So long as this policy was followed, the Association would prosper in the future as in the past.

In conclusion he thanked the officers and members for the excellent support given him during his term of office, and hoped that the same would be accorded him during the term they were about entering upon, assuring them that he would at all times endeavor to do his duty.

Bro. W. Sutton, who was re-elected Treasurer, next made a few remarks, and presented his yearly report, which showed a substantial balance in the bank to the credit of the Association.

Bro. W. Lewis, who was re-elected Vice-President, thanked the members for re-electing him, and said he would continue to try and do his duty.

Bro. W. Blackgrove has held the position of Recording-Secretary for the past three years, and has just been re-elected by acclamation. Bro. Blackgrove makes the best Secretary the Association ever had, and can point with pardonable pride to the fact that during his years of office not one omission or mistake has occurred in the minutes. The Association is studying its own interest by keeping him in the position which he is so well qualified to fill. The office of Recording-Secretary is no sinecure; there is any amount of work attached to it, but Bro. Blackgrove is a "hustler" (especially when he is running in a 100 yards race for a fine mantel clock).

Bro. C. Mosely was re-elected as Door-Keeper, and will continue to guard the wicket as zealously as in the past.

The Association is looking forward to a year's solid good work, and if it continues to prosper as it has done, it will before long become the leading stationary engineers association in America—and that without becoming part of the U. S. either.

By the way, I hear that some of the marine engineers are grumbling about the Marine Association not being any good. Why don't they join us? It would do them good. They would find that instead of our boys not being willing to tell anything they know in the Association, there are often two or three trying to get at the black board at once. And yet we are "only stationary engineers, anyway, and don't amount to a great deal," as a marine man said one day. Well, perhaps we don't, but we are in a fair way to 'get there." If a man is an "engineer" (which few of us and in all the word implies), it does not matter whether he is a marine, stationary, or what.

Yours, &c.,

"SAFETY."

STRENGTH OF BOILERS.

THE tendency of the pressure within a steam boiler is to force the material into the shape of a perfect sphere. Experiments have been tried by making models of various shapes of steam boilers of an elastic material, such as rubber, and then pumping air inside so as to produce pressure of any desired amount and noting the effect in altering the shape. By this plan the theoretical calculations have been tested and proved to be correct.

In a cylindrical boiler the ends, if made hemispherical, will require no stays, but if flat, must be stayed in order to enable them to resist the same pressure as the cylindrical part. In a cylindrical boiler of any given diameter, the strain tending to rupture the shell depends upon the diameter and the pressure, and is found by multiplying the pressure and diameter together. In making such calculations, it is absolutely necessary that the same standard of units be used. If the pressure be taken in pounds per square inch, then the diameter must be measured in inches, and it will be found convenient to assume one inch as the length of the strip of the shell, the strain upon which is to be calculated.

Let the shell be sixty inches in diameter, and the pressure one hundred pounds per square inch, what is the strain produced tending to rupture the cylindrical shell? Sixty pounds × one hundred is six thousand pounds. This, however, bears equally on two sides of the shell, tending to break the cylindrical hoop into two equal parts; hence the strain on each side is three thousand pounds. Had the cylinder been thirty inches diameter instead of sixty, the strain produced by the same pressure would only have been one-half that amount. It is important here to consider what is meant by a pressure of 100 pounds per square inch. It is 100 pounds and the pressure of the atmosphere, or about 115 pounds, but as the pressure of the atmosphere is on the outside as well, it is usually left out of the count.

Experiments are now being made with a steam boiler formed of one shell within the other. Each contains its own supply of water, and has its own safety valve and connections. In the inner one the steam pressure used is 500 pounds per sq. inch, in the outer one it is 200 pounds. By this means the pressure producing strains on the plates of the inner one is reduced to 300 pounds, and as it is smaller in diameter than the outer shell, the total strain on each shell may be made the same.

In the boiler sixty inches diameter 100 pounds pressure as shown on the steam guage was shown to produce a strain of 3,000 pounds on each inch of the length of the shell. What is there to resist this? The thickness of the plate, or rather the amount of metal left after the rivet holes have been made in it.

