

"I admire your spirit," he said, coarsely, "I should soon tire of a bride who had no will of her own. But I am about to try your nerves a little. Look down over this precipice."

He drew the trembling form forward; she gazed for a moment over the cliff and then drew back with a shudder.

"It is a pokerish place," he said, smiling grimly; "but you need not be afraid of falling over. I'm going to keep a fast hold of you."

He drew a long strip of rawhide from the bosom of his hunting frock, and fastened it about the young girl's wrist; and then, lifting her in his arms, swung her over the verge. She closed her eyes, and her face grew pale as death, but no sound came from her bloodless lips.

He lowered her slowly, inch by inch, till her feet touched a narrow ledge of rock jutting out from the ragged wall, scarcely wide enough for a scone football.

Her eyelids opened slowly, and sinking down upon the moss-covered rock, she gazed around.

Stepping back, Hammond tied the end of the rawhide cord to a small oak, and then, looking down at his captive, he said:

"I will return with all possible haste, Miss Marston, as I fear you will soon grow tired of your position. I have not far to go."

Irene answered his mocking speech without looking up.

"Should you be so unfortunate as to meet any of the men who are upon your trail, your return will be soon what is delayed, and I trust that it may be so."

"Thanks," he said lightly "I should deem myself fortunate indeed were I to meet a certain friend of yours—Guy Otis by name—I fear that you would lose a lover and I an enemy." And, turning, he sped along a rocky path which led toward the mountain.

With one hand grasping a revolver in his belt and his eyes scanning each bush and rock in his path, in whose shadow an enemy might lurk, Hammond pursued his way till he reached a small brook which crossed his path.

At its side he halted and gazing carefully around for an instant, stepped into the shallow water and went slowly up the little stream. At length he halted beside a large rock, covered with moss and running vines, and kneeling upon the earth, he brushed aside the many-headed vines, disclosing an aperture into which he crept. In the cavity he stood erect and gazed around the hut, for it had evidently been intended for a habitation or hiding place.

was built of poles and bark, several feet square, with a sloping roof covered with moss and vines in so skillful a manner as to seem a part of the rock itself, against which it leaned. At one side there was a bed of skins, with several traps and rube utensils scattered around. Scooping in one corner, Hammond raised a flat stone, which covered a small cavity in which lay a number of buckskin bags. These, one after another, the border ruffian transferred to the bosom of his hunting frock, a chuckle of satisfaction breaking from his lips as he placed the last in his capacious breast pocket.

Cautiously he left the hut, replacing the vines over the entrance, as he found them, and then sped away, following the little stream's course to the path which led to the cliff where he had left the fair captive.

The sun had sunk behind the distant mountains, and the red glow was fading in the western sky, giving place to the dull gray which precedes darkness. Hammond felt that night would come upon him ere he could start upon his flight, unless his movements were hastened; but he determined at the same time to proceed upon his journey in the darkness, rather than remain till morning in so dangerous a proximity to the town. As he hurried along through the gloom, a dark figure suddenly darted out of the bushes at one side of the path and caught at his sleeve.

With a low exclamation the outlaw started back, one hand seeking the hilt of the bowie knife in his belt. But his fears were allayed, as the figure spoke in a tremulous, boyish voice:

"Martin Hammond, where is my sister?" Hammond shook off the boy's grasp as he answered:

"I know nothing of your sister, Leonard Marsden. How could I?"

"You lie!" the boy cried, his eyes flashing through the darkness, one slender arm upraised. "You have stolen her and carried her away to the mountains. Help!" he shouted. "Here he is! Father! Guy!"

With a savage curse Hammond sprang toward the boy.

"Hush, you young cur!" he exclaimed, in a tone of suppressed passion. "Another word from your lips and I will thrust my knife into your heart!"

But, fearless as a lion, the boy sprang at the outlaw's throat, shouting for help at the top of his voice.

Another curse broke from Hammond's lips as he struck the boy's arms aside, and grasped him by the shoulder with one hand, while he raised his weapon with the other.

Even as the glittering blade descended, the boy grasped the outlaw's arm with both hands, and strove to avert the blow; but his slight strength could avail but little against the athletic ruffian, and in an instant he was crushed down upon the earth, the cold steel grazing his throat.

