PERFORATED HARDBOARD

Pegboard

Its Hook-Hanging Strength

by R.M. Granum
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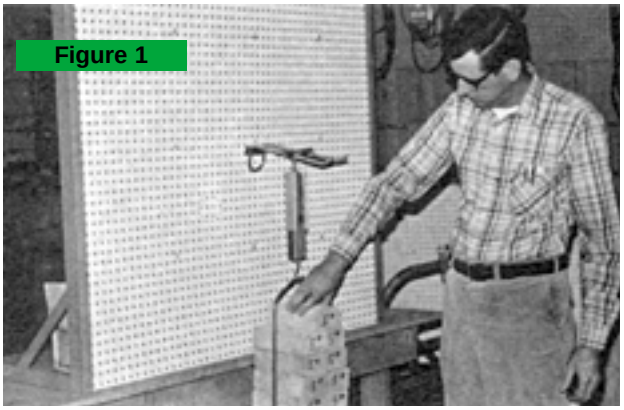
The attractiveness of a store fixture installation is sometimes marred by pegboard with paint-chipped or wallowed out holes. In extreme cases pegboard may become further disfigured when over-loaded hooks tear pieces out of the panels.

As a supplier of pegboard, we share the concerns of the store owner, the store fixture manufacturer and the pegboard hook manufacturer; we all want fixtures which give good service and remain attractive for at least ten years.

Why would a pegboard installation give unsatisfactory service? Was the pegboard strength substandard? Were the hooks poorly designed? Did the fixture frame not provide adequate support? Was the fixture loaded beyond reasonable capacity in the store?

METHOD DESIGNED TO TEST CAUSES FOR OCCASIONAL PROBLEMS



Test frame with test in progress.

In an effort to answer some of these questions we designed a series of tests to determine the behavior of various types of pegboard and pegboard hooks under very heavy loading.

We selected twelve types of hooks for testing, aiming to get a wide variety of hooks designed to carry medium to heavy loads. Then we built a test frame, shown in Figure 1, to simulate a common type of store fixture frame, The frame provided vertical, 1/4” deep channel support for panels 47” wide by 48” high. Bottom to bottom distance between the channels was 47-1/16”.

Three types of hardboard were chosen for testing which we broadly classified as

(1) Medium-strength 1/4”; **(2)** High-strength 3/16”; and **(3)** High-strength 1/4”.

Then each of the twelve types of hooks was tested with each of the three types of pegboard by applying a steadily increasing load on the hook until either the pegboard or the hook failed.

HOOK DESIGN IS USUALLY MORE IMPORTANT THAN PEGBOARD STRENGTH

A detailed description of the hooks tested, the testing procedure and the test results appears later in this article.

Briefly, test results indicated that many common types of pegboard hooks will perform almost equally well installed either in a pegboard panel of medium-strength or high-strength.

Apparently manufacturers of these hooks design them so that they yield before they cause tearout and thus permanently disfigure the pegboard.

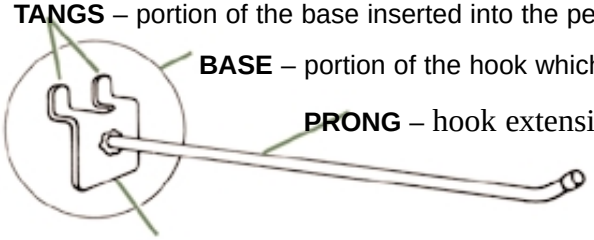
It appears that ***pegboard strength does not become a significant factor until the loading becomes very heavy***, that is more than 40 lbs. at the end of a 6" hook, assuming medium to high-strength pegboard. Hook design was found to be far more important to load-carrying capacity than the type of pegboard used for medium-weight loading (15 to 25 lbs. at the end of a 6" hook).

It also appears that hook design has an important bearing on the performance of the pegboard; under the same loading, some hooks will deface the pegboard whereas others will not. As a supplier of pegboard, we prefer a hook design which causes the hook to yield before it scars or breaks the pegboard. Also, in consideration of safety, we prefer a hook which yields through bending of the prong or tangs rather than by sudden breaking, which could drop a load on a bystander.

