

MISCELLANEOUS INVENTIONS.

Mr. Henry Reny, of Lewiston, Me., has patented an improved valve for musical instruments, such as trumpets, cornets, etc., which has a smaller stroke than the similar valves in use heretofore, and is therefore much more convenient for the musician or performer.

Mr. Aaron S. R. Overholt, of West Overton, Pa., has patented a nut locking device for fish joints of railroad rails. It consists of a gib keeper formed to fit snugly into the recesses formed by the top of the rail flange and the lower side of the nut and to clasp firmly the two sides of the nut; and also in a metallic tinned washer, by which the gib keeper is secured and maintained firmly in place within the recess in such a manner as to effectually prevent the jarring out of the gib or the unscrewing and loosening of the nuts by the jar incident to the traffic upon the road, and to provide for the removal of the gib as occasion may require.

An improved washing machine, patented by Mr. Robert D. Bennett, is so made as to allow the introduction and removal of the articles operated upon without removing the rubber from the tub. This invention consists in hinging one end of the rubber to radial arms extending from the shaft, and providing the other end with hinged bolts engaging in slots in other radial arms, whereby the said rubber may be lifted from one end for the introduction and removal of articles and then secured in place. This machine is intended to imitate handwork. Any information in regard to it may be obtained by addressing Mr. Marcius Bibbero, New York city.

Mr. Charles Oliver Chaplin, of Ridgeway Corners, Orleans Co., N. Y., has patented a fruit drying apparatus, which comprises a drying chamber heated by a furnace arranged at one end of the latter, and an endless chain of pendent grooved carriers for the support of trays on which the fruit to be dried is placed, said endless chain engaging and disengaging with notched wheels within the drying chamber, and being supported by wheels which run upon suitable upper and lower tracks. The invention consists in various peculiarities of construction and combinations of parts, whereby increased facility is afforded for tempering the heat of the drying chamber, for giving an easy traveling action to the trays through said chamber, and the top of the furnace compartment not only supports the furnace but serves as a stand for the operator in introducing and removing the fruit trays; also provision is afforded for charging the furnace through its top.

An adjustable trace loop has been patented by Mr. William G. Riley, of Corydon, Iowa. The object of this invention is to provide a simple and inexpensive loop for attaching a back band of a harness to a trace in an adjustable manner, so that the back band can be easily moved forward or backward, as well as lengthened or shortened, to accommodate horses of different sizes. To these ends the trace loop, which is adjustable both vertically and laterally, has deep rectangular recesses cut crosswise at its center to provide for a snug hold of the trace, and is furnished with a narrow central pin plate, which affords every facility for adjustment of the back band.

An improved feathering propeller has been patented by Mr. Alexander Davidson, of Springfield, Ill. The invention consists in a paddlewheel provided with pivoted oscillating rectangular bucket frames having longitudinal supporting bars and cross bars to resist pressure, in connection with oscillating buckets. It also consists in a combination with the main frame of a paddlewheel of bucket frames controlled by eccentrics and supporting oscillating buckets which are hinged to the forward part of the frame and have their rear edges free to vibrate, whereby the buckets when propelling are held at right angles to the line of progression and assume the position of least resistance when feathering. This propeller is readily adaptable to both deep and shallow water, may be arranged to work either vertically or horizontally, and be only partially immersed or wholly submerged.

TRADE MARK DECISIONS BY THE COMMISSIONER OF PATENTS.

EX PARTE FRIEBERG & WORKUM.

Appeal from the Examiner of Trade Marks.

TRADE MARK.

