

eyes sparkling with delight, and, in a low, inquiring tone, says: "Turkey? turkey?" "No, Bobby," Nat will perhaps say, "not turkey today."

THE FLOW OF SOLIDS AND ITS EFFECT UPON THE STRENGTH OF MATERIALS.

BY PROFESSOR R. H. THURSTON.

One of the most important properties of metals is that which has been carefully and skillfully investigated by M. Tresca, the distinguished "Sous-Directeur du Conservatoire des Arts et Méiers," and by him called the flow of solids.

Professor Henry proved long ago that liquids, which were previously regarded by all, and which are still regarded by many, as destitute of all cohesion, are actually endowed with considerable attractive force, their molecules clinging to each other with a tenacity probably nearly, and perhaps quite, equal to that of ice.

It has recently been found that any distribution of material which aids polarity in resisting the tendency of particles to slide among each other, under the action of any straining force, causes a power of resisting external forces to become evident, higher than is noted where the form is such as to permit flow.

It was shown sometime since, in an illustrated article published in the Railroad Gazette\*, that a piece of boiler plate having rivet holes, whether punched or carefully drilled, was actually weaker per square inch of breaking section than when solid.

The standard short specimen gives, almost uniformly, about twenty per cent higher resistance to fracture by tensile force than the long specimen, which has a uniform cross section for a length of several times its diameter.

A metal which exhibits a tenacity of 60,000 pounds per square inch when tested in the first form, the minimum area occurring at a single point, will usually resist with a force of but about 50,000 pounds when tested in the form of a long bolt.

The majority of experiments hitherto made and quoted in books and periodicals have been made with short specimens. We are consequently very liable to be led to expect more of our materials than they are really capable of sustaining.

It may be inferred, from what is above stated, that, in construction, we should always be careful to design the parts exposed to strain in such manner that their form should aid in giving resisting power by preventing, as far as may be, a flow of particles and consequent stretch or distortion.

Another inference would be that one large piece is less liable to yield under the attacking force than several small ones of equal total section. It is, however, to be remembered that small pieces are usually better worked and are less affected by internal strain than are large pieces.

Since the damaging effect of a blow is measured by the product obtained by multiplying the weight of the striking body into the height from which its fall would have given it its striking velocity, and since the resisting power of the piece receiving the blow is measured by the product of the strength of the material into about two thirds the distance it will stretch before breaking, it is seen that the proper method of forming the resisting piece is that which gives it the best opportunity to stretch to a maximum extent before breaking.

Thus the best bridge builders in this country make the

long bolts, which are used as braces, of uniform sectional area from end to end, except at the very extremities, which are upset for a distance equal to the required length of thread to be cut on them, and this enlarged portion at each end is given such size that the diameter at the bottom of the thread, when cut, shall be somewhat greater than that of the body of the rod.

The amount of flow of the metal is determined by the character of the metal. Hard wrought iron and tool steels, for example, exhibit it less, and are consequently more ductile and resilient, than soft iron and low steels, while the latter are weaker metals than the former.

It often happens in designing machinery, that pieces are necessarily made of such shape as to be liable to injury from the cause here considered. Should this danger appear serious, the designer might be justified in changing his whole plan to avoid such risk.

A connecting rod, as usually made, is an illustration of a piece unfitted by its shape to bear a blow. The less the taper of the rod, the less is its liability to yield to shock. To secure in any given case a form of rod that shall best combine power of resisting shock with maximum endurance under heavy strain is often an important problem.

The body of a piston rod being of uniform section, it is well fitted to meet either static or dynamic compressive stress, but it is so seriously weakened at each end by the taper given it in fitting it to piston and crosshead, and by the slots cut through it, that it is usually quite unfit to offer maximum resistance to shock in tension.

To resist perfectly steady strain, therefore, and to carry dead loads, we should always select the strongest material, rather avoiding ductility, and, where the minimum section occurs, make that as short as possible and of such form as shall best resist flow and change of shape.

To resist percussive action and to sustain live loads, we should select that material which is at once the strongest and most ductile, avoid brittleness as certain to produce danger, and make the piece of such form as shall allow the greatest possible stretch before breaking.

Where two materials have products of strength into elongation which have the same magnitude we would select the most tenacious. Where two materials are equal in other respects, we would select that which has least density, since it is less likely to produce a concentration of the effect of the shock near the point at which the blow is struck.

STEVENS INSTITUTE OF TECHNOLOGY.

Plant Trees.

Mr. Reuben Shelmandine, of Jefferson, N. Y., is evidently a philanthropist, and he proves his love for mankind in general by issuing a proclamation to farmers. Why he should embody a number of very useful hints about transplanting trees in this highly official document, we cannot explain.

Ornamental trees should be trimmed during the first few years, leaving the main shoot to form the trunk of the tree, in order to have the branching lower limbs of the final tree from six to seven feet from the ground. The land in such an orchard grove can be cultivated for all ordinary crops, including a garden, by plowing shallow and carefully near the trees.

It is suggested that the first ten trees be planted on the south side of the house, if none be there already.

If a wind break is wanted on the west, northwest, or southwest, plant as near together as possible and have a part of the trees evergreens, to complete the thicket. The forest and fruit trees, arranged about twenty feet apart, as above described, will be estimated by the owner or other persons at the expiration of five years from the time of planting to be worth at least five dollars each, and at the expiration of ten years at ten dollars each, with an increasing value thereafter.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.) From April 14 to April 16, 1874, inclusive.

