A. S., of Richmond, Va., says: What are your ideas concerning a cupola, consisting of a cylinder within another, the space between sealed at either end, having a pipe entering at top and a smaller opening at bottom, with a stream of cold water running through, keeping the space between these cylinders filled, and doing away with bricking altogether, the blast to enter as in any other cupola? Again, can you give me some method of mixing plaster of Paris, so as to increase its strength, that it may be worked into patterns, etc., or any new composition suitable for such uses? Answer: We should fear that your water backing would chill the metal and also cause a greater expenditure of fuel. Try mixing your plaster of Paris with good hydraulic cement, using as little water as may be possible, molding quickly, and leave to set just as long as possible. We hope to hear much, in the future, from our Virginia "Birmingham" whose facilities for manufacturing are hardly surpassed on our continent.

P. C. N. asks: Can an ice boat, with no other driving power than the wind, acquire greater velocity on the ice than the wind by which it is driven, allowing the wind to blow from any direction, and regardless of the relative position of the ice boat to the wind? Answer: Yes. Theoretically an ice boat sailed on a proper angle to the wind will make more than double the velocity of the wind, and in practice this velocity is approached but not wholly realized, owing to the friction and imperfections of make. When an ice boat sails directly before the wind it will move with the same velocity as the wind minus the friction of the boat on the ice. But when the boat is sailed at the proper angle to the wind, a constant pressure is maintained on the sails, and the velocity of the boat increases until its resistance equals the wind pressure on the sails. It is on the same principle that the extremities of the arms of a windmill are made to travel faster than the wind by which they are driven.

J. T. W. asks: Why is it that it is always darker just before the break of day than it is one hour previous? Answer: It is not darker just before the break of day.

Querist says: 1. On page 387, last volume, is an illustration of a button hole cutter which you say was "suggested" by H. Walker, of London, etc. This article was evidently patented, as well as "suggested," by somebody, more than a year since. One of your readers here infers from your mention that this is a British patent; I think it an American patent. Who is correct? Upon the decision pends a year's subscription to your paper at a news dealer's. Answer: The description was copied from an English paper, and is only an example of the way in which Yankee contrivances are gobbled up on the other side of the Atlantic. The device in question is the invention of John G. Howell, of Philadelphia, Pa., and was patented in this country May 9th, 1871.—2. On page 385, same issue, is an account of a torpedo craft, the dimensions of which are stated to be "about thirty feet long and three inches wide." Into this queer craft must go "motive power, machinery, electrical apparatus, explosive shells, and 500 lbs. of powder or nitro-glycerin, etc." As stevedores, we are entirely at sea over this statement in our favorite journal. Answer: Read it three *feet* wide instead of three inches, and return to the solid land.—3. The article of Van Bibber in same issue relative to the dangerous properties of bisulphide of carbon rather disconcerted us, as we had been innocently and extensively sniffing at a bottle of the "fragrant" which he so condemns. We shall give it a wider berth hereafter.

J. C. says: There are two boilers supplying steam to an engine 18 x 28, running about 80 revolutions to the minute at 75 or 80 lbs. to the inch. The boilers are 50 inches by 14 feet, with 55 three inch flues in each shell, five sixteenths of an inch thick. They are connected on top by a drum, 20 inch diameter, size of connections 4½ inches; they are not connected at the bottom, and are fed by separate pumps, and have no mud drum. They are cleaned out once a week, and burn 70 or 80 bushels of Ohio coal per day. They have about 50 square feet of grate surface. The grates are set 14 inches from the boilers and run up to 12 inches at the bridge wall, and up to within 4 inches at the smoke box. They had not been in use five months when the plates started a crack from the edge to the rivet holes, then across between the holes in the first joint, and the rivet holes in the second joint began to leak badly. In order to put on a patch, there were 4 flues taken out, 2 out of each boiler; they were put back in their places after the patch was put on, when, on firing up and running two days, they stripped the beard off of two of the flues. What is the matter with the boilers? Answer: Such cases are difficult to decide upon without personal knowledge of all the circumstances affecting them. We suspect that the effect described is due to the expansion of metal over a hot fire and covered on its inner side, possibly, with earthy deposit, and to its contraction when the feed water is forced in. Put in mud drums and a feed water heater, and thus avoid this alternate expansion and contraction as far as possible. Such an action is a frequent cause of disastrous explosions, and the boilers described are, probably, very likely to furnish another example. To leave the cause of danger undetermined would be criminal.

