free steam from the steam space having left in one puff), while the boiler shell, with the remaining parts of the flue, started in the opposite direction, precisely as a rocket would do similarly placed after the compound was ignited, and in a similar manner it continued its flight until the explosive force was exhausted. Hence it will be seen that with so large an opening there must have been considerable contained water to send it so far.

THE STRENGTH OF WROUGHT IRON AND STEEL.

There is something very interesting, but not altogether as yet understood, in the behavior and strength of iron and steel when loaded.

It is all very well to institute certain tests to find the number of pounds it requires to break a piece having a sectional area of one square inch, and from this pronounce what is the strength of the iron; because with our present knowledge and appliances, it is all we can do, and a test of some kind is of course imperative. It is a curious fact, however, that the strength of a piece of iron or steel varies according to the manner in which the load is applied. If the metal receives its load suddenly, it will break under a less weight than if the load comes on slowly and gradually increases; and the difference is not a minute one either, for it is as great as 20 per cent. under the two extremes of conditions. At the recent meeting of the Society of Mechanical Engineers at Hartford, Conn., one of the most eminent constructing engineers in this country stated, in reply to a question, that he would make as much as 20 per cent. difference in the strength of two beams to receive the same load, one to have the load suddenly, and the other to have it gradually applied. From this it is a fair and reasonable deduction that if the load when applied caused vibration, the beam would require still greater dimensions to be of equal strength, because vibrations are simply minute movements and, in the case of horizontal beams, on moving downward increase the pressure of the load.

A short time since some experiments were made to ascertain the strength of iron and steel wire, two specimens of each size of wire being used, one just as the iron came from the mill and the other an annealed specimen.

The wires were suspended vertically, and a certain weight as say 10 lbs., was hung on them. Then in some cases a ½lb. weight per day was added, in others 1 lb. per day, in yet others the weights were increased as fast as they could be put on, and in every instance it was found that the breaking strain increased according as the time between the increases of weight was made longer the amount varying from 10 to 20 per cent. The recent failure of the boiler plates of the English steamship Livadia has elicited some interesting facts and strange opinions upon the behavior of low-grade steel, and we present the most important to our readers. The boiler was 14′ 3″ diameter by 16′ long. The plates were ⅞″ thick, lap-jointed and treble riveted. The plates were all punched, then slightly heated and bent to shape; afterwards put together, and the rivet holes reamed out to size. While under this treatment one of the plates fell out of the slings on to an iron plate and was cracked right across the rivet holes. Naturally this gave some anxiety, but after the plates were all in the boiler itself, they cracked across the rivet holes in nearly all directions; that is, many of them did,

Investigation was immediately set up, chemically and mechanically, when it appeared, as nearly as could be ascertained, that although the stock was good of which the plates were made, it had not been thoroughly worked under the hammer before rolling.

Dr. Siemens, the inventor of the process which bears his name, surprised many of his audience by stating that annealing plates, either before or after working (punching), was of no advantage; tending if anything to injure rather than benefit the materials. This position was vigorously combated by the practical men present who were unanimous in condemning it!

DESCRIPTION OF E. HAUGH'S STEAM-BALANCED SLIDE VALVE.

The main principle in this device is that a bearing plate of the same size and form as the Valve seat of the steam-cylinder rests steam tight on the back or top of the Valve. Said bearing plate forms the bottom part of a cylindrical chamber, having in its bottom surface cavities, corresponding in size and form exactly with the inlet and exhaust ports of the steam-cylinder. The Slide-valve itself is in consequence of said arrangement symmetrically shaped, in as much as its top face is of the same form, size and area, as its bottom wearing face.

The mentioned cavities being located exactly vertically above their corresponding ports of the cylinder, become filled with steam at the same moment as said ports, thus the pressure of the steam against the bottom face of the slide-valve, when the latter has cut off, is counteracted. A number of vertical openings in the Valve are made for the purpose of equalizing the pressure of steam below and above the Valve, as soon as expansion takes place behind the piston of the cylinder. In order to make up for the wear automatically, there are on the upper hedge of the upper edge of the mentioned cylindrical chamber some inclined planes, to which are fitted other inclined planes, being on the bottom edge of a ring. Inside of this is fastened one end of a coiled spring; the other end of this spring is attached to a shaft, which goes vertically through it and enters in a hub, being located in the centre of the cylindrical chamber. Outside of the chamber, on the upper end of the shaft is fastened a ratchet; a dog prevents this ratchet, or rather the spring, when strained, from unwinding itself.

The purpose of this arrangement is to exert just as much pressure or strain of the spring, as is necessary to overcome the friction of the ring to turn, and by means of the inclined planes, instantly take up any or the least amount of space caused by wear of the valve. It may be seen clearly that this slide-valve can be considered a perfectly balanced one, and will run a considerable length of time without getting out of order, as the strain of the spring can be adjusted accurately from the outside of the steam chest without disarranging or moving a single part of the whole arrangement.

Since the above described invention was patented, a small but very important improvement, especially for locomotives, has been added to it, which consists in an also automatic arrangement to lift the top valve seat viz. cylindrical chamber from the back or top of the valve to the amount of about 1-50 of an inch, as soon as steam is shut off, for instance, when running down grade, or before reaching stations. As soon as steam is admitted again, said top valve-seat is brought back to its former and proper place. The object of this arrangement is to prevent only undue friction resp., cutting of the wearing surfaces. Another advantage of this device will be, that the lubricating oil will, by means of the suction, readily and rapidly spread over the whole surface of the valve, as well, as it will easily run down the holes and openings of, or through the valve and thus lubricate the surface of the cylinder valve seat equally as well.

E. HAUG, *Whistler, Ala.*

USE OF GLASS FOR ENGINEERING CONSTRUCTION.

A revolution in the common use of materials is promised by Mr. F. Siemens, who is at the present time making arrangements for the production in this country, on a large scale, says the London *Journal of Gas Lighting*, of his special make of toughened glass. This material has for some time been manufactured in Germany, and with the most satisfactory results; but it is believed that in England even greater facilities exist for its establishment as a regular industry. The glass is made from materials found naturally in great quantities in the neighborhood of Barrow-in-Furness, and other localities, where fuel and labor are also to be obtained on favorable terms. The method of manufacture is as simple as the reduction of iron-stone, and the annealing process, instead of being a separate and costly addition to the ordinary routine, as with the system of M. De la Bastie, is as strikingly direct and economical as it is efficacious. The finished material may be made of any degree of fineness, and colored or enameled like ordinary glass, from which it differs chiefly in being practically unbreakable. Gas lamps glazed with Siemens' glass cannot be broken by the most violent storms, and pebbles thrown with force against panes will rebound harmlessly. It is said that the lamps along a promenade in Hamburg were regularly broken every winter by storms of sleet, until the tough glass was used, whereupon this destruction was no longer experienced. Other qualities of material are used for rail and water main pipes. These articles are much stronger than iron castings and imperishable and incorrodible. It is said that common castings, which are now procurable at prices which do not return the iron founder more than the barest profit or none at all, can be produced in Siemens' glass at about twice the figure, giving ample profit to the manufacturer. As the specific gravity of glass is only about one-third that of cast iron, the purchaser will be able to obtain glass articles at about 33 per cent. cheaper than similar goods in cast iron, as he will get, say, three pipes for the weight of one cast iron piece of main. It should be remarked that the Siemens' glass does not crumble to powder or break explosively when it is crushed, but cracks in precisely the same manner as cast iron.—*Industrial News.*