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THE WEYGAND TIGHTWAD BEATER - Its design & Construction
James L. Weygand
PP of Indiana Kid ; 1970
36 pages

Printed by papermaker on his own paper

The WEYGAND Tightwad BEATER

Its Design & Construction

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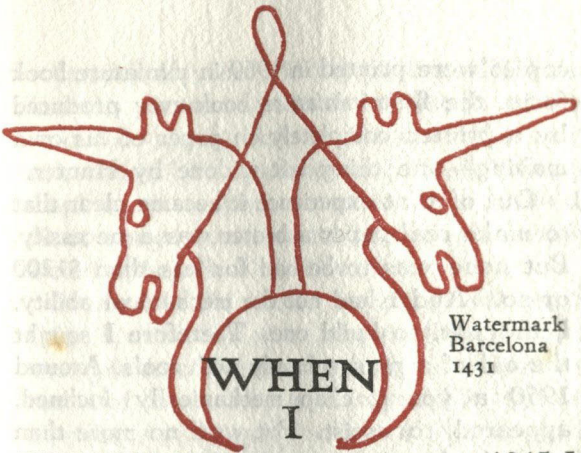

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WHEN I

FIRST ATTEMPTED TO MAKE PAPER IN 1945 I tried the meat grinder technique outlined by Dard Hunter in his *Papermaking in the Class Room*. It was an exercise in futility. What sheets I produced seemed more like low grade toilet tissue than paper. It was primarily my own fault of course for I'd used old toweling for stock! (The gruesome experience was recounted in my own *Adventure with Paper; Encounter with a Meat Grinder*, of which 65

copies were printed in 1969 in miniature book form, the first *miniature* book ever produced by a printer completely on paper of his own making—one thing left undone by Hunter.

Out of that experience it became clear that to make *real* paper a beater was a necessity. But none was to be had for less than $1200 or so. And I had not the mechanical ability, I thought, to build one. Therefore I sought the aid of a person handy with tools. Around 1950 a young chap, mechanically inclined, appeared to assist. But we'd no more than started when he got mad at his employer one day, quit his job and left town the next. In 1967 I started again when a brother-in-law agreed to help. But he too got no further than the talking stage.

I knew therefore, mechanical ability or no, if I was ever to build a beater it would be on my own. (Faint hearted prospective paper-makers take heart; if I could make one, just about anyone can).

Incidentally, early in the process I'd been lent the photos and instruction sheets of the so-called Law's Beater. However the construction of the "pressure arm" and "rubber diaphragm" seemed unnecessarily involved. And, many measurements and exact details were lacking. So I abandoned it.

Meanwhile I'd studied anything and every thing I could find about papermaking. There were pictures of beaters galore, but measurements of components were vague. Dimensions of dozens of nagging and vital details were scarcely mentioned.

From all my studying I tried to sift out all the broad principles involved—*what* exactly it was expected to do and *how*. Then reduce those various, and often vague and conflicting, practical construction details to smaller scale, adapting the design so construction could be handled by a dub. A not too simple assignment, for how does one miniaturize a 9-ton roll, in proportion!

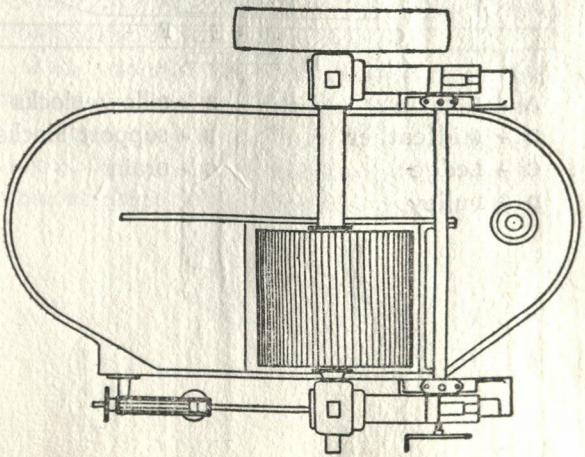
This book, in response to many requests, is that design and method of construction. It should be remembered everything has been simplified (I hope, not complicated) as much as possible. Further it is not, admittedly, the ultimate, but rather a starting place for others to adapt and redesign to those principles. It has worked however. With "improvements" which will be outlined, I think it would do even better. My complete cost came to less than $200.