At this moment there was a hurried tramping through the underbrush close at hand,

and a man's voice rang out upon the night air—

"Leo ard, where are you?" Mar-in Hammond was at heart a coward, and as the manly voice sounded in his ear, he relaxed his hold upon the boy's throat, and in an instant he had twisted himself from beneath the shining blade.

"Here, Guy, here!" he shouted, as soon as he could find his voice.

Foaming with fear and rage, Hammond struck wildly at the boy, and then turned to flee; but his sin was untrue, and the weapon glanced harmlessly off, inflicting no wound. Agile as a practised gymnast, Leonard sprang up, and clashing his arms around the outlaw's neck, clung with all his strength.

Already fleeing through the gloomy forest, pursued by one who had cause to hate him, Hammond did not halt to tear off the boy's clasp, but hurried on as fast as it was possible, burdened with the fatal gold and the boy's slender form, which clung like an incubus to his back.

Again and again he stumbled, but recovering his feet, staggered on until he could hear no sound of his pursuer; then halting, he tore off the boy's clasp with brutal hands, and hurled him, bleeding and so senseless, at the foot of a giant oak, where he lay as though dead.

For a moment the outlaw stood silent, listening for a sound of his pursuer, and soon the hurried rustling of leaves, and crackling of dry twigs, told of the approach of some one moving hastily, and again Hammond turned to fly, with one swift glance at the boy's still form, lying close to the foot of a tree.

On through the forest he rushed with head-long haste for some moments, when suddenly, through the gloom directly ahead, flashed the bright light of a torch, and as he halted in dismay, the man came rapidly forward, and as the light streamed over his form, he shouted—

"This way, boys! Here he is! Halt, you villain!"

But Hammond had turned once more, and was flying as before; and ere many moments another torch appeared in his path.

"I am surprised," he muttered, as he halted to catch breath. "I must fight my way through or be captured. Curse the gold that has brought me into this scrape!"

At this moment another torch became visible through the darkness, and a voice familiar to the hunted man's ear rang out upon the night air.

Answering shouts came from every side of the circle, of which the outlaw was the center, and his bronzed face became pale as death. He looked eagerly around for some hiding place, and through the gloom discerned the massive trunk of a large tree, where gnarled limbs came close down to the earth.

In an instant he stood beneath it, and was about to spring up among the foliage, when his foot came in contact with some yielding substance. Stooping, he laid his hand upon the body of Leonard Marsden, lying where he had hurled it. The body was warm, and as Hammond rolled it over, the boy moaned as in pain.

"He is not dead," the outlaw muttered, "and he may yet serve me to some purpose."

A broad stream of light fell suddenly over and around him, and looking up, Hammond saw two men, the foremost bearing a torch, emerge from the forest and approach him with rapid steps. Another and another appeared, until a dozen men, clad in rough, toil-stained garments, with bronzed faces and grizzly beards, stepped forth from the shadows and advanced, surrounding the tree to prevent the outlaw's escape.

"Martin Hammond, you are surrounded and cannot escape. Will you give up?"

The speaker was a man whose silver hair and beard proclaimed him to be past the prime of life.

"Never!" he hissed between his clenched teeth.

As he spoke the word, a young man, who had spoken first, sprang forward, revolver in hand.

"Back!" cried Hammond, "back, Guy Otis! Another step, and I will blow the brains of this stripling from his skull!" And he raised the boy's slight form and held it before him as a shield, the muzzle of his revolver pressed to his temple.

A low cry of horror came from the young man's lips, and it was echoed by the others.

"Hammond, you have murdered my boy! Oh Leonard, my son, my darling!"

"No, old man," returned the outlaw; "your son is not dead, though his life hangs by a single thread. You cannot harm me without killing him."

"But where is my daughter?" cried the old man, in a trembling voice.

"She is in my power," Hammond answered briefly; "and unless you permit me to go in safety, she will never live to see another day."

Guy's face grew deadly pale, and the grasp upon his pistol was rigid as steel, as he muttered—

"Villain! villain! Oh, that I had you in my power. I would tear your false heart from your bosom!"

"Threats are useless," said the outlaw, coolly, "and I am far from being in your power."

"Oh, Guy, what shall we do?"

And the old man laid his hand upon the young man's shoulder.

Guy Otis stood for a moment silent; then, turning to the stalwart hunters who stood gathered close around, he said—

"Friends, how shall we act? Shall we let this ruffian escape?"

All were silent.