Marble, Commissioner:

Appeal is taken from the decision of the Examiner of Trade Marks in refusing to register as a trade mark subject-matter described as follows:

The words "J. A. Bowen" and the arbitrary symbols of a shield on which is emblazoned the arms of the United States. These have generally been arranged as shown in the accompanying facsimile, the words "J. A. Bowen," in a curved line, forming the upper part of a circle, and the word "Bourbon," in an inverted curved line, forming the lower part of a circle. Between these words is the representation of a fancy shield, upon which appears the Stars and Stripes, that form the conventional armorial bearings of the United States of America; but the word "Bourbon" may be omitted without materially altering the character of our trade mark, the essential features of which are the words "J. A. Bowen" in connection with the shield having emblazoned thereon the Stars and Stripes, that form the conventional armorial bearings of the United States of America, the whole surrounded by a plain circular border.

It is stated in the application that this alleged trade mark has been continuously used in the business of the applicants as a trade mark on whisky since the year 1857. The application was rejected by the Examiner because applicants

refused to erase therefrom the words "J. A. Bowen," the attorneys of applicants having admitted that he was the person whom the applicants succeeded in business. The Examiner's objection to the registration of said trade mark is stated as follows:

Their use of this name is evidently intended to inform the public of the fact that they are the successors in business of J. A. Bowen, and are now engaged in the distillation of liquors formerly sold under his name. It would seem to the Examiner that this is simply a transfer of "good will," and nothing more.

A trade mark is an arbitrary character or characters without special meaning, adopted by persons, firms, or corporations for the purpose of identifying the goods manufactured by them or of which they have the sale. Persons have the right to adopt any device or form of words possessing these characteristics as their trade marks so long as public propriety is not violated. It may be true in this case, as it is in many cases, that the name of a person associated with a particular trade or business carries with it the good will of the establishment with which he was connected. If it is the good will simply that is sought, then it should not be registered as a trade mark; but if the name of a person possessing the characteristics of a trademark in itself, not an applicant, is adopted by any person, firm, or corporation to identify their particular goods, I see no good reason why it may not be used as a trade mark and be registered as such. On the contrary, there are many reasons why it may be so used. The long use of the name of a particular person with a particular class of goods manufactured by that person or in his name, serves to identify those goods as particularly as any other character, device, or collection of words. This is all that is required to make it a legal trade mark. Whether persons other than the person whose name is used have the right to use such name is another question. In this case it is claimed that the applicants have used this name with the device mentioned as their trade mark upon their goods since the year 1857. This is sufficient *prima facie* evidence of their legal right to use it.

The decision of the Examiner is overruled, and the certificate of registration will issue in due course.

Frederic Sauvage.

The London *Times* gives a sketch of the life of Frederic Sauvage, to whom the people of Bologne have just erected a statue, as the inventor of the screw propeller. His claim to this honor rests on the fact that in 1832, hearing that the French Government proposed to build a number of paddle steamers, he was led to devise a better means of propulsion, and eventually he constructed a screw.

Early in that year Sauvage exhibited to the Boulogne authorities his new invention, which was highly approved. As he was anxious to bring it under the notice of government, he gave up his Boulogne residence and left for Paris, where he took out a patent for fifteen years. The screw was acknowledged to have its advantages with small boats, but the commissioners, who sat by order of the Minister of Marine to report on it, concluded that it would be of no use for large vessels.

The English Government, in 1835, it is stated by the *Times*, offered him a sum for the invention, on the condition that it was to become the exclusive property of England, but the inventor, who was at that time stricken down by poverty, would not consent. It is further said that Sir Francis Pettit Smith derived his first idea of a screw from a visit to Sauvage's workshop.

In 1841 Sauvage made an agreement with a shipbuilder and an engineer for the construction of a steamboat, to which the screw was to be fitted, he giving the plans, while they carried them out, and at their own expense, but the agreement, owing to a technical misunderstanding, was badly worded. The boat was built and fitted, but not as Sauvage wished, and the two others took all the credit. The unlucky inventor, forsaken by all, after many years of toil, was, in the year 1843, shut up in the debtors' prison at Havre, where he remained some time, but was eventually released through the instrumentality of Alphonse Karr, who had taken a deep interest in him. From the time he had set on foot his experiments with the screw, he had spent in the course of ten years about 80,000 francs (£3,200), in exchange for which he afterward received from the State a yearly grant of 2,500 francs (£100). Driven to despair, and in deep misery, Sauvage, who was advanced in years, was conveyed in April, 1854, to the Picpus Asylum, where he passed the remainder of his life, dying at the age of 71.

