oxen, where it was joined to a wooden yoke; this was again strapped round the bodies and necks of the horses, or tied to the horns of the oxen. The addition of bridles and reins would complete the simple harness. Some horses were attached to the pole by an iron bar with knobs at each end, which passed through a ring at the end of the pole, and through a similar ring upon each of the pads or saddles of the horses. This would be very similar to the currie bars used in modern time, and would allow of more freedom in motion than a fixed yoke would give. The bodies of these chariots, in Egypt at least, were small, usually containing but two persons standing upright. It may be remarked that, as they were so small, they could not have been of much use, and from the small size of the wheels, too, they would be jolted by every little obstacle on the road; and, as they were so near the ground, those using them would be exposed to mud and dirt; yet, in spite of these objections, they were used in vast numbers. They were very light, and could be driven at a great speed—nearly as fast as the horses could gallop. They were narrow, and, therefore, suitable to cities in which the streets are still very narrow, and to mountain roads which were often only 4 feet wide. They suited the period and the people, or their usefulness would not have lasted 2,000 years. According to Homer, a strong man could lift a chariot on his shoulders and carry it away. Possibly this would be without the wheels, but even then it could not have been heavier than one of our wheelbarrows. From Egypt the use of chariots spread into other countries, and they were used in war in large numbers upon the extensive plains of Asia. We read of the 900 chariots of Jabin, king of Canaan; that David took 700 chariots from the kings of Syria, and 1,000 from the king of Zobah. Solomon had 1,400 chariots, and his merchants supplied northern Syria and the surrounding countries with chariots fetched up out of Egypt at 600 shekels (about £50) apiece. They were not the first nor the last merchants who have preferred their pockets to their patriotism, and supplied nations who might become their country's enemies with the weapons of warfare. Solomon, we find in the Song of Solomon, built a state or wedding chariot of cedar with pillars of gold, probably supporting a canopy. We may also notice the poetic description by the prophet Nahum of the future state of Nineveh, no longer to echo "to the noise of the chariots raging up and down the paved streets, jostling against one another in the broad ways, with the crack of the whip, the rattle of the wheels, the prancing horses and the jumping chariots;" and the remark in another place of "the stamping of strong horses, the rushing of the chariots, and the rumbling of the wheels," all pointing to the great impression which was made upon the prophet of the wilderness by the carriages and noise of the crowded city. In a museum of New York is a wheel of an Egyptian chariot, found in a mummy pit at Dashour, by Dr. Henry Abbott. It is 3 ft. 3 in. high, the nave is 14½ in. long, and 5 in. in diameter, and worked upon an axle of wood which tapered, and was from 3 in. to 2½ in. in diameter. The unusual size and length of this axle arm would be very apparent in so small a vehicle as the Egyptian chariot; the spokes, six in number, are 2 in. by 1½ in. at the nave, and taper towards the felloe to 1½ in. round; it has a double rim all round. The six inner felloes do not meet as in modern wheels, but are spliced one over the other, with an overlap of 3 in.; the felloes are 1½ in. square. The outer rim is formed also of six felloes, but they are tenoned together, and are pierced all round the lower edge with small holes, through which, we may well conjecture, leather thongs passed, binding the outer to the inner rim. The total depth of the double rim is 3½ in. by 1½ in. to 1¼ in. in width. From the ancient sculptures preserved from Nineveh and Babylon, some of which are in the British Museum, we observe the use of chariots was continued in the great plains, for the purposes of hunting as well as for war. The chariots of Assyria were larger than those of Egypt, and would carry three or more persons; they seem, too, much heavier in the build. The Greeks used chariots, and at the siege of Troy, which Homer has immortalized in his poem, all the chief warriors on both sides are described as going into battle and fighting from their chariots. As years passed on, however, the Greeks no longer used chariots for war, but only for processions in public on state occasions, or in their great races, or for the amusement of their leisure hours. Erechtheus, king of Athens, is reported to have been the first to drive four horses in a car; afterwards it became common to use, in the races, four horses attached to each car. The Grecian chariots were all curved in front, and were rather larger and on higher wheels than those used in Egypt.

