They should match accurately and *snugly*, so as to avoid "back lash."

The worm is held upon the plate, A, by the two clips that are drilled to receive the stem and small journal at end of screw, as shown at C, Fig. 1, or a plate of metal with two ears may be got out, as shown at D, Fig. 1.

The stem of the screw is prolonged, as shown, and is provided at its end with an index plate, shown at P, Figs. 1 and 2, which index plate may be drilled with whatever number of holes one may wish. Various division circles are indicated at P, Fig. 2, and one circle is shown with twenty-four divisions.

The index plate is held from turning by the spring stop, S, Figs. 1 and 2, which is fastened to the edge of the plate, A, and is provided with a slot, as shown, so as to enable it to be set to any of the circular divisions.

From the description, as given above, and an examination of Fig. 3, it will be seen that the work to be divided is to be fastened in a chuck, or to a face plate, and then screwed upon the nose, N. This nose and the dividing wheel are practically one, and turn freely upon plug, O, which is accurately centered (by its turning) with the lathe spindle. Any work, therefore, to be divided will be accurately spaced by turning the dividing wheel so as to give the number of divisions or spaces that may be needed.

The machine from which this drawing was taken was made by the writer to graduate circles into degrees in order to make graduations for compasses, galvanometers, etc. The dividing wheel was, therefore, made with 180 teeth, of a circular pitch of 10, so as to fit a worm screw of a pitch of 10 to the inch. This was chosen because the tools at hand made it the easiest to construct. The number of teeth, however, was determined as above stated, so as to be an even part of 360, so as to give degrees or portions of a degree with the greatest facility.

The index wheel or plate, P, has its greatest circular division at 40. This was taken as giving ½, ¼, ⅛ turns to the worm screw. The dividing wheel having 180 teeth, one full turn of the screw would move the work 2 degrees; ½ a turn, 1 degree; ¼ turn, ½ degree; ⅛ turn, ¼ degree, and so on, down to $\frac{1}{40}$ of a turn, which would give a division of three minutes.

To use the machine the following method was adopted:

The work to be graduated was accurately turned up and polished in a true running chuck, or soldered to a brass soldering chuck, as the case might be. It was then put upon the nose, N, and run up snug, the dividing machine being in its place on the nose of the lathe spindle.

The lathe head is then locked in position, so as not to move the least particle. A tool with a horizontally placed chisel cutting edge is put in the tool post, accurately adjusted to exactly correspond to the height of the center of the lathe, so as to be sure to mark radii upon the circle to be graduated.

A stop or gauge is then fastened to the lathe bed, so as to regulate the depth of cut as the tool is brought up against the work, a gauge having been constructed that could be used to regulate this depth by the 0·001 of an inch. A stop is also secured to the tool carriage itself to regulate the extent of the cut across the face of the scale.

Preferably the degree marks are made first all around the circle.

The tool is rolled up against the work gently by moving the tool carriage against the stop, and the tool is then drawn across the face of the work by the cross feed screw until the tool block brings up against its stop. The carriage is then rolled back a half turn from the index plate, a second cut made, and so on around the circle. This gives all the marks the same length absolutely, which would not be the case were another method used.

To indicate the division at every ten degrees, as is usually the case on all scales, the index plate is now turned five times around, and the mark it drops into recut to the length desired, the stop on tool carriage having been moved back so as to give that length of movement to the tool. Five turns again, and another ten degree division is made, and so on around the circle.

The five degree marks are similarly made, the stop put to make the right length of cut, two and one-half turns gives the first five degree mark from which we left off, and then five turns again for the next five degree mark, and so on around.

With careful work and a well made machine, the graduation should be accurate. The writer has thus gone around a circle three times, and every cut the second or third time fell exactly upon the mark made the first time around.

To avoid errors from "back lash," if a mistake is made in turning the index plate so as to have gone too far, it is not enough to simply turn back to the hole giving the proper division. The turning back should be away by the hole, and then turn forward again slowly, and then take up all "back lash" before the pin drops into the correct division.

To assist in keeping track of the proper holes in the plate to give the graduation desired, it is well to fill all the holes except those in use for the time being with chalk upon the circle that is being used, but care and attention will prevent mistakes.