I will try to concern myself only with the beater since that information is most difficult to ascertain. Moulds, the beating process, the dipping of sheets present problems as well. But there are books, and articles, available on those processes. But none pertaining to a beater so detailed as what follows.

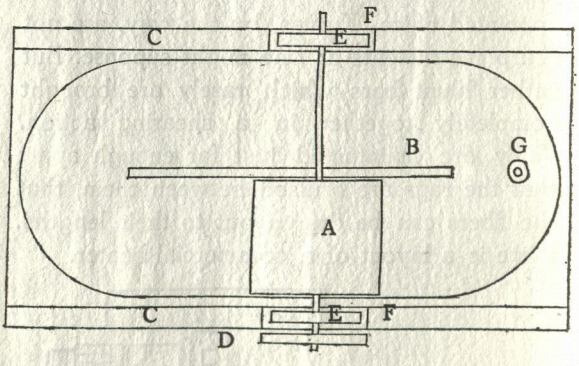
THE FUNCTION OF THE BEATER

Just what is a beater supposed to do? Or not do? Decidedly it should *not* chop or cut

the rags into bits, else they lose all of their strength. Rather, by the action of the knives (and the friction and the rubbing of the rags among themselves as well), the beater should draw out the fibers to their full length. And it should circulate them again and again between the knives that they can perform their appointed office. Knives, by the way, are not sharp instruments as one might suppose. But rather blunt bars which rarely are brought completely together in a shearing action. They are maintained just far enough apart that the rags are bruised between them, that the fibers can be drawn out to their lengths. Here is a layout of a commercial beater.



THE WEYGAND TIGHTWAD BEATER



A ~ Bedroll
B ~ Midfeather
C ~ Ledge
D ~ Pulley
E ~ Pillow Blocks
F ~ Support Blocks
G ~ Drain

THE WEYGAND

LIGHTWAD PAPER MAKER

Watermark
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Basically my beater is a marine plywood box and splash top, with appurtenances of easily-worked, lightweight galvanized sheet metal, completely fiberglassed to make them watertight. And a bedroll and bedplate which I had made by a metal machine shop.

Aha, you say: there's the catch. You did not build it yourself. You had the expensive aid of a machine shop. True. The cost of the bedroll, bedplate, shaft and the pillow blocks came to about $125. With high priced labor

it would probably be more today, However that was the most expensive element and the most exacting and precision work. And that cost is included in the total outlay of $200. In any event a bedroll *could* be made of wood sheathed in copper, with brass knives, which would probably work as well, perhaps better. You will have the dimensions, the necessity, so one with power tools can substitute the wooden bedroll. It's construction will be outlined in the Appendix of this volume.

If you prefer the metal bedroll, it would be prudent to start with it. All is built around it. And if union labor is involved it will entail the longest wait. And not a great deal else can be done without it.

While a bill of materials follows, it should be preconditioned by availability of pulley, pillow blocks and shaft of a common size. I used seven-eighth inch of each. Your decision should be determined by the common size of those elements you find. 1" will serve as well.

Or ¾". But it will be wise to make certain what is readily available in the same size.

BILL OF MATERIALS

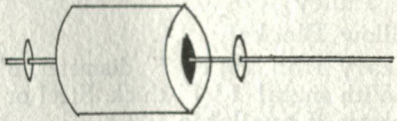
1 Steel Shaft, 24" long
1 7" Pulley
2 Pillow Blocks
Heavy Iron Pipe, 7" diameter, 8" long With metal 1½" thick. Steel or bronze better if available
42 Knives (8" lengths cut from a bar of stainless steel or tool, 1" wide and 1-8" thick)

CONSTRUCTION OF BEDROLL

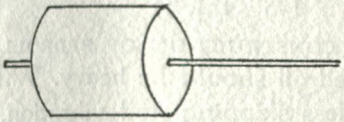
The bedroll should be heavy. With weight there is less skipping and vibration. Further, its action is steady and certain. I used an 8" length of a heavy 7"-diameter iron pipe, on which the metal was about 1½" thick. This thickness is important since grooves are cut ¼" into the pipe for the knives. The knives are 8" lengths cut from a bar of stainless steel or tool steel, 1-8" thick, 1" wide. My

bedroll has 16 equally spaced knives; plan on double that number which would be better.

