ly are the best fitted to take and hold any dry powder brushed over the surface. The parts of the surface where the light has had full force do not hold any dust. The dust for the purpose under consideration is dial painter's black, a species of intensely black glass ground to an impalpable powder and now used dry. This powder is brushed over the face of the print with a soft camel's hair brush, and all particles, except such as are held by the tacky surface, carefully removed. The positive pictures by this process are very beautiful and perfect. To transfer to the watch cap, the picture on the glass has now a coating of tough collodion flowed over it and allowed to dry, after which the collodion film is separated from the glass and the coat of gum and dextrine washed away.

The positive picture is now placed on the watch cap (which was previously coated with transparent enamel) with the collodion side out. On heating the cap in a muffle, the collodion burns away and the black enamel pigment fuses and incorporates itself with the transparent glaze on the watch cap.

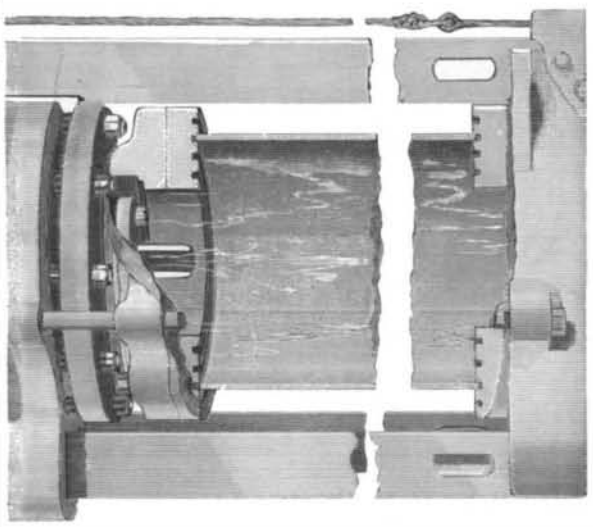
The St. Lawrence River Canal at Massena, N. Y.

Massena is situated in St. Lawrence County, New York State, on the Grasse River, which, nine miles below the village, empties into the St. Lawrence. The St. Lawrence River Canal will extend from a point on the St. Lawrence three miles northerly from Massena, having its intake just above the Long Sault Rapids, which have a fall of a little over fifty feet from the point of intake to the mouth of the Grasse River.

The canal, three miles in length, will be 225 feet wide and have an average depth of 25 feet, although in places cuts will reach 90 feet in depth. The canal will thus receive an almost level course, falling but 4 feet to the mile. At the mouth, where the water empties into the Grasse River, there is a fall of 47 feet. The volume of water will be much greater than is used at the Niagara power plant. The fall, however, is much less; therefore the turbines and generators will be differently arranged. A vertical shaft 140 feet in depth is used at Niagara; at Massena the turbines will be placed upon an inclined shaft. A ring of steel encircles each dynamo, the central revolving portion being the field magnets and not the armature, as in most other dynamos. The extreme diameter of the ring is 15 feet and the width 3 feet. This flywheel-like ring revolves within a stationary cylinder upon a surface made of thin soft steel set edgewise, which contains slots filled with copper bars parallel to the shaft, these bars being insulated with mica. The current will be delivered at 2,000 volts to the purchaser, and for long distance transmission it will be raised to 20,000 volts. The power house, the largest in the world, will be built upon a solid rock foundation. It will be about 600 feet long and 130 feet wide and 60 feet high; and will be provided with an electric traveling crane capable of lifting 85 tons. The generators, of which there will be 15, will weigh 350,000 pounds each and will make 180 revolutions per minute. They will be capable of developing 5,000 horse power each, or a total of 75,000 horse power. The total capacity of the canal is 150,000 horse power.