The tool will make a slight "burr," no matter how sharp. After the graduation is complete, the work may again be driven by the lathe, the dividing machine having first been removed, and the slight burr removed by a *very light* cut with a sharp tool, or it may be polished down with any of the well known polishing methods.

To give the well known black marks to the graduation, the following method may be used:

The scale is varnished over with a little thin shellac, so as to sink into all the cuts. When this is dry, a black varnish of lamp black and shellac is spread on, so as to fill all the cuts. This is allowed to *thoroughly* harden. When hard, the work is driven in the lathe, and the superfluous varnish polished off with fine flour emery cloth until only that in the cut is left. This gives a finely finished and distinct marking to the scale.

It is obvious that by the proper use of the principle of this dividing machine, graduations down as fine as one may wish may be made. With teeth enough to the wheel, and fine divisions enough to the index plate, one may go down to so fine a graduation as to be invisible to the unaided eye; or, another way, a compound machine may be made by driving the index plate by a worm screw, and so got down to microscopic work.

The amateur then has a simple means to graduate all his work, and as finely as he may desire. The accuracy will depend upon the truth of the worm wheel and screw, and in the general case any error will be reduced by the proportion of the diameter of the circle to be graduated to that of the dividing wheel. It is well, therefore, to make this latter wheel as large as possible—the bigger the better, so long as the lathe will swing it.

Besides graduating circles into degrees, this machine may be used to lay off and to drill a finely divided index plate, or to space off any work as may be desired. Fastened to the back spindle, with a "set-off" and tools, such as were described in a former article, the index plate may be drilled with any divisions desired, and other work done in a manner sufficiently obvious to need no description.

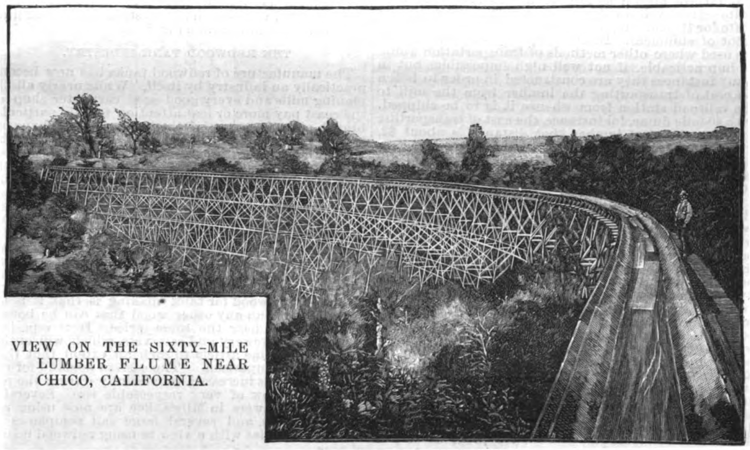
C. D. PARKHURST.
Lieut. 4th Artillery.

CALIFORNIA REDWOOD LOGGING.

By C. E. POTTER.