Have the metal worker fill in the ends of the pipe and mount it on the shaft (balanced)

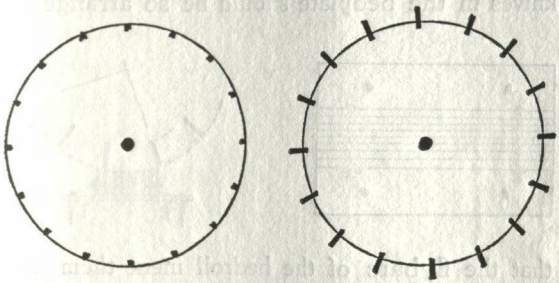


5" from one end which has been cut for a key to accept pulley. It will then look like this.



In that pipe 16 (or 32) equally-spaced 1-8" wide grooves are cut ¼" deep to accept the knives. On my machine they are welded in to place. However, welding may not be the best solution. Small flecks of the welding can break away, and appear in the paper. Too, should a knife become inoperative, replace-

ment could be a problem. Perhaps a retaining ring could hold them at each end, thus dispensing with the welding.

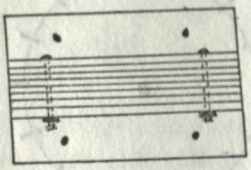


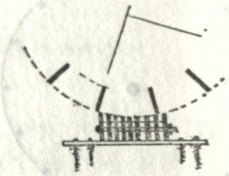
The bedplate is made of 9 knives spaced 6 to 8 points apart by metal slightly lower than the knives, arced, with several bolts thru the mass to hold all together. The component is mounted on a metal plate (about ¼" thick, about 5x8") with four holes for bolting it to the floor of the box.

Obviously the bedplate knives must have a contour corresponding with the bedroll, so

the knives should be so placed by the metal worker, and ground into the bedroll.

Incidentally, some authorities contend the knives in the bedplate should be so arranged





that the flybars of the bedroll meet them at a slight angle so that the action is more of a tearing process rather than a cut or a chop. My knives are straight across. The exact value of the slight angle is in question, but it might be wise to pursue the matter futher.

So much for the bedroll and bedplate. Unless you decide to try a wooden one, which should not be difficult for one with power tools. In which event turn to the Appendix now to get going on this component.

THE BOX AND SPLASH TOP

Now comes the easiest element, the box. One full sheet of ¾" *marine* plywood will be needed. If you have a friendly lumberman have him cut it to the various sizes wanted. It should cost little more; and it is more easily handled. Save the scrap for some smaller appurtenances.

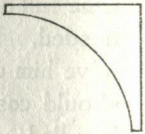
BILL OF MATERIALS

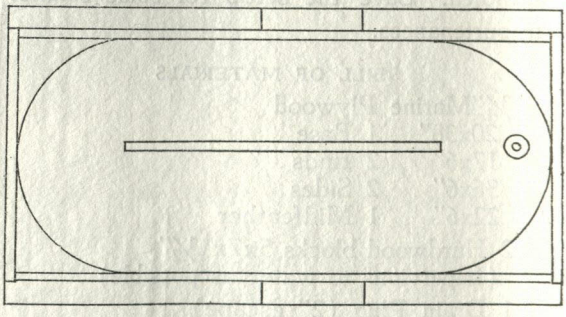
¾"Marine Plywood
20x38" 1 Base
17x6" 2 Ends
36x6" 2 Sides
22x6" 1 Midfeather
2 Hardwood blocks 5x7x1½"
(Impervious to water as possible)
1 Drain Plug (2" escape)
8 Corner Reinforcement Irons
Lightweight Galvanized Sheet Metal

CONSTRUCTION OF THE BOX

Nail or screw the two sides and two ends and base together to form a box, leaving a

1½" projection of the base or floor along each long side (on which the two 5x7x1½" blocks or supports will later be mounted. For further strength, two corner irons should be screwed to each of the four corners.