From the power house the circuits will extend to the factories to be constructed near by, one syndicate already having contracted for 35,000 horse power, for the purpose of manufacturing acetylene, this being made possible because of the limestone formation that underlies the whole section about Massena. Electricity converts this rock into calcium carbide, the basis of acetylene gas. Numerous other chemical compositions essential to the manufacture of gunpowder will be produced. Saltpeter will be refined and manufactured as in France and Germany. Other enterprises are contemplated, principally those which have in view the manufacture of certain chemicals which are now imported. The company already assert that they have contracted for all the power they can supply for some years to come.

The large operations upon the work of excavating the canal and the building of the power house attract hundreds of visitors to Massena almost daily, and that quiet little town, formerly in obscurity, except for its curative sulphur springs, has become in one brief month a thriving, bustling community. Midway along the canal, and at the point on the survey, has grown up what has been christened the "White City," the distributing point of the construction company. Here it will, for some distance, be necessary to excavate between 60 and 90 feet of earth. Over one hundred two-horse scrapers are at work. Two large graders, with eight mules in front and four behind, remove the surface dirt to a depth of fifteen inches, and roll it up from a plow-shaped blade into an endless belt, finally dumping it into wagons, a dozen or more being required to carry away the dirt from each grader. The graders are the most efficient excavating machines yet produced. They will excavate to within five feet of the water's level, and six, and later fifteen, big steam shovels then finish the work. These powerful machines, built much upon the plan of a harbor dredge, scoop the dirt out by means of cantilever cranes, carry it over the banks or upon dump cars, for a temporary railroad is being constructed the entire length of the canal. The soil is soft and sandy, with the exception of some very fine clay strata, and no serious engineering problems are encountered in the process of excavation. Occasionally a streak of quicksand is found, which causes temporary embarrassment, but otherwise the work is accomplished with very few difficulties. The number of steam shovels, graders, and the force of men, now numbering six hundred, will be increased as the work progresses, it being calculated that three



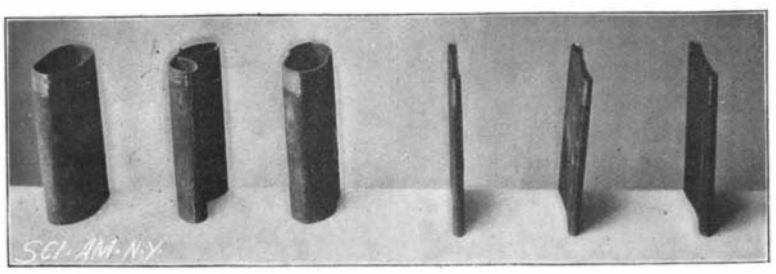
9.—DETAILS HYDRAULIC TESTING MACHINE.

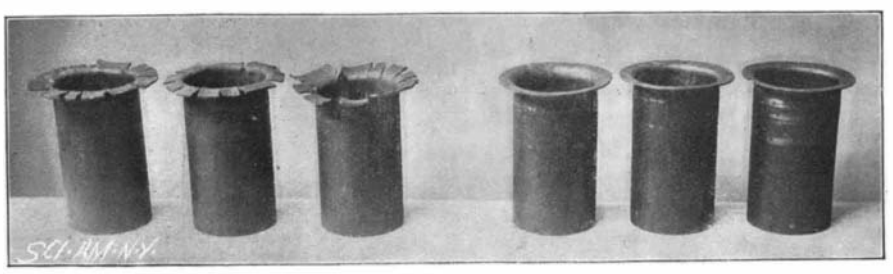
years will be required to comp.ete the canal. The pay roll at present exceeds $15,000 per month.

The railroad facilities at Massena are favorable. The New York Central, by the R., W. & O. branch, and the Grand Trunk meet here. The navigation companies on the St. Lawrence are numerous, and this waterway will undoubtedly receive the greatest share of patronage when the works are finished. It is estimated that the volume of water emptied into the Grasse from the canal will raise that river by ten feet, thus making it a most favorable outlet for the products to be manufactured.