J. T. asks: How are the sizes of governor balls determined, for governors intended for different horse power engines, after the number of revolutions and hight of the cone in which the arms must revolve are determined? I think, without such a rule as this, the rules for finding hight of cone and number of revolutions are mere fallacies, because I think it is possible for the balls to be so light that they would not shut the valve at all; and if it is, it is also possible for them to be too large, requiring too much power to drive them. All our celebrated engineers talk about governor balls resembling the pendulum of a clock; if this is so, take the pendulum of a clock off and put a heavier one on, and it will lose time, put a lighter one on and it will gain time, proving the rule I ask for. Answer: The proper size of balls for the fly ball governor can usually be determined only by experiment. The resistances offered by different valves and connections vary so greatly that there can be no reliable general rule. The rules for determining the hight of cone are reliable and their use is indispensable in designing governors. The difference in the power required to drive a governor with heavy or with light balls is principally due to difference in the amount of friction and, usually, is an exceedingly small percentage of the power of the engine. Many of our best engineers prefer a pair of small balls (driven at a high speed, and weighted down to the proper hight of cone by a weight on the spindle) to a pair of larger balls running at their ordinary speed.

D. L. M. asks: What is the cause of the loud humming or rolling noise heard on telegraph wires? Is it caused by the electricity in despatching messages, or by spontaneous electricity, or is it caused by the wind? The sound is heard when it is wind-still and also at night when no operators are on the line. Answer: The sound is caused by the wind. A very gentle breeze will produce it. The principle is the same as that involved in Æolian harp, which produces musical sounds on being placed upon a window sill so that an air current will pass over the strings.

E. M. asks: What difference of pressure per square inch will there be (at the end of the stroke) in two air cylinders, both being forced by the same pressure of steam, one cylinder being 12 inches in diameter and the other 6 inches, both pistons working to within one sixteenth of an inch of the cylinder head? I believe the pressure in both cases would be the same per square inch; my friend thinks the pressure would be the greater in the larger one; which is right? Answer: The pressure would be the same in each cylinder.

W. G. B. says: As it is not the design of your paper to take sides with those in error, I must be allowed to criticise your decision on the balance wheel question, page 394 of Volume XXVII. R. says a balance wheel (which is always a heavy wheel) may be keyed on to a shaft at an angle of 45° and run fast without affecting the steadiness, except from its resistance to the air. You admit the tendency of the wheel is to turn itself at right angles with its axis. In other words, one side of the wheel will pull its end of the shaft one way, and the other side will pull its end the other way, which would be equivalent to two pulleys, of a certain weight and certain distance apart, with the weight of one all on one side of the shaft and the weight of the other all on the opposite side. I will give you a case in point, which may be a hint to some who have pulleys to balance. I once saw a binder pulley which shook so when running at a high speed, whether in contact with the belt or not, that it was always working its fastenings loose. It was only a ten inch pulley, with eight or nine inches face, and in the very best of standing balance; but instead of running still and smooth, as a properly balanced pulley ought, it kept up a vigorous rattling and shaking. The trouble was that, at one end of the pulley, the rim was twice as thick on one side as on the other, and the person who balanced it put his counter weight in the other end, making both ends out of balance, though they balance each other when standing still. Answer: W. G. B. is right. He is referred to the reply to S. W. H., in last week's paper, on same subject, and to an editorial in this issue, which will, we think, dispose of the subject satisfactorily.

