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F. S. SCHADE

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PAPER SHEET FOR LOOSE LEAF BOOK PAGES

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Fig. 1.

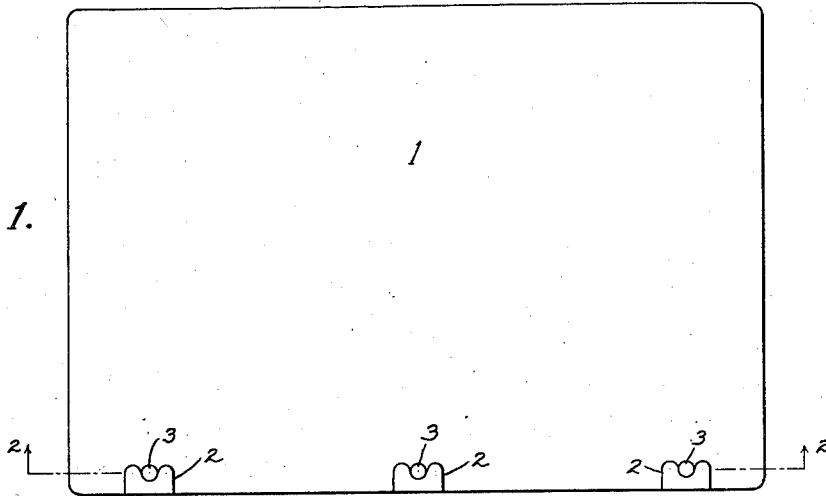


Fig. 2.

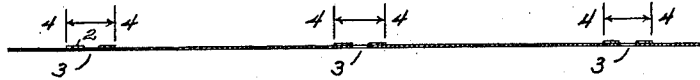


Fig. 3.

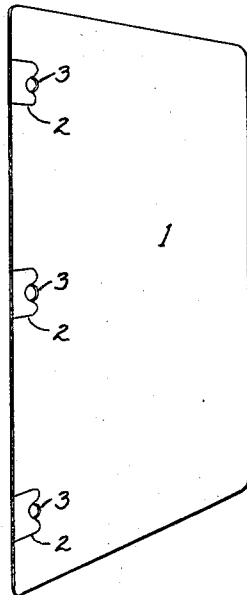


Fig. 4.

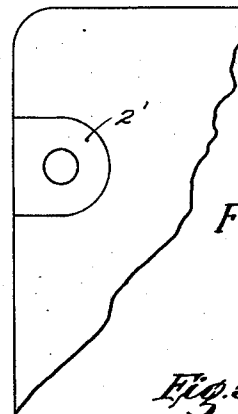
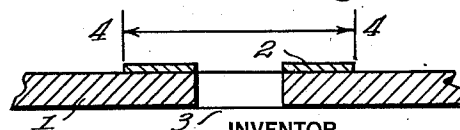


Fig. 5.



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PAPER SHEET FOR LOOSE LEAF BOOK
PAGES

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6 Claims. (Cl. 129—1)

This invention relates to an improvement in paper sheets for loose leaf book pages. Such pages are commonly perforated at spaced points along the binding margin. The paper is frequently too thin and weak so that it tears loose at the binding holes. The plan of this invention is to improve the means for reenforcing the book pages at the binding holes and particularly with respect to thin weak sheets of paper.

In the prior art it is common to use perforated wafer reenforcements, particularly of cardboard and fabric, around the holes. The objection to this has been that when the sheets are piled into book form the binding margin has been bulged out with the increased thickness due to the reenforcements. It has been proposed to avoid this objection by embedding the wafer reenforcement within the normal thickness of the paper. One prior plan is to cut out a "bed" for the wafer and another is to press eyelet rims into the paper so that in either case the top of the reenforcement is flush with the paper. There are objections to either plan in the high cost, but a more serious objection is that the paper must be thick enough to take a wafer and embed it. The thicker the paper is the less need there is for reenforcing the binding holes. My problem arises from the desire to reenforce loose leaf pages that are too thin to embed the reenforcement, even if the cost and convenience of that method to avoid objectionable increase in thickness made it otherwise feasible.