There is heard much talk that the projectors of the St. Lawrence Canal contemplate opening it for navigation purposes, thus making a water route on the American side that will compete with the Long Sault Canal, about nineteen miles long, which brings vessels below the Long Sault rapids. If this were done, it would shorten the canal route by nine miles and give vessels but three miles of canal to traverse under slow speed. Although this is a feasible enterprise, it is yet only a future possibility. Locks, which would be necessary under those circumstances, are not being constructed or provided for, and the navigation feature of the canal could only be realized after our government had dredged the Grasse River and opened it to navigation. It would undoubtedly be of great assistance to St. Lawrence River navigation, as well as a source of revenue to the owners of the canal; but whether it is thoroughly feasible to combine the two enterprises is problematical. The water for the Massena Canal comes entirely from the American side of the river and from this side of the Long Sault Island, therefore no international questions or complications can arise.

EDWIN WILDMAN.





10.—COMPARATIVE TESTS OF IRON AND STEEL TUBING.

THE STEEL PIPE AND TUBE INDUSTRY.

THIRTY KNOT TORPEDO BOAT CATCHER "BAILEY."

BY LIEUT. G. L. CARDEN.

The accompanying engravings represent the new torpedo boat catcher Bailey, so named by order of the navy department after the distinguished naval officer Theodoric Bailey, who was second in command to Farragut in the action of passing Forts Philip and Jackson on the Mississippi. The Bailey is one of three torpedo boat catchers for which provision was made at the last session of Congress. The sum appropriated for each boat was $250,000. In advertising for bids the navy department stipulated that a speed of 30 knots per hour would be exacted on the official course. The details of the design were left to the discretion of the builders.

The contract for the Bailey was awarded to Charles L. Seabury & Company and the Gas Engine and Power Company, of Morris Heights, New York. The work was obtained by this establishment at its bid of $210,000. The time in which the boat is to be finished is stated at eighteen months. A peculiar feature in connection with the contract is the fact, as stated above, that all designing work is left entirely to the builders. If the boat fails to do what is asked of her, the fault will be that of the contractors, and not of the navy department. In calling for bids, berthing space for forty officers and men and ability to carry the armament indicated, besides the 30 knots speed, were made conditions. Attention was called to the fact that all material used in hull and engines must conform to the navy department standards.

The Bailey is the first torpedo boat catcher ever built in the port of New York. The yards of the contractors are located on the Harlem River. When completed, as she will probably be, before the close of 1898, the Bailey will stand for the fastest craft possessed by the United States government. This statement is made on the expectation of the builders to attain a speed with the new boat of 33 knots per hour. Just what may be expected of the two sisters of the Bailey cannot at this time be conjectured. They have yet to be heard from. In making the great speed demanded of the new torpedo boat catchers there will be no opportunity for jockeying work. Specified weights must be carried, and on the occasion of the official trial run the boat must be in service trim. The designs which have been submitted to the navy department by the contractors, and approved, embrace the following principal features: Length, 205 feet; beam, 19 feet; depth of hold, 13 feet 5 inches; displacement on trial, 235 tons; and displacement when in commission, 265 tons. The trial weights must not be under the following figures: Hull, 67·5 tons; machinery, 115 tons; water, 10 tons; ordnance, 12·6 tons; coal, 20 tons; and equipments, 9 tons.

The armament will be a powerful one for a boat of this size. It will embrace four 6-pounder rapid-fire guns and three 18-inch torpedo discharge tubes. The latter are for Whitehead torpedoes.