J. A. K., of Allegheny City, Pa., is desirous that we should understand that that illustrious municipality is not a part and parcel of the neighboring village of Pittsburgh. It is his firm belief that the Observatory will remain in Allegheny, notwithstanding the puny efforts of the smoky Pittsburghians to gobble it up. Allegheny has a population of 60,000.

A. J. S. asks: What is, in your opinion, perpetual motion? If a machine is so constructed as to furnish its power and run with no other obstruction than the friction while running, is that perpetual motion or self motive power? Answer: Such a machine as you describe, we should style a perpetual motion. Many forms of perpetual motion machines have been invented. The simplest form is the tub. When a man places himself in a tub and by a steady pull at the handles lifts himself from the ground, then he has produced a successful perpetual motion. All such machines necessarily operate on the same principle, and, until an individual is enabled to operate the simple form above described with success, it will be useless for him to expect that he can work a more complicated perpetual motive machine. The addition of cog wheels and levers will not help the matter.

S. Y. O. asks if adding to the running weight of a clock will cause it to gain time, every thing else being equal? Can the action of the verge on the pendulum be made to quicken its vibrations by thus adding to its power? Of course we might apply enough power to drive the pendulum independent of gravitation. Another question is: If it takes a force of one pound to run a balance wheel at a given rate, what would be the effect of the application of a force of two pounds? I say that in order to double the motion, the power must be quadrupled. Consequently the balance wheel would only move at about one third greater speed. Answer: The escapement of a clock may be so constructed as to cause its effort to turn, under the impelling action of the weight, to accelerate the motion of the pendulum, and it is frequently, probably generally, so made. The effect is very slight, however, and the intention is, we presume, rather to make it certain that the verge shall not retard the motion of the pendulum than to secure a means of increasing the rate. The balance wheel question can be most satisfactorily decided, by the parties interested, by experiment.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted.

