B. T. & B.

Saw and Knife Fitting MANUAL

Fourth Edition

THE

B. T. & B. MANUAL

A Treatise on the Care of Saws and Knives

4TH EDITION

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MACHINERY COMPANY OF AMERICA BIG RAPIDS, MICHIGAN

This company acts as distributor for the Saw and Knife Fitting Machinery and Tools manufactured in the factories of Baldwin, Tuthill & Bolton, Covel Manufacturing Company and the Hanchett Swage Works. Our catalogues illustrate equipment suitable for Saw, Shingle and Cooperage Mills, Pulp, Paper and Textile Mills, the Paper, Tobacco and Quarry trades, Pattern Shops, Crating Rooms, Steel Mills and Miscellaneous Metal Working Plants and indeed for plant operators in all industries that employ saws or machine knives in an important commercial way.

Grouped up, our manufacture covers the following principal lines:
Scroll Band Saw Fitting Machines.
Band Rip and Band Resaw Fitting Machines.
Log Band Saw Fitting Machines.
Gang or Frame Saw Fitting Machines.
Circular Saw Fitting Machines.
Knife Grinding and Balancing Machines.
Tool Grinding Machines.

REFERENCES TO OUR EQUIPMENT

In connection with the practical information contained in this Manual, occasional reference is made to some of the machines or tools manufactured in the three factories, each of which has specialized in this line of manufacture for 30 or more years, but referring the reader more particularly to our complete catalogue which illustrates a highly specialized, composite line, carefully selected with regard to construction, convenient adjustments, and general working efficiency, as well as general adaptation to the varying requirements of different industries throughout the United States and over 30 foreign countries to which the machinery is being largely exported.

We make these references with the hope that same will make the text matter or general information and suggestions more practical and helpful, but it is not our intent to challenge in any respect, the quality or efficiency of machines or tools produced by other manufacturers. The principles or practice outlined in the following pages are presumed to apply in general terms to all types of sharpening and grinding machinery.

REPETITIONS AND CONTRADICTIONS

We desire also to call attention to the fact that in selecting and grouping up the practice of numerous writers and saw filers, there results something of repetition or even contradiction, for which we must beg the indulgence of the reader. The purpose of this manual is to afford information, to stimulate personal inquiry, criticism, and experimentation, on the part of the fraternity of saw filers, each of whom should put to personal use only such methods as prove best by test.

SAW FITTING

The matter presented in the following pages is not an expression of opinion of a single individual, but rather the grouping together of ideas advanced by a considerable number of saw makers, saw filers and mill experts, who as is well known, are not wholly agreed upon what constitutes the best practice in the fitting of saws. It is manifestly impossible to present directions that may be successfully applied in every instance. The quality of different saws and the conditions under which they are used are widely different. There is diversity of opinion among expert filers as regards proper tension, spacing and shape of teeth, amount of throat room, hook, method of swaging and side-dressing, and numerous other details. Where saw doctors thus disagree, it remains for each one to diagnose the case according to his own light, and then prescribe the treatment that his saw appears to need. Care, attention to details, the study of cause and effect, and the use of common sense, must characterize every successful saw filer. The filer, whose work is purely experimental, has no proper place in the filing room and should abandon the profession rather than be forced out of it.

It is hoped that this treatise will present some information that may be applied with advantage or serve as matter for consideration or investigation.

While there is no universal method for the fitting of saws and knives, there is a sort of common ground where all filers can meet and harmonize, and while one man may question the merit of the method of another, he does not necessarily need to feel that such method is an impracticable or an unsuccessful one. We are indifferent whether the matter presented is always in line with the reader's experience or practice and shall anticipate that there may be some statements made that will be challenged. But if criticism and discussion amongst filers shall result, if they shall be set to thinking and talking, something of good will surely follow.

We are indebted to writers in The Woodworker (published by S. H. Smith Co., Indianapolis, Indiana,) for many practical suggestions, and we cannot give better advice to any saw filer than to become a subscriber to that journal. We are also indebted for some illustrative cuts and special matter to W. B. Mershon & Co., E. C. Atkins & Co., Henry Disston & Sons, A. J. Burton, J. H. Miner, N E. Huff, E. L. Mason, N. L. Botten, J. D. Gebott, and others.

DONT'S FOR MILLMEN

Don't keep poor men about you or allow such to experiment upon your saws.

Don't maintain a small, vibrating and dimly lighted filing room and expect your saws to be well fitted.

Don't think that hand fitting of saws or knives can discount machine fitting, unless you are indifferent to profits.

Don't buy any filing room machines on the single ground of cheapness. Facilities of the manufacturer, known quality of his product, evident disposition to give value received, efficiency acknowledged by users, perfect fit and finish, abundant weight and strength and consequent rigidity—these are the elements that govern intelligent and exacting buyers.

Don't refuse your filers good equipment if you value fine results.

Don't be afraid to scrap machines because they are not worn out.

Don't refuse to pay good filers good wages; they make money for you and are the only kind you can afford to have around. Great business to keep 50 to 100 men waiting on the saws 5 to 30 minutes a day because of poor saw fitting.

Don't order a cheap machine in preference to one higher priced. Unwise economy is another name for foolish prodigality. Consider whether a temporary saving will be a permanent one. It is literally true that concerns frequently fail in business because of poor equipment. They can't manufacture as cheaply as better equipped competitors who spread their fixed charges over a much greater and better manufactured output, and make money every day the wheels turn round.

Don't figure that the first cost of a machine or tool is its final cost. Will it last and stand up without continual repairs? Will it be efficient in six months or a year or five years? Every mill has plenty of poor machines that are scrapped soon after purchase or that are continued in use because on hand, but at a direct positive loss. How many such have you?

Don't conclude that a filer who asks you for a better machine or an additional machine is your natural enemy. He gets no rake-off. He is simply seeking for better results, or to save time, or to preserve the life and efficiency of the saws or knives. Give him proper credit for honesty and industry and intelligence.