- BOILER AND FURNACE.—D. Renshaw, Hingham, Mass.
HORSE COLLAR LINING.—D. Curtis et al., Madison, Wis.
LEATHER DRESSING MACHINE.—J. M. Callier, Salem, Mass.
NEEDLE.—W. Trabue, Louisville, Ky.
PUMP.—W. D. Baxter, New York city.
TEMPERING APPARATUS.—G. F. Simonds, et al., Boston, Mass.
WASHING MACHINE, ETC.—E. Marshall, Toia, Kansas.

DECISIONS OF THE COMMISSIONER OF PATENTS.

PATENT TOBACCO BAG.—JAMES D. CULP.—Appeal.

[Appeal from the decision of the Board of Examiners-in-Chief in the matter of the application of James D. Culp, for patent for Improved Tobacco Packages.—Decided April 15, 1874.]

LEGGETT, Commissioner.

Applicant claims—

1. The use of elastic knit or loosely woven tobacco sacks, substantially as herein described, for packing tobacco.
2. A new elastic tobacco sacks made of knit or loosely woven fabrics, substantially as herein set forth and described.

Heretofore sacks for containing small quantities of granulated tobacco to be sold at retail in small packages, have been made of woven fabric, pieces being cut out, folded, and sewn at one side and one end to form the sack.

In packaging the tobacco it is pressed into a metallic tube, over the end of which the bag is slipped to receive the tobacco as it is forced out of the tube. Applicant proposes to knit long tubes of the diameter of a tobacco package and cut them into suitable lengths to form tobacco sacks, and merely sew them across the bottom.

The following points are made by the applicant against the soundness of this opinion. He says his sack can be manufactured with less expense than the old sack, because it requires less sewing. But this advantage is due solely to the method employed in its manufacture, which, broadly considered, is old.

Decision of the Board reserved and a patent allowed to the applicant.

RIGHTS OF EMPLOYERS AND EMPLOYEES TO INVENTIONS.

GILBERT, AND CLARKE, BONZANO & GRIFFEN.—INTERFERENCE.—ELEVATED RAILWAY PATENT.

[Appeal from the decision of the Board of Examiners-in-Chief in the matter of the interference between the application of Rufus H. Gilbert, and Clarke, Bonzano & Griffen, for patent for Improvement in Elevated Railways.—Decided April 16, 1874.]

LEGGETT, Commissioner.

The invention in controversy is an elevated street railway. Such a means of transit in large cities has long been a project of absorbing interest to the applicant, Dr. Gilbert.

With such a scheme more or less developed in his mind, he went to the firm of Clarke, Bonzano & Griffen, at Phoenixville, Pennsylvania, distinguished engineers and bridge builders, to enlist their skill and services in a practical furtherance. It is admitted that the widespread reputation of this firm as engineers and bridge constructors led to those business transactions between the parties from which this controversy sprung.

Gilbert needed and sought the practical suggestions and instructions of skilled mechanics and engineers. They could and did tell him that a gothic arch would not do. They probably told him, as all other engineers would have told him, that he must provide for expansion and contraction, and without making any invention they could readily suggest how it should be done.

Decision in favor of Gilbert.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT ELASTIC FABRIC.—WILLIAM SMITH VS. THE GLENDALE ELASTIC FABRICS COMPANY.

[In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

The previous production to a limited extent of goods resembling those fabricated by the plaintiff's process, and by means somewhat similar, held to have amounted to no more than abandoned and unsuccessful experiments, and not to impeach the validity of his patent.

SHEPLEY, J.

This is a bill in equity founded on alleged infringement of letters patent reissued to the complainant, numbered, respectively, 2,848 and 2,814.

Ferdinand Hoebly and Henry G. Gurney, witnesses in behalf of the defendants, testify to the use of looms with stationary warps before the date of complainant's invention. Neither of them give any drawing or model of the looms to which they testify, nor do the witnesses themselves or any experts in the case testify that the mechanism described by them was substantially like that described by the complainant in his specification.

Decree for complainant.

[2. A. Jencks and L. Scott, for complainant.

Benjamin Dean, for defendants.]

United States Circuit Court.—District of Massachusetts.

WADE H. HILL et al. vs. G. H. WHITCOMB et al.

[In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

The Court held as follows: Shepley, Judge:

The Alien Manufacturing Company, being the owners of the rights secured by three different letters patent of the United States, for the inventions of Edwin Allen in the printing press, in the organization of which were included the inventions secured to the complainants by their said patents, entered into a certain contract with the complainants.

The contract begins with a recital that the Allen Manufacturing Company are the owners of a patented automatic envelope printing press, which they styled a patented automatic envelope printing press, in the organization of which were included the inventions secured to the complainants by their said patents.

The second clause provides that the company shall, within a reasonable time, supply all presses ordered by the complainants. The third clause is a covenant to protect and defend the complainants in the exclusive use and enjoyment of the said automatic envelope printing presses in the territory aforesaid.

The fourth clause provides for the payment by complainants of the sum of one thousand dollars for each press ordered and received by them, and of a royalty of one dollar per day on each press on which envelopes can be printed of size No. 6, and of corresponding royalties for other sizes when said parties of the second part shall be protected in the exclusive use and enjoyment of them according to this agreement.

\* Railroad Gazette. † Trans. Am. Soc. Civ. Engrs.