The 6-pounder guns will be mounted two on the main deck, one on each side amidships, and two on platforms supported by the conning towers. The deck guns will have an arc of fire from sharp on the bow to right astern. The guns on top of the conning towers will have an almost all-around fire. The province of the torpedo boat catchers, or, as the British term them, "destroyers," is literally to destroy or capture torpedo boats proper. The average torpedo boat does not possess a speed much exceeding 22 to 23 knots. A torpedo boat like the Ariete of the Spanish navy, which is credited with a 26 knot showing on the measured mile, is an exceptionally high-powered craft. Even the Ariete could be easily overhauled by such a craft as the Bailey. Having run the little torpedo boat down, the catcher annihilates her with a heavy fire from her 6-pounder guns. The 6-pounder is a heavier piece than is given to torpedo boats. In consequence, the light 1-pounders which the latter usually carry are no match for the heavy guns of the pursuer. In the case of the Bailey this government has for the first time placed 6-pounder guns on its torpedo boat catchers. The Dupont and Porter, both torpedo boat catchers now in service, are armed each with four 1-pounder guns. The British practice is to equip their destroyers with one 12-pounder rapid-fire gun and three 6-pounders.

As in the case of all high speed vessels, there is no feature more interesting than the motive power. The Bailey will be supplied with engines capable of developing 5,600 horse power. This power is more than one-half the power employed on the Cunard steamer Umbria. The latter is a vessel of some 8,000 tons displacement, while the Bailey on trial will displace but 235 tons. The Bailey's engines are of the four cylinder triple-expansion type. The diameters in inches for the high, intermediate and low pressure cylinders respectively are 20, 30½ and 32. The com-

mon stroke is 18 inches. The development of 5,600 horse power is expected when the engines are making about 400 revolutions per minute.

Steam will be furnished by four Seabury water tube boilers. Each boiler will be equipped with two furnaces. The working pressure will be 250 pounds to the square inch. As arranged, there will be two fire-rooms. Each boiler will have its own funnel, making four in all.

All steam pipes are to be constructed of steel, and all pipes leading into the bilge must be constructed of copper. The hull plates, frames and angle irons below the water line will be galvanized. The metal used in the construction of the "Bailey" will be so thin and light that no portion of it can be afforded to be wasted in rust. Although galvanizing is commonly understood to weaken metal, it is deemed safer to accept this initial reduction in strength than to trust to the uncertainties of water action and untreated plates.

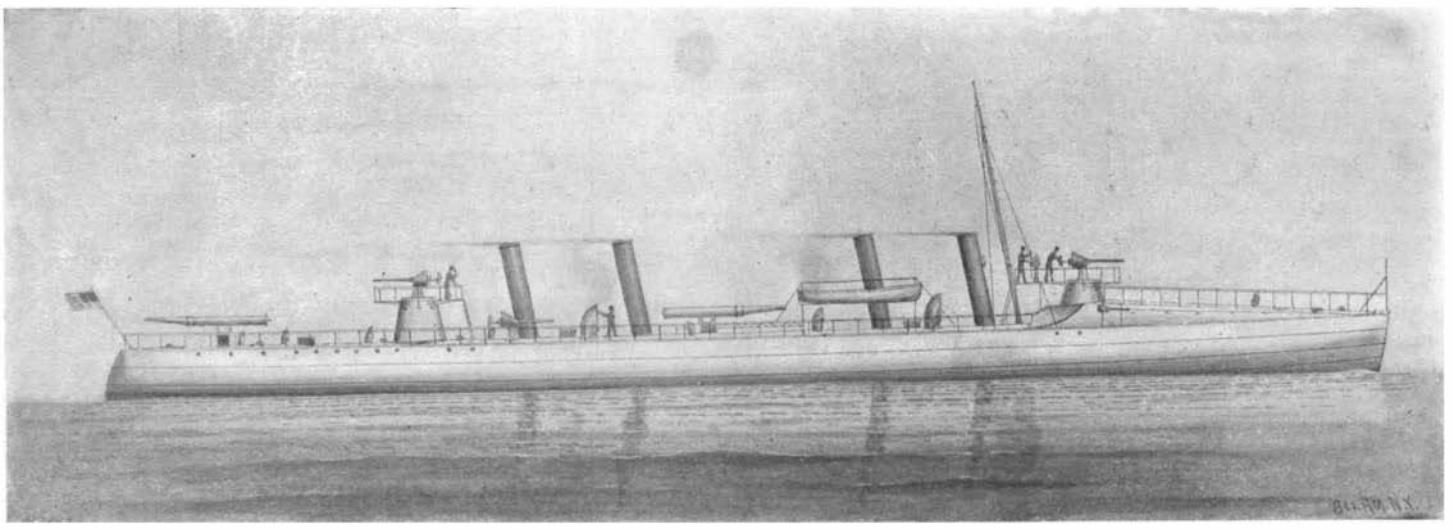
In the crew space forward there will be folding berths for thirty-three men. Of this number, eight will be for the machinists. The officers' bunks will be Pullman car berths, fitted into the sides of the boat, aft in the wardroom.