Don't try to run a sawmill with inconstant or insufficient power.

Don't suffer your carriage to be out of proper alignment with the saw.

Don't run band wheels with faces out of true.

Don't tolerate a carriage track that is neither level nor straight or a sprung mandrel or lost motion in boxes or end play in arbor or trucks, or weak and imperfect collars and pins or guide pins.

Don't buy saws too thin or too thick. You will need to make some saw dust, but this need not be your specialty.

Don't forget that there is some direct relation between the gauge of the saw and the power and the feed and the fitting of the teeth as regards swaging, sidedressing, hook, pitch, spacing and gullet outline, the sawyer and the saw filer.

Don't be satisfied with anything short of the best in mill equipment, for this insures the best in lumber manufacture, and guarantees your profits.

Don't fail to write us when you want information concerning our machines or prices or business practice.

DON'TS FOR SAW FILERS

Don't fail to make yourself indispensable to your employer.

Don't fail to be progressive and on the lookout to find out and try new ideas that show decided merit in them.

Don't attempt to use poor filing room equipment. Ask for improvements.

Don't fail to keep your filing room and machines clean and in good order.

Don't recommend machines to your employer through ignorance or prejudice.

Don't fail to carefully inspect each saw as it comes off the mill.

Don't depend wholly upon sawyer to line the mill or adjust the guides.

Don't pound your saws.

Don't run dull saws.

Don't run saw with more swage than is needed for proper clearance.

Don't use poor emery wheels that glaze or fail to hold their shape.

Don't neglect to check every crack as soon as it appears.

Don't run a saw with many small edge cracks. Shear it. Make it equal to new.

Don't braze often, by avoiding the causes that make brazing necessary.

Don't burn the teeth by severe grinding or defective feeding.

Don't tolerate a rickety, poorly lighted, improperly heated filing room.

Don't run a saw with teeth of uneven length or too slim.

Don't fail to have good lights upon your work

Don't use a poor stretcher. If your stretcher does not tension perfectly, it is a fault of construction, not a fault of the principle.

Don't use a side file in preference to a swage shaper.

Don't fail to keep your swage dies and clamps in good order. Poor swaging and side-dressing waste and spoil quantities of lumber.

Don't use a sharpener that will not feed or grind evenly.

Don't neglect to keep your emery wheels properly dressed.

Don't use a lap grinder that will not grind a square, true surface.

Don't use a retoother or shear that does not cut easily and clean, and without buckling the teeth.

Don't use hammers that cut or mark your saw. Have hammers of proper weight and shape for your work.

Don't use soft, brittle silver solder.

Don't use a brazing clamp that will not braze.

Don't use straight edges that are not straight.

Don't use a forge that will not heat the irons evenly.

ECONOMICS FOR FILERS

Saw filers should be interested in any method, or machine or tool that is well calculated to improve or facilitate saw fitting. Their service is largely mental and mechanical rather than physical. Hence intelligence and skill in a filer are better recommendations than physical strength, or a disposition to hammer and file from morning till night. It is not a question of quantity but quality of work.

The quantity and quality of the lumber cut, and the steady employment of the common labor, depends largely upon the fine fitting of the saws; and the filer is therefore a profitable or profitless man for his employer according as he fits the saws in condition to go.

Mill men and factory operators are rapidly coming to appreciate the importance of a perfect filing room equipment and are usually ready to purchase anything calculated to improve or facilitate the filer's work, if they have confidence in his ability and judgment. There are never too many good men in any calling, and with regard to saw filers, the good filer is the one who makes his services indispensable to his employer. Such a man can command his price.

Every saw filer should seek to become well informed—in the broadest possible manner upon everything pertaining to his trade. The experience of no one man is universal, and hence the need of constant effort to familiarize one's self with all changing conditions in saw and mill management and operation, that as each new condition arises, one may the better meet it successfully.

The competent filer or sawyer should understand millwright work, at least to the extent that he may ascertain when faults lie in the saw, in the mill, the carriage, the track, or any portion of the plant directly under his personal supervision or operation. Defects may lie in any one of these places which, if not ascertained and remedied will render only partially effectual the best of efforts tending to improvement in the care of saws.

The services of a filer may be invaluable at from $4.00 to $12.00 per day, or expensive at $3.00 per day. One filer may increase the cut of well manufactured lumber from two to ten thousand feet per day; another may not only lessen the average cut, but also impair the quality of the output, a double loss.

The actual results in the running of the saws depends upon the skill of the filer, and upon his having high-grade, efficient saw fitting machines to work with. If the filing room is not well equipped the filer should ask for improvements, and it is his business to know what machines will afford the longest and most satisfactory service. He should familiarize himself with what the market affords for each branch of saw fitting, that his recommendation may be based upon comparative merits and actual intrinsic values, rather than on ignorance and prejudice.

As makers of saw fitting machinery we solicit the careful attention of saw filers to our various appliances. We request correspondence concerning our equipment, or respecting new designs or inventions pertaining to saw filing. We recognize the fact that the practical daily user of a machine or tool has opportunities for discovering improvements or suggesting modifications that are rarely possible to the mechanical draughtsman or machine builder, and we are wide open to take hold of improvements or new appliances that promise to have commercial value. But as manufacturers we are bound to consider practical utility and selling qualities as prime considerations in any new device offered us, and are therefore sometimes obliged to decline devices that possess utility but doubtful commercial value.