The townspeople of Boulogne, in 1872, through the mayor, M. Auguste Huguet, had his remains removed from Paris and interred in the cemetery, where a monument surmounted by a bust was erected to his honor.

It is probable that Sauvage's claims will receive but little attention outside his own country. In England, it will be remembered, in 1770, James Watt, writing to Dr. Small, proposed to use one of his steam engines to drive a screw for the propulsion of a ship. In 1776 the American, Bushnell, described a submarine boat propelled by a screw. Trevithick patented a screw propeller in 1816; and before him, in 1800, Edward Shorter patented a propeller, which was afterward, in 1802, tried on H. M.'s ships *Dragon* and *Superb*. In America, Stevens, in 1804, tried to propel a boat by a screw. In 1816, Millington described a screw with a very ingenious steering arrangement connected to it, and this was apparently the first of a great number of attempts which have been made in that direction—all, as

yet, unsuccessful. From this date till the date of F. Pettit Smith's invention (1836), the records of the Patent Office show that many minds were working in the same direction. The point of Smith's invention was the placing of the screw propeller in the dead wood of the vessel, nor has it ever been claimed for Smith that he was the inventor of the screw propeller, though he was, there seems little doubt, the one to bring it into actual use. There seems little question that Sauvage did nothing more than was done by very many others—by Watt, Trevithick, and the rest—conceived a most valuable idea, but never carried it beyond the stage of a model.

Sylvester Doolittle.

One of the pioneers of American internal commerce, Sylvester Doolittle, died recently in Oswego, N. Y., in his 82d year. Mr. Doolittle built and owned the first canal boat that made the trip from Rochester to Albany. It was called the *Genessee* of Wheatland, and carried a cargo of flour. This in 1822. For several years Mr. Doolittle built packets and freight boats, and in 1826 removed to Utica, where he built, owned, and commanded the first canal boat that passed down the Hudson River to New York. She was called the *City* of Utica, and carried oats and lumber. In those days all the Hudson River lines carried freight, and none of them would tow his boat to New York. At length he induced a Mr. Hitchcock, who owned a small steamer running independently of any line, to tow him. He moored at Coenties Slip, and his queer craft was visited by many curious New York merchants. He reloaded with merchandise, which he delivered at Utica, and soon towage of canal boats to New York became a large business, which it still continues to be. When the railroads destroyed the packet business Mr. Doolittle removed to Oswego and built vessels for the lakes.

In 1841 Ericsson's screw propeller engaged his attention. Ericsson met with little success in introducing it, and in consideration of Mr. Doolittle's putting it in one of his boats, agreed to give him the right to use it in all the vessels he might build in three years. Mr. Doolittle immediately built the propeller *Vandalia*, the first screw wheel steamer that sailed the lakes. She made her first trip through the Welland Canal to St. Catharines at a speed of six miles an hour. Crowds of people turned out to see her, and a public dinner was given Mr. Doolittle at St. Catharines. The next year he had a line of five propellers on Lake Ontario, and soon they were on all the lakes.

The Land Slip at Elm, Switzerland.

In the recent disaster at Elm—otherwise known as Unterthal—a great mass of earth and rock from the Plattenberg or Tschingler Alp, 1,500 feet wide, at least 2,000 feet high above the valley, and, according to the engineers, from 60 to 100 feet deep, fell over upon the village, its farms, gardens, and meadows, covering several thousand acres. Tons of rock were dashed entirely across the valley, and now rest quietly 300 and 400 feet high upon the hillside. The air pressure was so great that houses were lifted up from their foundations and carried a distance of 1,000 feet. A barn built of heavy logs, and filled with hay, was carried entirely across the valley and overturned 200 feet high on the mountain opposite the Plattenberg. An iron bridge which crossed the Sernf was torn up, carried scores of feet away from its abutments, and now rests on end more than half buried in mud and loose stone. The whole valley, as far as it can be seen from the village inn, which is still standing, very closely resembles the bed of a glacier which has receded.

