
Better
AND MORE ECONOMICAL
Sawing

DISSTON STEEL

Henry Disston, in his early years of saw making, was obliged to use foreign made steel. Having difficulty in obtaining high grade steel of uniform quality which he required for the production of hand saws, he determined to make his own steel. He then set about mastering the art of steel making, turning to crucible steel in order to obtain the highest grade steel of that day.

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In 1855 Henry Disston built his own furnaces and melted the first Crucible Saw Steel ever made in America, becoming a pioneer in fine steel making. From that day on, Disston has been making its own saw and tool steel.

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In 1906, faced with the necessity of making steel in larger heats, Disston again made a pioneering step. Electricity was used in heating the furnace and the first commercial heat of Electric Tool Steel of crucible quality ever made in America was cast in the Disston plant. Since then, Heroult Electric Furnaces, capable of pouring from three to six tons at a heat, have been placed in operation.

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The steel mill in the Disston plant today is equipped with modern steam hammers, steel rolling mills, annealing furnaces and all other modern devices for making high grade saw and tool steels. Heat is controlled in the furnaces to the closest degree by pyrometers; testing is done by skilled men in the laboratories under the close supervision of Disston's nationally known metallurgists. Exacting tests and laboratory checks control the output of the Disston Steel Works at all times.

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Disston Steel is known the world over and is famous for its toughness, stamina and long cutting life.

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The high quality and uniformity of Disston Steels, is such that manufacturers of other products who require steel to meet the most exacting requirements, come to Disston for their finer steels.

Foreword

This book is issued to help operators of portable sawmills (sometimes called "ground mills") to obtain the best results. It is not written with any idea of being a handbook on the erection of permanent mills, or on those having their mill decks above ground, but operators of these mills will find much to interest them in the following pages.

Our book is inspired largely by our desire to help beginners in this business, of whom there is an ever-increasing number in recent years, especially those buying light powered sawmills.

Inexperienced operators often have trouble, for which they blame their saws, while what is usually necessary to correct the trouble is a readjustment of the mill. We recommend that a copy of this book be kept in the tool chest where it can readily be referred to by the sawyer, and that a thorough examination of the mill be made before any saw is condemned.

We have found, in an experience of many years, that 90 per cent of all saw trouble is occasioned by improper adjustment of the mill, or by the mill getting out of line. Therefore, in compiling this book we have co-operated with manufacturers of sawmills in attempting to solve the troubles most frequently met, and dedicate this book to "Better and More Economical Sawing."

HENRY DISSTON & SONS, Inc., PHILADELPHIA, U.S.A.

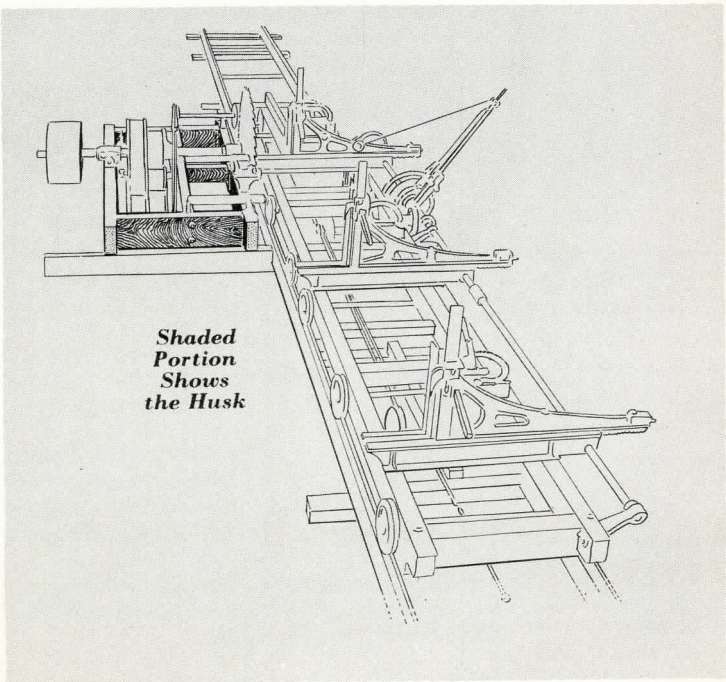
CANADIAN FACTORY: TORONTO, CANADA
AUSTRALIAN FACTORY: SYDNEY, N. S. W.

SETTING UP A GROUND MILL

FOLLOW the directions of the maker of your mill as to general details of "setting up", adjusting the feed works, etc., but before starting to lay anything down, pay special attention to the following suggestions, which, if added to the sawmill manufacturers' instructions, will save you much trouble and expense and aid in making your mill a money-earning proposition.

SETTING THE HUSK

The proper foundation. To secure the best results the mill should have a firm, solid foundation, one which will not move when heavy logs are rolled on the head blocks.



Placing the timbers. The timbers or sills on each side of the saw-pit should be at least 6 inches x 10 inches x 14 feet, or long enough to extend out under the track stringers. These

mud sills, or timbers, should be not smaller than 6 inches x 10 inches, while larger timbers, 8 inches x 10 inches or 8 inches x 12 inches, will be better and should be made of seasoned timber. Sound-heart yellow pine is preferable.

These timbers should be bedded solidly in the ground about half of their thickness, and cross-ties which form the foundation for carriage track ways should be leveled with the mud sills on which the saw husk rests.

If the ground is at all spongy, stakes driven down to solid ground under the sills will help maintain their position.

To obtain the best results it is very important that all foundation timbers and stringers be level.

Disposing of sawdust. In digging the saw-pit be sure to get it deep enough to allow the saw to clear itself of dust readily.

There are several inexpensive forms of sawdust conveyors designed especially for use with portable sawmills. The addition of one of these to your mill will be a profitable investment.

One economical and efficient way to handle the sawdust where it is used for fuel in a steam boiler is to set the front end of the steam boiler on a line with the back end of the saw husk. Then by digging a pit in front of the boiler, the same depth as the sawdust pit under the saw husk, by using a "chute" made of sheet iron, the sawdust will be deposited from the saw to storage space in the front of the boiler without the use of a dust conveyor or exhaust fan.

When the husk is secured properly with bolts through mud sills, go over the husk carefully with a level *to see that it is level in every direction.* This is most important.

THE STRINGERS, OR WAY TIMBERS

These should be made from well-seasoned timbers. Sound-heart yellow pine is preferable, size 6 inches x 6 inches.

Size of cross-ties. If the track stringers are not over 3½ inches thick, the cross-ties supporting them should be 18 inches apart; if heavier, 24 inches will be close enough.

Leveling the way timbers. They should show exactly level for the entire length—tested lengthwise and crosswise with a good level.