Every filer should take pride in keeping his filing room in good order, free from dirt and dust, and especially in keeping his machines clean, solidly set, in proper repair, and free from lost motion. Saw sharpeners and lap grinders are particularly liable to cutting and wear, because of the quantity of emery dust that settles upon them. Dust pipes and exhausters are very desirable adjuncts for such machines, and it is highly important that machines using emery wheels be designed and constructed with reference to protecting the slides and journals from dust and keeping them well oiled. Keep the emery wheel head set square with saw, look out for lost motion in feed pawl, pawl slide, and emery wheel slide, and keep all boxes properly babbitted. Otherwise the operation of machines will be impaired and their life shortened. The manufacturer may use good material and endeavor to produce a machine mechanically well built, but he cannot impart brains or the ability to care for itself to any machine.

As a general rule it may be said that the less experienced the filer, and the less he is familiar with up-to-date practice and machine tools for saw and knife fitting, the more prejudiced he is against the use of such tools and the less he is inclined to believe in their efficiency, and to place the responsibility for any failure in their successful use where it belongs—to his own ignorance or lack of skill. He may be likened to a cloud darkening the pathway of progress.

A good filer never hesitates to ask for needful machines, tools or supplies. He knows what he needs and can demonstrate the need to his employer. He anticipates his needs in the small supplies or repair parts such as solder, brazing compound, emery wheels, swage and shaper dies, anvils or other parts liable to breakage or wear and that ought to be at hand for instant use when required. Similarly he equips himself with the essential hand tools such as emery wheel dresser, saw set or tooth straightener, set gauge, side file, jointer, speed indicator, brazing or annealing torch, crack drill, tension gauge templets, hammers in suitable weights and shapes, so that whatever the need may be, he is equipped to meet it promptly under any circumstances. It is certain that the average filer can much better afford to own his own "small tools" than to do without them, if not willingly provided by his employer.

THE SAWYER

A good circular sawyer usually develops into a good band sawyer, although during his first few weeks of practice on the band, he is apt to not appreciate the need of care in feeding and gigging. It is usually but a question of time when by careless feeding or gigging he throws off saws or puts in some twists. The band saw requires an even steady feed, with no spurts and all the feed it will fairly stand without snaking, or dodging. Give the teeth plenty of hook for heavy feed and having plenty of hook give plenty of feed. There should be a well established ratio between the pitch, power and feed. The expert sawyer wastes no time with unnecessary carriage travel. He avoids passing the back of saw with the end of the log. His practiced hand imparts a strong, steady feed to the very end of the cut and he reverses as the teeth leave the cut. Don't attempt to train a poorly fitted saw with the guides These are not designed to make good the want of careful saw fitting. They are only a safeguard. The guides should fit snug up to the blade without binding it, to steady it into the cut and guard against dodging, should the feed be forced in hard or tough places. The lining metal of the guides should not be too hard. The use of extremely hardened liners in the guides may produce cracks. A hardened babbitt liner may be made by melting one part antimony to sixteen parts babbitt.

Set the guide rolls for back of saw about ¾ inch back from saw when saw is running in natural place on the wheels. These rolls should not be required to hold up the saw when in the cut but are simply a backstop for the saw in case of accident. They should run freely, so that when the saw does happen to strike them, there is nothing but the revolving friction. Don't waste time with a snaky saw. Such a saw either needs more tension, or needs an equalized tension, as a saw not open enough or with fast or loose spots will run snaky. A saw with teeth spaced too far apart or with teeth too long or slim, will also snake unless opened a good deal, in which case it is only a question of time when cracks will start in the throats.

Sawyers should be quick and energetic and the man who can hammer, file and repair, has marked qualifications over the one of lesser experience. Given good saws and the mill in good condition, the quantity and quality of the output then depend directly on the judgment and hustling qualities of the sawyer. The ideal sawyer is quick, active, strong, of temperate habits, cool-headed, fearful enough to comprehend danger and possesses quick decision to avoid it.

DETAILS FOR THE BAND FILER'S ATTENTION

1. Mill and track must be solidly set and in perfect alignment.

2. Straining device must be exceedingly sensitive and so constituted as to require the least possible load or strain on the saw. That is to say, if 3,000 lbs. strain will enable your saw to do good work, don't run it with 6,000 or 8,000 lbs. Look to this element with the utmost care. It is unquestionable that many saws are being run with a load on them that is wholly unnecessary and very certain to produce cracking and breaking of saws. Every filer should be millwright or machinist enough to test and satisfy himself on these points.

3. The scrapers or brushes for cleaning the wheel should be looked to frequently, and must serve their purpose properly. Your own mill must have them in proper condition, ready to work right, without wearing the wheel unduly.

4. Know that the dust and bark and dirt of every kind leave the wheel and saw.

5. Clean the wheels whenever necessary, if coated with gum or dirt, with a kerosene wash, or whatever will serve the purpose.

6. See that the face of wheels is flat and true, or, if you prefer a crown, that they are crowned as you want them. You had better shut down a day or two each year and regrind your band wheels, than crack saws on badly worn wheels and make a lot of miscut lumber.

7. Don't think that guides or the cross-line are primary essentials to good band saw cutting. They may be helpful and serve a good purpose, but the less you depend upon them, generally speaking, the better off your saws will be. They should not be steady diet for a saw.

8. Stand in with the sawyer, especially if he is a poor one. If he is a good one, or you are a good sawyer yourself, so much the better. Don't let him "hit the saws too hard."

9. If the logs are dry and sandy, gravelly, or the bark filled with boom spikes, nails or similar foreign matter, calculated to strip corners or teeth, and proper care is not being taken to wash or bark or trim same before coming to the saw, better urge your employer to provide means for reducing this form of trouble to the minimum. All these things concern his profits, and he can't afford to be regardless of them.

The preceding are elements that are extraneous to the filing room, but all of them are likely to be important ones, in one mill or another, and no filer can afford to be a clam, shutting himself up in his filing room and when trouble comes turning his searchlight only in that locality. The good filer is always and everywhere vigilant, and it is this constant and comprehensive vigilance that makes him a good filer, and secures for him better wages than the man of limited resources.