The river Sernf has made for itself a new channel through the *débris*, and has flooded and ruined much of the land below, land which was not directly harmed by the avalanche of stone. So in one way or another the whole valley has been injured beyond all hope of repair. The loss in property will reach not less than 2,000,000f.; at the lowest estimate 123 people have lost their lives; other estimates make the number 150 or more. The state engineers, fearing further land slides, have forbidden those who have escaped to return to the houses which remain standing, and in consequence more than 800 men, women, and children, who but a few days before were prosperous and well-to-do, are now almost without a roof to cover them.

The chief cause of the disaster, after the heavy rains of the past summer, is said to have been injudicious quarrying for slate, whereby the mountain was in part undermined and so rendered unsafe. Some three years ago ominous signs of danger were observed, and the cantonal forest master, Herr Seeli, warned the proprietors of the quarries that they were carrying on their excavations beyond the bounds of safety. The work went on without interruption until Thursday, Sept. 8, when the premonitions of disaster became so alarming that all the men were withdrawn from the quarries; yet no one seems to have thought the village was in danger until Sunday afternoon, when, as the people were coming from church, a quantity of stones, rolling from the Tschingler, crushed several houses in Unterthal nearest the foot of the Alp. Ten minutes later came the great catastrophe; a thunderous noise rent the air, a black dust-cloud overspread the valley, and all was still. In those two or three seconds Unterthal had disappeared, and with it were buried nearly every one of the unfortunates, who a few minutes previously were worshiping in the village church. Scarcely any, in fact, who on the first alarm crossed the Sernf, either out of curiosity or fear, to lend a helping hand to those whose houses had been struck, escaped, and they include nearly all the manhood of the village. Forty dwellings, the best in the village, were buried.

This is not the first disaster of the sort in Switzerland, nor anything like the worst. On the 4th of September, 1618, the rich though small town of Plurs, in the Grisons (near the Engadine valley), was entirely buried by a land slip. Over 2,400 persons lost their lives. The site is now occupied by a fine forest of chestnut trees. No remains of the town have ever come to light, with the exception of a bell which belonged to the church, and which turned up twenty years ago.

On the 2d of September, 1806, the Rossberg, a mountain some miles to the north of the Righi, gave way on its eastern side, and slid down into the lake of Lowerz, which is half filled up, converting the once picturesque slope, studded with chalets, pasturages, and herds of cattle, into a chaotic mass of mud and rock. 111 houses and 457 persons were overwhelmed and seen no more.

The occurrence of all these catastrophes in September points to a common cause, the overcharging of the steep mountain slopes with water after periods of unusual rain.

The Brooks Denning Comet.

The new comet in Leo, discovered independently by myself, on the morning of October 4, at 2 hours 45 minutes—civil reckoning—and by Mr. Denning, of England, the following morning, has been observed at the Harvard College Observatory and at Dun Echt, Scotland.

From these observations Prof. S. C. Chandler, of the Harvard Observatory, has computed and just sent me the following elements and a finding ephemeris:

ELEMENTS.

Perihelion Passage, 1881, September 3.47. G. M. T.
 Long. Perihelion, $20^{\circ} 15'$
 Long. Node, $82^{\circ} 29'$ Eq. 1881.0.
 Inclination, $10^{\circ} 25'$
 Log. Perihelion Distance, 9.8605.
 Motion direct.

EPHEMERIS.

Wash. midnight, 1881.	h.	m.	s.	—R.A.— Decl.	Log. r .	Log. Δ .	Light.
Oct. 12.	9	41	12	+14 50	0.0222	0.0636	0.71
16.	9	49	24	14 53	0.0438	0.0751	0.61
20.	9	57	4	14 56	0.0648	0.0857	0.53
24.	10	4	0	+15 0	0.0858	0.0946	0.46

Light on October 4 is taken as unity.