The midfeather is positioned equal distance from either end, and in 8¼" from one side. It is held in place by screws or nails from the bottom. Your box will then be divided 8¼" on one side and 6½" on the other. In theory

this difference in width is supposed to hasten the flow of stuff as it courses the track.

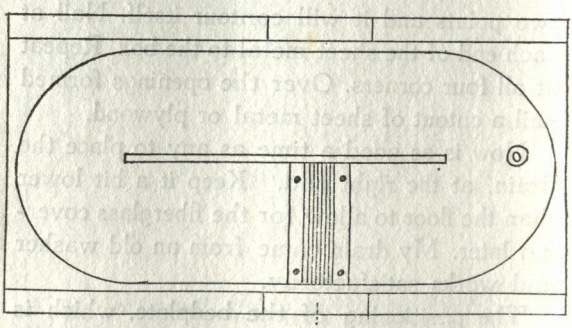
Oval each corner, race-track fashion, with a length of light weight galvanized metal. From a corner, measure about 6" in each direction; lay on the metal, holding same at the two points and it will contour itself. Nail at each end of the sheet metal to the box. Repeat at all four corners. Over the openings formed nail a cutout of sheet metal or plywood.

Now is as good a time as any to place the drain, at the right end. Keep it a bit lower than the floor to allow for the fiberglass covering later. My drain came from an old washer and works satisfactorily.

The positioning of the bedplate, which is bolted to the bottom of the box in the 8¼" section, places everything else. The *center point* of the bedplate component should be approximately 16½" from the drain end. It will thus be somewhat off center the long way and nearer the right, or drain, end. It should

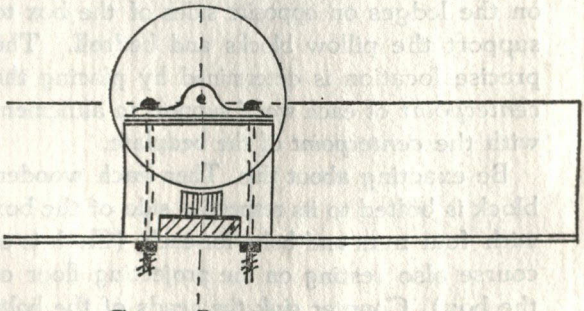
be mounted on a block of wood of like size, of thickness that the tops of the knives will be approximately 2¼" above the floor of box.

Two bolts on each side, thru the bedplate base and block and bottom of the box, with



nuts under the box should hold it securely. The position of the bedplate will determine *exactly* the placement of the supporting side blocks for the pillow blocks, and ultimately the bedroll exactly above the bedplate.

This is done by precise alinement of the *centerpoint* of each of the three elements involved. Carefully aline the *centerpoints* of the pillow blocks to the *centerpoints* of the wood support blocks, whose *centerpoints* are alined to the *centerpoint* of the bedplate. Everything is placed in relation to the *centerpoint* of the bedplate which is already in place.



Center Point

So let us start. The wooden support blocks (5x7x1½") must each be drilled thru the 5" way for two 9" bolts for securing the pillow

blocks. Center exactly a pillow block on each of the wooden blocks to determine the precise location for those holes. (The diameter of the holes, and bolts as well will be determined by the size of the holes in the pillow blocks. The bolts should fit as snug as possible to prevent any play or shift of the pillow blocks).

The wooden support blocks are then placed on the ledges on opposite sides of the box to support the pillow blocks and bedroll. The precise location is determined by placing the *centerpoint* of each wood support in alinement with the *centerpoint* of the bedplate.