10. Don't think new saws, fresh from the shop, are always fit to run. Many filers think they never are and it would be better for all saw makers if all filers thought so. The steel may be very good, but the tension and the fitting very poor, as applied to your mill and compared to your experience with your mill, examine new saws with utmost care for flaws, revise the fitting and tension, if desirable, and thus give the new saw the best possible show, instead of the poorest. If, then, the new steel is at fault, you have clean hands. It is the number of saws that fly to pieces or crack up on the first tour or two, that keep sawmakers poor, and the prices up.

Now to take up the elements that must necessarily most directly concern your work in the filing room.

1. Swage light and often, to make lumber—not sawdust. Adjust your swage to suit the teeth and make your swage do all the swaging, without recourse to upsetting or spring setting, unless special injury to a tooth makes one or the other of these aids desirable. Uniform swaging requires uniform teeth on all your saws.

2. Adopt a shape for the tooth that common sense dictates. Avoid abnormal shapes, which no sharpener can produce without difficulty, much less any emery wheel maintain uniformly. There are four elements that affect the shape of teeth, called spacing, hook, pitch and general outline of back and depth, all of which are mutually dependent elements. You need enough throat room to chamber all the dust that your feed and speed will cut, and no more. For most band or band resaw requirements, a spacing of 1½ to 2 inches, a depth of ⅝ or ¾ inch, a hook from 5 to 7 inches in 10, a round gullet, a back pitched from point for proper clearance and with an easy curve to base of gullet, which must be lower or higher according to the amount of hook, will serve. If you increase the hook, you must increase the back to correspond or you lose strength and so to get more throat room, either lengthen your teeth, which, beyond a limit, weakens them, or must increase the spacing, which lessens the number of teeth to work with or do both.

If you want a tooth for business adapted to almost any wood, and that can be made and maintained with a modern band sharpener, you can bank on the above limits. If you are looking for trouble try 1½-inch spacing with a 1-inch depth of gullet and 8 or 9 inches of hook in a 10-inch saw, and you will be right face to face with it.

THE FILING ROOM

The filing room is one of the most important departments that make up a sawmill or woodworking plant. The perfect fitting of the saws is the initial step in the manufacture of lumber, or its development into finished product. The men employed in the mill, the daily output, the quality of the output, wait on the saw filing. The steady hum of the saws from morning till night, or the occasional or frequent delays from breakage or poorly fitted saws, depend, to a degree, upon the saw filer. The filing room, and the work of the saw filer, are, therefore, starting points for profit or loss.

The filing room ought to be well located, of good size, well lighted and equipped. In late mill construction more attention is paid to these details than formerly, and many of the older mills are rebuilding their filing rooms, with proper regard to modern requirements.

Filing rooms are variously located in attic of mill, on mill floor, at one side of mill attached, or at one side detached.

A convenient and suitable place for a filing room is to have it detached from the mill and on a level with the mill floor, because if detached from the main frame, it will not be subject to the vibration of mill and the jar of the nigger, bullwheel, etc. A sharpener, power swage, or lap grinder ought to be free from all vibration if you wish to obtain the best results. A sharpener cannot be expected to sharpen a saw to a keen, sharp edge, making all the teeth alike, if the floor on which the machine sits is vibrating and subject to the jar of the logs and the nigger. Too much attention cannot be paid to this point. For a single band mill the filing room may be on the carriage side of the mill detached from the mill. For a double band, it is best to have the filing room overhead, provided the mill is built strong enough to be free from vibration, and the room is sufficiently large, well lighted and cool. It is a mistake to make a filing room too small, for the machines will then be crowded and there will not be room for the filer to lay out his work. Always make the room about two to four feet longer than the length of the saws you will use, and not less than twenty-six feet wide. Some prefer the stretcher and leveling bench put up crosswise of the room. Have the bench erected so that you look to the light as you work, and have it dark at your other hand and at your back.

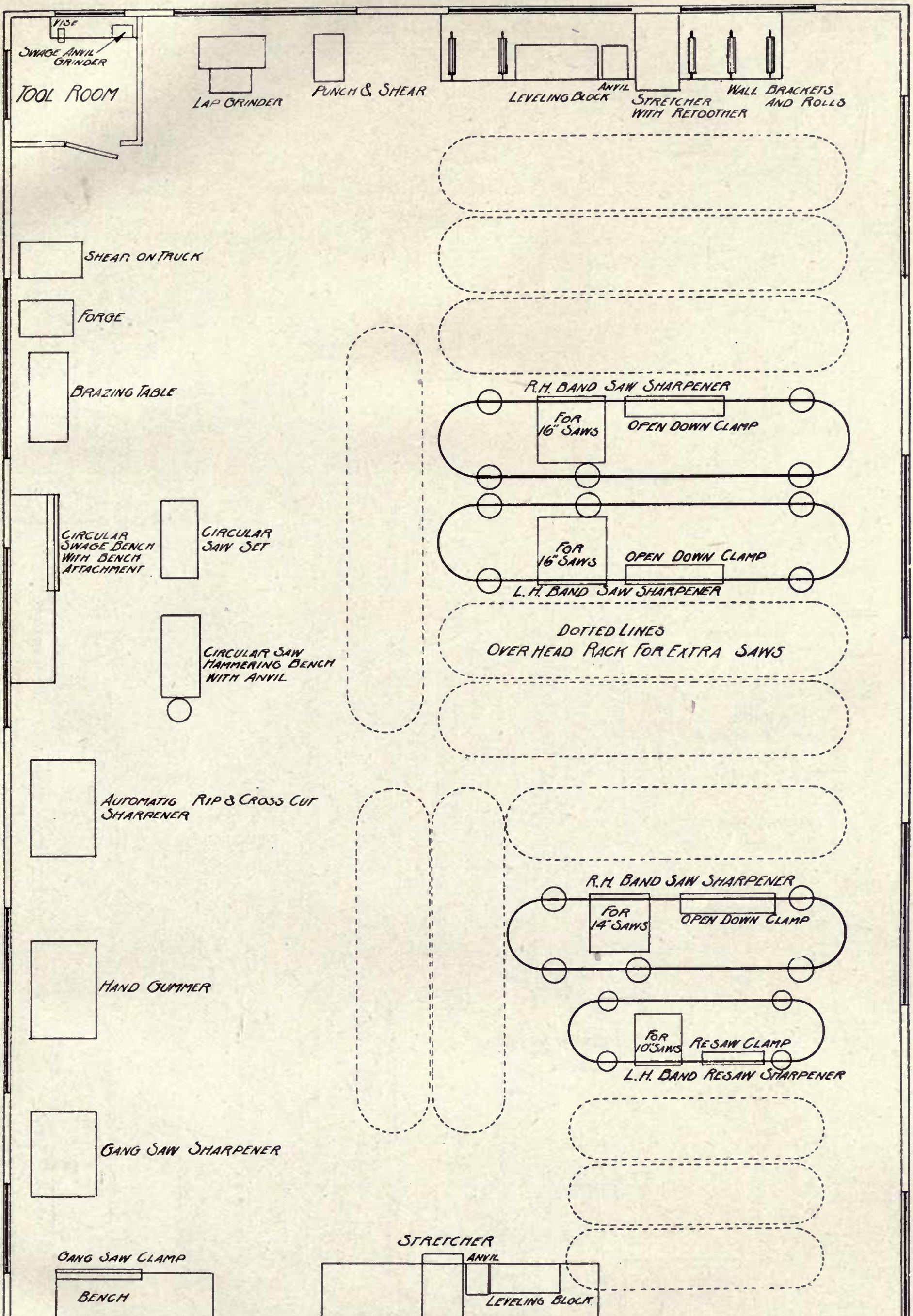
Filing rooms should almost universally be made larger, and there is little danger of getting them too large.

