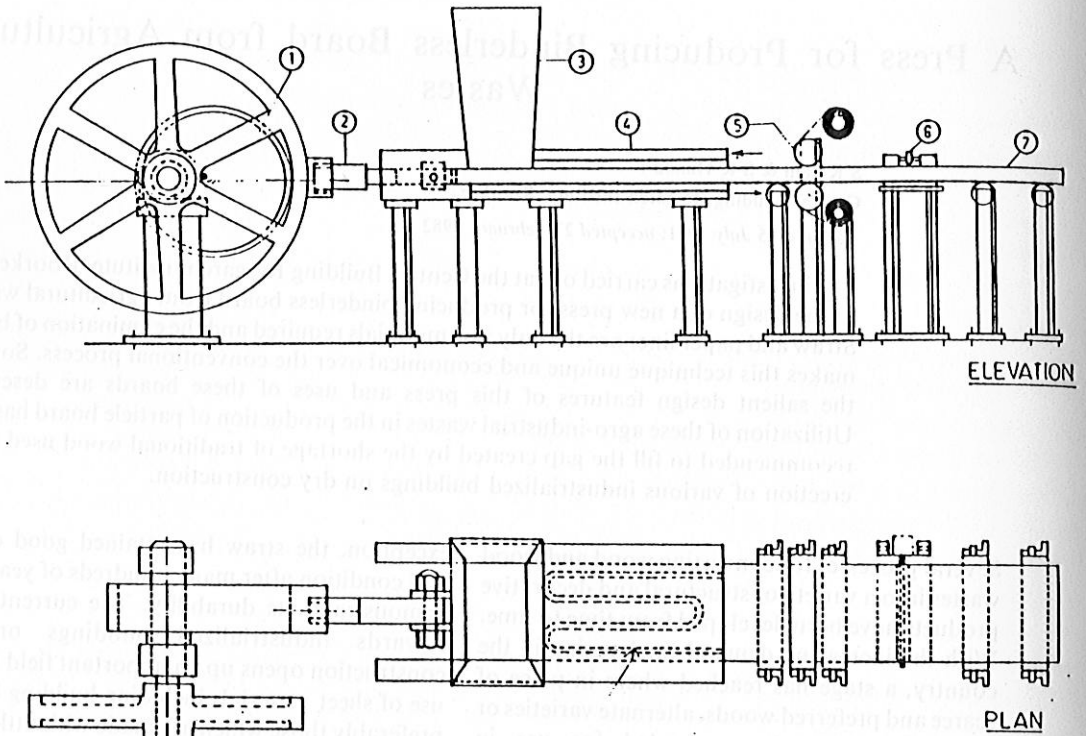


Fig. 1—Salient components of CBRI's extrusion press—1 eccentric, 2 piston, 3 feeding hopper, 4 steam chamber, 5 roller, 6 cutter, 7 finished board

and is a comparatively new technique of manufacturing such boards.

Paddy straw is normally used as a fodder and a packing material; but still large quantities are available as waste. Being light and perishable, these materials can not be stored for a long time. These long fibrous materials have been considered quite suitable for producing strong boards similar to those made from wood chips by pressing.

Extrusion process

An extrusion press has been designed by the Central Building Research Institute, Roorkee,

for producing binderless board from agricultural wastes. Research investigations were carried out for the production of these binderless boards in the Institute and the extruder design has been described in this paper.

Through an extrusion press more pressure is obtained as it squeezes the particles through a heated die. These boards are produced semi-automatically with very little manual labour. The basic raw material (straw) is subjected to heat and pressure when passed through the press as shown in Fig. 1. This gives it a predetermined size to which a smooth liner (normally strong cardboard) is glued automatically to both surfaces and the edges.

A PRESS FOR PRODUCING BINDERLESS BOARD

Description of the press

The designed machine essentially consists of a pressing assembly, extrusion barrel with the provision of applying heat and pressure, a separate attachment for gluing smooth liner to both surfaces of the board and a cutter. The pressing assembly consists of an electric motor which transmits power through a V-belt pulley to the main shaft. An eccentric (1) connected with a piston (2) is mounted on the shaft to convert rotary motion into rectilinear motion. Other end of the piston is rectangular in shape whose cross section determines the width and thickness of the finished board.

Rice or wheat straw which is fed through a hopper (3) is pushed longitudinally by the movement of the piston into the extrusion barrel. Heat and pressure are applied by steam into the extrusion barrel through the cavities made in the body of the barrel during its casting. After extruding the board into a predetermined shape through the orifice, a thick smooth card board liner, which is wrapped into the rollers (5) is glued to both surfaces of the board and the board is cut at desired lengths by the cutter (6) which is operated manually or mechanically.

Some of the salient features of this press are given below:

Bulk density of the raw material	.. 30 kg/m ³
Moisture	.. 8 to 10%
Bulk density of the finished board	.. 500 kg/m ³
Applied pressure	.. 20 kg/cm ²
RPM of the main shaft	.. 72
H.P. of the motor	.. 10 at 960 RPM
Expected cost of the press	.. Rs 25,000/-

Normally boards of 3 m length are most suitable for building purposes.

Straw and paper liner are the only raw materials required for producing these boards. The glue is used to stick the liner to the straw core. As such no binders, glue or cement is added to the straw. These features make the process unique and economical.

The rigid building panel coming out of the press is a finished building component ready for use. It is easy and quick to fix by dry process.

The boards may be used for interior partition ceiling and lining. With proper water-proofing or metallic lining, it can be used for roofing as well.

Strength—Due to the method of manufacture the strength of the board lies in the width of the slab. Although not load bearing as a wall, a binderless straw slab has ample strength as a roof deck on open frame work.

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