The Roman nation, as it increased in power, adopted the car, which had also been for many years in use by the Etrurians, a neighboring country to their own in the Italian peninsula. The Etrurians were traditionally the first to place a hood or awning over the open two wheeled car; they decorated both the car and the awning with that beautiful tracery and ornamental bordering which is familiar to us from the copies of their pottery. The Roman car was chiefly used in the cities, and for purposes of show and state rather than for daily use. A beautiful marble model of one of these still exists at the Vatican of Rome; a copy of it and the horses drawing it is in the Museum of South Kensington.

Besides the chariots, the Romans had other two-wheeled cars, and four-wheeled wagons of different shapes, and giving different accommodation; but first they were kept for conveying agricultural produce, and for moving goods and baggage, and the better sorts were reserved for the conveyance of the mages of their gods and vestal virgins in religious processions. Then came the triumphal processions of successful military commanders, and a variety of vehicles conveyed the conqueror, the captives, and the arms and valuables taken from the enemy. Plutarch tells us that Emilius, the Roman Consul, had 750 wagons in his triumph in the year 170 B. C., bearing the spoils of Perseus, last king of Macedonia. On the column of Trajan at Rome is modelled one of these wagons. It is a large square basket on four wheels, the back a little higher, and the hind wheels also are a very little higher than the front.

Roman history, of the time of Camillus, 350 B. C., mentions a carriage termed a pilentum, as a splendid four-wheeled carriage with a covering to it, and with seats suspended by straps. The use of these pilenta was allowed as a special favor to a few great Roman ladies. The Empress Agrippina also had a carpentum, an elegantly carved carriage on two wheels, the arched covering of which was supported by four female statues; it was drawn by two mules. The Romans also used basterna, which were litters or couches with low coverings, carried on poles by horses or mules; and lectica, or litters carried by men only. The Roman chariot was called a currus.

Herodotus (450 B. C.), and other writers tell us of the vehicles of the ancient Scythians. These were a race of people who inhabited the country near the Caspian Sea, and wandered about with large herds of cattle and horses. They used a

rough two-wheeled cart which consisted of a platform, on which they placed a covering shaped like a beehive, and composed of basket work of hazelwood covered with skins of beasts or thatched with reeds. When they were stationary in any part, these beehive huts were taken off the carts and placed upon the ground to serve as their dwellings, like gipsy tents.

The war chariots used by the Persians were larger and more unwieldy than those previously built. The idea seems to have been to form a sort of turret upon the car, from which several warriors might shoot, or throw their spears. These chariots were provided with curved blades or scythes projecting from the axletrees. The Persians had also cars that were used for state processions, in which the king or noble was raised above the crowd among which he passed on a sort of throne of many steps.

The Dacians, who inhabited Wallachia on the Danube and part of Hungary, were conquered by the Romans about the year 300. Their cars are sculptured upon Roman monuments, and resemble the Persian cars. They are on two wheels and drawn by two horses; the shape is that of a large square box or chest, with a smaller box upon it, which formed a seat for the passengers. The spokes of the wheels are six in number, and are widest at the ends supporting the rims of the wheels. A Dacian car of this sort is represented upon a fragment of terra cotta in the British Museum.