To this point in this article, we have described hook loading as, for example, "40 lbs. at the end of a 6" hook." Two factors determine the stress placed on the pegboard panel, the **weight** placed on the hook and the **leverage** of that weight. A 40 lb. load at the end of a 6" hook creates the same stress as 20 lbs. at the end of a 12" hook. Both loadings are described as 20 ft.-lbs. If a 40 lb. load is distributed evenly over the length of a 12" hook, the loading would also be 20 ft.-lbs. thenceforth we will describe hook-loading in terms of "ft.-lbs."

TERMINOLOGY Description of Hooks Tested

Figure 2



Pegboard hooks in common use vary widely in design. Figure 2 shows one basic type. Terminology used in Figure 2 may generally be applied to describe the four basic parts of any hook.

Figure 3 shows and describes the 12 types of hooks tested, it may be used for easy reference while reading the remainder of this article. In describing the hooks, the terms, ***heavy duty*** and ***super heavy duty*** are used only if this description appears in the manufacturers' literature.

PREPARING PEGBOARD PANELS FOR TESTING

MEASUREMENTS OF PEGBOARD STRENGTH AND RIGIDITY

Pegboard panels for testing were first cut to 47" x 60". Before insertion in the test-frame we cut a 12" x 47" piece from the 60" length of each panel and put this in a "transverse-strength-tester" (Figure 4). This simple test seems to offer best correlation with the more difficult measure of "hook-hanging strength."

In our testing we supported the 12” x 47” samples on a 24” span and then applied a steadily increasing load until they broke. Test results in Table I show the average of three tests of each type of pegboard.

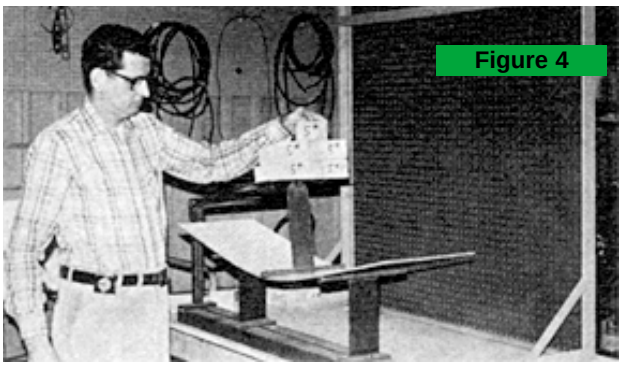


Figure 4

Testing pegboard for stength and rigidity.

• **TABLE I** •

TRANSVERSE STRENGTH TEST RESULTS FOR PEGBOARD USED IN TRIALS

Hardboard Type	Breaking Load in lbs.	Deflection At Breaking Load
Medium-strength 1/4”	42.3	2.9”
High-strength 3/16”	39.3	8.2”
High-strength 1/4”	57.7	6.8”

Note that the *high-strength 1/4”* pegboard accepted a load 36% greater than the *medium-strength 1/4”*. Note also that the high-strength 3/16” pegboard, though accepting a breaking load near the same as a medium-strength 1/4” pegboard deflected more than 8 inches before breaking whereas the 1/4” deflected less than 3 inches. *The lesser defection of the 1/4” pegboard is a decided advantage in case of marginal support of fixturing frames* where the possibility of springout may exist. However, careful examination of test results later presented gives indication that the more-rigid, medium-strength 1/4” pegboard may be more susceptible to damage from heavily-loaded hooks than the more-flexible, high-strength 3/16” and 1/4” pegboard.

We started with six 47” x 60” pegboard panels of each of the three types. After cutting the 12” x 47” strip for transverse-strength-testing, the remaining 47” x 48” panels were marked in 9 places for hook testing locations. These marked locations are visible on Figure 1.

No marked location on a pegboard panel was used for more than one test, nor was a single hook used for more than one test, even though the test caused no evidence of hook or board weakening. Each of the 12 types of hooks was tested at least twice on each type of hardboard. When there was substantial disagreement between two tests, additional tests were run until consistent results were obtained.