A filing room, well equipped and built with full regard to its important use, will quickly pay for itself over one of inferior type.

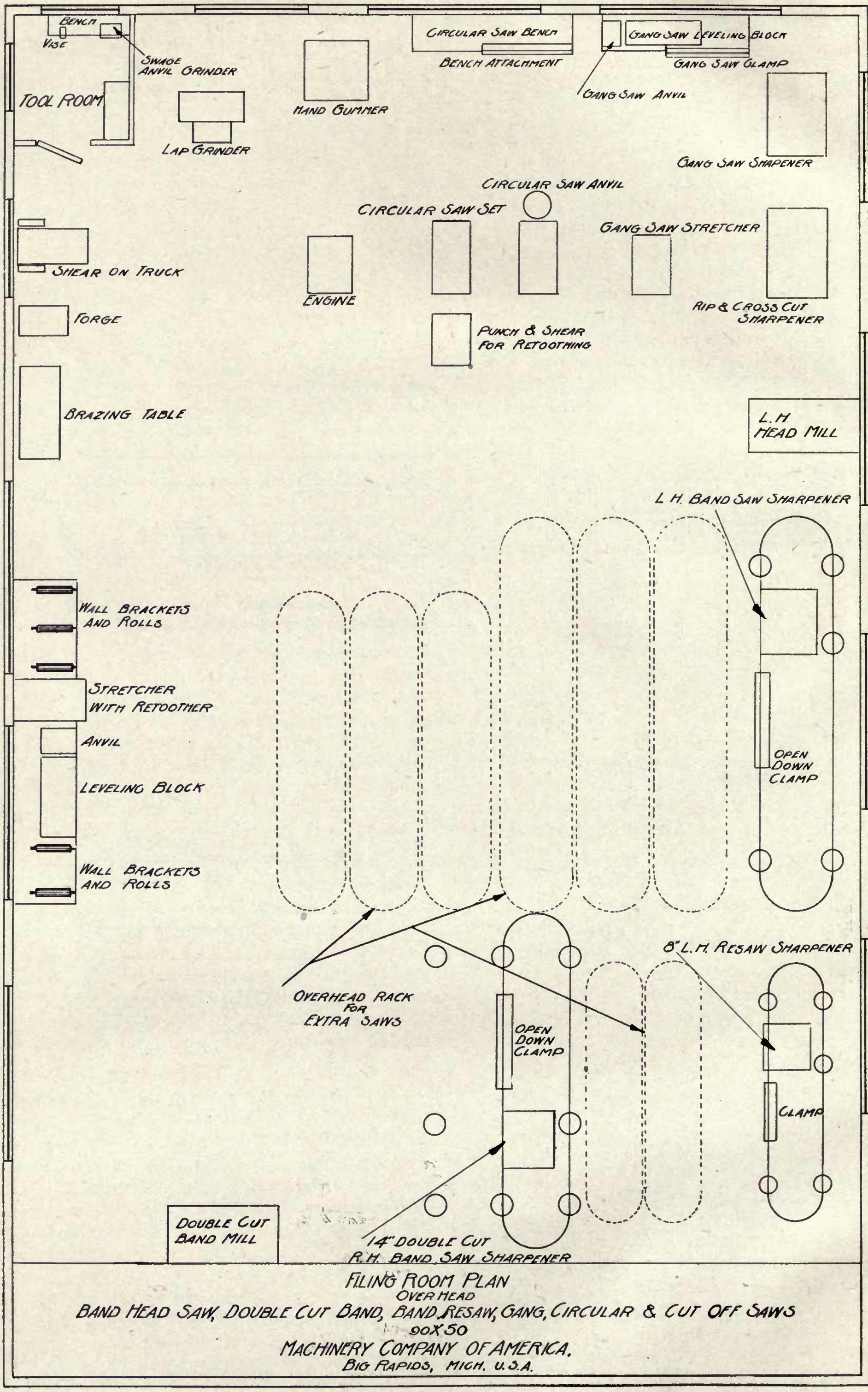
In the single and double band saw mills most recently erected, far more attention is being paid to the arrangement and equipment of the filing room and a perfection of detail is observed that is not characteristic of the older mills. Much more attention is also being paid to these details in the modern woodworking plants, but many of these have no filing room at all other than some corner of the factory, or a small, dimly lighted, unheated and dirty room and with little of equipment in it. There being so much room for improvement in factory filing rooms, we give some detail of a well equipped and arranged room suitable for an ordinary woodworking plant employing a band resaw, with the usual variety of small circulars, machine knives, etc.

