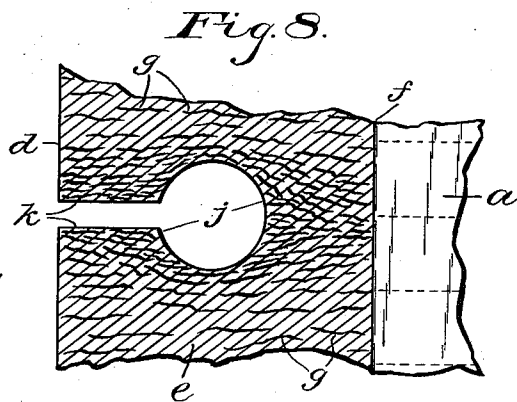
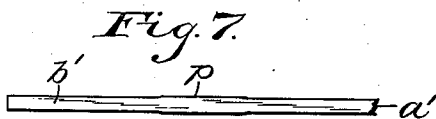
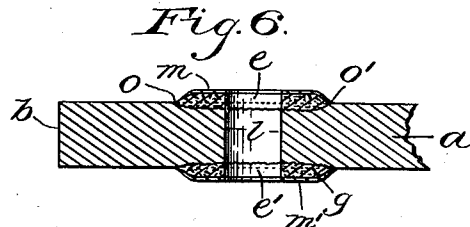
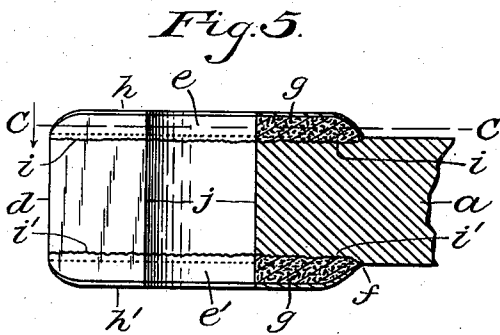
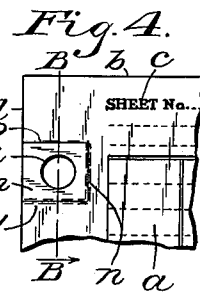
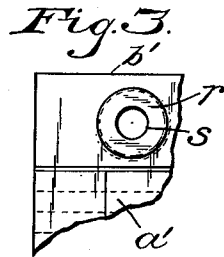
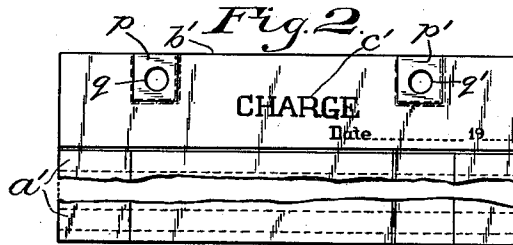
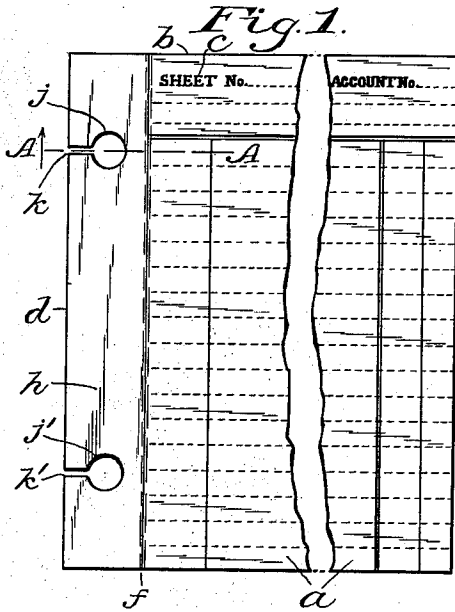


A. SMITH.
ARTIFICIALLY STRENGTHENED PAPER.
APPLICATION FILED DEC. 23, 1909.

1,014,341.

Patented Jan. 9, 1912.



WITNESSES:

J. H. Gardner.
H. R. Woddell.

INVENTOR:

Aurelius Smith,
BY
C. T. Silvius,
ATTORNEY.

UNITED STATES PATENT OFFICE.

AURELIUS SMITH, OF INDIANAPOLIS, INDIANA.

ARTIFICIALLY-STRENGTHENED PAPER.

1,014,341.

Specification of Letters Patent.

Patented Jan. 9, 1912.

Application filed December 23, 1909. Serial No. 534,718.