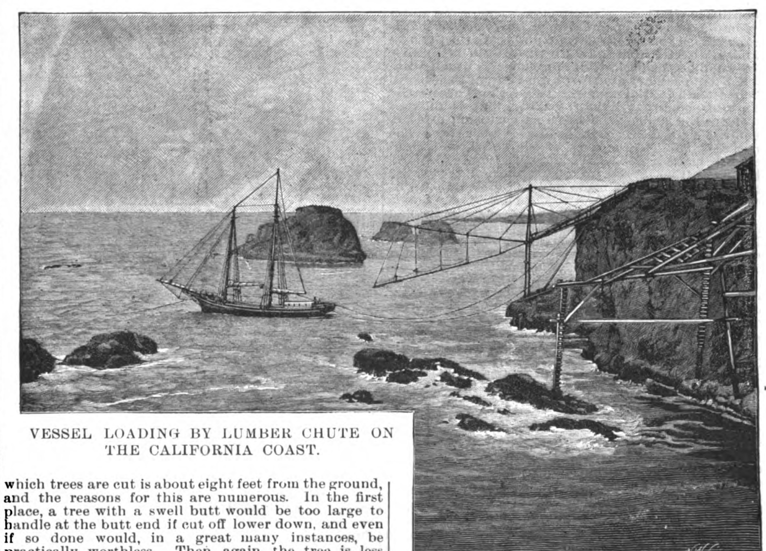
A VISIT to the scene of logging operations in the redwood country is usually an eye opener to the Eastern man, lumberman though he may be, and generally excites his interest in no small degree. Nearly if not quite all of the methods used are peculiar to the section of country lying west of the Rockies, and are so different from those in vogue in the East that only those having made personal inspection have any very well defined idea of just how the thing is done. The character of the country and size of the trees are such that redwood must be handled in an entirely different manner from almost any other timber. The tools used in felling are the ordinary cross-cut saw, usually from 10 to 12 feet in length, ax, wedges, and sledge hammer; but most of the work is now done by saws, the ax being but little used, as the insertion of the wedges serves the purpose of giving free play to the saw. The average height at which trees are cut is about eight feet from the ground, and the reasons for this are numerous. In the first place, a tree with a swell butt would be too large to handle at the butt end if cut off lower down, and even if so done would, in a great many instances, be practically worthless. Then again the tree is less apt to split when felled, and the work can be done much more rapidly, easier, and consequently much cheaper, than would be possible were the tree cut nearer the ground.

The redwood district being very hilly, a good deal of care is necessary in felling the timber, the rule usually followed being to fell a tree up-hill, no matter which way it may happen to lean. The logs are cut from 16 to 24 feet in length, the average being 18 feet, although the bulk of the lumber sold measures only 16 feet. Extra lengths are cut only on special order. As in other sections of the country, logging railways play an important part in lumbering operations, being largely used in transporting logs to the mill, and in many cases to carry the lumber from the mill to tidewater, or the place of shipment. Where the railroad runs into the tract of timber being cut, donkey engines are used to load the logs on the trucks and for other heavy work usually done by horses or oxen.



VIEW ON THE SIXTY-MILE LUMBER FLUME NEAR CHICO, CALIFORNIA.

Another way to get logs to the railway or direct to the mill, and which is used exclusively in this section of the country, is what is commonly known as "snaking." This manner of handling logs is confined to that portion of the country where railways would be either impracticable or impossible. On entirely level ground it does not pay to "snake" logs more than a quarter of a mile, for the reason that it is much cheaper to run a railroad directly into the timber. Oxen are generally used, also in some instances horses are better adapted for the work. From 12 to 14 of these oxen constitute a team, which is handled by one man, and if he be a good driver he can command a salary of $150 a month. At the starting point stands a man known as the "sniper," who sizes up the logs and decides which way they will ride to the best advantage, and they are hitched accordingly one behind the other. The road is prepared beforehand by removing every obstruction, however light, and before many loads have passed over it will be an exact fit for an ordinary-sized log. In preparing the road, should there be the misfortune to strike a piece of level ground, a sort of skidway is constructed, over which hauling is made comparatively easy by a man whose sole business is to go a short distance in advance of the load and scatter a liberal amount of grease on these skidways. Should the road rise the least particle, tanks are placed at short intervals, from which water is obtained and thrown upon the road, thereby relieving the strain upon the team. Six or eight logs are a good load for the average team, and it is really wonderful the way timber can be hauled in this manner. On a round trip taking an ox team say 10 hours, 35 minutes will be about the time required to land the logs at the pond or mill, the balance of the time being taken up with the return trip. Horses will do the work much more rapidly, but in a less satisfactory manner.



VESSEL LOADING BY LUMBER CHUTE ON THE CALIFORNIA COAST.

Nearly all the redwood is shipped by water, the Pacific Ocean being the only outlet at present, although Sonoma county lumber is shipped by rail; but as the output in that county is limited, and the market is confined to the immediate vicinity, it does not cut much of a figure in the redwood supply. These shipments are, if possible, made direct to point of destination; but when that cannot be done, the product is reshipped at San Francisco or some other large coast port.

LUMBER FLUMES.