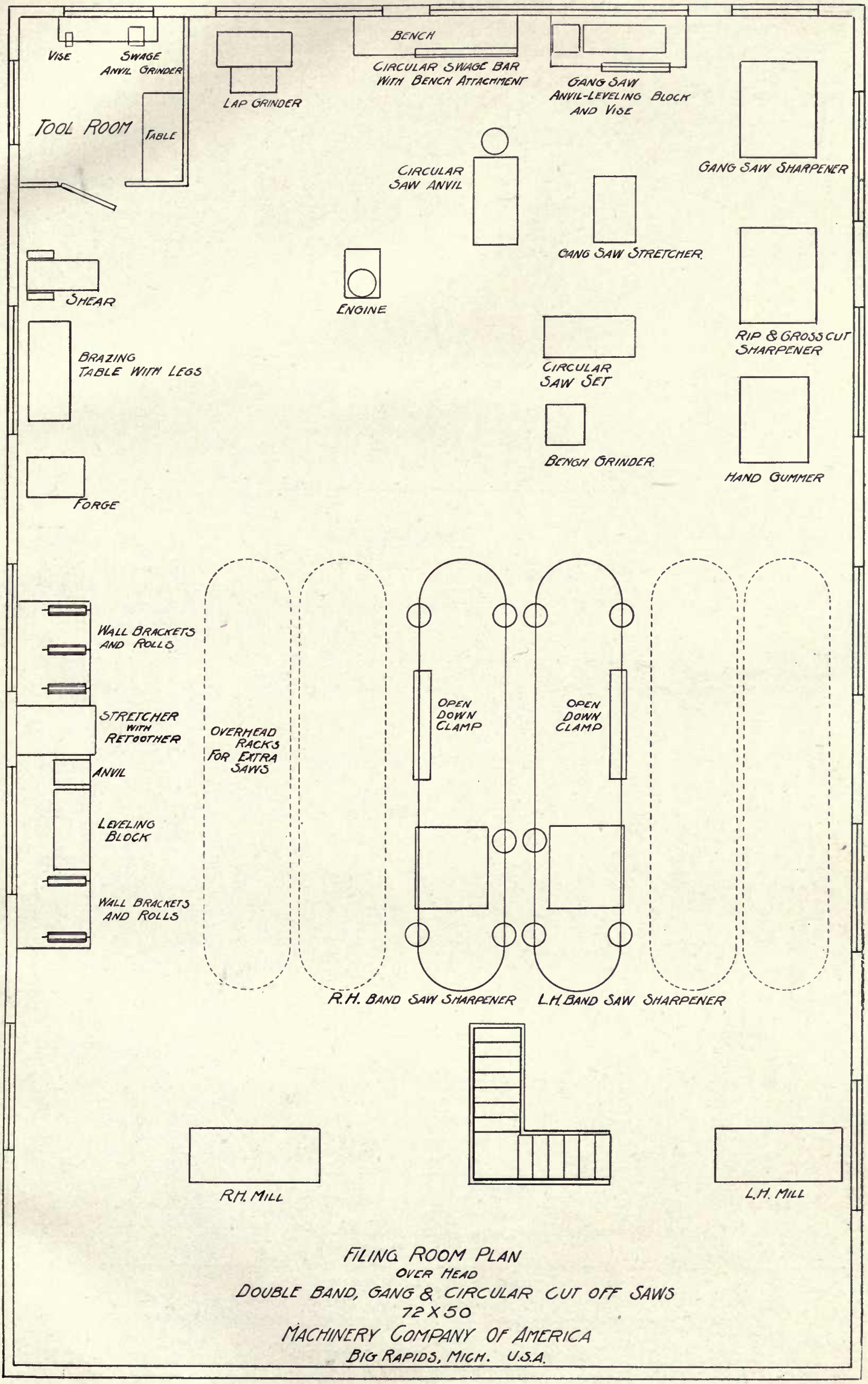
In some factories, the planer knives have to be sent away to be ground; saws have to be sent away to be sheared, retoothed, brazed, etc., when boxes need babbitting, ladles must be borrowed and the metal heated in the fire room, and many other little jobs have to be performed outside, which could and should be done at the mill, if the proper equipment were at hand, thereby saving many a dollar and lots of time. Some filing rooms are so lighted that the filer has to stand in his own light when filing a saw; others have been laid out with a view to saving space for other work, and the result is a small crowded corner, poor light, and plenty of vibration caused by the line of shafting put through from the mill to run the grinders.