Every one of the rough miners loved Irene Marsden, as they hated her abductor, and no one of them would have scrupled to shoot him dead. But as he stood leaning against the tree, his pale yet determined features shown by the flickering light of the torches, no bullet could reach him without passing within a hair's breadth of his living shield.

But Guy Otis determined to run the risk and suddenly, without a moment's warning, he raised his revolver, his keen eye swept across the sights, and a stream of fire flashed across the muzzle.

A terrible cry of pain and rage echoed through the forest, and then the outlaw turned and sprang into the woods ere a hand could be raised to stop him, leaving the body of the boy where he had fallen when Guy's bullet shattered his arm.

Again the race for life began, and, as before, he who ran to save his life gained rapidly on his pursuers. The moon was rising in the east, and by its feeble light, which grew stronger every moment, Hammond shaped his course toward the cliff. Every moment the sound of his pursuer's footsteps grew fainter, and when at last he came out upon the summit of the cliff, he could hear no sound of him, though he knew he would follow on his track like a bloodhound. At the very verge he halted and gazed downward.

Clearly shown by the bright moonlight, he saw the maiden reclining upon the ledge, her pale face turned upward.

With reckless haste Martin Hammond clambered down the rugged wall and stood beside her.

"I have come back, girl," he cried, his voice sounding hoarse and unnatural. "I have come back, never again to leave you. Do you hear me? We shall never leave this ledge alive. We will die together."

Irene gazed up at the ruffian with mute terror in her eyes, powerless to move.

His face was pale as death, but splashed with blood, giving him the appearance of a demon. His right arm hung dangling by his side, but his left was raised in the air, holding a long glittering knife.

"Girl, I could not escape from this place, even if I would. Your lover, curse him! has shattered my arm with a bullet, and I cannot climb to the top of the cliff with but one hand. I must die here, but I will not die alone; you must die with me. He is coming; I hear his footsteps on the rock. He will find his bride, but not alive!"

He bent over the maiden, his blazing eyes fixed upon hers, his hot breath fanning her cheek, and his knife raised for the fatal blow.

The maiden could hear rapid footsteps approaching, and, knowing that help was at hand, she uttered a wild cry, and then, with the strength born of despair, she hurled the outlaw back, even as the shining weapon fell. The ruffian, weak from loss of blood, staggered back, tottered for an instant on the brink, and fell; but, with a desperate attempt, he clutched a jutting portion of the rock, as he hung suspended, his evil face just above the ledge.

"Ho!" he cried wildly. "I did not mean to harm you, Irene. Save me!"

At the same moment the face of Guy Otis appeared above.

"Oh Guy!" cried Irene, breathlessly.

"Irene? Irene! found at last!"

And in a moment he had leaped down beside her.

"Help, help, in Heaven's name!" moaned Hammond, his face convulsed, his eyes staring from their sockets.

Kneeling, Guy attempted to grasp the outlaw's hand, but as he did so, the fingers slowly unclenched, and the terrible face shot downward, never again to be seen by men.

SCIENTIFIC.

HOW TIN PLATE IS MADE.

A paper recently read before the Franklin Institute of Philadelphia, by Mr. T. S. Speakman, representative of the Institute at the Vienna Exposition, gives the following interesting details of the manufacture of tin plates as carried on in Wales:

In the opinion of Mr. Henry I. Madge, tin plate manufacturer, of Swansea, in Wales, from whom I received the following information, the manufacturer prefers making his own iron to purchasing it, because he can thereby insure a more equitable quality; he therefore buys suitable pig iron.

For common coke tin plates, the "iron bars" are made from puddled iron. The puddled ball is sometimes squeezed and sometimes hammered; much depends on the care of the pudpler to bring forward his ball that all its parts shall be equally decarbonized, when the fracture will be of a uniform, dull gray color, without crude admixtures of bright crystals. The unreduced crystals produce "wasters" of the iron plates; and if any such escape the notice of the mill manager, the wasters are thrown aside again after being covered with tin. If they escape the eye of the "assorter," the tin plate worker will find them fracture across the angle or bends of the sheets in working them up. The puddled ball, produced