To all whom it may concern:

Be it known that I, AURELIUS SMITH, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Artificially-Strengthened Paper; and I do declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to paper, woven fabrics, vellum, or the like, adapted to be used in sheet or leaf form and bound together, temporarily or permanently; the invention having reference more particularly to paper sheets or leaves, either printed with rulings and headings to constitute business forms, or blank sheets, or reading matter, adapted to be connected together by means of mechanical temporary binders or filing devices, the sheets being either perforated to receive binding devices, or imperforate, as may be required to conform to the requirements of the binding or filing devices used or preferred.

In the use of paper sheets, especially such as comprise printed forms for mercantile purposes in offices, factories and elsewhere, it being customary and desirable to bind the sheets together so as to be practically in book form, it has been found that much trouble and expense has been occasioned on account of the sheets or leaves tearing at the binding or where they are connected to binding or filing devices, especially when the sheets are perforated near their edges to receive the filing devices, and in some cases the sheets have been reinforced near their edges by means of pieces of cloth or paper glued or pasted to the sheets, which expedient, however, while being fairly successful in preventing fracture of the sheets, necessarily adds so much to the thickness of the sheets that the practice proves greatly objectionable because of the fact that there must be a much less number of sheets than ordinarily placed in a binder.

The object of the present invention is to provide an improved paper or like substance in sheet form that shall be stronger or have greater tensile strength in some portions than in others without entailing the objectionable multiplication of thickness due to

additions of welts of paper or the like to the sheets; a specific object being to provide paper or the like with strengthened portions in which are perforations to receive binding devices, in order that not only the better quality of paper may be improved for binding purposes, but that inferior paper, which otherwise is suitable for order blanks and other printed forms, may be cheaply adapted to be bound together durably and economically.

With the above mentioned and minor objects in view the invention consists in improved paper or like substance in sheet form having portions thereof strengthened artificially near an edge thereof, the strengthened portions being flexible and either perforate or imperforate, and the invention consists further in the parts and combinations and arrangements of parts, as hereinafter particularly described, and then defined in the accompanying claims.

Referring to the drawings, Figure 1 is a plan view of one of the improved sheets of paper partially broken away; Fig. 2, a fragmentary plan view showing the strengthened portions of the sheet slightly modified as to shape; Fig. 3, a fragmentary plan showing another modification as to shape of the strengthened portion; Fig. 4, a plan view showing another modification as to arrangement of the strengthened portion; Fig. 5, a fragmentary section greatly magnified on the line A A in Fig. 1; Fig. 6, a fragmentary section highly magnified on the line B B in Fig. 4; Fig. 7, a fragmentary view of a sheet highly magnified as viewed at the binding edge; and Fig. 8, a sectional view on the line C C in Fig. 5.

Similar reference characters in the different figures of the drawings indicate corresponding elements or features of construction herein referred to.

In practically carrying out the objects of the invention sheets of various kinds of material or substance may be used that may be found desirable, sheet paper being more commonly employed in various business enterprises, in the conduct of which a large variety of blank forms are commonly used, and, therefore, the invention is conveniently described as relating to paper sheets *a* and *a'*, the former being adapted to be bound at one side edge, the top *b* having suitable headings *c* thereon, *d* indicating the binding edge portion; the other sheet *a'* being de-

signed to be bound at the head or top b' on which is a suitable heading c' .

The sheet a is strengthened throughout its length from top to bottom and from the edge d to a suitable distance to insure being engaged by clamping binding apparatus, the strengthening element comprising flexible and tough adhesive substance e and e' on the front and back respectively of the sheet extending from the edge d to f , the substance preferably having fibrous material g embedded therein and is covered on the exterior by a non-adhesive substance h , h' all compressed on the sheet, and the joints i , i' between the strengthening material and the sheet being uneven as the result of the strengthened material entering the surfaces of the paper when moist and subject to pressure. The strengthened portion has one or more apertures as j , j' , therein near the edge d and slots k , k' , extending from the apertures to the edge d , thus permitting the sheets to be slipped onto or off of rods or binding rings laterally without necessitating the removal of other sheets.

Fig. 4 shows a portion of a sheet adapted to be bound at the side edge d , which edge portion has a perforation l therein extending through a relatively small strengthened portion m , m' that extends from the binding edge beyond the perforation to n and upward and downward beyond the perforation to o and o' respectively, and it should be understood that the sheet may have any suitable number of such strengthened portions extending around the perforations.