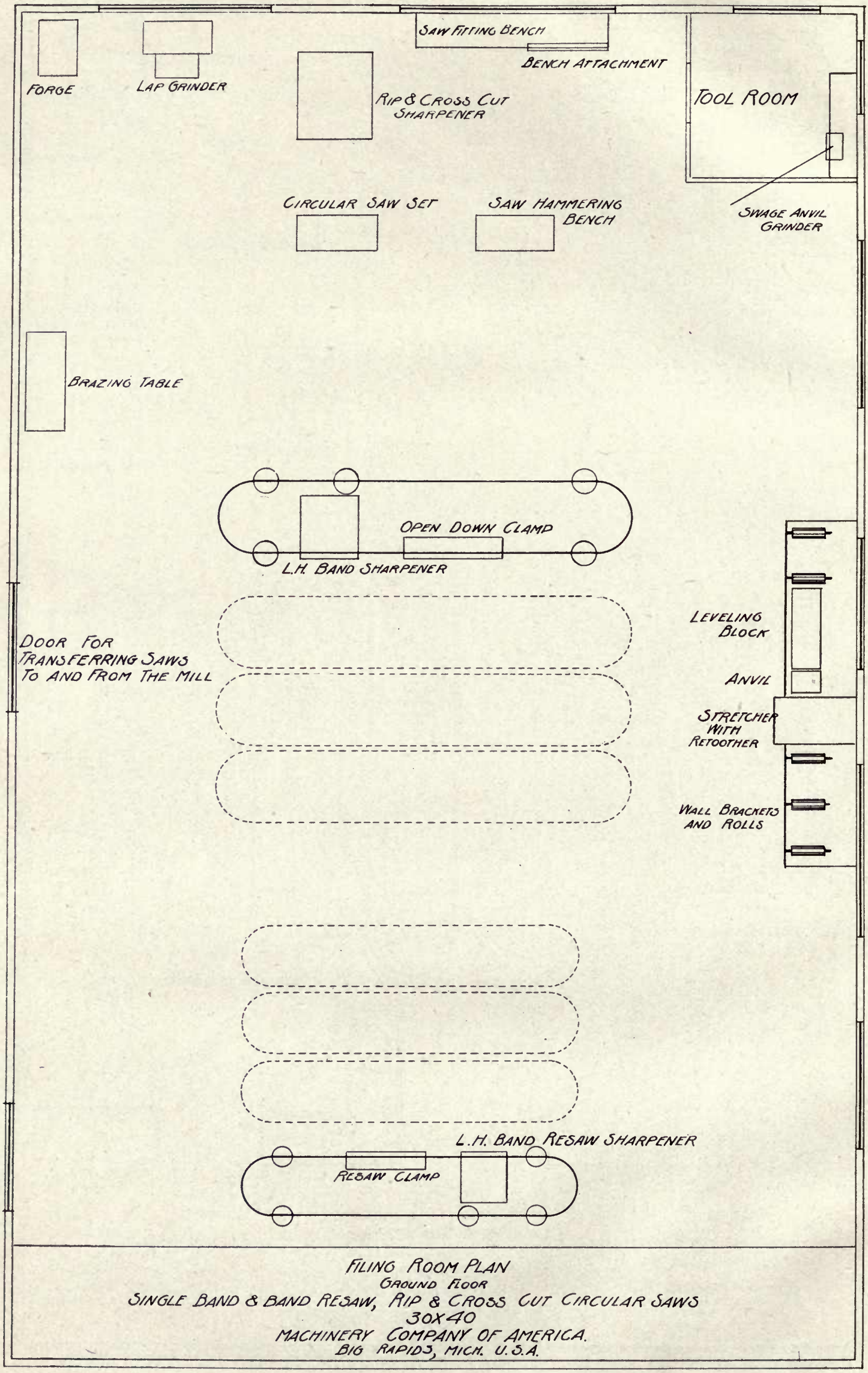
We illustrate in this connection several plans for the erection of Filing Room Machinery. The plans given serve to illustrate the arrangement followed out in several of the best band filing rooms in the United States, and while there are numerous filers who may individually prefer a somewhat different arrangement, which can be followed out at will, nevertheless these plans will doubtless meet the approval of many practical men. During the past few years, it is probable that 90 per cent of the new mill filing rooms, whether of single or double mills, are located in top of mill, because it is easier and quicker to handle the saws upward, with less liability of bending the braze, and in the case of a mill solidly built, while there will be some vibration in the filing room, there should not be so much as to seriously detract from efficiency in sharpening. With everything favorable, it should not take but little if any over three minutes to change the saws on a double mill. If it takes more than this, there is something wrong in the method or means for the handling of the saws. If the mill sets east and west, the hammering bench may be located on the north side of the room. If the mill sets north and south the bench may be located on the east side, but the side of the room where