under the best conditions, is then taken to the "shingler," who submits it to the squeezer or hammer, sometimes both. This operation should be carefully executed. As the puddled ball is rugged and full of cinler, the cinler has to be squeezed out by this operation, and at the same time the roughness must be so managed as to be welded into a solid compact mass, which cannot be so well done in after operations. Some say it cannot be done afterwards, as the whole mass can never again be brought up to a thorough welding heat throughout, unless at the expense of much waste and loss. The bloom from the "shingler" is at once passed through the rolls, or roughed down to No. 1 bar. Some prefer letting the blooms lie exposed to the action of the elements for a time, and others think it of no importance. The bar, while hot is cut into lengths and piled, five pieces being put and heated together in the "balling" or reheating furnace. When the faces are brought up to a welding heat, and the whole mass softened, it is again taken to the laminar, some rolling at once, others returning the bloom into the furnace to again bring up the heat. It is then rolled out into the finished bar, of suitable size and thickness for the kind of plates required.

Some manufacturers have made very good iron from the puddled ball direct, saving in wasters and improving the quality; but as the labor and number of hands were reduced by this mode, the men struck against it, and spoiled the work if not well looked after. This kind of iron was homogeneous and not fibrous, as the iron "piled" and brought through the reheating furnaces. The "shingler" must be very careful to form a second bloom under the hammer, and the bloom should be upset once or twice, so as to secure a welding of all the rough edges. If, after the shingling, the bloom has lost too much heat, it should be reheated. Care and expedition will remedy that necessity, and the reheating furnace dispensed with altogether. The saving is much in cost and waste; but the trouble with the workmen was great. Some also produced very excellent iron from the puddling furnace by adding to the charge about 60 lbs. of scrap or shearing, the trimmings of the plates when cut to size! The 60 lbs. of shearings were thrown into a bath of saturated solution of nitrate of soda, but added to the charge during the "boiling." The advantages gained were: the scrap iron improved the charge in proportion it bore to the whole mass; it was melted down quickly without waste, as the smelting took place under the surface. The weight of solid cold iron would take it to the bottom of the charge, carbon would be eliminated by fusion with the nitrate, and thereby improve the quality of the charge again. The ball was treated in the same way as ordinary puddled balls afterwards. The iron was tough as charcoal iron, with the characteristics of puddled iron, arising from crudities; for crystals unreduced were not exterminated but greatly lessened. A careful pudpler can at all times prevent these crude lumps to a very great extent. Another saving arising out of the process was that the scrap "shearing," formerly put into a furnace and reduced to a welding state, hammered out and rolled, gave only a return of 13 per cent to the tin, whereas the other returned the full weight of the shearings.

The bars are cut up into the required sizes, brought to a cherry red heat in a reverberatory furnace, rolled out to a certain length by gage, "doubled," and returned to the furnace, re-rolled again doubled, heated and reheated. The several foldings of the sheets adhere slightly.

After the sheets have been cut down to the size for trimming, they are separated from each other by what is called opening; during the process of opening, "stickers" and imperfect plate are thrown out, and passed sheets then go into the "pickling room." There they are put into a hot pickle of dilute sulphuric acid, to be cleansed from oxidized and silicious matters, and undergo another rough examination in the "scouring process;" that is, any plate not cleansed is rubbed with sand in water. Defective sheets are again thrown out and the sheets or plates are now passed into the annealing room.

The annealing furnace is a large reverberatory furnace, capable of holding several annealing pots. The pot is composed of a stand, of sufficient size to take the sheets, with a raised rim. Several hundred sheets are piled on the stand, and a square box-shaped cast pot completely the pot. This is inverted over the sheets, and the space between the rim of the stand and the rim of the inverted pot is filled with oxide of iron, to into it down and exclude the air. The pots are then put into the furnace until it is full, and the whole brought up to a cherry red heat or a little beyond. About eight hours are necessary for its perfect saturation by the heat. When removed from the furnace, they are slowly cooled in a place free from draft, and then the pots are opened. The plates never lie perfectly flat, and should be of a dark gray color at the edges. If the air should get in, in small quantities, a deep blue color will cover the sheets more or less. The plates adhere slightly, are again separated and ready for the second pickling room. The plates are then submitted to a hot but more dilute pickle of sulphuric acid, and again chemically cleansed; taken from the acid bath, they are well washed in running water, and kept in clean water until the tinman is ready for them.