In the drawing,

Fig. 1 shows a plan view and

Fig. 2 shows a section on line 2—2 of Fig. 1 of a loose leaf book page as it will look with its holes reenforced by my invention;

Fig. 3 shows a perspective view of the sheet of Fig. 1;

Fig. 4 shows a differently shaped reenforcement wafer;

Fig. 5 is an enlarged detail of a portion of Fig. 2.

The invention is one that cannot be disclosed by a mere drawing as its more important characteristics are not clear except by description.

In the drawing, the paper sheet 1 is intended to be of the inexpensive kind used for ordinary writing or loose leaf notebook paper. It is too thin as well as too cheap to take or warrant any expensive reenforcing means at the holes. My plan is to reenforce the paper at the factory before its distribution to the trade and to do it so inexpensively as to keep the cost down. Thus, the low cost reenforced paper pages can be generally sold in price competition with such paper that is not reenforced. The product of the invention is to

render the present practice of ultimate users applying paper reenforcing wafers of linen and the like unnecessary and to give them better paper pages or fillers for loose leaf book use that will not bulge the book.

The first consideration, therefore, is to avoid the application of my reenforcing wafer or border 2 (at each binding hole) in a form that will appreciably increase the thickness at the points of application. To do this I conceived the plan of making the wafers of metal and of a thickness so small as to be negligible, much as the nickel-plated coating of a finished and previously dimensioned article does not appreciably change the wanted dimension.

So far as I know, it is not feasible to deposit a metal coating on paper as one would coat metal articles by electrolytic deposition. But it is this kind of excessively thin metal coating that I want for the wafer or separate border of my paper reenforcement 2 at each hole. I get it by cutting the wafers to form the border metal out of copper metal foil that is made in finished sheet foil form which is exceedingly strong in proportion to its thickness. I am aware that thin metal foil is commonly made by rolling, particularly from wire rod form. But when thin small wafers are cut from sheet foil, with internal strains due to rolling, there is an inherent tendency to curl, making them hard to apply to paper and hold a flat form with the paper.

When the thin wafers for my invention are cut from electrolytically deposited correspondingly thin flat metal sheets, the wafers tend to lie out flat with the paper and join with the paper (upon being cemented) with substantially the same flat effect as if the metal had been deposited directly on the paper (assuming that it would stick) by electrolytic coating means. The advantages which flow from the preferred plan are so important that I point it out in detail with respect to the character and nature of the metal used for my reenforcing wafers. I prefer to use copper foil for these wafers. But in its broader aspect I do not desire to limit my invention to these particular characteristics of the wafer foil metal.

A wafer 2 preferably made as described is applied at each binding hole portion of the sheet as indicated in the drawing. The best arrangement I know of is to apply such a wafer on the back of the sheet, punch the hole 3 through the paper and wafer at the same time, and leave the front of normal sheet appearance with all holes thus reenforced. Then the book sheets will appear in their simplest and customary form from

the front, although they will be substantially re-enforced at the holes in the back. And the book with the pages of my invention will not be appreciably thicker (to the eye) along the binding margin than if the wafers were not used. The wafer is not in the form of an eyelet but in the form of a flat lamination.

The reason for this novel action of the re-enforcements will appear from a consideration of the factors which go into the thickness of a pack of sheets. If a pack, say of one hundred sheets in number, is measured without subjecting it to any compression—that is to say, if the measurement be so taken as to correspond to the thickness of the pack as it appears to the eye—it will be found that the total thickness is considerably more than one hundred times the thickness of a single sheet. This is due to the layer of air entrapped between each pair of sheets and to the minor irregularities by which the sheets depart from absolute flatness, and will be greater after the sheets have been separately handled in use than when they are initially compressed in a pack for sale. These minor irregularities are not of course similar in each sheet, and as the sheets are stacked up for binding these irregularities serve to separate the sheets still farther. In the case taken for example one one-hundredth of the total pack thickness may be taken by definition as the pack forming thickness of the individual sheets; this being made up of two components, one the actual sheet thickness and the other being referred to for convenience as the interspace. It is this interspace that is increased as is described above when the sheets are used, and of course becomes important only when a number of sheets are stacked together. The reason why no substantial visible increase in pack thickness occurs when my novel re-enforcements are used is because they are of substantially the same order of thickness as this interspace, and because they tend to lie so flat in superposition that the pack forming thickness of the sheets at the reinforced areas is substantially the same as the pack forming thickness of the free edge of the sheet.