FOR THE WEEK ENDING DECEMBER 17, 1872,

AND EACH BEARING THAT DATE.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

Annunciator, O. Hagendorf	134,053
Balcony, portable, E. Balmforth	133,962
Bale tie, J. W. Gurley	134,052
Basket, H. C. Jones	133,941
Bed bottom, D. P. Mahan	134,079
Bed spring, E. Krieghoff, (reissue)	5,189
Bed lounge, S. Kennedy	133,992
Bedstead, folding, T. S. Thorson	134,111
Bedstead, invalid, H. A. Scott	134,008
Bedstead, sofa, C. F. Fauchert	134,016
Bird cage, Osborn and Drayton	134,094
Boiler, wash, Tinner and Tregear	134,017
Boiler, culinary, J. Bowlin	133,918
Boiler for steam heater, P. Estes	134,044
Bolt trimmer, W. Dunlop	133,972
Book, hand rest for, W. F. West	134,116
Boot and shoe heel, N. Mole	134,087
Boot heel, elastic, T. P. Monzani	134,088
Boot last, nailer for, G. McKay	134,083
Boot jack, J. A. McKinstry	134,084
Boot moccasin, J. J. Drown	134,041
Boring machine, J. W. Shaw	134,009
Bottle stopper, J. B. Barsaloux	133,915
Bottle tube, sauce, J. B. Lyon	133,947
Box, fare, W. H. McLellan, (reissue)	5,194
Box machine, B. E. Dexter	134,039
Bracelet, W. W. Knapp	133,943
Brush, paint, L. A. Lightenhome	133,996
Bustle, S. Smith	134,010
Butts, finishing, E. C. Blakeslee	134,029
Candlestick, safety, T. A. Washburn	134,113
Can holder, R. J. Tanner	134,015
Car axle box, W. G. Beattie	134,026
Carbureter, J. B. Terry	133,957
Car coupling, E. W. Barker	133,963
Car coupling, D. J. Tittle, (reissue)	5,191
Card holder, P. B. Groat	134,051
Carpet beater, J. Hothersall	134,059
Car spring, J. B. Quirk	133,952
Car, street, W. H. T. Hughes	134,060
Cartridge, D. C. Farrington	133,929
Churn, J. W. F. How	133,940
Churn, J. Rengel	134,100
Cigar cutter and holder, J. Brady	134,030
Clothes washer, W. H. Nice	134,000
Coal scuttle and sifter, C. McCleaver	134,081
Cock, compression, A. Pearce	134,095
Cock, gage, N. Ray	135,098
Cooler and stand, G. Giebrich	133,979
Cooler, W. A. Jones	133,990
Cooler, milk, W. Eaton	134,043
Copy holder, L. G. Davis	134,036
Cultivator, F. Reese	134,099
Curtain fixture, W. R. Cole	133,921
Ditching machine, L. W. Fisher	133,974
Drill adjuster, well, J. Gallagher	133,977
Dyeing, Jarosson and Müller Pack	134,066
Dyeing, F. Lamy, *dis.*	134,076
Egg carrier, A. H. Bryant	134,031
Elbow, sheet metal, H. S. Hoeller	133,989
Engine, hydraulic, J. H. and R. W. Welch	134,115
Engine, rotary, J. McGowan	134,082
Engine, stationary, C. S. Crane	133,926
Engine coupling, fire, D. J. Tapley	134,110
Faucet, protected, P. A. Schwarz	134,102
Ferrule machine, W. L. Newsham	134,092
File, portable, C. A. Cook	133,923
Filter, C. C. Savery	133,953
Fire arm, J. F. Swinburn	134,014
Fire arm, cartridge for, P. Giffard	134,048
Fire extinguisher, A. J. Sparrow	134,107
Fire extinguisher, B. T. Babbitt	134,024
Fire kindler, E. Everett	133,973
Fruit basket, L. W. Beecher	134,027
Fruit corer, O. W. Alexander	133,914
Furnace, hot air, C. White	134,118
Gas, illuminating, T. G. Springer	134,108
Gas, illuminating, T. G. Springer	134,109
Gas retorts, charging, A. F. Havens	134,055, 134,056
Gate, E. B. Whitaker	133,960
Gate, farm, C. E. Gillespie	133,980
Glass press, W. C. King	134,070, 134,071
Glove, J. I. McMartin	133,998
Grain binder, J. H. Morse	134,089
Gum, chewing, N. Wood	134,022
Harvester cutter, H. Mewes	134,085
Harvester dropper, W. H. Forker	133,933
Harvester, rake for, M. K. Church	133,966
Hat, G. Johnson, (reissue)	5,188
Hat, felt, J. T. Waring, (reissue)	5,192
Heater, water, J. S. Woolsey	134,120
Heater, steam, J. C. Kilgore	133,942
Hoe, S. H. Folsom	133,932
Hoe, garden, C. Belden	134,028
Hoisting machine, S. Van Emon	134,019
Household tool, H. R. Ives	134,064
Injector and ejector, W. B. Mack	133,997
Iron and steel refining, N. B. Hatch	133,937
Jack, lifting, W. A. Middleton	134,086
Jack, lifting, J. D. Otstot	133,949
Jar for candy, W. C. King	134,072
Knife and fork, W. D. Smith	134,011
Knife, fruit, H. Soggs	134,106
Lamp chimney holder, J. H. Irwin	134,063
Lifter, track, L. Grover	133,934
Lime kiln, C. B. Corey	133,925
Lock, J. Keath	133,991
Lockets, die for basils of, H. Henrich	133,986
Logs, turning, E. C. Dicey, (reissue)	5,187
Loom shuttle, Ladd and Henderson	134,074
Loom shuttle, P. A. Lambert	134,075
Medical compound, T. Copeland	133,924
Metal ware, die for, M. Bray	133,919
Milk, transporting, J. A. Whitney	134,020
Mill, smut, C. Küderli	133,948