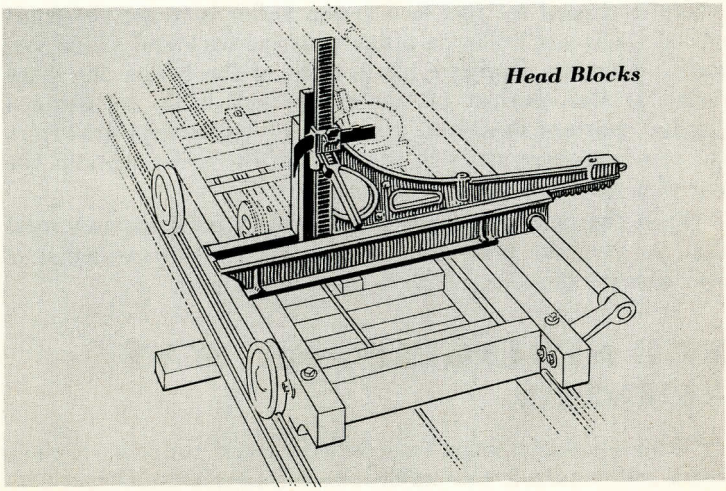
Do not fail to have the track parallel with the husk and true and level from end to end. When the track is not level, or not in line, good work cannot be accomplished with the saw.

No lead in track. Do not attempt to give the track any lead with the idea of putting the lead into the saw with the track. The track should be parallel with the husk. This book will tell you how to properly line the saw for lead. (See page 9.)

Adjusting screws are on the mandrel journals or bearings to take care of the lead.

HEAD BLOCKS

The track should be so placed that the nose or front end of the head blocks clears the saw by ½ to ¾ of an inch. Head blocks should be about one inch above the saw collar. Do not line up under the head blocks; raise the stringers or lower the husk frame until the head blocks clear in this way.



Head Blocks

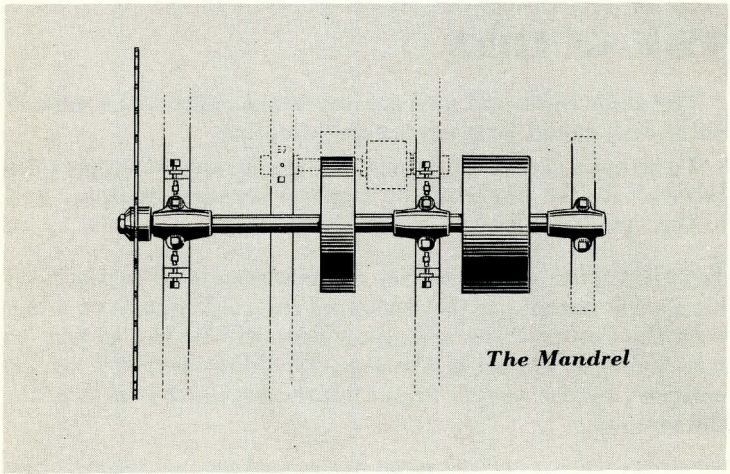
Testing head blocks. Run the carriage its entire length with a level on each head block to see that carriage will pass the saw without rocking.

TIGHTENING UP

Be particular to see that every nut, screw, or set screw collar is properly fastened. Make everything good and solid.

THE MANDREL

Having followed the instructions to see that the husk is level, see that the mandrel is level and that the shaft fills the boxes. The mandrel should be constructed so that there is no end play when the saw is running. End play of mandrel should be taken out by using set screw collars against bearing box.



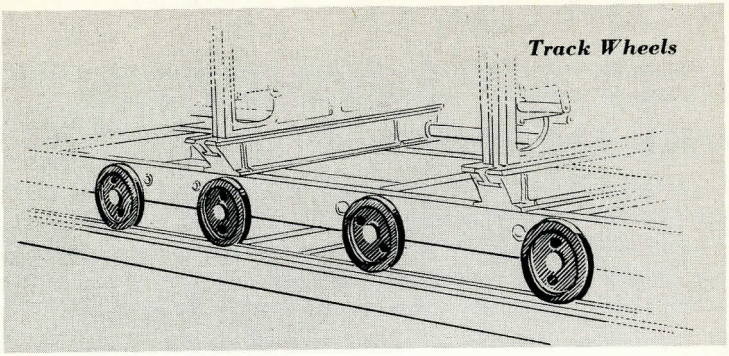
The Mandrel

TRACK WHEELS

(See illustration, page 8)

The track wheels are a source of great trouble when not properly looked after, and many a good saw has been spoiled or condemned when the trouble really is due to wear in the track wheels.

These wheels should move freely, but must not have any end play. Close up space between boxes and hub of wheel with nut provided for this purpose, or tighten up the set screw collars holding them in place, frequently, but do not set the wheels so tight that they bind and stick.



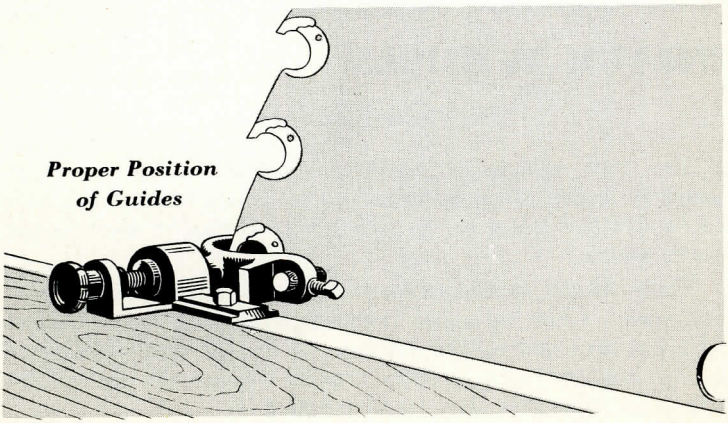
Track Wheels

THE GUIDES

The guide block and pins are important parts of the sawmill outfit and should be given special attention.

To insure a good-running saw, the guides should support the blade above the center of the mandrel because the upper half of the saw does all the work.

Setting the guides. Set the guides as high as the head blocks will permit. If the bottom of the guide pins is on a line with the center of the saw, the guides will be low enough to miss knots or crooks in the logs, providing ordinary care is exercised by the sawyer in placing the log on the carriage for the first cut.



Proper Position of Guides

Secure the guide block firmly to the husk frame. Loose guides will cause a lot of trouble.

The guide pin on the board side should be even with the face of the fast collar and should be set with a long, straight edge, before placing the saw on the mandrel.

Inside guide pin. Set up the inside guide pin when the saw is in motion. The guide should be just close enough to steady the saw. The guide pins should not force the saw over to one side, nor should they be set close enough to heat the rim of the saw. Another way to set guide pins is to "open up" the pins while the saw is not in motion. Then, after the saw is running, at full speed, bring the pins up to the saw, leaving about $\frac{1}{32}$ inch between the saw and each guide pin, and securely lock both pins in position.

Material for guide pins. Guide pins should be made of hard end wood. If the saw rattles in guides, have saw and mandrel examined immediately.