HOOKS GENERALLY FAILED BEFORE THE PEGBOARD DESIRABLE SINCE HOOKS ARE EASIER TO REPLACE

(See **Figure 6** for a bar chart of test results.)

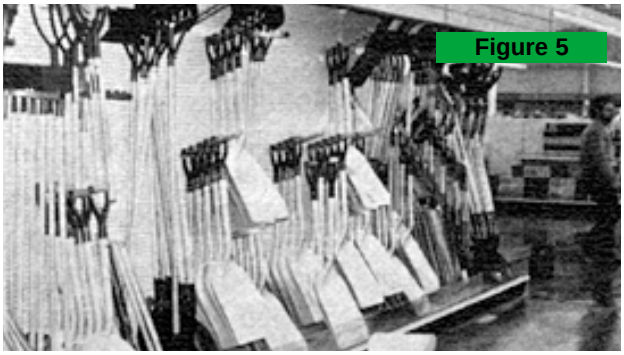


Figure 5

An example of hook-loading averaging 15 to 20 ft.-

Test results are shown in the bar chart, **Figure 6**, alongside the fold-out description of hooks tested, **Figure 3**, for ease of cross-reference. **Table II** describes more specifically how each failure occurred.

To get a mental picture of the various levels of loading used to bring about failure, refer to **Figure 5**. This shows a typical *heavy-duty* application with loading *in the range of 15 to 20 ft.-lbs*.

In our test results you will note that *two-thirds of the hooks tested would have failed under this loading*. You will also note that the *maximum* loading used in our testing (34 ft.-lbs.) was *double* the loading shown in **Figure 5**.

Our conclusions regarding the performance of the three types of pegboard and twelve kinds of hooks are as follows:

Hook Type No. 1 - We find this type of hook to be "very kind to pegboard panels." The plastic tangs break before damage can be caused to even a medium-strength pegboard panel. The downward slope of the prong indicates hook overload well before the tangs break. However, loading this hook to its breaking point could become dangerous because the prong is catapulted from the base when the tangs break.

Hook Type No. 2 - This was the only shelf bracket tested. lt performed well with all three types of pegboard in supporting our maximum loading of 34 ft.-lbs.

Hook Type No. 3 & **4** - Because we have seen instances where the "can opener" action of the sharp wire-end of its apron cut through pegboard panels of medium-strength, we purposely tested both a medium-duty and a heavy-duty hook of this common type. The heavier hook (Type No. 4) did cut into and cause failure of the 1/4" medium-strength panel. Since our major concern is the protection of pegboard panels, we recommend this type of hook be limited to a maximum wire diameter of 0.187" so that the prong will bend before damage to the pegboard can occur.

SOME HOOKS ARE "VERY KIND TO THE PEGBOARD" -- OTHERS HAVE A "CAN-OPENER" EFFECT

Hook Type No. 5 - This is another hook that is kind to a pegboard panel. The tangs straighten out before overloading causes damage to the pegboard.

Hook Type No. 6- This hook, though designed and recommended for use only with pegboard a full 1/4" thick, accepted a surprisingly large load, even with the 3/16" panel. Failure came from the tangs pulling through the pegboard holes, causing rather bad disfiguring of the holes in the medium-strength 1/4" pegboard and slight paint chipping at the bottoms of the holes in the high-strength 3/16" and 1/4" pegboard. Heavy-loading of this hook must be regarded as potentially dangerous, due to sudden pull-out.

Hook Type No. 7 - This well-designed "implement- holder" type hook proved strong enough to break out the medium-strength 1/4" pegboard panel when loaded to 28.8 ft.-lbs. Most store managers would regard this as excessive loading, as it is the equivalent of 47.6 lbs. distributed evenly over the length of a 12" hook.

Hook Type No. 8- Again we find a hook kind to a pegboard panel. The weldment of the prong to the base seems to be intentionally designed so that it will break before damage to a medium-strength pegboard panel could occur. Though the load this hook is designed to support is quite low we must again point out the small hazard of sudden dropping from an overloaded hook.

