sired most. A small edition of prints from three of Talbot's photogravings on copper have been made and published, the money received from purchasers of these will be handed over to the fund without any deduction of expenses.

TURPENTINE AND ROSIN.

BY C. K. HAWKINS.

The manufacture of spirits or oil of turpentine, and rosin has been for many years the principal industry of the entire part of the Southern States known as the long leaf pine belt, and the business of "yarding" and shipping of these and other naval stores has been and is now the basis of the prosperity of many of the cities on the South Atlantic and Gulf Coast.

Both spirits of turpentine and the solid product known as rosin are obtained from the exuded gum or resin of various members of the yellow pine family, but principally of the variety Pinus Palustris, or "long leaf" yellow pine.

The resin which is of a semisolid consistency and whitish in color, is insoluble in water, but readily soluble in ether or spirits of turpentine. It is obtained from the tree by boxing, or cutting a deep notch in the trunk, about a foot from the ground. These "boxes" hold about a quart, their number is limited by the diameter of the tree, the usual rule being to leave 12 inches of bark between each box, this giving two to four and sometimes six boxes to each tree, the box being 10 to 12 inches across the opening. Ten thousand boxes constitute one working unit or "crop," requiring from 100 to 200 acres in the new regions along the Gulf Coast, and from 500 to 1,600 in the "worked-out" districts of North Carolina.

The boxes are cut with an axe having a very long and narrow blade, and short and heavy handle. This is done during the winter months, when other work on the turpentine farm is at a standstill. Upon the opening of the warm weather, which causes a flow of sap into the boxes, the trees are "chipped" or scarified, by removing the bark and wood to a depth of about an inch just above the box. This operation is repeated every week during the season, each "chipping" exposing about an inch and a half further up the tree, but maintaining the same depth. The tool used is called a "hack."

The gum exudes from the scarified surface and flows down into the box, whence it is collected every four weeks by means of a "dipper" which is simply a flat pear-shaped blade, and sets into a handle. The average weight of a barrel of "crude" is 240 pounds, and a crop of first-year or "virgin" boxes should yield 35 to 50 barrels at each dipping, or 245 to 350 barrels during the season, decreasing to 12 or 16 barrels per dipping during the fourth year, at the end of which the farm is usually abandoned and turned over to the timber men, although some of the smaller landowners in the older districts, especially in North and South Carolina, work their trees as long as they can get anything out of them.

The stills usually hold from 10 to 50 barrels of crude, and are made of copper. The kettle, which is in a brick setting with furnace underneath, has an opening near the bottom with a gate faucet, out of which to run the charge after distillation.

A little water is run in when the still is charged, and heat applied gently at first, being gradually increased until the whole mass reaches the boiling point, where it is maintained during the remainder of the process. The steam produced by the evaporation of the water passes over into the worm, bringing the turpentine in a vaporized form with it, and being condensed, runs off into a vessel placed to receive it, in which the water settles to the bottom, and the turpentine, being of a less specific gravity, collects on the surface and is dipped off into barrels. Water is constantly added to assist in the vaporization and to prevent burning of the charge. With a glass the distiller notes the proportion of spirits and water coming over, and when the spirits has decreased to about one-tenth of the whole the distillation is stopped and the remainder of the charge is run out into a wooden trough, passing first through a strainer of No. 6 mesh, next through one of about No. 40, and last through a No. 80 mesh. While still hot is is dipped up into barrels.

The number of charges per day which can be run in a still of ordinary capacity is from two to five, depending on the character of the crude and the time of distillation.

A charge of twelve barrels of crude gum should yield 120 to 130 gallons spirits and seven or eight barrels of rosin.

Spirits of turpentine fresh from the still is perfectly clear and transparent, with a faint, pleasant, aromatic odor, and is very different from the ill-smelling, yellowish liquid that we usually see in paint stores.

The spirit barrels are prepared by being coated on the inside with glue, which being insoluble in turpentine renders them impervious to the action of the liquid and prevents leakage.