Position of guides. Set the guide pins to clear the bottom of the sockets, or gullets of teeth, about one-quarter inch. This is particularly important with inserted tooth saws; if the guide pins rub or touch the holders, they will turn the holders out of place.

Moving the guide. When the saw gets slightly dull, the guide may be moved toward log slightly. When the saw is filed, the guide pins should be moved back to their original position. Do not run saw too long without filing. If the logs are gritty or dirty, it will pay to file the teeth often.

THE LEAD

Proper alignment of saw with carriage track is very important.

How much lead? In order that the blade may clear itself properly and to avoid heating, it is necessary to give the saw a slight lead into the log. A saw which heats at the center requires more lead; one which heats at the rim, less lead.

Adjustment of the lead is best accomplished by use of the adjusting screws on the saw mandrel boxes.

The saw should have a lead into the log of about one-eighth of an inch in twenty feet. Some saws need a little more, some a little less. Hard wood requires less lead than soft wood. A sawyer often finds that his saw operates well in soft wood, but will not work in hard wood. The trouble frequently can be corrected by reducing the amount of lead.

Under no circumstances should the saw be lined straight with the track and then held in with the guide pins. Line the saw properly, and it will cut more and better lumber with less power consumed.

Be careful to see that the guide pins do not touch the saw when adjusting the lead.

Rules for lining the saw. The following methods of lining the saw: Move the rear head block up opposite the center of the saw. Fasten a stick lengthwise across the head block, so that the end of the stick is set one-eighth of an inch from the saw. Now run the carriage back toward the log deck until this stick is twenty feet from the center of the saw. Stretch a line from the end of the stick along the face of the saw, so that it touches the rim of saw on both sides of the center of saw. If it does not touch the saw on the rim on both sides of the center, adjust the main mandrel box by the set screws on each side until it does. The saw then has a lead into the log of one-eighth inch in twenty feet. This is called "slewing" the mandrel to regulate the lead.

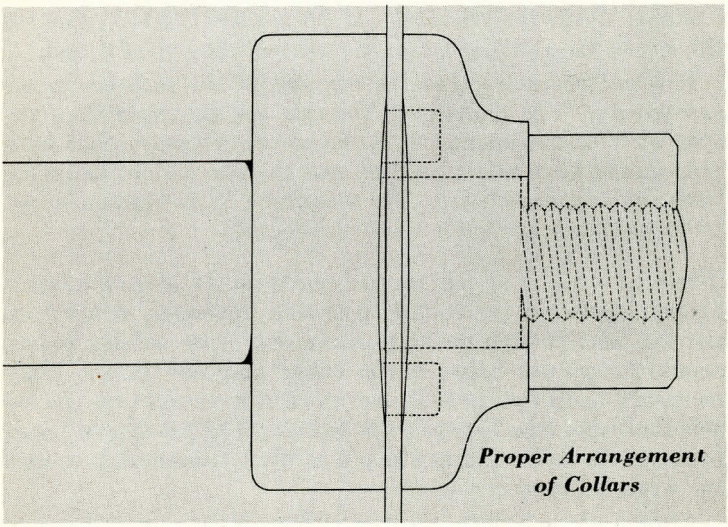
Another method is to hold a pointed stick on one of the head blocks which has been moved up to the edge of the saw that engages the log and which we shall call the "front edge." Then have the carriage slowly pushed forward until the pointed stick reaches the rear edge of the blade. At that point it should show a clearance of one-thirty-second of an inch in a sixty-inch saw. Turn the saw around and try again on all four quarters. The pointed stick on each test should clear the saw the instant the carriage moves forward. This test should be made from the side of the saw itself and not from the corners of the cutting teeth. The foregoing will provide a lead of one-eighth of an inch in twenty feet.

There are many other excellent methods of adjusting the lead, but they are all more difficult and more subject to error than those we have outlined.

Always be careful to see that the guides do not touch the saw when adjusting the lead.

COLLARS

It is desirable to have saw collars as large in diameter as possible and thick enough to stand all strains. Small collars do not give sufficient support to the saw, and thin collars are liable to bend and run out of true.



Proper Arrangement of Collars

Shape of the fast collar. The fast collar should be perfectly true, but slightly concave on the face; just enough to show light under a straight edge. This is to insure that the outside rim of the collars will grip the saw.

Shape of the loose collar. The loose collar should be perfectly straight on rim and slightly concave toward the center to insure the saw hanging straight on the face, or log side.

Proper construction of collars. The construction of the collars should be such that they are recessed, or hollowed out slightly toward the center, having rims ¾ inch wide with which to engage the saw. In other words, it is not necessary for the collars to grip the saw over their entire surface. Indeed, this is quite impossible. If they hold the saw blade firmly for a distance of, say, ¾ of an inch around their rims, it is sufficient.

Putting in lug pins. When driving in the lug pins, a burr is sometimes thrown up on the collar in which the pins are secured. This should be watched carefully and the burrs removed, otherwise the saw is liable to be thrown into a twist.

Size of hole in saw. The size of hole in saw should be a sliding fit on the mandrel. If the mandrel is too small, or the eye of the saw too large, the saw will be out of round.

It is not necessary that the lug pins fit the pinholes in the saw snugly. The pinholes in the saw can be larger than the pins without detriment. It is, however, necessary that both pins should have a fair bearing, and the saw should be pulled back on tug pins before the mandrel nut is tightened up. Otherwise they are liable to be sheared off.

Truing the saw between collars. If, after the saw is fastened between the collars, it should not stand straight on the log side, enough packing pieces, cut from writing paper, should be placed between the collar and saw in the place necessary to throw the saw over until it is straight on the log side and runs true between the guides. The placing of paper between the collar and saw is not at all detrimental, provided the work is properly done.

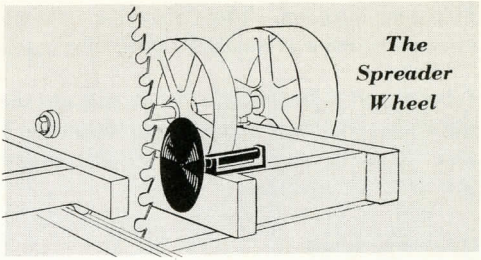
Always use a wrench when screwing up the mandrel nut to tighten collar and saw. The use of a hammer on the nut is damaging.

SPREADER WHEEL

The spreader which is behind the saw should be set in line with the log side of the saw and about one inch clear of the teeth.