Hook Type No. 9 - We were surprised by the large load this hook was able to support. It broke the medium-strength 1/4" panel, but not until the load closely approached the maximum which the hook itself could carry before bending. Users of this type of hook should be aware of the possibility of overloading a pegboard panel.

Hook Type No. 10 - We dislike the design of this hook because we feel the 3/8" dia. rod which comprises its prong could encourage overloading of a pegboard panel. Also, this hook has only two tangs and quite sharp apron on the back plate, both of which increase the hazard of damage to the pegboard.

Hook Type No. 11 - Hinging on the base of this hook permits horizontal entry of the prong on installation. The three tangs and good support of its apron allowed it to carry a very heavy load.

Hook Type No. 12 - Here again we have a “can-opener” type design on the order of Hook Types No. 3 and 4. The sharp wire-end of its apron caused it to break-out the medium-strength 1/4” panel at relatively low loading. Again, we recommend that a hook of this general design be limited to a wire diameter of 0.187” so that the prong bends before the sharp wire-end cuts into the pegboard.s

HOOK DESIGN IS OF OVER-RIIDING IMPORTANCE

Simple tests show adequacy of pegboard.

We started this test program with no preconceived notion that we would find either pegboard strength or pegboard-hook design primarily responsible for the occasional failures which destroy the attractiveness of a pegboard installation. However, we believe our tests give strong evidence that careful selection of hook-type is of overriding importance in preserving an attractive installation.

This observation confirms a conclusion arrived at by the Engineering Department of a large store-chain following several years of study. They concluded that it was impractical to develop specifications for pegboard which would insure its trouble-free performance and turned instead to specifying acceptable hook-types.

These comments aren’t intended to imply that quality of pegboard should be held blameless in case of a failure. To check its adequacy we recommend that buyers of pegboard look particularly at reliability of supply, attractiveness of a finished installation and results of two simple tests:

1) Try to break a hand-sized piece off a corner of the pegboard panel. This should be difficult and the board should break with a crisp snap.

2) Try to scar the paint-coating with your thumbnail. A normal thumbnail should be damaged before the coating is scarred.

In a large majority of cases these checks should be sufficient. In the few cases where a very high level of loading is required the buyer should seek special advice.