Be exacting about this. Then each wooden block is bolted to its respective side of the box with four nuts and bolts for each. (Each is of course also resting on the projecting floor of the box). Counter sink the heads of the bolts inside the box so that the fiberglassing later will be smooth. After these are bolted in place the four bolt holes can be extended thru the ledges of the box. If care has been taken you

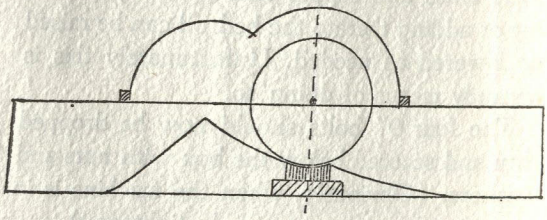
can now install the pillow blocks and bedroll and shaft. Maintain a ¼" clearance between the knives of the bedroll and the knives of the bedplate by means of shims between the wood blocks and the pillow blocks. For that purpose I've provided like amounts of shims for each side: several 6 point thick, several 2 point and some brass and copper thin ones. By removing or adding thereto the bedroll can be raised or lowered as needed. Unfortunately this is my only means of doing so.

The four 9" bolts should now be dropped thru and secured below the box with nuts and washers. (Obviously, when the machine is in operation keep them properly tightened).

Once again check to see that the knives are clearing. Now you are ready to turn the bedroll slowly by hand to note its relationship to the bedplate. If care has been taken the bedroll should be centered directly over the bedplate. The knives can now be brought nearer together, but never quite touching, by remov-

ing equal shims from each side. (One observation here: The knives will never be brought nearer together than barely touching. So the only adjustments from that point will be up, and never below that point).

For the ramp, which brings the stuff up to the knives, patterns are included herein. Cut



Center Point

2 matching pieces from marine plywood and nail or screw one to each side of the 8¼" course (to side and the midfeather) to form a base upon which lightweight metal sheets can be nailed to cover the expanse. The ascent of

the ramp from the floor of the box begins at about the right end of the midfeather, and leads up to nearly the tips of the knives of the bedplate (about 2¼" above floor of box).

There is also a pattern for the backfall. It starts at the left edge of the bedplate knives, at about 2¼" above the floor, and reaches a slightly rounded peak 5" above he floor at a point approximately 12" from the left end of the box. From its peak it makes a rapid descent to the floor. Again two matching pieces are cut from marine plywood, nailed to side and midfeather and the expanse covered with lightweight sheet metal.

Once again install the bedroll and turn it slowly to note its action in relation to the back fall. At the bedplate knives the backfall will clear by about ½", and then tapers away to about a 3" clearance of the bedroll knives at its peak.

The top splash is two matching pieces of marine plywood cut to contour herein, with

sheet metal across the expanse. Strength can be added by screwing cross supports at each end of same. At the center of the larger semicircle a hole must be cut to clear the shaft. It can set atop the box freely, or be hinged at the left end. One precaution: *never* operate the machine without the splash top in place!

The larger dome fits exactly over the bedroll, its diameter being about 2 inches larger than the bedroll (or about 11" in diameter), thus providing about 1" clearance between the knives and splash top. The center of the other arc is directly over the peak of the backfall, and stuff thrown against it is directed downward back into the trough. To prevent leakage where splashtop and box meet, a piece of sheet metal the length of the splashtop and about 2" wide is affixed to each side of the inside of the splashtop, with 1" overlapping the splashtop, the other 1" projecting downward into the box. Obviously the sheet metal must be cut away for the shaft.

To make all waterproof, box and splashtop must be fiberglassed. This is a messy operation, but not difficult. It is a good outdoors project if you've a spot free of dirt and dust and out of the sun. For this I used marine fiberglass materials ordered from Sears Roebuck catalog: 7.5 oz. fiberglass cloth and clear epoxy resin. (Use *epoxy* resin; Sears does not recommend polyester for hardwood.)