Its function is to spread the board clear of the saw to keep

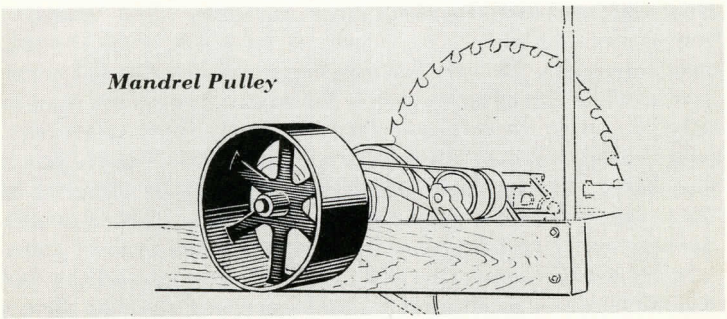
it from scratching the lumber: at the same time to keep the log from rubbing the center of the saw in case of springy timber. Bolt the spreader wheel securely.



The Spreader Wheel

PULLEYS ON SAW MANDRELS

In an endeavor to make saws run fast, sawmill men often use mandrel pulleys which are too small. While speed is power,



Mandrel Pulley

it ceases to be power when the engine behind the saw is not of sufficient strength to maintain the speed, both in and out of the cut. It is possible to use up all the power in speed without accomplishing anything.

Maintenance of speed. Nothing whatever is gained from a condition which allows a saw to run at a high speed out of the cut and drop down to two-thirds or one-half of this speed in the log.

Increasing the size of the mandrel pulley to run the saw at a regular speed has the advantage of gaining power by increased leverage at that point. Run the engine at the highest speed it will stand, without overspeeding, and select the proper diameter of pulley in accordance with the foregoing.

Proper speed. The question of proper speed for the various powers is treated under the caption of speed, page 17.

Changing pulleys. It is always better to use a larger pulley on the saw mandrel to decrease the speed of the saw, and to use a larger pulley on the engine if the speed of the saw is to be increased.

POWER

Most of the sawmill troubles are due to a lack of power. In buying an engine and boiler be sure to have a surplus of power instead of a shortage. The new high-pressure boilers now being operated in portable sawmills are very beneficial and have been found a paying investment.

Bad adjustments decrease power. The effective horsepower available in most mills is far below what the mill owner supposes. He may have an engine of 25 indicated horsepower, while the effective power for working purposes may be only 10, owing to excessive friction, badly lined machinery, poor belting, leaking cylinders, or ratio of transmission of power too sharp. The speed of the driven can only be obtained at the expense of the driver. In steam powered portable sawmills having twenty to thirty-five horsepower, if the ratio of transmission is two to one, this will give good results, and the saw will come nearer maintaining a uniform speed while in the cut than it would if the ratio of transmission is sharper, say, two to three.

Where gasoline or fuel oil motors are used, we find that a ratio of transmission of one to three gives better results than a ratio of one to two and one-half, for while the latter would work to advantage while cutting small logs, it would over-load the motor and cause the saw to lose its speed while cutting large logs.

Consideration should be given to the length of belt that drives the saw, as a belt of fair length gives better results than a short belt.

The remedy. Employ an experienced, efficient mechanic to overhaul the appliances and put everything in proper shape.

BOILER WATER

A steam boiler needs good water as much as it needs good fuel. Hard water invariably forms scale, and comparatively soft water may also form scale if the boiler is used too long without being emptied.

Clean the boiler frequently. A boiler should be emptied regularly—opened, cleaned, and the scale removed. The frequency of this is determined by the quality of the water used, but in no instance should the boiler-cleaning periods be further apart than one month of actual use.

"Foaming". Foaming is caused chiefly by an excess of alkaline salts, which causes the water to form suds, as if soap had been placed in it. In case of foaming, close the throttle and keep it closed long enough to show the true level of the water, because foaming water tends to show more water than is actually in the boiler. If the level is sufficiently high, feeding water and blowing off will tend to correct this evil. In case of violent foaming caused by dirty water, or a change from fresh to salt water, or vice versa, check the drafts and bank the fires in addition. When foaming is constant, change the water frequently.

"Mudhole" Water. It is believed by many millmen that if a mudhole can be dug out or enlarged, so as to furnish enough water for the boiler, then the water problem is solved. Many boilers have been ruined in this manner.

None but clean water should be taken into a boiler, for, as the mud settles, it gathers on the tubes and around the firebox, making it more difficult to keep up steam, besides ruining the boiler.

The use of a suitable boiler-scale compound, recommended by a responsible manufacturer for each individual case and suitable to local conditions, is advised.

The safety valve. Watch the condition of the safety valve. Test often and comply with the state laws covering them.

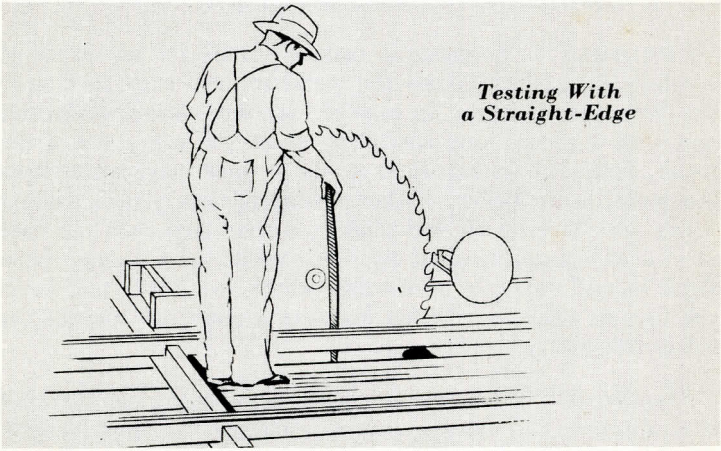
Heat the feed water. Feed water should be as hot as possible. Always heat the feed water, even if only with a jet

of steam in a barrel. Best of all, use all of your exhaust steam in heating feed water. Cold water should never be pumped into a hot boiler.

HANGING THE SAW

Be sure that the saw hangs plumb. A saw which is out of plumb will not cut square lumber.

Examine this point frequently, because the husk frame may sink slightly on the side bearing the saw, thus throwing the saw out of plumb.



Testing With a Straight-Edge

Test with straight-edge. Try the log side of the saw with a long straight-edge to see that it is flat.

Never attempt to run a saw which is dished on the log side, for it will draw into the log.

Use of paper rings. If a saw is found to be full or rounding on the log side, cut two rings of paper one-half inch wide—one the full diameter of the collar and the other the size of the hole in the first ring. Oil the papers and stick the large ring on the fast collar and the small one on the loose collar. The reverse practice is necessary when the log side of the saw is dished.

If two rings are not enough to throw the saw straight on the log side, cut additional rings and put enough of them in to make the saw straight on the log side.

Not all saws hang alike on the mandrel. Remember, it does not follow that because one saw works well on a mandrel that another will, or that two saws will hang exactly alike on the same mandrel. This is also true of the lead.

Heating is a danger signal. Remember, when the center of a saw heats while the box next to the saw runs cool, it is an indication that it requires more lead into the log, and the reverse if it heats at the rim. See article on "The Lead", page 9.