As pointed out above, the thin metal is very stiff and tough in relation to its thickness, giving the reinforced zones a localized stiffness much greater than the stiffness of the remainder of the sheet. Any bending of the sheet in use therefore, will occur almost exclusively in the unreinforced zone; and any residual distortion of the sheet which would increase its pack forming thickness is thus confined for practical purposes to the body of the sheet exclusive of the reinforced areas. This tends to equalize still further the effective thickness elsewhere, the reinforced areas tending to lie flat in the slightly irregular surface formed by the body of the sheet. This effect is of course increased by the localization of the re-enforcements to areas immediately around the holes, for long reinforced areas such as a complete marginal reinforcement will tend to be distorted as a whole when the sheet is flexed and may reverse the tendency to leave the slightly thicker marginal reinforced areas flat which is present in the preferred form of the invention.

Another advantage possessed by the preferred form of the invention, in which the re-enforcements are localized around the holes to be re-enforced, lies in the freedom from differential effects due to changes in atmospheric humidity. As is well known, paper is very responsive to changes in humidity, while metal is not affected at all. If, as has previously been proposed, metallic re-en-

forcements are extended throughout the binding margin of the sheet, the paper will constantly change in length while the metal will not. The result is that the paper will become buckled at the region adjacent its attachment to the metal, and the composite sheet where the metal overlies the paper will receive a decided tendency to curl. By localizing the re-enforcements to the immediate region of the holes it is possible to reduce this effect to a point where it has no practical effect. In contrast the localized metallic re-enforcements will not appreciably increase the pack forming thickness of the sheet at the binding margin, while a continuous marginal metallic reinforcement will under atmospheric conditions differing in any way from those at the time of manufacture increase its pack forming thickness at the binding margin by a very substantial amount.

The relation that my invention attains is a large proportionate increase in book strength at the binding holes of thin book paper and an entirely negligible proportionate increase in thickness due to the reinforcing means in such paper. This negligible increase in thickness is one that can be measured by scientific instruments but cannot be measured by the eye so as to be objectionable in the appearance of the book.

An important feature I discovered in the experiments leading up to my invention is the best way to secure the thin metal wafer to the paper, both for convenience and effect. I coat the wafer with thermo-plastic cement, of which there are many available types on the market. The term "thermo-plastic cement" is intended to include a plastic like "bakelite" in uncured form, as such a plastic can be used for my purpose, since it acts like thermo-plastic cement in my use. This is characterized by the fact that it is not sticky but hard at normal temperatures and is sticky and soft at higher temperatures. I coat the wafers with such cement and handle them with the cement in hard form. I lay the wafer on the paper and press it hard against the paper by a presser foot that is heated. The heat conducts through the very thin metal and softens the cement which sticks the metal to the paper. I have found that the heat with this kind of cement causes the latter to penetrate the paper, apparently softening it enough to let the pressure spread the fibers. The result is that there is enough spreading or condensing action on the paper to take up the cement so that the layer of its thickness is not found by scientific measuring instruments after the wafer is applied. Such instruments will measure the cement layer before it strikes into the paper. The result is substantial with regard to using all possible thickness of metal that will not appreciably thicken but will most appreciably strengthen the paper.

I have in my practice used copper wafers of thirteen ten-thousandths of an inch thick with paper of approximately the thickness of the paper ordinarily used for loose leaf books and very slightly over and under, by which I mean ordinary paper for pen and ink writing or typewriting paper. Such paper will range in thickness from say twenty to fifty ten-thousandths of an inch, so that in contrast to prior devices for reinforcing the paper around the ring holes the reinforcement is of less thickness than the paper itself. The total combined thickness of the paper and the reinforcement is slightly greater than the caliper thickness of the paper itself—although not substantially or appreciably greater than the virtual pack forming thickness of the paper as

heretofore defined—but for reasons previously pointed out the increase will not be noticeable to the eye unless the pack of sheets be artificially compressed. The increase of strength at the holes is appreciable to any user but the increase in thickness is not. It is like a thin nickel-plated coating.