The Bailey, like the Dupont and Porter, will be able to do battle with battleships after the fashion of torpedo boats. When thus engaged she will have recourse to her torpedo tubes. But, as above shown, the principal duty of the new craft will be to drive off and annihilate with gun fire the torpedo boat torments of the battleships and cruisers. Speed alone will enable the Bailey to do this, and this speed the catcher is expected, by reason of her size, to maintain in a high sea.

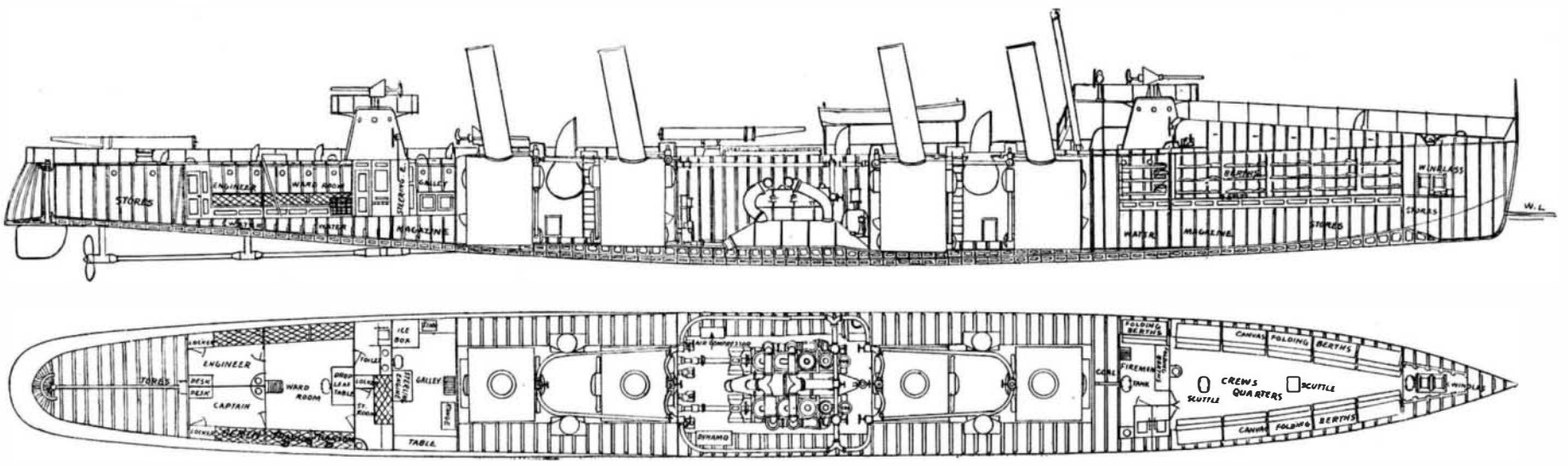
The Bailey is essentially a seagoing vessel. Her bunker capacity is deemed sufficient to enable her to steam three thousand knots at economical speed. In time of war she may be expected to accompany the battleship fleet, and to serve both as a scout and defense for the heavier vessels.

From the price to be paid for the Bailey, it will be seen that a torpedo boat catcher is an expensive craft. A torpedo boat possessing a speed of twenty-three knots per hour can, nowadays, be turned out for about $75,000.