With respect to this there are several hints to be attended to. Bring the cloth and resin coating over the tops of the sides, and down the outsides of the box several inches. If this is not done water will ultimately waste away the exposed plywood and specks of wood will appear in your paper. Most important of all: read the manufacturer's instructions and then follow them faithfully. Keep the work smooth as possible: the least bump or projection will attract lumps of pulp. Sand everything carefully. Sears recommends at least two coats of resin; three coats are even better. Use cheap

dime store brushes for the resin, and throw them away. It's as cheap as buying a cleaner to clean them—even if you can find it.

You might consider a copper or galvanized metal lining rather than fiberglassing. It could be expensive, but might be better.

And that's about it, except for a motor. I have mine mounted at the drain end, to turn the bedroll clockwise. My first one came from an old washing machine, but it gave out. The present one is a 1700 RPM, ½ h.p. from a 20-year old furnace. The pulley on the shaft is 7"; on the motor 3". Authorities say the bedroll should revolve at 400 RPM. So I may, or may not have the right size pulleys.

I fill the beater about ¾ full with water to get the proper circulation. It then takes about 1¼ pounds of dry rags, torn into 3" squares soaked over night or longer. In about ½ hour they are well broken. But another four hours of beating is necessary for paper. Sometimes a still longer period is necessary; other times

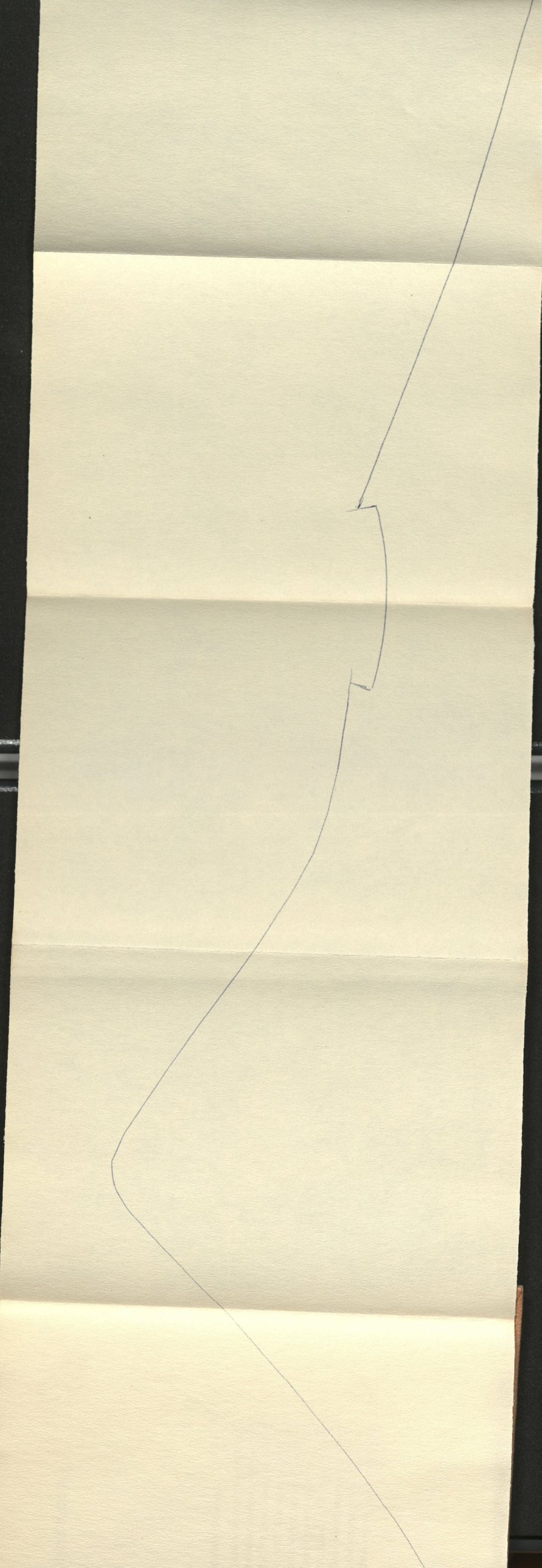
a shorter period. At the end of the beating, the bedroll can be raised slightly to "clear" the stuff of lumps. Another method is to remove about half the beaten stuff and replace its volume in the beater with water and allow to beat another twenty minutes or so. Then drain off this stuff, for it is ready for dipping sheets. That stuff removed earlier can be replaced to the beater, additional water added, and allowed to beat another twenty minutes.