The tinman takes the plates from the water bath; (where they lie some hours) and plunges

them wet into a bath of hot palm oil, called the "grease pot." When they have acquired the temperature of the grease pot, they are removed with tongs and quickly submerged into a bath of tin. The oil mixed with the water from the plates floats on the top, forming a flux which covers the melted tin and prevents oxidation. With the tongs, the sheets or plates are continually kept moving and separated, to insure the tin getting between all of the sheets. When the bath has recovered its heat, which it generally does in about half an hour, the tinman examines the charge, and if he finds that perfect amalgamation has taken place between the two metals, he removes them with a tonge to the next bath, which is kept at a low temperature.

The temperature, raised by the change from the "tin pot," is again allowed to cool down to a few degrees over the melting point of the tin, when the plates are taken in lots of a dozen or two at a time, and laid on an iron slab, which is at the side or head of the pot. The waste metal and grease run back into the pot, the slab being inclined. The workman then takes up sheet by sheet with the tongs, and dips each into another bath of fine metal, kept at a heat little over melting point, immediately withdrawn it, and places it in a rack immersed in a large pot of melted palm oil kept at the proper temperature, where they are allowed to remain a certain time.

The sheets are then slowly lifted out of the grease by a boy, who separates them into proper lots by counting carefully, regulating the intervals of time between them. The grease recoils from the top plate; and as little is left on the sheets, they are again placed in a rack in the open air to cool, a lad takes each sheet in a tonge, and dips the lower edge into a small bath of melted tin so regulated that the sheet can only enter to about the eighth of an inch. It is kept long enough to melt off the drops of metal which adhere to the lower edge; and when lifted, the sheet is struck to throw off the superfluous metal from the edge. The plates are again put into a rack, and taken while warm to a bin of bran, where each sheet is thrust into and under the bran, to get rid of the grease which adheres. It is then passed on to a second and third bran, when the grease is pretty well behind in the last tin, which is kept filled with new bran. The sheets are turned out covered with fine dust and bran, and dusted off with cotton shaggy cloth.

The next process is in the sorting room. Here the finished sheets are laid on tables, and each sheet undergoes an examination by the sorter, who throws out those shearings which are defective in the iron or trimmings. The latter are reheated to reclaim the tin; the imperfect sheets are sold as "wasters" at a less price; the sheets are counted, and the box of 100 lbs. weight is composed of 225 sheets of 14 inches by 10 inches, for home use or for exportation.

ZINCING IRON.

The following is an excellent and cheap method for protecting iron articles exposed to the atmosphere, such as cramp irons for stone, etc., from rust: They are to be first cleansed by placing them in open wooden vessels, in water, containing three fourths to one per cent of common sulphuric acid, and allowed to remain in it until the surface appears clean or may be rendered so by scouring with a rag or wet sand. According to the amount of acid this may require from 6 to 24 hours. Fresh acid must be added according to the extent of use and of the liquid; when this is saturated with sulphate of iron, it must be renewed. After removal from this bath, the articles are rinsed in fresh water, and scoured until they acquire a clean metallic surface, and then kept in water in which a little slaked lime has been stirred until the next operation. When thus freed from rust, they are to be coated with a thin film of zinc, while cold, by means of chloride of zinc, which may be made by filling a glazed earthen vessel, of about two thirds gallon capacity, three fourths full of muriatic acid, and adding zinc clippings until effervescence ceases. The liquid is then to be turned off from the undissolved zinc, and preserved in a glass vessel. For use, it is poured into a sheet zinc vessel, of suitable size and shape for the objects, and about 1-30 per cent of its weight of finely powdered sal ammoniac added. The articles are then immersed in it, a scum of fine bubbles forming on the surface in from one to two minutes, indicative of the completion of the operation. The articles are next drained, so that the excess may flow back into the vessel. The iron articles thus coated with a fine film of zinc are placed on clean sheet iron, heated from beneath, and perfectly dried; and then dipped piece by piece, by means of tongs, into very hot, though not glowing, molten zinc, for a short time, until they acquire the temperature of the zinc. They are then removed and beaten, to cause the excess of zinc to fall off.

A NEW DYE-STUFF.

Since all possible shades of color have been produced from aniline, chemists have turned their attention to anthracene and alizarine; and Springmühl obtains an accessory product, in the artificial manufacture of alizarine out of anthracene, from which a beautiful blue can be made, superior in many respects to all aniline blues. Dried in a vacuum, it forms a blue powder, with a few crystals, and differs from aniline color in having the same color in solution.