The inspection work on the Bailey for the navy department is in the hands of Passed Assistant Engineer Carr, United States navy.



THIRTY KNOT TORPEDO BOAT CATCHER 'BAILEY," BUILDING AT NEW YORK FOR THE U. S. GOVERNMENT.



LONGITUDINAL SECTION AND PLAN OF THE "BAILEY."

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE. — Ward B. Story, Freehold, N. Y. Two patents have been granted this inventor for an engine in which abutments are mounted to swing on a cylinder, folding into recesses in the cylinder wall, and resting with their free ends against shoulders on the cylinder heads, a piston revolving in the cylinder having a fixed head extending in its working chamber, and the hub of the cylinder having inlet and exhaust ports. The arrangement is such that the steam is cut off during a part of the revolution to allow it to act expansively in the cylinder on the piston head, to which two impulses are given during every revolution of the main shaft. The piston may also have a plurality of piston heads, in connection with a series of movable abutments in the cylinder, a rotary valve connected with the supply and with an exhaust being adapted to connect with a series of ports leading into the cylinder, each port forming alternately an inlet and an exhaust port.

Railway Appliances.

RAILWAY SIGNAL.—John D. Taylor, Chillicothe, O. This invention relates to highway crossing signals provided with an electric bell which is automatically thrown into circuit by an approaching train and cut out of circuit by the train when it passes the crossing, the invention being designed to simplify such apparatus and reduce to a minimum the cost of construction and maintenance, while also lessening the liability to derangement.

Bicycles, Etc.

SADDLE. — David Basch, New York City. This saddle is made with a removable and interchangeable cushion at each side of its center, the cushions being held firmly in connection with the body of the saddle by a tie plate secured to the saddle body. The cushions are also provided with removable covers, held on by means of the tie plate, the cushions being light, durable and elastic, and resuming their original shape the moment they are relieved from pressure. All the parts of the saddle are readily and quickly dismantled and as readily assembled.

BICYCLE AIR PUMP.—Albert S. Noonan, Rome, N. Y. An air pump which may be conveniently operated by one hand is provided by this invention, the pump having the usual cylinder and piston, mounted on an outwardly extending stem to which is attached a handle, and the cylinder having a reduced outlet with which is connected a flexible tube, the other end of the tube being provided with a holder for attachment to the valve leading through the rim into the tire. The flexible tube allows the pump to be engaged with the valve nipple while the body portion of the pump is at a slight incline relatively to the wheel, the pump being held rigidly in place by the adjustable holder.

DEVICE FOR LOCKING BICYCLES. — Emil Buebel, of Altoona, and Jack Hall, of Juniata Kipple, Pa. This is a device for application to the front fork to prevent the wheel from being turned to the right or left, thereby preventing the unauthorized use of the machine. The lock is applied to the lower head tube fitting, adjacent to the crown of the forks, and the locking device proper and adjuncts are inclosed in a thin metal casing detachably secured to the fitting, the locking bolt sliding vertically, and its lower end when depressed entering a socket in the cone or fork crown bearing, thus locking the fork so that the front wheel cannot be turned to the right or left.

Mining, Etc.

PORTABLE GOLD WASHER. — Felix Kahn, Laredo, Texas. According to this improvement, two rotatable basins are mounted one above the other on a spindle or shaft held in suitable bearings in a small tank, means being provided for breaking up clods and stirring the pulverized ore as the basins rotate and also for discharging the liquid contents of the tank as required. The basin, spindle and connected parts are adapted to be easily removed from the water tank, and mercury may be placed in the basins to amalgamate the free gold. The device is particularly adapted for use by prospectors and m laboratory work.

AUTOMATIC DUMPING CAGE. —William K. Gordon, Thurber, Texas. For use in the shafts of coal mines, etc., this inventor has devised a platform so made and hung as to avoid pounding and racking of the guides and tower building, the platform turning on a true circle. Means are provided for automatically restoring the platform to a horizontal or carrying position after it has been dumped, locking the platform, and automatically unlocking it for dumping. The platform may be made to dump at either end, and provision is made to prevent the spilling of coal from the car into the shaft.