There are fifteen recognized grades of rosin, those known as W. G. (window glass) and W. W. (water white) being the finest and most valuable. and from N, which is very clear, the grades run through M, L, K, J, H, etc., to A, which is almost black. Of these the W.W. and W. G. grades are produced from the "virgin dip," or first year's run, each subsequent year's run producing a poorer grade.

During the latter part of the season, as the weather becomes cooler and the flow of sap diminishes, the gum forms on the boxed face in a hard white mass, greatly resembling honeycomb. The scraping off and distilling of this is the last operation of the season. This scrape which amounts to from seventy barrels per crop the first year to 100 barrels in the fourth, produces rosin of an inferior grade and but little turpentine.

The next important step is the shipping of the finished product. The stills are usually situated at a considerable distance from transportation, and most of the larger operators either build tram-roads to reach the shipping point, or else make use of those built by the sawmill people. The rosin which is shipped in very rough barrels, made at the still, and holding 350 or 400 pounds is, upon its receipt by the factors at the seaport, first weighed, then graded, and after reheading, is stored in open yards, to be presently loaded upon vessels for export. The vessels usually employed in the foreign trade are Norwegian and Swedish barks, of a tonnage varying from 500 to 1,100 tons.

The spirits receive a rather different treatment, being run from the cars under open sheds, and the barrels emptied and reglued, if necessary. The spirits is then rebarreled, if destined for export, or run into tank cars, if for shipment to the interior.

A shipload of spirits when the price is ruling between 30 and 40 cents per gallon is rather more valuable than the average reader would at first suppose.

By far the largest amount of rosin produced is consumed in the manufacture of soaps and varnishes, of which it is an important constituent. A great deal of it is redistilled for rosin oil, which is used as a basis for various grades of machine oils, and in the manufacture of wagon grease, printing inks, and lacquers.

Spirits of turpentine is used in the manufacture of varnishes and paints, and to some extent in chemical operations and medicine.

OUR RAPIDLY GROWING IRRIGATION AREAS.

The United States Department of Agriculture has issued a bulletin regarding irrigation in the Rocky Mountain States, by J. C. Ulrich an irrigation engineer, of Denver, Colo., describing the agricultural conditions of the Rocky Mountain region, covering more particularly the States of Colorado, Idaho, Montana, Utah, and Wyoming. How ditches are built, rights to water established, and the water diverted into canals and ditches and applied to the land, as well as the climate, resources, and general character of the region, are well covered, the main purpose being to instruct those to whom the subject is new and enable them to avoid the costly mistakes which novices are liable to make. The difference between ditches belonging to individuals, corporations, or districts are outlined as well as the methods of operation. Of the latter Mr. Ulrich says:

"The owner of an individual ditch operates it as he pleases, subject only to the State laws governing the diversion and use of water. But when several persons are interested in the same ditch the necessity for some system of control arises. In the case of unincorporated community canals, this control is secured by the selection of a water-master, who is usually one of the owners, to have charge of the operation and maintenance of the system and the distribution of its water to those entitled to its use. It is on the large corporation canals, however, that the necessity for a careful system of operation and management is most apparent. Many of these canals are more than 50 miles long and number their water-users by hundreds. The Ridenbaugh Canal in the Boise Valley, Idaho, furnishes water to more than 500 farmers. The High Line Canal in Colorado has 433 consumers under it; the Loveland and Greeley has 257, and many other systems are as large or larger. . . . It can thus be readily seen that the proper operation of such canals involves a very thorough business organization and careful attention to many important details."