SPEED

The question is often asked, "What is the proper speed at which to operate a circular saw? The answer is:

The speed of a circular saw for a portable sawmill is the greatest speed which can be maintained both in and out of the cut.

A common mistake. The usual mistake of portable sawmill operators is to try to operate their saws at too great a speed. A regular uniform speed, both in and out of the cut, insures more lumber and better cut lumber.

Read the article on "Pulleys on Saw Mandrels", page 13, and on "Power", page 14.

Speed governed by horsepower. The speed of a circular saw in a portable mill should be governed by the horsepower available to drive the saw. Operators of small power mills must be content with slow speed. The speed may be increased as the power to drive the saw is increased.

Speeds recommended. For portable mills we suggest the following speeds:

Available power	A diameter of saw	Speed per min.
12 to 15 H.P.	44″ to 60″	300 to 350 rev.
16 to 20 H.P.	44″ to 60″	350 to 400 rev.
21 to 25 H.P.	44″ to 60″	400 to 450 rev.
26 to 30 H.P.	44″ to 60″	450 to 500 rev.
31 to 35 H.P.	44″ to 60″	500 to 550 rev.
35 to 50 H.P.	44″ to 60″	550 to 600 rev.

Additional speeds for high-powered mills. Where the power is ample and sufficient to maintain a speed of 10,000 rim feet a minute, the following is a table of speeds, but this list is not given as an indication that we recommend these speeds for anything but the highest-powered mills, and only where the speed can be maintained both in and out of the cut.

(Approximate speed for saws running 10,000 feet per minute on rim)

72″ 530 R.P.M.	36″ 1080 R.P.M.
68″ 560 R.P.M.	32″ 1225 R.P.M.
64″ 600 R.P.M.	28″ 1400 R.P.M.
60″ 640 R.P.M.	24″ 1630 R.P.M.
56″ 700 R.P.M.	20″ 1960 R.P.M.
52″ 750 R.P.M.	16″ 2450 R.P.M.
48″ 815 R.P.M.	12″ 3260 R.P.M.
44″ 890 R.P.M.	10″ 3920 R.P.M.
40″ 980 R.P.M.	8″ 4600 R.P.M.

Ordering new saws. When new saws are ordered, it is important that we be advised of the exact speed at which the saw is to be operated, both in and out of the cut. This should not be guessed at or figured up from the pulleys, but actually taken with a speed indicator.

RULES FOR CALCULATING SPEED, ETC.

Problem 1: The diameter of driver and driven pulleys and the speed of the driver being given, find the speed of the driven.

Rule. Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

Problem 2: The diameter and revolutions of the driven pulley being given, find the diameter of the driver.

Rule. Multiply the revolutions of the driven by its diameter, and divide the product by the revolutions of the driver shaft; the quotient will be the diameter of the driver.

SUMMARY OF IMPORTANT DETAILS

Put down the mill solid, level, and straight.

Carriage trucks should be free from end play.

Set works should be accurate and positive.

Saw arbor should be heavy, level, and with as little end play as possible.

Saw must hang plumb.

Saw must be an easy, sliding fit on mandrel.

The collars should both be recessed.

Saw should be straight on log side when collars are screwed up.

Saw must never hang dished on log side.

Saw must be hammered for correct speed.

Saw must have lead into log of about $\frac{1}{8}$ inch in twenty feet.

Guides must not hold saw in or out of cut.

Set guides after saw is in motion.

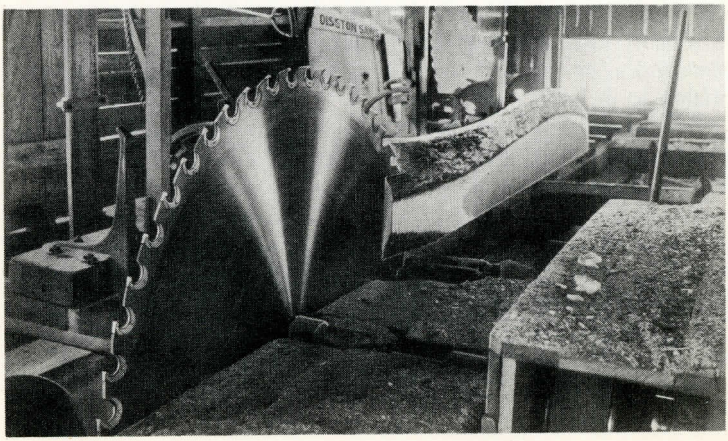
Set guide on board side even with face of fast collar.

Keep guides above center of saw.

Mandrel must not be allowed to heat in its bearings.

Speed of saw should be uniform in and out of cut.

Keep all gum and sawdust off the tracks.



THE SAW AND ITS CARE —

In the first place, it is essential to select a saw of the proper diameter, gauge, and number of teeth to suit the power, kind of mill, kind of timber, and average size of logs to be sawed.

If you can not decide on these points after reading these pages, submit the entire proposition to us, giving full particulars regarding your outfit, whether hard or soft timber is to be cut, the horsepower available to drive the saw, the speed of the saw mandrel, and the size of logs. Then we will advise you.

Thickness of blade. In selecting the saw do not buy too thin a blade. A thin saw will not stand up to the work as well as one of proper thickness.

Number of teeth. Do not buy a saw with too many teeth. The maximum number of teeth is only desirable when the logs are small and knotty.

An excess of teeth in a saw simply means that the dust is cut up into fine powder, resulting in a loss of power and a reduction of capacity.

Be sure to have enough teeth to secure the full benefit of the power employed. Under these conditions an increase in the number of teeth has been known to materially increase the output.

High-powered sawmills of large capacity generally use solid tooth saws. A high-speed, fast, steam-fed saw requires the greatest number of teeth that can be put in it and still allow sufficient dust room in the gullets. Such a saw, having the maximum amount of work to do, requires more teeth with which to do it.

The number of teeth will, therefore, depend not only on the thickness of the blade, but also on the kind of timber sawed and the speed and feed of the mill.

Twelve teeth to the inch of feed in hard wood and ten teeth to the inch of feed in soft wood are considered good in general practice, although fast mills often crowd a saw down to six or eight teeth to the inch of feed. Thus a 60-inch saw, 6 or 7 gauge, should have 80 to 100 solid teeth for fast work, and fewer as the power is limited. The fast mills in the south, cutting yellow pine, find a 60-inch saw, 6 gauge straight, with 90 teeth, desirable. Saws of these dimensions are cutting up

to 100,000 feet a day in long-leaf pine, being operated at speeds of 850 to 950 revolutions per minute.

The more teeth a saw has, the smoother it will cut, but it will require more power to drive it. Hard wood requires less hook than soft wood.

Saws for portable mills. Portable sawmills can use an inserted-tooth saw to the best advantage, saving power. Less experience and skill are necessary in the care of an inserted-tooth saw than in a solid tooth.