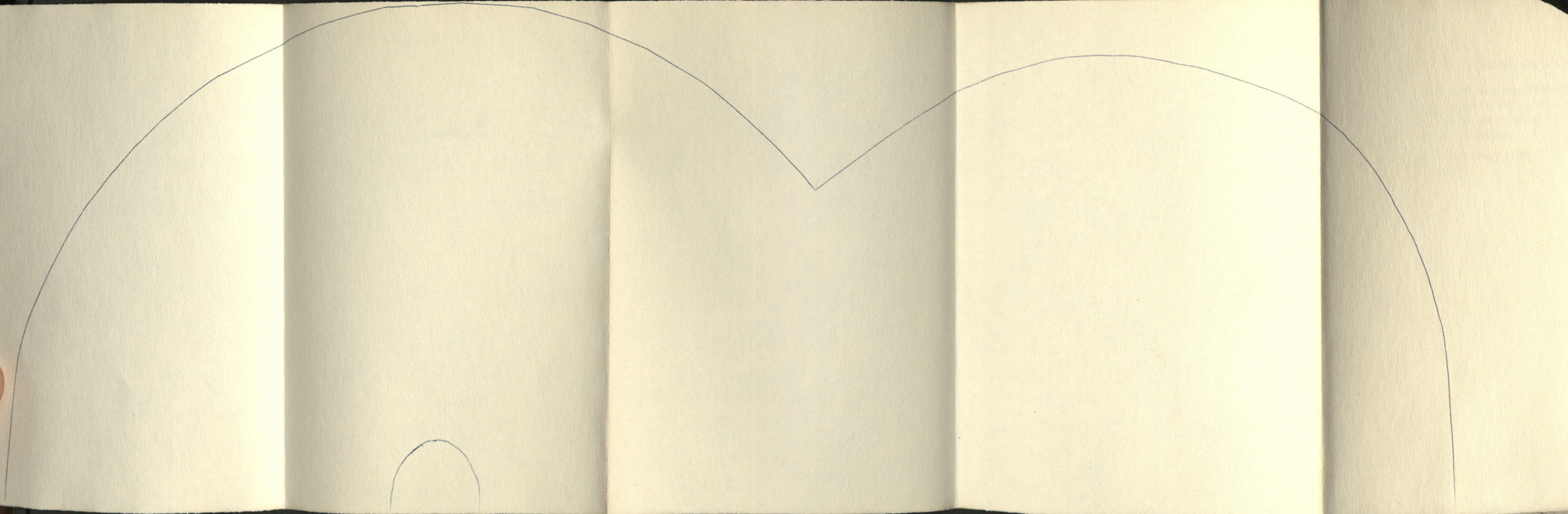
One final hint: The left end could be extended upward another 3 inches or so as the pulp splashes out in that area. Or a cover can be extended from the splash top.

PATTERNS: (Foldout, right)

FRONT: One-Piece Ramp, Bedplate, Backfall. (See Appendix). For separate front ramp, and backfall use pertinent sections; ignore bedplate-arc section).

BACK: Approximate contour for Splash Top or "Bubble".