Alexander the Great, King of Macedon, invaded Asia and advanced to India; he was met upon the banks of the river Indus by King Porus, in whose army were a number of elephants of large size, and also several thousand chariots; each chariot carried six persons; but the historian notes that in a soft soil or in rainy weather it was difficult for these vehicles to move quickly. On Alexander's return from India towards Persia, he travelled in a chariot drawn by eight horses, on which a square stage or platform was erected and covered in by a tent. His car was followed by an innumerable number of others, covered with rich carpets and purple coverlets; some shaped like shells or cradles were shaded with the branches of trees. I have seen a drawing of a Persian car in which the body is raised above the wheels and seems to swing from pivots like a large cradle, or such a cot as is used on board ship. After Alexander's death a funeral car was prepared to convey his body from Babylon to Alexandria, in Egypt, a distance of several hundred miles, which car perhaps has never been excelled in the annals of coach building. It was prepared during two years, and was designed by the celebrated architect and engineer, Hieronymus. It was 8 ft. long and 12 ft. wide, on four massive wheels, and drawn by 64 mules, eight abreast. The car was composed of a platform with a lofty roof supported by 18 columns, and was profusely adorned with drapery and gold and jewels; round the edge of the roof was a row of golden bells; in the center was a throne, and before it the coffin; around were placed the weapons of war and the armor that Alexander had used. This car was thought so much of that several historians have described it, and there are various plans of its appearance, one of which may be seen in Ginzrot's work on ancient carriages in the British Museum library.

(To be continued.)

MM. PELOUZE AND AUDOUIN'S NEW APPARATUS FOR THE MECHANICAL CONDENSATION OF THE LIQUEFIABLE MATTERS IN GASES OR VAPORS.

By M. FELIX LE BLANC.

(Report presented to the "Société d'Encouragement pour l'Industrie Nationale," on behalf of the Chemical Arts Committee.)

This is a new apparatus, designed by MM. Pelouze and Audouin, of Paris, with a view of obtaining a more perfect condensation of the tar produced in the manufacture of illuminating gas, but equally applicable for the condensation of the various liquefiable matters contained in other gases or vapors.

The apparatus employed up to the present time for the condensation of these matters has been generally based upon the lowering of temperature resulting from the contact of these matters with surfaces of very large area, cooled by a great body of water or by a large volume of air. Frequently, a current of liquid is made to act upon the gas, which is con-

ducted methodically through serpentine pipes, condensers, scrubbers, etc.

In the manufacture of illuminating gas, by means of the distillation of coal, the condensation is almost exclusively obtained with the aid of apparatus arranged on these principles. This condensation is efficacious merely by reason of the cooling imparted to the vapors existing in suspension in the gas at a more or less elevated temperature, after the manner of steam in atmospheric air. Recourse is occasionally had to another method, based upon the compression of the gas; this method is, however, but rarely employed, except in the manufacture of what is called portable gas, obtained almost exclusively by the distillation of bituminous schists called Boghead.

The process proposed by MM. Pelouze and Audouin is based upon an essentially different principle. Impressed, like most chemists, with the difficulty of avoiding the transport to a distance, and in a liquid state, of globules or vesicular vapors, and of arresting them while on their passage,

before the arrival of the gas at the purifier, they have proposed to effect this by bringing these vesicles into contact with solid surfaces, after having caused them to traverse, under a pressure of at least from 50 to 60 millimètres (2 to 2½ inches) of water, a series of narrow orifices made in metallic plates.

The apparatus may be constructed of a rectangular or a cylindrical form, of sheet iron, and having thin sides. These are pierced with several sets of small holes. The streams of gas having traversed these orifices, are projected against a fixed solid surface placed close to the perforated plates.* The liquid globules carried forward are wire-drawn in the course of their passage through the holes, and afterwards consolidating on coming in contact with the flat surface, soon acquire sufficient weight to cease to remain in suspension; they therefore flow down in the form of a liquid easy of collection in proportion to the rate at which it is produced.

The above engraving shows the arrangement of the apparatus. The arrows *fff* indicate the direction of the gases or vapors. The lines *ee*, shown between the plates, A and B, represent the form presumed to be taken by the jets of gas which have come in contact with the screen after their passage through the orifices. A A are plain surfaces, forming screens, on to which the gas is projected. B B are small circular orifices to allow of the escape of the gases or vapors. C C are the outlets for the products of condensation. This mechanism renders the condensating action instantaneous, and the tarry matters, which had not before undergone decomposition by cooling during their long passage in contact with large refrigerating surfaces, now become liquefied, and flow away in the space of a few millimètres.