In single rivetted seams the strength may be taken at one-half that of the solid plate, and in double rivetted seams at seven-tenths of the solid plate. If the plate be three-eighths of an inch thick and the strength of the plate 60,000 pounds per square inch, then the strength of the double rivetted joint will be $60{,}000 \times \frac{3}{8} \times \frac{7}{10} = 15{,}750$. The strain was found to be 3,000, and the strength to resist it 15,750, or a little more than five times. This is a very common difference and is called the factor of safety. It is common to have in new boilers a factor of safety of 6, or 5 or sometimes 4. The necessity for having such a difference between the strength and the strain arises from imperfections in workmanship, and uncertainty as to the actual strength of the particular plates.

ENGINEERS' PICNIC.

THE C.A.S.E. picnic at Oakville, on July 1st, proved to be an unqualified success. Notwithstanding the fact that in the early morning there was a regular downpour of rain, and a very gloomy outlook for the day, Toronto engineers and their friends turned out about 350 strong. With abundance of provisions and good feeling, all were bound for a good time, and their expectations were fully realized.

The long list of competitions was carried out to the letter. Steam was let on at three o'clock a very late start owing to the weather. Owing to the high pressure carried and the fact that the governor worked to a charm, the bottom of the programme was reached without a hitch of any kind.

The first event was a 100 yards race, members only, the prizes for which, a shaving set, a caddy of coffee and a hack saw, were won by Bros. Chillman and Bellington, of Hamilton, and Bro. Hughes, of Toronto, in the order named.

100 yards race, open to all—1st, *Dowling*, $3; 2nd, *Agerst*, $2.

Running long jump—1st, Bro. Bellington, 1 ton coal, 2nd, Bro. Chillman, 1 pocket knife, 3rd, Bro. Butter, knife sharpener.

75 yards, old man's race—1st, *Bro. Sutton*, engineer's oil set, 2nd, Bro. Gilchrist, spring mattress, 3rd, Bro. Carter, Hamilton *Times*, one year.

100 yards boys' race—1st, Finlay, $1, 2nd, Boyle, 50 cents.

Tug of war—Hamilton vs. Toronto Prizes, silver cup and box of cigars, won by Toronto in two straight pulls.

50 yards girls' race—1st, Miss Williams, pair vases, 2nd, Miss Irving, toilet soap.

Standing high jump—1st, Bellington, rubber coat; 2nd, Anderson, hat, 3rd, W. Lewis, knife sharpener.

Smoking race—1st, Bro. Caffrey, Meerchaum pipe, 2nd, Bro. Tarranto, caddy tobacco, 3rd, Bro. Wilcox, briar pipe.

Standing broad jump, open to all—1st, Mr. White, ton of coal, 2nd, Bro. Bain, bag of flour, 3rd, ———, knife sharpener.

75 yards race, engineers' wives—1st, Mrs. Bain, silver water pitcher, 2nd, Mrs. Moseley, silver butter dish, 3rd, Mrs. Marshall, Hamilton *Times*, one year.

Best waltzers—1st, H. Graham and lady, silver cruet stand; 2nd, Mr. and Mrs. Witty, lady's fan, 3rd, Mr. Benwell and lady, pound of tea.

Quarter mile race, members only—1st, Bro Moseley, *household bank*, 2nd, Bro. Nichol, copy of S. P. Thompson's "Dynamo Machinery", 3rd, Bro. Miller, 40 yards cotton duck.

Putting shot, open to all 1st, J. O Rieley, ton of coal, 2nd, W. Brush, box of soap; 3rd, W Leith, knife sharpener

Shoe race—Miss Waterson, 1 pair boots; 2nd, Miss Fassants, bird cage.

Engineers' young ladies race—1st, Miss Everett, G. P. clock, 2nd, Miss Nichol, Hamilton *Spectator*, one year, 3rd, Miss Fassants, three bottles of pickles.

Judges and starters' race—1st, Mr. Johnson, 1 ton of coal, 2nd, Bro. Moseley, ½ ton of coal, 3rd, Mr Harrison, knife sharpener.

Consolation race—1st, W. Blackgrove, *mantel clock*, 2nd, *Hamilton*, ½ cord of wood; 3rd, W. Terry, monkey wrench.

The intention was to have had a game of baseball, Hamilton vs. Toronto, but a shower stopped the game at the end of the first innings, with the score in favor of Hamilton.

The wet morning prevented many from attending. As it was, this was the largest gathering of engineers ever got together in Canada. All present expressed themselves as satisfied with the day's outing, and the picnic bids fair to become an annual one.