What are known as lumber flumes are being used quite extensively in the northeastern portion of this State for the carrying of lumber from the mills to the point of shipment. In the majority of cases flumes are used where other methods of transportation would be impracticable, if not well nigh impossible, but in many instances they are constructed in order to lessen the cost of transporting the lumber from the mill to the railroad station from whence it is to be shipped. On a 40-mile flume, for instance, the cost of transporting a thousand feet of lumber that distance is about $2, when the cost by teams is fully $9. From this it will be seen that in certain portions of this coast flumes are far better, both practically and financially, than any other method of transportation.

These flumes are for the most part all constructed alike, and are known as the V flume, being made of two 20-inch boards, which are battened on the outside wherever a joint occurs, and a piece is laid across the bottom of the flume inside and about four inches from the V joint to prevent boards getting stuck in the bottom and to give a full movement to the water. It is five feet across the top and at a height above the ground depending entirely upon the character of the country it traverses. The support is termed staging, and on top of this framework is a sort of bracket in which the flume proper rests. These flumes sometimes run for quite long distances at an angle of from 30 to 45 degrees, and in order to check the fall of the lumber and prevent it doing any damage a long stretch of level flume always follows one of these falls, and the water resumes its normal velocity. At the lower end of the flume the lumber is thrown out on skidways, and from there loaded on tram cars and carried to point of piling, or to where it is reloaded for shipment. A first class flume can be put into operation for $5,000 a mile, the cost of those now in use ranging from $3,000 to $15,000 a mile. They will carry 100,000 feet of lumber and 50 cords of wood a day without being pushed. For operating one man is required for every five miles of flume, and there is a walk-away constructed along the entire length for their use. The water runs at an average speed of five miles an hour.

CHUTES.

Chutes are a somewhat common affair in this section of the country, especially in and around Mendocino county, where the character of the coast precludes any attempt to load vessels from a wharf. Very few, if any, of these places have any harbor facilities whatever, either natural or artificial, and the abundance of dangerous rocks compels vessels to make fast several hundred feet off shore. The stationary chute generally extends out from 200 to 300 feet, with an apron extension of from 40 to 90 feet. The rocks usually form the foundation for the supports of the chute proper, and if the underpinning is solid, guys are strung from either side of the chute to the shore, to prevent swaying from side to side, but if the foundations are not steady, additional guys are provided leading upward and backward from the main part, and attached to "Samson" posts, thus preventing any great amount of swaying up or down. The apron is made fast to the chute by immense hinges and guys or stirrups extending to strong supports built upward from the main chute, thence downward to a sort of cleat arrangement. These guys control the apron, either raising or lowering it, as the case may be, according to the condition of the water or the movement of the tides. The apron is generally kept at a height of from five to ten feet above the rail of the vessel, thus allowing for the action of the swells in ordinary weather. Near the lower end of the apron is a brake, which is operated by a set of levers. This brake is used to so control the lumber that it can be handled directly from the chute, instead of being first thrown upon the deck. The chute itself is usually constructed of ordinary dimension lumber, put together in the most substantial manner. The apron is necessarily made of somewhat lighter material, but is fully as strong as the main part. From seven to ten men are required to properly handle the lumber from the trucks, or cars, to the deck of the vessel, and 50,000 feet will make a good day's work. A chute costs all the way from $2,000 to $6,000, according to the manner in which it is made and the difficulties to be overcome.