Experience has taught us that in gas works it is impossible for the gas to reach the purifiers divested of the tar it holds in suspension, notwithstanding its somewhat long journey from the hydraulic main through the condensers, scrubbers, etc. It is true that the tarry matters carried forward condense on coming in contact with the purifying material, but little by little they clog up the oxide of iron, and thus render the purifying process less perfect and more costly.

It can be easily shown that illuminating gas, on its arrival at the purifiers, still holds in suspension tarry matters which could not be precipitated by the simple process of cooling. To do so it is sufficient to pass a stream of gas, under a pressure of at least two or three inches of water, through a narrow orifice in a funnel-shaped vessel. A piece of white paper, placed over the wide orifice of the funnel, and made to receive the full force of the current of gas, is instantaneously blackened by a deposit of tarry matter. This deposit ceases to be produced, and the paper remains white, when the gas submitted to this test has been previously passed through MM. Pelouze and Audouin's condenser. We submit to the Society's notice a number of test-papers, which have been acted upon by the gas, both before and after its passage through the condenser. In the former case, the disc of paper is invariably blackened; in the latter case it remains white.

The experiments made in the works of the Paris Gas Company during the coldest weather of last winter were most conclusive. At the Ternes station, especially, the condensers, which are of considerable extent, and the coke scrubbers, proved inadequate to deprive the gas of the whole of the tar it held in suspension. This could only have been done by the employment of very small wetted pebbles, which would leave narrow spaces between them; but with this arrangement the scrubbers would be rapidly obstructed. Now, under the previously cited conditions of temperature, the mechanical condenser, placed after the refrigerators, acted most efficaciously in completing the condensation of the tar.† Thus the apparatus which is the subject of this report solves, with very great simplicity, the problem of the condensation of the tar by impingement.

Figs. 1 to 5 are representations of MM. Pelouze and Audouin's new condenser, which has already been erected in a great number of works.

Fig. 1 represents in elevation the condenser connected with the gas-main on the works. A is a differential pressure-gauge indicating the pressure absorbed by the gas through the perforated sides of the condensation cylinder.

Fig. 2 is a plan of the condenser corresponding with Fig. 1. B is the gas inlet-valve; C, the outlet-valve; D, a check-valve for allowing the gas to pass direct into the main in the event of the stoppage of the condenser for cleaning, repairs, etc.

Fig. 3 is a vertical section of the condenser: *a* is a cylinder of perforated sheet iron, constituting the condenser; *b*, channel or annular space in which the cylinder moves and the tar produced by condensation accumulates; *c*, receptacle for the tar overflowing from *b*; *d*, inlet for the gas charged with tar; *e*, outlet for gas after purification; *f*, pipe, terminating in a syphon, for carrying away the products of condensation falling into the receptacle *c*; *g*, guide with hydraulic seal and counterbalance weight, allowing of the variation in the movements of the cylinder (which is also a self-acting regulator) proportionately to the quantity of gas produced at any time during the day; *h*, pipe by which the channel *b* is filled when the apparatus is put into action; *i*, pipe for emptying the channel *b* for cleaning or repair; *j*, graduated scale for indicating the height of the cylinder out of the hydraulic seal.

Fig. 4 shows portions of the plate of perforated sheet iron forming the sides of the cylinder, and Fig. 5 is a transverse section of the plates; *k* represents the perforated plate which divides the gas into jets; *k'* is the second plate, presenting a series of plain surfaces corresponding to the openings in the plate *k*, and against which the gas is projected.

Before arriving at the purifiers, the gas passes through the vertical sides of the sheet iron condensation cylinder, which is of relatively small size; a single one of about 35 cubic feet capacity suffices for gas works producing 3¼ million cubic feet of gas per 24 hours; and the apparatus acts equally well whether the works are provided with exhausters or not. The openings in the cylinder should be proportionate in number to the volume of gas required to pass through the apparatus in a given time.