Our years of experience with inserted-tooth saws, coupled with more than ninety-nine years of saw making, has produced the DISSTON Double Ball Chisel-Tooth Saw, patented November 10th, 1931, which has proved itself, under the hardest tests, to be the easiest-cutting, lightest-running saw on the market, and its use will insure to the mill owner the maximum results in well-sawed lumber and cause him the least amount of trouble.

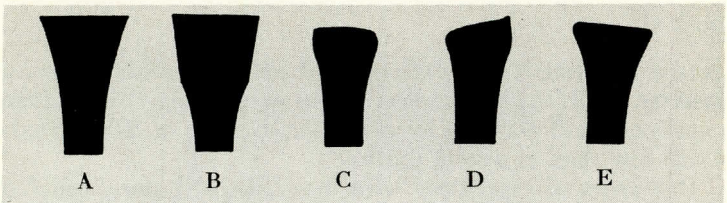
FITTING THE TEETH

Observe the following essentials:

Saw must be perfectly round and in balance.
Backs of teeth must not be higher than the points.
Teeth must be filed perfectly square on the face.
Swage or spread of teeth must be sufficient for perfect clearance.
Swage must be evenly distributed on each side of saw.
Corners of the teeth must be sharp.
Cutting edge of teeth must not be blunt.
Gullets or throats must be properly shaped and sufficiently large to carry the dust.
Avoid sharp corners in the throat of teeth.
Soft wood requires more set or swage than hard wood.
Soft wood requires more hook than hard wood.
Teeth must all be the same length.
Teeth must be kept sharp and not run when dull.
Cutting edge of tooth must be the widest.
Never side dress, so as to leave flat places on sides of teeth.
Teeth should be relieved from the extreme cutting edge backward on sides.

It is necessary that the saw be round, so that every tooth cuts its share of the work.

"Jointing" the saw. Joint the saw carefully, so that every tooth strikes; this is done by running the saw slowly and applying a straight block of emery to the teeth.



Proper (A and B) and Improper (C, D, and E) Shape of Bits

Filing the teeth. Never file so as to lower the point of the tooth, for this will cause the saw to buckle and refuse the feed. After a set of teeth has once been jointed, NEVER file on the top to sharpen except when necessary after jointing. The short bevel caused by jointing should be removed by filing but be sure to hold the file flat on the entire top of the tooth so that you remove as much metal from the heel as at the point. The original top clearance must be maintained.

Keep the cutting edges square. If they are not square and at right angles to the sides of the saw, the saw will lead in the direction they are inclined.

When swaging inserted teeth, the points of teeth should be raised a little, say, two or three thousandths of an inch, because the tooth, while cutting, wears mostly on the face. It also wears a little on top or back, near the point on the cutting edge, which causes the point of tooth to rub for about $\frac{1}{64}$ inch to $\frac{1}{32}$ inch back of the cutting edge, which puts an undue strain on the rim of saw, causing it to pull hard. This condition is eliminated if points of teeth are raised.

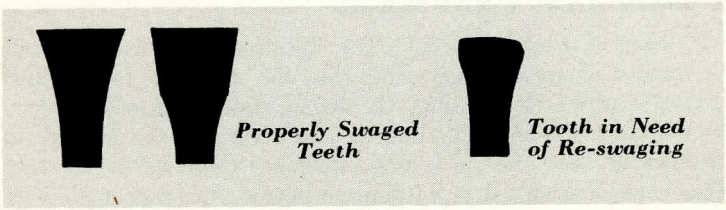
Side dressing. Keep the corners sharp, for while the cutting edge of tooth does the scoring, the side of the tooth cuts the chip loose, and if the corners or side of cutting edge becomes dull, the saw will pull hard, is likely to "put whiskers" on the bottom edge of the cut, and cause the saw to run snaky. Chisel teeth are of uniform width and evenly spread on both sides of the saw. If extra-smooth work is desired, use a side gauge, which can easily be made in the mill with a file, triangular piece of wood and four wood screws.

After side dressing, relieve the sides of the teeth backward from the cutting edge, so that the corners stand out boldly.

Sharpen teeth in saw. It is best not to remove teeth from the saw to sharpen or swage them. A saw can be pointed up and side dressed in twenty to thirty minutes. In this way the greatest value will be secured from the teeth.

Sharpen often. It does not pay to run a dull saw. If the logs are dirty or difficult to cut, it will be necessary to sharpen the saw five or six times a day. A beginner should take special notice of the points, corners, and sides of new bits just as they come from the factory, and endeavor to keep them in the same shape and condition as received.

Swaging teeth. It is not injurious to the saw to swage teeth slightly with a conqueror swage, provided the hammer weighs about three-quarters to one pound. Strike light blows and keep the swage high, so as not to lower top of tooth at the cutting edge. When this angle is altered, the tooth loses its



Properly Swaged Teeth

Tooth in Need of Re-swaging

top clearance, will run hard and pound in the cut. Before swaging, points should be brought up to a sharp edge.

Use the proper file. It is not necessary to do a lot of filing to keep the teeth in good condition, especially if the special DISSTON Inserted Tooth Saw File, which is designed for the purpose, is used. This file enables the operator to retain the original curve on the under side of the bit. File teeth as thin as they will stand without crumbling, and after using the curved side of the file, apply the flat side to file the bevel on the face, exactly as new teeth are beveled.

Inserted Tooth Saw File

File points square. Do not be persuaded that it is necessary to file one corner of the teeth long to make the saw lead in one direction or the other. Always file the teeth perfectly square. The trouble might as well be located and corrected one time as another, and this booklet will tell you how. Look for this little trouble carefully, then fix it and go ahead.

Be sure to file your teeth before it gets too dull, otherwise it will make frequent trips to the repair shop. Put a rule or straight-edge on the back of the teeth occasionally to be sure that they have proper top clearance.

Allow sufficient clearance. Do not run a saw with too narrow a swage. Give the blade sufficient clearance at all times. If the teeth are worn too short to permit swaging, replace them with new ones. Running them too close is false economy. Let us stress the caution not to file out or swage out the proper hook of the teeth if you want an easy-running saw.

FROZEN TIMBER

Winter is a trying time to the millman who lives in cold territories where the logs come into the mill in a frozen condition, and we advise that the entire mill be carefully overhauled to see that everything is just right. If the holders in the saw are worn flat, it is well to replace them before starting this kind of sawing and purchase a new set of swaged holders. Save the old holders until the frost is out of the timber. In winter sawing a fine dust forms, which passes down the side of the saw, freezes to the log, and forces the saw out of the cut. It is necessary to keep good sharp corners on the teeth, and a side file, which will leave flat places on the sides of the bits, should never be used. Be careful to see that the corners are relieved behind the points to the extreme edge.

Special teeth for frozen timber. In sawing frozen timber narrower teeth can be used. In this work short points do better than points of the full length. Teeth which have been discarded in the summer can be used in the winter. Select the teeth in sets of one length. File the corners good and sharp, swage them a little, put them in good shape, and you will be surprised at the results.