In Fig. 2 the head or top portion of the sheet a' has two strengthened portions p and p' similar to the strengthened portion m , but extending downward from the binding end b' , the strengthened portions having perforations q and q' respectively therein to receive the binding devices.

In Fig. 3, is shown a circular strengthened portion r near the binding edge and a perforation s in the strengthened portion.

It will be understood that the strengthened portions may be of various shapes in plan as may be desired, but in practice the strengthened portions are not and should not be materially thicker than the remaining portions of the sheet, and it will be understood that in some cases the strengthening material may be used on only one side of the sheet; also that the binding edge in some cases may not require slitting into the binding apertures and that when desired the slitted binding edge portion may be strengthened only around and adjacent to the apertures and slits instead of extending throughout the length of the sheet. Furthermore when desired to reduce the cost of production to the minimum the fibrous material g may be omitted with consequent loss of strength.

The strengthening material may be composed of various substances and for the present it is found that the composition below mentioned is suitable for the purpose. Glue is dissolved in water to a stiff consistency; linseed oil, preferably boiled, and glycerin are mixed together under heat and then added to the glue by stirring, there being approximately equal proportions of oil and glycerin used. A smaller percentage of alcohol relative to the oil or glycerin is preferably mixed therewith before mixing these with the glue. In some cases it is found desirable to add a small quantity of vinegar to the glue, and if desired a small quantity of oil of sassafras may be stirred into the composition. If desired a small quantity of carbolic acid may be added for preserving the quality of the material.

The composition should be of proper consistency to be tough yet sufficiently thin that it may enter the fiber of the paper, and it may be applied by rubbing it onto the surface of the paper by means of a suitable brush or otherwise, after which the coatings h , h' , are applied, so as to render the strengthening material non-adhesive on its surface, and the coatings may be composed of whiting, aluminum, or bronze. When it is desired to further strengthen the portions of the paper the fibrous material g is sifted or otherwise placed on the adhesive material (to be pressed into it) before applying the coatings thereon. The adhesive composition moistens the portions of the paper on which it is placed, and after the application of the non-adhesive substance the sheets are passed between rollers under pressure, so that the strengthening material is smoothed and flattened down nearly to the plane of the surface of the sheet, and the fibrous substance embedded in the other strengthening material and the sheet under the strengthened material slightly reduced in thickness, as illustrated in Figs. 5 and 6, in an exaggerated degree. In some cases the strengthened portions are also brushed in order to polish them when coated with bronze or the like.

It will be evident from the foregoing that the strengthened sheets or leaves when connected to binding devices may be turned or moved on the rods or rings of the devices more freely and rapidly than is possible with the ordinary frail sheets, owing to the fact that the perforations may be made nearer than ordinarily to the edges of the sheets, which is permissible by reason of the greater strength attained in the present improvement at the portions that are subject to the greater strains.

In practical use the sheets may be bound together by any suitable appliances or connected together by various filing devices, and it will be clear that the sheets may be handled and removed and replaced as is custom-

ary with more or less frequency without the liability of the paper to tear away at the binding portions, and the sheets, therefore will remain in good condition and arrangement for future reference thereto.

I am aware that prior to my invention it has been proposed to strengthen portions of sheets of paper by applying reinforcing material, such as fabric, to the pulp of the paper while in the process of manufacture, so that the pulp interpenetrates the interstices of the fabric and covers both sides of the fabric; or by sprinkling threads or fibers on the pulp while the paper is in process of manufacture so as to be incorporated as parts of the mass forming the paper; but it is evident that since pulp can not be formed into separate sheets of paper except at great expense, and that the paper is made in web form most successfully, it is not practicable to reinforce certain portions only of the web at measured distances apart and afterward cut the web into sheets with the reinforcement at the edges of the sheets.

I am aware also that it has been a common

practice to glue or paste relatively stiff reinforcing strips or pieces upon the surface of paper, and perforate the paper and the reinforcement, with the result that the reinforcement ends abruptly and the paper is liable to fracture at the edge of the reinforcement. I therefore do not broadly claim such reinforced paper; but

What I do claim, is—

In reinforced paper, the combination of a sheet formed of pulp, flexible inherently adhesive substance laid on and adhering to a portion of said sheet, fibrous material embedded in said adhesive substance adjacent said portion of said sheet, and non-adhesive substance laid on the surface of said adhesive substance and thereby retained and covering the fibrous material.

In testimony whereof, I affix my signature in presence of two witnesses.

AURELIUS SMITH.

Witnesses:

DAVID C. MORRIS,
WILLIAM H. POTTS.