On the 20th and 24th inst. the comet will be just above and within three degrees of Regulus, and will move very slowly eastward from that point. It is growing fainter, being at the last named dates about one-half as bright as when first seen at my observatory. It is suggested by Mr. Chandler that it may prove to be a periodic comet of about six years eleven months, and observations with large telescopes will be of great value in determining this interesting point.

It was well seen by me at discovery, in the absence of moonlight, with a telescope of five inches aperture.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
October 15, 1881.

A Singular Accident.

The engine house of the Nightingale Brothers' silk mill in Paterson, N. J., was demolished by the bursting of a flywheel, October 19. Pieces of casting weighing five or six hundred pounds were thrown half a block away, but fortunately no lives were lost. The engine, of about 100 horse power, had lain idle for years, a smaller one having been used since the mill was turned from a cotton to a silk factory. The addition of new machinery, however, required the use of the big engine for additional power, and machinists had been at work on it several days. On Tuesday afternoon it was run experimentally, and seemed to go all right. The governor was arranged for it to make 60 revolutions a minute. Wednesday morning, when the fireman started up the boilers, the engine started off on its own account and could not be stopped, as the steam supply valve was already closed, and there was no apparent reason for its going. It continued to increase its speed until it was estimated that it was running at the rate of 150 revolutions a minute. The limit of safety was considered to be 75 revolutions. In alarm the few men about the building fled for their lives, except fireman Carlough and a workman named James Killen, who were still trying to turn off the steam valve, when the flywheel broke and the pieces flew in every direction. The flywheel was 15 feet in diameter, and weighed eight tons. The engine house, which was about 30 by 15 feet and two stories in height, was almost demolished. The cause of the engine's sudden starting was discovered to be a fracture in the seat of a new supply valve in the main steam pipe leading to the engine. In shutting off steam on Tuesday night it is supposed the pressure broke off the fractured seat, which left the pipe open for the passage of steam from the boiler.

Another Keely Motor Exhibition.

Keely has just given another exhibition of his celebrated motor, or, rather, of a combination of cylinders, plungers, pumps, globes, and connecting rods, somewhere within which his motor was alleged to be at work. The trial was a very peculiar one. This motor has been threatening, for the last six years, to run a train of cars to New York and a vessel to Liverpool on about a cupful or bucketful of water. What Keely actually did was to turn a wheel, as one experiment; to fire a bullet through three inches of plank as another; and to perform two or three other trivial feats, any of which could be produced by a very ordinary use of very

familiar forces. When it is added that the exhibition was given in Keely's own workshop, and that the room directly underneath, also occupied by him, was kept locked and bolted, and that he refused, in some confusion, to allow his visitors even to look into it, the value of the trial is obvious. To make the thing complete, the inventor, before each experiment, scraped a large tuning fork with a fiddle bow, in order to get the right pitch for the motor, which was hinted to be derived from the force of cohesion. Instead of the presto! agrimento! change! of mere conjurers, Keely gave an explanation that, by means of the introductory impulse and the fifth compound, he so impinged on the molecular lead as to disturb the equilibrium, and then to multiply the atomic ether or liberated interatomic impulse. The only thing in the workshop, visible or invisible, which the assembled party seemed to understand, was the collation. But there is no denying the fact that by dint of some qualities Keely has kept this sort of thing going for six years, and that he still finds stockholders who have abundant faith in him.—*N. Y. Sun.*

New York Board of Health Rules for Plumbers.