The outline of the wafer conveniently used is shown in Figs. 1 and 3 at each binding hole.

Some books do not need the extra strength all around the hole, so the wafer form of Figs. 1 and 3 can be used. It adds strength only on the arc of the pull to tear it loose from a binder. It adds such a thin layer to the paper that its edge is not apparent to the unaided eye, and such layer edges exist between margins 4—4, as indicated in Fig. 2, spaced along the length of the paper edge. Fig. 3 also indicates that the edge of the reinforcing layer is not appreciable to the eye.

The metal of the wafers is so thin that a pound of metal will divide up and supply a great many sheets. The result is that the thin, inexpensive paper can be reinforced, as I have described, at the factory, with an exceedingly slight increase in cost, and the reinforced paper sold without appreciable increase in thickness or weight, for general loose leaf book consumption. It is not limited to the special class of expensively eyeleted paper, extra thick paper, fabric and metal marginal band paper, and the like. It has the additional and great advantage of not increasing the thickness of a loose leaf book appreciably when such book is arranged with its most common character of thin paper, the pages of which are arranged in any order desired.

In Fig. 4 I show a type of reinforcement 2' to extend all around its hole.

Having fully pointed out my invention in paper sheets for loose leaf book pages,

I claim:

1. A reinforced loose leaf sheet adapted for use with others to build up a pack for binding, and having perforations adjacent one margin to receive binding prongs; characterized by localized reinforcements of metal foil of sufficient thinness so that they would be independently distortable under normal flexing, laminated upon and pressed into adhering contact with the full body of the sheet adjacent the perforations, the sheet between the reinforcements being of substantially the same flexibility as the body of the sheet, and the reinforcements being sufficiently thin and flat so that when superposed on the full body of the sheet the pack-forming thickness of the sheet at the reinforcements is substantially the same as the pack-forming thickness of the sheet elsewhere, and the normally flat condition of the reinforcements will not be disturbed by normal flexing of the body of the sheet.

2. The combination in a loose leaf paper sheet with binder holes and no thicker than common book or writing paper, of perfectly flat metal wafers of small area cemented to the paper to reinforce the holes, said wafers being made of such extremely thin metal that the paper and metal surfaced spots are substantially flush without substantial sinking of the metal into the paper.

3. A pack of loose leaf filler sheets, each of said sheets having a perforated margin and carrying a plurality of localized and separated perforation bordering reinforcements superficially and adherently applied thereto, each reinforcement being composed of tough and tear-resisting metal having a thickness sufficiently small so that the pack forming thickness at the binding margin of the sheet is substantially no greater than the pack forming thickness of the free margin thereof.

4. A pack of loose leaf filler sheets, each of said sheets having a perforated margin and carrying a plurality of localized and separated perforation bordering reinforcements superficially and adherently applied thereto, the reinforced areas on the several sheets being similarly placed and substantially identical in area, each reinforcement being composed of tough and tear-resisting metal having a thickness sufficiently small so that the pack forming thickness at the reinforced margin of the sheet is substantially no greater than the pack forming thickness at the free edge thereof.

5. A pack of perforated loose leaf filler sheets, each of said sheets being of the order of three thousandths of an inch in thickness and having on its binding margin an adhesively applied series of spaced perforation bordering reinforcements each composed of a wafer of electrolytically deposited copper having a thickness of the order of a thousandth of an inch, pressed snug and flat against the surface of the sheet, and adherently coupled to the sheet by a thermo-plastic cement, the area of each of said wafers being sufficiently restricted so that no substantial distortion of the sheet occurs by reason of the differential response of the metal and the paper to variations in atmospheric humidity.

6. A pack of perforated loose leaf filler sheets, each of said sheets being of the order of three-thousandths of an inch in thickness and having a plurality of separated perforation bordering reinforcements of tough and tear-resisting metal superficially and adherently applied thereto and each localized in the immediate vicinity of a perforation, the metal of each of said reinforcements having a thickness of the order of a thousandth of an inch.

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