The flooding, furrow, and compartment systems of applying the water to the land are described, and their special conditions and applications are setforth. The value of reservoirs in equalizing the supply from streams and in enlarging the watered area is pointed out. Of this the author says:

"The quantity of water necessary or used for irrigation fluctuates during the irrigating season, but unfortunately the period of maximum use does not coincide with the period of maximum flow of the streams. . . . The time of greatest need for water varies somewhat in different localities, but generally there is very little water used in April, and the quantity used in May is relatively unimportant. June and July are the months of maximum use, and the use in August is usually considerably greater than that in May. . . . The August flow of streams is that which limits their irrigating capacity. Not more than about 20 per cent to the total annual discharge of streams can be made available for irrigation from their natural flow. . . . Where the topography of the country is favorable this loss of water may be prevented or greatly diminished through the construction of reservoirs for storing the surplus during the early part of the season for use in the later months. . . . With these benefits there are also complications. If a comprehenisve system of storage is to be adopted it will doubtless increase the difficulty of dividing water among the different claimants to a common supply and make it necessary to have additional legislation to define the character of the rights to these stored waters."

In an appendix, Mr. Ulrich describes the methods by which the various States divide water among appropriators and gives the names of officials in charge. One gathers that there is now pressing need for National legislation to control the whole subject of water storage and supply, where more than one State is involved in the same system, as is not frequently the case.

E. M. A.

NEW STEAMSHIPS BUILDING.

In many respects a new era of steamship building is in progress, both abroad and in this country, and the recent withdrawal from commerce of the large fleet of steamers to carry British soldiers to South Africa seems to demonstrate the inadequacy of the present vessels for the ocean-carrying trade in emergencies that may at any time arrive. Not only was our Pacific Coast trade hampered by the withdrawal of steamers for duty in the Philippines, but the passenger service to the Paris Exposition next summer will be more or less seriously affected by the lack of ships. There will be few if any steamers that can be chartered for carrying the extra crowds, and some of the regular liners will probably be out of commission. Six of the Cunard line's steamers are employed by the British government, including some of the most commodious vessels engaged in transatlantic service, and three of the White Star steamers, including the big "Majestic." These vessels will hardly be returned to the companies in time to participate in the active ocean traffic for the Paris Exposition.

There will be several new ocean liners finished by spring which will partly compensate for the loss of these big steamers of the English companies. The Holland-American line expects to have ready for the spring rush to Europe the new "Potsdam," a liner of large dimensions and superb accommodations. The French line will launch three new steamers equal in capacity and service to any engaged by that company in transatlantic service. These vessels, "La Savoie," "La Lorraine" and "l'Aquitaine," will form quite a formidable little fleet by themselves, and they will add greatly to the carrying capacity of the French line.

There is building in this country quite a formidable fleet of steamers which will be completed at different times within the next year or two. The Pacific Coast will monopolize many of these new American coasters, and they are being built for trade on that side of the world. The Pacific Mail Steamship Company will soon launch two fine steamers for Oriental commerce to ply between San Francisco and China and the Philippines. The Oceanic Steamship Company has three steamers under way, and the International Steamship Company is having two commodious vessels constructed. There are four new steamers being built for the Hawaiian trade with a gross tonnage of 26,590. The New York and Cuba Mail Steamship Company have three more vessels partly finished.

The majority of the new steamers are being built on the Pacific Coast, and indicate the prosperity that will follow our new policy in the Far East. President Hill, of the Great Northern Railroad, promises that within five years there will be twenty-five new steamships in the Oriental trade, plying between the Pacific Coast and China, Japan, and the Philippines. These, he predicts, will be of the largest size, with enormous carrying capacity, and slow of speed. Speed is not considered so much an object as to be able to lay the goods down on the other side of the Pacific so that they can compete with the native product.

The shipbuilding yards of both coasts are reported to be full of orders, and even those on the Great Lakes have all they can reasonably construct in the next year. According to the Commissioner of Navigation there are 50 war vessels, with a total displacement of 140,813 tons, under construction or contract in this country, and 45 coasting vessels besides the large ones mentioned above with a total gross tonnage of 76,007. The construction of these vessels assist in promoting the new era of prosperity in American shipbuilding. The world's carrying trade has in recent years increased faster than the number of steamers built to transport it, and the peculiar conditions brought about by war have merely tended to emphasize this fact and bring the matter to an acute crisis. In the new shipbuilding era we shall no longer stand by and permit other nations to do most of the building; for the signs are unmistakable that the long-looked for and urgently-needed revival of American shipbuilding is at hand.