APPENDIX

A WOODEN BEDROLL

If you wish to bypass a high priced unionized metal worker, a wooden bedroll, sheathed in copper is possible. For one measuring 8½" at the knives, start with four pieces of hardwood (impervious to water as possible—ash, cypress or mahogany), each 2x10x10", cut from a 2x10" plank. Mark the center of each for later drilling. Saw them into circles 8½" in diameter. Thru the center of each drill a 7-8" hole, string them on to your shaft and

glue them together. To secure them to the shaft, position the rough cylinder 5" from the pulley end. Drill a ¼" hole thru each, and thru the shaft and 1" beyond. Into each hole drive a ¼" steel pin, about 3" long, thru the shaft and beyond. Close each hole by driving in a ¼" wooden dowel. To form a perfect roll balanced on the shaft, use your pillow blocks mounted on other blocks to form a lathe. Turn to a perfect 8¼" diameter. Sheathe it with copper sheet, a piece at each end and a long piece for the circumference. ¼" brass knives (8" lengths cut from a bar), drilled and then countersunk for flathead screws can be used. The circumference sheet is laid on and held in place when the knives are attached with 1" brass flathead screws. Solder all joints. Or the wooden roll could be fiberglassed and the brass knives affixed over it, thus dispensing with copper sheathing and soldering.

A ONE-PIECE RAMP, BEDPLATE AND BACKFALL

One further alternative. A ramp, bedplate and backfall can be made in one piece. You will need four pieces of 2x6" plank, each 22" long. Saw each as accurately as possible to the proper pattern herein. Glue them together and carefully sand to form a piece 8" wide. The bedplate arc should be sheathed with copper, with the ¼" brass knives binding it thereto. Allow the sheathing to extend 1" on to the ramp and 1" onto the backfall. Set the whole into the 8¼" side of the box, the *center point* of the bedplate arc positioned as explained earlier. The ramp and backfall sections will be fiberglassed along with the rest of the box later.

Following is the text of an insert printed here in November, 1970 for William Haywood's SMALL WORLD Annual.

AND YOU THINK YOU HAVE

TROUBLES?

Then try papermaking, and learn what problems really are! Let's say you have "mastered" beating, couching, drying—which is saying a great deal—and at last you are dipping some nice sheets for a change. When suddenly you spy a half-inch hair in a sheet. And another several sheets later. From where do they come? The beater? The rags, or the pulp? The ceiling? The blankets? The furnace that is nearby? Your bald head? In my case, would you believe I traced them to my own arms? In dipping,

pulp adheres to the hairs. Then, with a clump of pulp, fall off into the tub of pulp. And then into a sheet of paper. I also learned old-time papermakers shaved their arms to prevent the situation. I have no plans to resort to that extreme. Rather, I now wash my mould and deckle—*and* my hands and arms—in clear water after each sheet. But still an occasional hair, and knots and clumps slip by.

But all the problems are soon forgotten when nice sheets begin to emerge from the tub of pulp. The homemade WEYGAND TIGHTWAD BEATER and moulds and deckles are now working quite well. I'm stockpiling sheets of 10x13 antique laid, for printing a book outlining the construction details of my beater. The type is all set; I await only the illustrations. In fact, by the time this is read probably all will have been finished and distributed.

Incidentally, there is already at least one other beater built to my specifications in use. When my brother and his wife were here most of the summer from Phoenix (to duck the miserable weather there) he became so involved dipping sheets he took all the

specifications of my beater. When he returned home in mid September he set to work building. A beater was finished in time to have its first trial run early in November! Really quite a record.

As he is not a printer (his eyes would not take the strain) his efforts will take him in one of two directions—or both. Making paper in short runs for sale to private pressmen and artists. Or accepting a few commissions to make beaters for those who do not relish such a chore, but who want a beater. He is reasonably certain he can furnish one complete, less motor, for $200. Which is quite a bargain. So if there be private pressmen who seek distinctive hand made paper in short runs, or a beater at reasonable price to make his own, I may be able to offer him encouragement or information on one, or both.

For SMALL WORLD, *printed by*
James Lamar Weygand,
the bald headed little ol' papermaker
The Private Press of the Indiana Kid
Nappanee, Indiana 46550 USA

About 200 copies printed on an 8x12 press by James Lamar Weygand at the Private Press of the Indiana Kid. 100 copies are on Antique Laid IK paper made by the author-printer at his Weygand Tightwad Mill; 100 copies are on Curtis Rag. Printing finished Dec., 1970.

frist copy off press
sent to Henry Morris
who found typos corrected
in the rest of the edition

FF