CHANGING THE TEETH

Place a cup of oil, together with the new teeth to be inserted, conveniently near you at the back of the saw; place the wrench on the holder; remove holder from socket; clean out and oil the socket and free it of dust and pitch; pick up a new tooth, dip the grooved segment into the oil, place it in position on the holder and hold it firmly and evenly with the sides of the blade, and at the same time press the wrench downward until the stops meet. Do not use undue force. Let the stops meet lightly, and when the tooth is in place, no further pressure is necessary.

Lining up tooth and holder. If the teeth, after being inserted, inclines to one side of the holder, use the wrench as an anvil on one side, and a hammer on the other, to line up the tooth and force it to its proper position. Tooth and holders must be in line and must be kept in line to secure good results.

Removing tight teeth. If a tooth refuses to move with the wrench, never hammer the wrench or the tooth, but place a blunt cold chisel on the heel of the holder, being careful not to touch the saw plate, and tap lightly with a hammer. This will start the tooth and holder and enable you to remove them easily with the wrench.

Many sawyers use a regular mill file to sharpen the teeth. Unless carefully used, this file makes a sharp nick underneath the point. This works to a disadvantage and may cause the breakage of a tooth and thus damage the rim of the saw. We make a regular chisel-point file with one round side, especially designed to keep the throats of teeth round. Saws filed in this manner cut more freely and consume less power.

WIDTH OF CUTTING EDGES

Nothing is gained by attempting to use inserted teeth too narrow on the cutting edge. Teeth should be, when new, 1/4 inch wide for 10 gauge saws, 17/64 inch for 9 gauge; 9/32 inch for 8 gauge; 5/16 inch for 7 gauge; 5/16 inch for 6 gauge.

What happens when teeth are too narrow. Teeth which are too narrow when new become entirely too

narrow to clear the saw blade properly after one or two filings, resulting in the heating and buckling of the saw blade and causing trouble generally. Swaging teeth will restore them to their proper width of cutting edge.

Frozen timber an exception. The cutting of frozen timber is the only exception to this rule. Timber, when frozen, cuts very clean, and consequently it is possible to use, with success, shorter and narrower bits than when the frost is out; be sure to observe the directions given for filing, on page 23.

A poorly hammered saw with proper swaging will run better than a well-hammered saw with poor swaging.

THE GAUGE OF THE SAW

The greater the speed and feed used, the heavier the gauge of the blade must be to stand up to the work. Consequently, in the large and fast mills, where the saving of time and the quantity of the daily output is more important than the saving of sawdust, saws of 6 or 7 gauge are used principally.

For ordinary mills, where the feed is to be pushed to the capacity of the power, chisel-tooth saws 40 to 56 inches in diameter should be 8 gauge on the rim and a gauge or two heavier at the center. Saws larger than 56 inches and up to 68 inches should be at least 7 gauge on the rim and a gauge or two heavier at the center.

For especially hard woods. For cutting the extremely hard woods found in other countries, such as teak, kauri, jarrah, mahogany, prima vera, quebracho, iron bark, lignum vitae, purple heart, the saw blades should be at least a gauge or two heavier, i. e., 7 gauge for 56 inch saws and smaller.

For portable mills cutting mixed timber. For portable mills of more or less limited power, cutting mixed timber, saws 40 inches to 56 inches diameter, 9 gauge on the rim and a gauge heavier in the center, and 56 inches to 60 inches in diameter, 8 gauge at rim and a gauge heavier at the center, can safely be used. This is a popular combination for ordinary small mills where the work is not unusually hard.

Tractor mills using saws 38 inches to 48 inches in diameter can use saws 10 gauge on the rim and 9 gauge at the center. Many users of tractor-driven sawmills prefer saws 9 gauge on rim and 8 gauge in center, because the heavier saw is less liable to injury. By tractor mills we mean mills driven altogether by gasoline or fuel oil.

THE NUMBER OF TEETH

The specific type of saw and the number of teeth placed in the saw is, for a log mill, a highly important matter. If the operator or the prospective buyer is not quite certain of his ground in this particular, it will be to his advantage to consult our factory, giving full details as to the make and type of mill on which the saw is to be used.

Give also the horsepower available to drive it; or, if this is not certain, the size of engine with its speed and the boiler pressure; the speed of the saw or the diameter of the driving pulley on the engine and the diameter of the pulley on the saw mandrel, with sizes of all pulleys intervening, if saw is not driven directly from engine. State the kind of timber to be cut and the average size and length of log. We will then be in position to recommend the proper number of teeth.

How to determine the number of teeth required. Where the timber is clear and fairly free from knots, the minimum number of teeth will work to the best advantage in mills having light power. Where the timber is small and knotty and the desire is to push for quantity, the number of teeth should be increased accordingly, sometimes to the maximum number.

Thus in a mill of 25 horsepower, if the logs are of fair size and a 48-inch saw is the proper diameter, 34 to 40 teeth will prove ample. If the logs are small and knotty and the power is ample, the number of teeth can be increased advantageously to 48. A 48-tooth Double Ball Saw will do all the work possible with a 25 (steam) horsepower mill and will be found a well-proportioned saw for fast cutting in small logs.

Bearing in mind what is contained in the foregoing, and also that the number of teeth bears a close relation to the power and speed, we give the following table for powers ranging from

10 horsepower (steam) to 60 horsepower (steam). Gas and oil driven engines are not considered in the preparation of this table:

Diameter of Saws	40″	42″	44″	46″	48″	50″	52″	54″	56″	58″	60″
10 HP....	16	18	18	20	20	20	22	22	24	24	26 Teeth
RPM.....	350	350	350	300	300	300	300	300	250	250	250
12 HP....	18	20	20	22	22	24	24	24	26	28	28 Teeth
RPM.....	350	350	350	350	300	300	300	300	300	300	250
15 HP....	22	24	24	26	26	28	30	30	30	30	32 Teeth
RPM.....	400	400	350	350	350	350	300	300	300	300	300
20 HP....	24	26	26	28	30	32	34	36	38	40	40 Teeth
RPM.....	450	450	450	450	400	400	400	350	350	350	300
25 HP....	28	30	30	32	34	36	38	40	42	44	46 Teeth
RPM.....	500	500	450	450	400	400	400	400	400	350	350
30 HP....	36	38	40	40	42	44	46	48	50	50	50 Teeth
RPM.....	550	550	500	500	450	450	450	400	400	400	400
40 HP....	40	42	44	46	48	50	52	52	52	52	54 Teeth
RPM.....	600	600	600	550	550	550	550	550	550	500	500
50 HP....	40	42	44	46	48	50	52	54	56	58	60 Teeth
RPM.....	700	700	700	700	650	650	650	600	600	600	600
60 HP....	44	46	48	52	54	56	60	62	64	66	70 Teeth
RPM.....	900	850	850	850	800	800	750	750	700	700	640
For tractor use.....	28	30	30	32	34	—	—	—	—	—	— Teeth
RPM.....	550	550	500	450	450	—	—	—	—	—	—

HP—Horsepower. RPM—Revolutions per minute.