In order to obtain as complete a condensation as possible, the inventors have added to the first set of plates, with which

* In gas works MM. Pelouze and Audouin place their condenser after the refrigerators, in the position usually occupied by the coke scrubbers, although they state that if the apparatus be fixed at the outlet of the hydraulic main—that is to say, made to act upon a very hot gas (having a temperature of about 60° C.), it is capable of arresting the whole of the tar. To work under the best conditions, the condenser ought to receive the gas coming from the refrigerators at a temperature of 15° C., which is about the average temperature of the subsoil.

† Chemists well know the difficulties which present themselves when the absolute desiccation of a gas in motion is required, as well as the absorption by a liquid reagent of an absorbable gas disseminated in small quantities in a relatively large volume of nonabsorbable gas; as, for example, carbonic acid in atmospheric air. It would be impossible to succeed by causing the gas to bubble through the absorbent liquid. More than 35 years ago, M. Boussingault overcame this difficulty by making the gas pass through long columns of finely granulated matter (pumice-stone), which was wetted with the absorbent liquid. These means are still employed in all chemical laboratories. They would succeed for the condensation of the tar, but in commercial practice the inconveniences above mentioned would quickly manifest themselves.

the gas first comes in contact, a second set, which are placed close to the others, so that the stream of gas may sustain two successive collisions against the screens, the effect of which is to produce absolute condensation. As the plain portions only of this second set of plates are brought into action, the inventors have considerably enlarged the diameters of the openings, in order to facilitate the flow of the condensed tarry matters. This arrangement, which has been recently adopted, is found to be very successful.

It was of importance to render the apparatus self-acting; that is to say, to so arrange it as to ensure the passage of a greater quantity of gas whenever the production of the works increased. The cylinder, properly balanced, is capable of acting as its own regulator. For this purpose it moves in a hydraulic seal, which allows of the closing of those gas passages which are not required to be in action. When the pressure increases—and this will correspond to an increase in the production of gas—the cylinder rises, and a larger number of openings are uncovered to allow the gas to pass through.

At the expiration of a certain time, variable according to the nature of the tar produced (once or twice a year at least, or at most once a month), the apparatus should be cleaned. This may be effected in a few minutes by immersing the cylinder in a bath of boiling water, which liquefies any tar that may be obstructing the orifices. (If required, a thin stream of vapor may be supplied from a small serpentine pipe, placed in the channel, to prevent the tar from falling to too low a temperature.) An inspection of the pressure-gauge will indicate when this operation has become necessary, the

A NEW AND REMARKABLE GAS BURNER.

At a recent meeting of the Manchester Chemists and Druggists' Association, Mr. John Wallace exhibited a series of gas burners of the Bunsen or atmospheric type, by which he demonstrated that very high temperatures could be obtained from coal gas without the aid of either blowpipe or chimney draught. The chief feature of the Wallace burner is a cylindrical cap of finely perforated metal fitting over the top of the tube, and made adjustable to various heights, so as to regulate by back pressure the quantity of air drawn in by the jet of gas to be mixed with it previous to combustion. As the perforations in the cap are too small to allow the passage of a flame downwards, a much more inflammable mixture of air and gas may be burned than would be possible with another form of burner. The result of this arrangement is that a flame may be obtained which is perfectly solid, containing no hollow conical space within, as is usual with all other round flames; it burns with a temperature of over 3,000° F., and its peculiarities involve a new theory in the structure of flames. Instead of a dull blue color within, it presents to the eye a spectrum of the most intensely brilliant green at that part of the flame where combustion commences. Above this the flame is of an amber color, and combustion is so complete that it makes no stain if played upon a white porcelain plate.

The tubes of the burners exhibited varied in diameter from $\frac{1}{4}$ in. to 2 in., the largest burning 30 to 35 cubic feet of gas per hour in a manner as completely as did the smallest.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

CONDENSING APPARATUS FOR LIQUEFIABLE MATTERS IN GASES.

fouling of the apparatus causing an increase of the normal pressure over that which is required for its proper working.