Mechanical.

ROUND BAR ROLLING MILL.—Paul J. Delay, Boucan, France. For making straight shafts or axles, and shafts of varying diameter, this mill is made with a series of rollers surrounding a central space adapted to receive the blank, slides carrying the rollers and being arranged to move radially in the frame of the machine, the rollers being carried bodily by the slides so that during the movement of the slides the axes of the rollers remain parallel to their original positions. Means are provided for moving the slides radially with the rollers, and for rotating the rollers while they are being moved inward against the blank. A hollow blank may be worked by inserting in it a mandrel, and blanks of original polygonal cross section may be worked in the mill.

SHAFTING COLLAR. — Heinrich Meltzer, Ratibor, Germany. An abutment ring or collar for shafting, to diminish the friction between bearings or loose pulleys, is provided by this invention, the collar having an exterior groove at one end forming a neck in which is a channel ring in which are located anti-friction balls. The channel ring bearing against a loose pulley permits the latter to turn independently of the shaft and at the same time holds the pulley from sliding on the shaft.

PATCHING SAWS.—Michael D. Ahearn, Green Bay, Wis. For cutting or grinding a concave recess in the side of a metal plate for the purpose of patching fractures in saws by brazing across such places cross sections, this inventor has devised a machine comprising horizontal guide rods on which slides a non-rotary frame, an oscillating frame being arranged within the non-rotary frame and carrying a horizontal shaft with drive pulley and cutting wheel, there being means for vertically adjusting this shaft and wheel.

SANDPAPERING MACHINE.—George C. Bonniwell, Hickory, N. C. A machine more especially designed for sandpapering the edges of door panels, etc., is provided by this invention, the machine having abrading disks with oppositely arranged abrading faces, and permitting of readily fastening the paper to the disks. The invention provides for a disk with inner and outer beveled edges, and clamping devices for holding a sheet of sandpaper on the edges, the disks being free to yield according to any unevenness in the work, to insure a proper and smooth sandpapering of opposite faces.

MECHANICAL MOVEMENT. — Sumpter L. Harwood, Uniontown, Ala. To transform reciprocating into rotary movement, and vice versa, this invention provides a shaft divided into two sections, each section being spirally grooved, but in opposite directions, a collar engaging each of the sections, and means being provided for moving one relatively to the other, and at the same time preventing the rotation of the collars except in one direction. The device possesses the advantage of having no dead center, and the stroke of the reciprocating member may be varied without affecting the rotation of the shaft.

NUT LOCK. — Townson Hand, North Vernon, Ind. According to this invention, any attempt to unscrew a nut on which this lock is employed will cause a cam member of the lock to rotate and bind firmly against the nut. The device comprises a fixed member having an inclined surface concentric with the bolt opening, and upon which rests the inclined inner surface of an annular locking cam, adapted to rotate and ride up the incline on the fixed member, and wedge firmly against the inner face of the nut, whenever the nut is turned in a direction to unscrew it.

PAPER WINDING MACHINE.—William H. Decker, Rumford Falls, Me. A machine more especially designed for use with machines for making wide paper has been designed by this inventor, the machine being arranged to relieve the winding shaft of its load, to prevent the shaft from springing, and, consequently, prevent irregular winding. Sliding bearings are provided for the shaft on which the paper is wound, and a supporting drum adapted to support the paper on the shaft is journaled in bearings fitted to slide at an angle to the line of movement of the shaft. The device is simple and durable and entirely automatic in its operation.

EDGE SETTING MACHINE.—Adam H. Prenzel, Reading, Pa. For setting and polishing the edges of the soles of boots and shoes, this improved machine affords a novel construction, arrangement and adjustment of the reversible head carrying the setting and polishing tools. The arrangement is such that two tools may be alternately brought into use or thrown out in a very convenient and practical manner;