For Pacific Coast Mills. On the Pacific coast or in mills west of the Rocky Mountains it is the rule to place about 20 to 26 teeth in a 48-inch saw, and the speed should not be in excess of 400 revolutions per minute for the smaller mills. Pacific coast mills of the portable or semi-portable type use saws with fewer teeth than the eastern mills and use sizes of teeth which will give the greatest amount of throat room.

Generally speaking, a heavier feed per tooth can be carried when cutting western timber, because it is not so hard to cut as the hard woods and resinous timbers of the Atlantic coast.

HOLDERS OR SHANKS

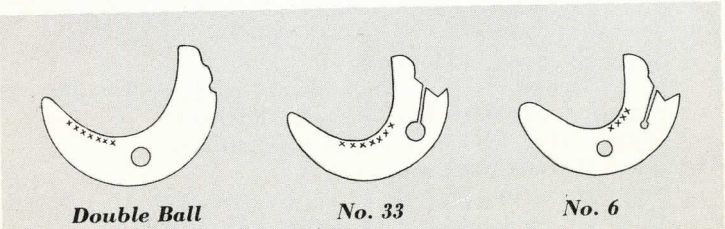
The retaining pieces which hold the teeth in place are given so many names by millmen that it is difficult at times to understand what they mean. They are called "circles", "moons", "gums", "rings", "collars", etc., but the real name is holders.

A holder always should be held in line rigidly when the tooth is inserted to see that it follows the V in the saw and stands absolutely in line when turned into its position.

Kinds of holders. Holders are made of swaged patterns, which are one and one-half gauges thicker under the head or ball than the saw plate proper, thus forming a flange which keeps the cut clear of dust and which is particularly necessary in cutting frozen timber.

Never run saw with loose holders. The holders should maintain practically the same pressure on the tooth at all times. If they are allowed to become loose, the tension in the center of the saw will seem to be increased. This is because the pressure on the rim has been released.

The remedy: replace the holders, if they are worn thin. If they simply have "set" or become compressed, take them from the saw, lay them on an anvil and strike them on both sides at points indicated by the X marks on diagram, until they are expanded sufficiently to hold the teeth securely.



Double Ball *No. 33* *No. 6*

In different patterns of holders it is necessary that these blows be put in different places. See above illustrations.

Be careful not to hammer more on one side than the other and do not bend the holder in doing this work. Never hammer the saw blade or the V-ed portion of the holders.

Worn Sockets. Through long usage the socket in the saw holding the shank may wear. To overcome this we make two extra sizes of holders—one 1/64 of an inch, the other 1/32 of an inch larger than regular.

The proper way to insert new teeth. When inserting new teeth, do not permit the holder to ride up out of the bottom of the socket or ride on the head of the holder. If held properly, and if the wrench is pulled down as well as turned with the socket, the teeth should move in easily. If a tooth rides, raise the wrench and so bring the head of the holder up until it again assumes its proper place in the recess in the tooth. It will then turn in readily. When inserting a new set of holders and when changing teeth, oil the V in the holder and point to avoid binding and undue wear.

HAMMERING

A poorly hammered saw oftentimes runs well with skillful fitting of teeth and care of the holders. A well-hammered saw can not do good work with poorly fitted teeth. The care of the cutting edges of teeth is of utmost importance.

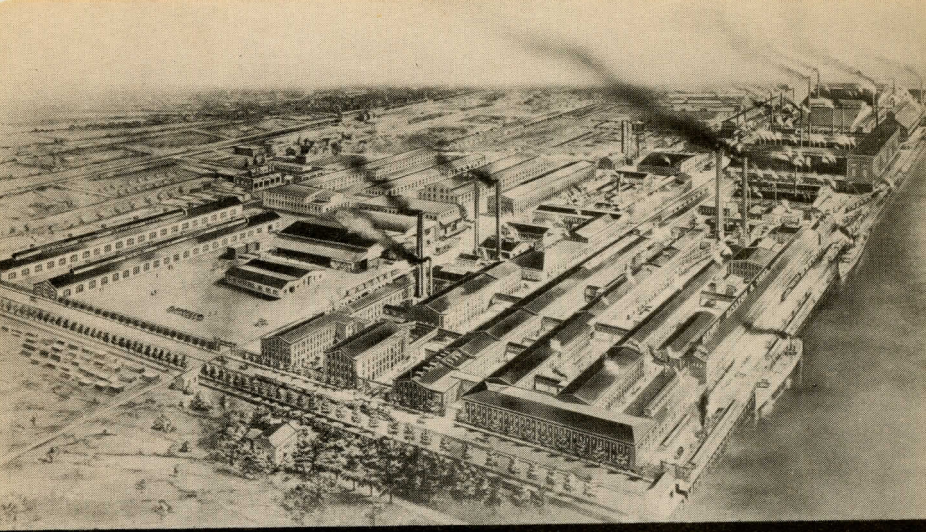
Sending saws for repairs. If all our instructions have been followed regarding the adjustment of the mill and care of teeth and the saw still does not operate to your satisfaction—write us in detail regarding the trouble and we will advise what should be done.

Whenever inserted tooth saws are returned to factory for repairs, leave all points and holders in place. Also:

State the hand of the mill;
Speed in and out of the cut (do not guess at or figure from the pulleys, use a speed indicator);
The greatest feed in inches per revolution;
Kind of timber being sawed;
Horsepower available to drive the saw; and
Whether the mandrel runs warm, hot, or cold.

To judge the "hand" of a mill, stand in front of saw, with it cutting toward you. If log or carriage is on right side, it is a right-hand mill; if on left, it is a left-hand mill.

FINALLY *We have attempted to make these instructions complete. If, however, you do not understand clearly what we have said, or if there is some problem that we have overlooked, write to us. We will be glad to give you complete information.*



DISSTON SAW, TOOL, FILE, KNIFE AND STEEL WORKS

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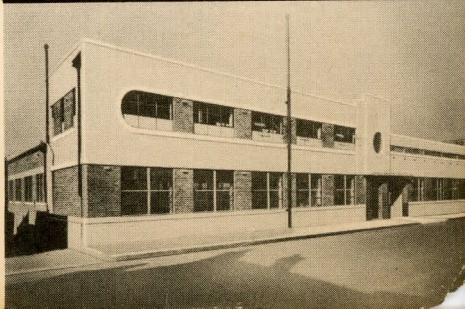

AUSTRALIAN FACTORY
SYDNEY, N. S. W.

HENRY DISSTON & SONS, Inc.
111-115 N. JEFFERSON ST.
CHICAGO, ILLINOIS

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