In an experiment made at the Ternes station of the Paris Gas Company, which, as we have said, is provided with powerful refrigerators, and produces 100,000 cubic metres (about 3½ million cubic feet) per 24 hours, 253 kilogrammes (556 lbs.) of tar, and 30 litres (6½ gallons) of very rich ammoniacal liquor were obtained at a relatively low temperature. These quantities represent a period of production of 28,200 cubic metres (about one million cubic feet) of gas. The quantity of tar contained per 1,000 cubic metres (35,300 cubic feet) was, therefore, 8.9 kilogrammes (about 19½ lbs.). From 9 to 10 kilogrammes (20 lbs. to 22 lbs.) of tar condensed by the effects of collision may be allowed per 1,000 cubic metres of gas, when the temperature is relatively low, and when the works are already provided with tolerably powerful cooling apparatus.

It is clear that the new condenser may be employed otherwise than in gas works, either for obtaining dry steam, or for arresting the liquid globules and particles of solid bodies carried away simultaneously during the evaporation of liquids. These applications of the apparatus have been foreseen by the inventors.

Quite recently, MM. Chev and Girard, manufacturers of acetic acid and wood spirit, have adopted MM. Pelouze and Audouin's condenser at their works at Courville (Eure-et-Loire), and are quite satisfied with its employment in the treatment of the products of the distillation of wood. It may also serve, as indicated by the inventors, to arrest the metallic or other dust arising from certain manufactures; this is done by damping the walls of the apparatus, or by sending into the gaseous current a jet of spray.—*Journal of Gas Lighting*.

One of the $\frac{1}{4}$ in. burners was perforated with half inch air holes for its whole length, and yet burned gas above the cap with a heat which rendered a twisted mass of platinum wire immediately incandescent. A link of $\frac{1}{4}$ in. wire was added to a chain of copper and the joint of the link fused together by simply suspending it over the flame. The gas in all experiments was taken direct from the chandelier of the room. By careful experiments made with the test apparatus of the Newcastle-on-Tyne Gas Company, Mr. Wallace found he could mix previous to combustion 4½ volumes of air in his burner with gas whose total combining quantity was 6½ volumes. The experiments concluded by the exhibition of a singeing flame.

A one inch burner was made to burn within the end of a piece of 3 in. stove pipe 4 feet long. The loud monotonous roar which followed, although it crowned the experiment with success, showed that the title was a complete misnomer.

MINING AND METALLURGY IN THE UNITED STATES.

In order that a clear idea may be formed as to the relative position now held by the United States in the world of mining and metallurgy, I have selected the production of coal, which is the main reliance for power of all organized industry, and of iron, which is the chief agent of civilization, as the basis of comparison with other nations, using, so far as coals concerned, the figures given in the Forty-third Annual Report of the Philadelphia Board of Trade, for the year 1873:

	Tons.	Per Cent.
Great Britain	127,016,747	46.4
United States	50,512,000	18.4
Germany	45,335,741	16.5
France	17,400,000	6.4
Belgium	17,000,000	6.2
Austria and Hungary	11,000,000	4.0
Russia	1,200,000	0.5
Spain	570,000	0.2
Portugal	18,000	—
Nova Scotia	1,051,567	0.4
Australia	1,000,000	0.4
India	500,000	0.2
Other countries	1,000,000	0.4
	273,704,055	100.0

The following estimate, in round numbers, of the world's present production of iron is taken from various sources, and may be considered approximately correct. The figures for Great Britain and France are those of 1874, and the product of the United States for the same year has been taken. For other countries the estimates are principally for 1871 or 1872, except Austria and Hungary, for which the official returns for 1873 have been taken:

	Tons.	Per Cent.
Great Britain	5,991,000	45.2
United States	2,401,000	18.1
Germany	1,600,000	12.1
France	1,360,000	10.3
Belgium	570,000	4.3
Austria and Hungary	365,000	2.7
Russia	360,000	2.7
Sweden and Norway	306,000	2.3
Italy	73,000	0.5
Spain	73,000	0.5
Switzerland	7,000	—
Canada	20,000	0.2
South America	50,000	0.4
Japan	9,000	0.1
Asia	40,000	0.3
Africa	25,000	0.2
Australia	10,000	0.1
	13,260,000	100.0

An examination of these tables will serve to show that, in the products which measure the manufacturing industry of nations, Great Britain stands first, the United States second on the roll, and that there is a clear and almost identical relation between the product of coal and the product of iron. The United States now produces as much coal and iron as Great Britain yielded in 1850. We are thus gaining steadily and surely upon our great progenitor, and in the nature of things, as the population of the country grows, must, before another century rolls around, pass far beyond her possible limits of production, and become the first on the international list, because we have the greatest geographical extent, and our natural resources are upon so vast a scale that all the coal area of all the rest of the world would only occupy one-fourth of the space in which, within our borders, are stored up the reserves of future power.—*Centennial Address of Hon. Abram S. Hewitt*.

COMSTOCK BONANZAS.

In common with all other mineral lodes a portion of the vein material of the Comstock is poor and a portion rich. When the ore is found concentrated in a large and connected body, this body is called a "bonanza." The word is similar in meaning to the terms "pocket," "shute," "chimney," "ore body," etc. Because of the great size of these Comstock ore bodies, as compared with any other known ones in the West, the Spanish term was used as something grander, precisely as "canyon" is used to speak of a deep and narrow gulch.

It is these bonanzas, says the *Mining Review*, that have been the source of both the riches and the reputation of the Comstock. If the veins were laid down flat and their area measured, it would be found that they measured about one fourth of the superficial area of the lode. Measured cubically, they compare with the solid contents of the vein as about one to twenty-five. The general form has been somewhat egg shaped, though presenting quite irregular boundaries, and their dip has been generally to the south. There appears, however, but little regularity in their formation. It must not be supposed that outside of these great ore bodies the vein is barren. Connecting them, and running through other parts of the vein, are often found smaller veins of good quartz, but owing to the gigantic scale upon which mining is carried on at Washoe few of these narrow streaks can be worked to any profit. They are good encouragers, however, and often pay nearly for their own extraction. But the many miles of drifts and shafts in the great vein that have been driven through barren ground for prospecting, ventilation, and other purposes, are evidences of the cost and labor required to find the pay, while at the same time its enormous production, as compared with the total cost, proves that the investment has on the whole been exceedingly profitable.

The following list of the bonanzas of the Comstock will be interesting to all who are watching the marvellous history of that mammoth vein:

1. Ophir and Mexican.—Discovered on the surface, and extended 500 feet in depth. Average width of ore, 15 feet; cubical contents, 112,000 tons; approximate value of ore, \$22,000,000.
2. Gould & Curry.—Extended from the surface to the depth of 500 feet. Average width of ore, 15 feet; length along the vein, 560 feet; cubical contents, 190,000 tons; value of ore, \$37,500,000.
3. Savage.—This was a continuation of the Curry bonanza, but not so rich. The ore continued down in the Savage claim to the very bottom of that mine, which is now 2,300 feet below the outcroppings.
4. Hale & Norcross bonanza.—This body was struck at a depth of 450 feet. It averaged 10 feet in width, was about 200 feet long, and stretched down to the 1,200 foot level. Cubical contents, 75,000 tons; value, \$5,500,000.
5. Chollar Potosi bonanza.—Struck at a depth of 500 feet; width of the vein worked, 100 feet; has extended with but few interruptions down to the present bottom of the mine, which is over 1,700 feet. Cubical contents, 1,500,000 tons; value, \$24,000,000.
6. Gold Hill bonanza.—This body extended from the surface to a depth of 500 feet, and for 300 feet on the vein. Contents, 300,000 tons; value, \$10,000,000.
7. Yellow Jacket bonanza.—Discovered on the surface and extended downward for over 700 feet. The ore on this