Under the new law for the registration of plumbers and the inspection of plumbing by the Board of Health, the board has adopted the following regulations:

Whenever any plumbing work is completed, and before it is covered from view, the board must be notified in order that it may send an inspector. The arrangement of soil and waste pipes must be as direct as possible. The drain, soil, and waste pipes and the traps should, whenever practicable, be exposed to view for ready inspection at all times. When placed within walls or partitions they should be covered with woodwork fastened with screws, so as to be readily removed. In no case should they be absolutely inaccessible. Every house or building must be separately and independently connected with the street sewer by an iron pipe calked with lead. The house drain must be of iron, with a fall of at least half an inch to the foot if possible. It must be provided with a running trap placed at an accessible point near the front of the house, and there should be an inlet for fresh air entering the drain just inside the trap of at least four inches in diameter, leading to the outer air, and opening at any convenient place not too near a window. No brick, sheet metal, or earthenware flue shall be used as a sewer ventilator, nor shall any chimney-flue be used for this purpose. Every soil pipe and waste pipe must be of iron, and must extend at least two feet above the highest part of the roof or coping, of undiminished size, with a return bend or cowl. Horizontal soil and waste pipes are prohibited. All iron pipes must be sound, free from holes, and of a uniform thickness of not less than one-eighth of an inch for a diameter of two, three, or four inches, or five thirty-seconds of an inch for a diameter of five or six inches. Before they are connected they must be thoroughly coated inside and outside with coal tar pitch, applied hot, or some other equivalent substance. Iron pipes, before being connected with fixtures, should have openings stopped and be filled with water and allowed to stand twenty-four hours for inspection.

All joints in the drain pipes, soil pipes, and waste pipes must be so calked with oakum and lead, or with cement made of iron filings and sal-ammoniac, as to make them impermeable to gases. All connections of lead with iron pipes should be made with a brass sleeve or ferrule, of the same size as the lead pipe, put in the hub of the branch of the iron pipe, and calked in with lead. The lead pipe should be attached to the ferrule by a wiped joint. Every sink, basin, wash tray, bath, safe, and every tub or set of tubs must be separately and effectively trapped, and the traps must be placed as near the fixtures as practicable. Traps should be protected from siphonage by a special metallic air pipe not less than one and a half inch in diameter. Every safe under a washstand, bath, watercloset, or other fixture must be drained by a special pipe not directly connected with any soil pipe, waste pipe, drain, or sewer, but discharging into an open sink upon the cellar floor or outside the house. All water-closets inside the house must be supplied with water from a special tank or cistern, the water of which is not used for any other purpose. The closets must never be supplied direct from the Croton supply pipes. A group of closets may be supplied from one tank, if on the same floor and contiguous. The overflow pipes from tanks should discharge into an open sink or into the bowl of the closet itself, not into the soil or waste pipe, nor into the drain or sewer. When the pressure of the Croton is not sufficient to supply these tanks a pump must be provided. Rain water leaders must never be used as soil, waste, or vent pipes, nor shall any soil, waste, or vent pipe be used as a leader. No steam exhaust will be allowed to connect with any soil or waste pipe. Cellar and foundation walls should be rendered impervious to dampness by the use of asphaltum or coal-tar pitch in addition to hydraulic cement. Yards and areas should always be properly graded, cemented, flagged, or well paved, and drained by pipes discharging into the house drain. These pipes should be effectively trapped.

A Steel Tube for the English Channel.

A grand scheme is said to be in contemplation for crossing the English Channel. A line of steel tubes, sixteen feet in diameter, is proposed, to be sunk and firmly anchored at a sufficient depth below the surface to be out of the way of navigation. It is to be ballasted to overcome the buoyant effect, and secured to sunken caissons by chains.

Superheated Steam.

BY PROF. S. N. CARVALHO.

The vast and continuous increase in the use of steam for motive purposes, particularly during the last twenty years, and the consequent enormous consumption of coal (85,000,000 of pounds per annum) have furnished an incentive to inventors in this direction second to no other of modern times. The well understood fact that the most economical form of steam engine yet devised—considering the boiler and engine as a whole—renders us in useful energy but about 15 per cent of the true energetic value of the fuel consumed therein, presents the considerations of any improvement that may transmute into useful power some greater proportion of the heat evolved by the combustion of fuel, as the most important problem of the present day.