The wire chute is now making a strong bid for first place, more particularly on account of its usefulness in the roughest weather. No matter how strong the wind or how heavy the sea, vessels can be loaded almost, if not quite, as easily as under the most favorable circumstances. Three-inch flexible steel wire is used. This wire passes around a drum, which is operated by a donkey engine, thence out between the vessel's masts, from which it is supported by guys running up to the spars and which are so arranged that the wire can be raised or lowered, as the case may be. The main wire is then extended some distance beyond the vessel and securely anchored. A trip hook is made fast to the wire just above the surface of the water, so that in case of necessity the wire can be loosened instantly. To provide against losing the anchors in such cases, a buoy is attached. The active part of the chute is known as the "traveler," and this carries the load, running up and down the wire by means of a series of wheels. To this traveler is attached a small rope which goes around a drum connected with the donkey engine and used to bring the traveler back to the point of loading. Leading down from this traveler are a set of chains to which are attached two pieces of ½x2 inch iron. This carries the load and is so arranged that by pulling a rope connected with a trip hook, the whole load is at once thrown upon the deck of the vessel. The chain and bar arrangement remains open until the point of loading is reached, when it is again hooked up and another load started on the down grade. The great advantages claimed for the wire chute are that it can be put up in any place where a chute is demanded, a point that cannot be urged in favor of the stationary chute. Another and perhaps the greatest advantage of the wire chute is the fact that it can be extended out any distance required, the leeway given by its peculiar construction allowing it to move with the vessel during stormy weather, a thing which with a stationary chute is impossible. The carrier arrangement will take from 1,500 to 2,000 feet of lumber at a load, and will handle 1,000 railroad ties an hour. Seven or eight men are required to operate the chute up to the dumping of the load upon the vessel's deck. A first-class wire chute can be put up ready for operation at a cost of about $6,000. These chutes have accomplished wonders on this western coast in facilitating the shipment of lumber and ties.

THE REDWOOD TANK INDUSTRY.

The manufacture of redwood tanks has now become practically an industry by itself. While nearly all the planing mills and every good-sized carpenter shop on the coast pay more or less attention to this particular branch of trade, several of the larger concerns have put in a large amount of machinery especially for this work, and increased their facilities to such an extent as to make it really a business by itself. Some of the men engaged in this trade have made valuable improvements in the machinery used, and in some cases put upon the market entirely new machines that show a vast improvement over those formerly in use. One in particular, the invention of a well known San Francisco man, is so arranged that the stave is made on a form and worked on the outside and both edges at the same time. Nearly if not quite all of the tanks made or used in this State are of redwood. The great claim for this wood for tank making is that it is less liable to rot than any other wood that can be bought for anywhere near the same price. It is especially valuable for brewery and salt vats, which will outlast the ordinary pine article to such an extent that there is really no comparison. The eastern demand for redwood tanks has increased wonderfully during the past year, and is now of very respectable size. Several of the largest brewers in Milwaukee are now using redwood for vats, and several large salt companies are making inquiries with a view to using redwood instead of pine.

That the California export trade in lumber is far-reaching is indorsed by the following table, showing the destination and value of the export for 1888:

	Feet.	Value.
Australia	9,959,834	$333,348
Mexico	2,886,060	57,543
Central America	1,814,620	46,169
Great Britain	3,439,508	71,850
France	584,820	10,240
Hawaiian Islands	1,131,147	22,483
Tahiti	722,596	16,878
South Pacific Islands	702,976	14,721
Chili	130,842	4,218
China	37,500	1,302
New Zealand	15,665	717
British Columbia	3,531	717
Panama	13,806	578
Asiatic Russia	3,500	79
Belgium	41,000	840
Peru	38,000	660
Manila	11,000	220
Brazil	14,000	210
Total	21,550,405	$583,773

The above figures are made up of shipments of lumber to foreign countries, and do not include other shipments known here as "export."

For the foregoing particulars and for the engravings we are indebted to the *Northwestern Lumberman*.

ELECTRICAL CARPET SEWING MACHINE.

THE electric energy is constantly finding new application in our industries, and as each new idea is developed and applied, we are led to ask, When will the limit be reached? An addition to its many uses has recently been made in the ingenious invention by Mr. Franklin Ames, manager of the carpet department of T. Marshall Field & Co.'s wholesale house, at Chicago, of an electric carpet sewing machine.

The machine is mounted upon four wheels of the bicycle pattern, which combine strength with lightness and ease of motion. On the framework, which is suspended from the axles of the wheels, and immediately under the forward axle, is placed a motor—a C. & C. ¼ horse power, 110 volt incandescent—with its resistance box. The rheostat is situated over the rear axle, and under the shelf that supports the sewing machine.