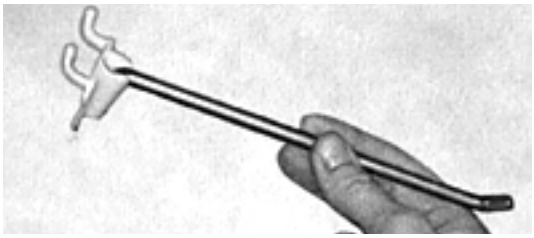
• TABLE II •

TEST RESULTS ON HOOK-HANGING STRENGTH OF 3 TYPES OF HARDBOARD

Hook Type	Hardboard Type*	Breaking Load ft. - lbs.**	Description of Failure
1	1/4 MS	11.5	Plastic tangs broke
	3/16 HS	10.0	Plastic tangs broke
	1/4 HS	10.0	Plastic tangs broke
2	1/4 MS	MAX	No failure at 34 ft.-lbs. max. load.
	3/16 HS	MAX	No failure at 34 ft.-lbs. max. load.
	1/4 HS	MAX	No failure at 34 ft.-lbs. misc. load.
3	1/4 MS	8.5	Hook prong bent
	3/16 HS	7.5	Hook prong bent
	1/4 HS	7.5	Hook prong bent
4	1/4 MS	10.5	Sharp apron cut into panel and broke it; prong bent slightly at the same time.
	3/16 HS	12.3	Hook prong bent
	1/4 HS	12.3	Hook prong bent
5	1/4 MS	9.3	Hook tangs straightened out
	3/16 HS	8.5	Hook tangs straightened out
	1/4 HS	8.3	Hook tangs straightened out
6	1/4 MS	8.0	Hook tangs pulled through pegboard holes; panel disfigured by paint chippping at points of pull-out
	3/16 HS	10.8	Hook tangs pulled through pegboard holes; slight chippping of paint at points of pull-out
	1/4 HS	11.8	Hook tangs pulled through pegboard holes; slight chipping of paint at points of pull-out
7	1/4 MS	28.8	Board broke
	3/16 HS	MAX	No failure at 34 ft.-lbs. max. load
	1/4 HS	MAX	No failure at 34 ft.-lbs. max. load
8	1/4 MS	13.5	Hook prong broke at weld to base
	3/16 HS	12.5	Hook prong broke at weld to base
	1/4 HS	12.8	Hook prong broke at weld to base
9	1/4 MS	16.0	Board broke
	3/16 HS	16.5	Hook prong bent
	1/4 HS	15.5	Hook prong bent
10	1/4 MS	23.0	Board cracked
	3/16 HS	25.5	Slight board crack; tangs slightly bent; panel badly bowed
	1/4 HS	25.5	Slight board crack; tangs nearly straightened; panel badly bowed
11	1/4 MS	23.5	Board cracked; hook prong started to bend
	3/16 HS	23.0	Hook prong bent
	1/4 HS	21.3	Hook prong bent
12	1/4 MS	8.5	Board broke at pressure point of sharp apron; hook prong started to bend
	3/16 HS	13.5	Hook prong bent
	1/4 HS	15.8	Hook prong bent; tangs straightened out

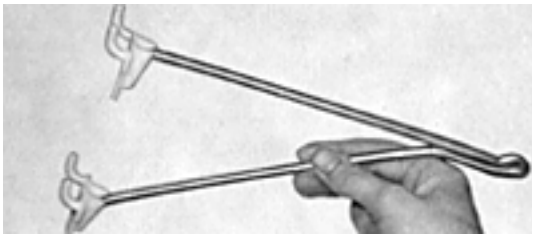
Figure 3

1



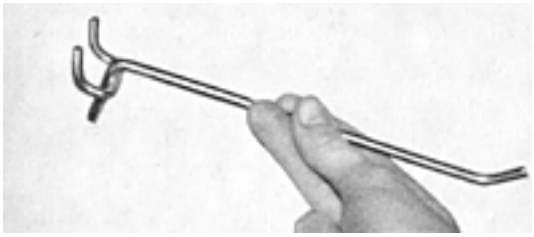
Type: General purpose, "heavy duty"
Prong: Single; 6" x .225"
Tangs: 2-.215" round plastic
Apron: Flat, 1/2" wide straight tip

2



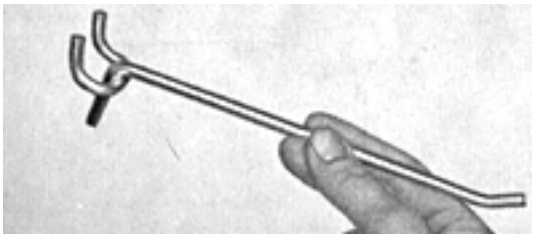
Type: Shelf bracket
Prong: Double; 8" x .225"
Tangs: Double base, tangs as at right
Apron: Double base, aprons as above

3



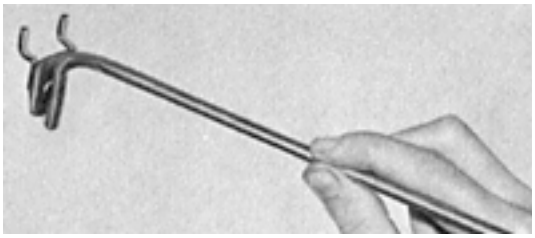
Type: General purpose
Prong: Single; 6" x .177"
Tangs: 2-.149" round wire
Apron: .177" round wire, sharp lip

4



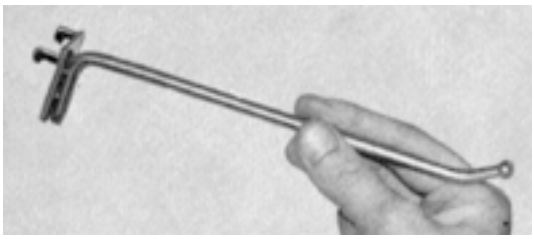
Type: General purpose
Prong: Single; 6" x .212"
Tangs: 2-.212" round wire
Apron: .212" round wire, sharp lip