Superheated steam has been demonstrated by the most distinguished engineers, from Watt down to the present day, as the best means of preventing "cylinder condensation," to which has been attributed the true cause for the enormous loss sustained in the use of the steam engine by the present method of using saturated steam. The way this loss occurs is exemplified as follows: With a cylinder in which steam at half-stroke, or 50 per cent cut off, is used—say at any pressure—imagine the steam admitted until the piston reaches half-stroke, the boiler communication closed, and the steam allowed to expand through the rest of the stroke, the exhaust opened, and the piston returned—then upon the steam coming in on the next stroke, we should expect to find the internal surfaces in the same condition as they were at first. But experiments and all experience have shown us, that in the operations which have gone on during the first stroke, the internal surfaces have become chilled to a certain extent, and that a considerable portion of the steam entering is condensed by them, and converted into water.

This fact has been shown by Isherwood in his experiments, made with great care and expense, and the result has been found to be nearly 39 per cent loss, at half cut off—and the best engineers now estimate that about one-third of the fuel is wasted in this way. The only known remedy for the prevention of cylinder condensation is the proper use of superheated steam, by which one-third of eighty-five millions would be about twenty-seven millions of tons of coal per annum, amounting to nearly \$100,000,000 per annum.

Let us give an example of the manner in which superheated steam acts in the cylinder. First, it follows a different law from saturated steam; it is governed by Marrotte's law of gases and air. You can, by the addition of 480° of heat to the steam in a separate vessel, or superheated, double its volume and also its pressure; if it were attempted to raise steam in a boiler to 692° , it would have to be strong enough to stand a pressure of 2,500 lb. to the square inch. Superheated steam is the safest and most economical method of using steam.

One pound of water heated in a boiler to 212° is, by the addition of 966 units of heat, converted into 1,720 volumes of steam at atmosphere pressure. The 1,720 volumes may be taken as the measure of the available mechanical force—the 966 units of heat are worth 1,720 volumes of steam. Now, if these 1,720 volumes of steam at 212° be raised 480° higher, or to 692° , you will have 3,440 volumes of steam at double the pressure, or 15 lb. to the square inch. The 480° used upon the steam has given you the same quantity as 966 units used upon the water.

How much heat is required to raise 1 lb. of steam 480° ? The specific heat of water is 1,000—the specific heat of steam is 0.475, or a unit of heat will raise 1 lb. of water 1° —and 1 lb. of steam 2° . But in our case, suppose the steam was raised 480° , and now it is evident at a cost of 240 units of heat, the 240 units of heat used in superheating have done the work of 966 units used upon water; heat goes four times further on steam than it does on water—if the heat costs the same as when used upon water, the clear gain is 25 per cent.

The primary causes of cylinder condensation are external and internal radiation of the metallic surface—conversion of heat units into work—and conversion of heat into work done during the first rush of the steam from the cylinder after the opening of the exhaust. A further economic effect is produced by the great increase of volume of steam caused by the addition of superheat. If 400° is required in the cylinder (which it is perfectly safe to use) at one-half cut off, it would be necessary to have your steam in the superheater at about 596° , so that having it expanded down to 400° at the half cut off, you not only suppress entirely cylinder condensation, with its enormous save, but you increase your power about one-sixth.

The *modus operandi* of superheated steam in the cylinder is this: All superheat is given off before condensation commences; the moment the superheated steam enters the cylinder the superheat is absorbed by the metallic surfaces. The piston is now propelled, with steam less the superheat, to the point of cut off. When a portion of the steam is converted into work, and the balance expanded into the remaining half of the cylinder, now the superheat absorbed by the metallic surfaces (upon the principle that all things in nature seek their equilibrium) gives out its superheat to the devitalized steam, revivifies it to a condition to enable it to perform the other half stroke, and the exhaust is then discharged at saturation. Steam used in this way makes the modern steam engine the most perfect in the world. It enables the maker to exhibit it as a real steam engine, and not one working half water.—*American Railroad Journal.*