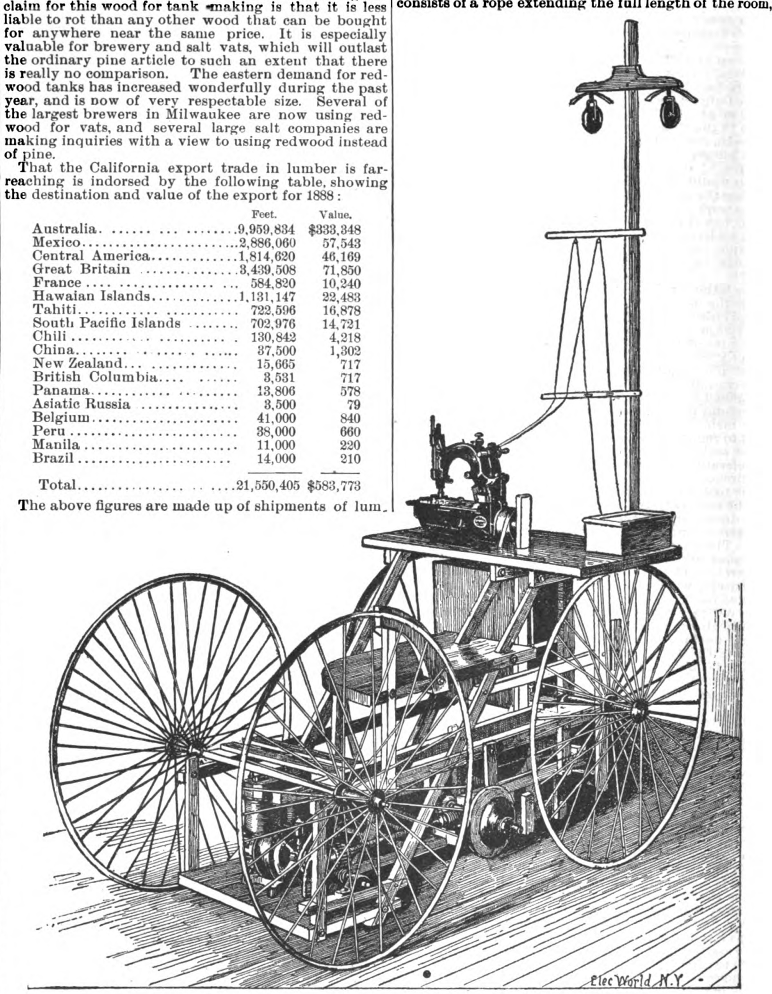
The sewing machine and the motor are connected to each other by a belt. A slender upright arm supports the trolleys upon two ⅛ inch brass wires that run the entire length of the building, and through which, from the Edison plant that lights a portion of the factory, is supplied the current for running the device. In front of the shelf supporting the sewing machine is a seat for the operator, who controls the action by means of a pedal connecting with the rheostat arm.

With this pedal is also connected an upright standard, thus rendering it feasible to dispense with a rider and to operate the machine while standing on the floor.

To obviate the necessity of the operator touching the carpet with his hand, a self-feeder is attached in front of the sewing machine.

The machine is placed on tracks at the side of a long table, upon which are placed the carpets to be sewed. In a groove running the entire length of the table are fitted a number of blocks and clamps; the blocks, which may be moved to any desired position in the groove, clutch the ends of the carpet, while the clamps, by means of a screw, tighten and stretch it. In this way a number of small carpets may be placed on the table at the same time, and stretched and sewn at once.

A rigging directly above the table greatly facilitates the handling of long and heavy carpets. This rigging consists of a rope extending the full length of the room, and having attached to it at intervals small pendent cords, each with a hook at the end. When it is desired to turn the breadths, these hooks are fastened into the edge of the carpet, the small cords are wound up on the main rope by a windlass, and the carpet raised up on end and held there until another breadth is put in place. The hooks are so arranged that they release themselves when brought into contact with the framework above, so that a few extra turns of the windlass drops the carpet. Basting pins are suspended by cords from a wire overhead, with a small weight on one end of each cord; this weight draws up the pin as soon as it is released from the carpet, until checked by a small wooden stop placed at the proper point on the cord. The pins are extracted by a V-shaped guard placed back of the needle on the machine.



THE ELECTRICAL CARPET SEWING MACHINE.

The practical working of the machine is as follows: The carpets are placed on the table and stretched by means of the blocks and clamps, with their edges flush with the edge of the table, and the basting pins put in at intervals of about a yard. The edge of the