5



Type: General purpose
Prong: Single; 8" x .217"
Tangs: 2-.080 x .240 wide
Apron: Flat plate formed to 3/8" radius at lip

6

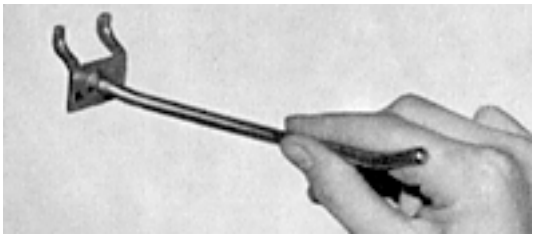


Type: General purpose, "heavy duty"
Prong: Single; 6" x .217"
Tangs: 2-.120" x .065" wide; design permits horizontal entry
Apron: Flat plate, 3/4" wide straight lip

7

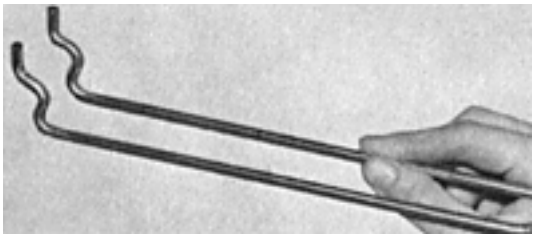
Type: Implement holder, "heavy duty"
Prong: Single; 6 x .225"
Tangs: 2-.215" round plastic
Apron: Flat, 1/2" wide straight tip

8



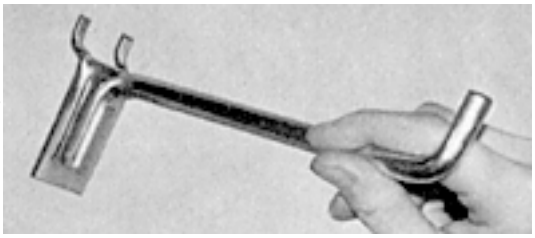
Type: General purpose
Prong: Single; 6" x .225"
Tangs: 2-.090" x .235" wide
Apron: Flat plate, 1-1/8" straight lip

9



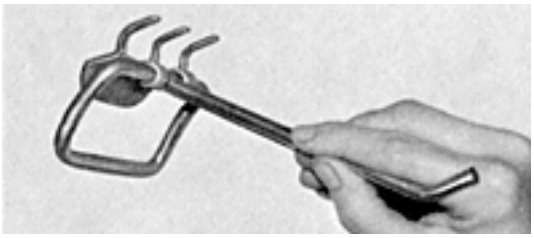
Type: General purpose
Prong: Loop; 8" x .187"
Tangs: 2-.187" round wire
Apron: .187" round wire shaped to form a "heel"

10



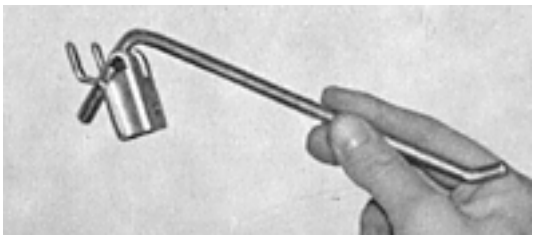
Type: General purpose, super "heavy duty"
Prong: Single; 6" x .375"
Tangs: 2-.085" x .190" wide
Apron: Flat plate, 1-3/16" straight lip

11



Type: General purpose
Prong: Single; 6" x .375"
Tangs: 2-.085" x.190" wide
Apron: Flat, plate, 1-3/16"

12



Type: General purpose
Prong: Single; 6" x .085"
Tangs: 2-.085" x .230" wide
Apron: .225" round wire, sharp lip

Figure 6

HOOK-HANGING STRENGTH OF 3 TYPES OF HARDBOARD