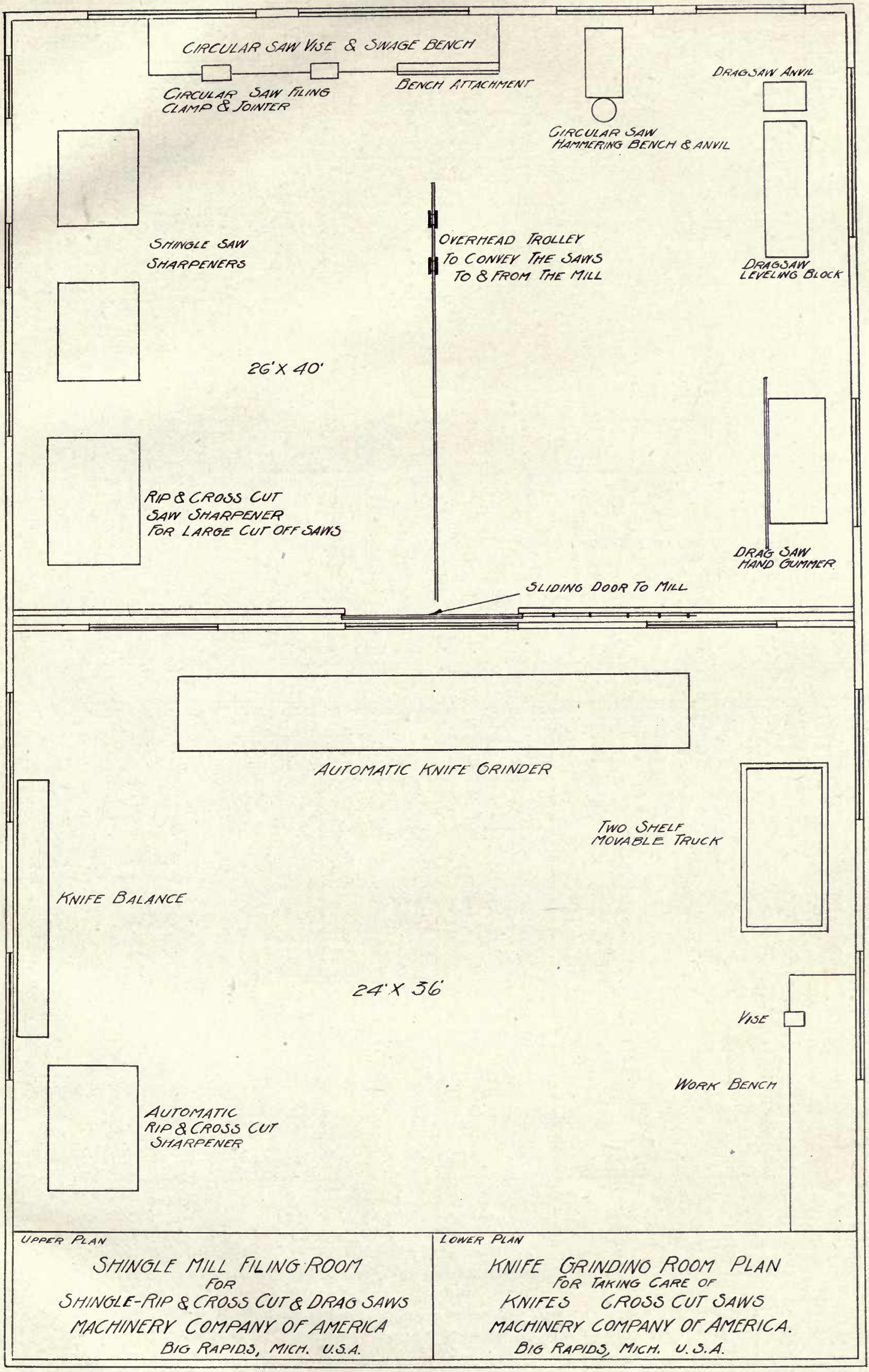
FILING ROOM PLAN
OVERHEAD
16" DOUBLE BAND, 14" & 10" RESAW, GANG & CIRCULAR CUT OFF SAWS.
90 X 60
MACHINERY COMPANY OF AMERICA
BIG RAPIDS, MICH. U.S.A.

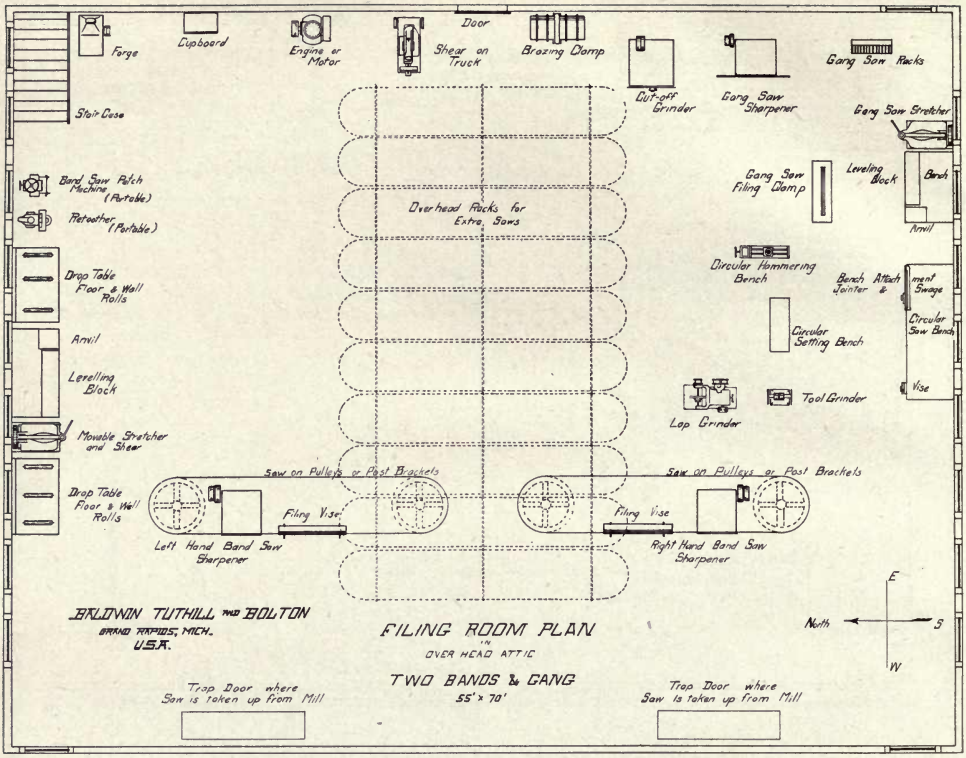

BENCH
VISE
SWAGE ANVIL GRINDER
TOOL ROOM
LAP GRINDER
HAND GUMMER
CIRCULAR SAW BENCH
BENCH ATTACHMENT
GANG SAW LEVELING BLOCK
GANG SAW CLAMP
GANG SAW ANVIL
GANG SAW SHARPENER
CIRCULAR SAW ANVIL
CIRCULAR SAW SET
GANG SAW STRETCHER
SHEAR ON TRUCK
ENGINE
RIP & CROSS CUT SHARPENER
FORGE
PUNCH & SHEAR FOR RETOOTHING
BRAZING TABLE
L.H. HEAD MILL
L.H. BAND SAW SHARPENER
WALL BRACKETS AND ROLLS
STRETCHER WITH RETOOTHER
ANVIL
OPEN DOWN CLAMP
LEVELING BLOCK
WALL BRACKETS AND ROLLS
8" L.H. RESAW SHARPENER
OVERHEAD RACK FOR EXTRA SAWS
OPEN DOWN CLAMP
CLAMP
DOUBLE CUT BAND MILL
14" DOUBLE CUT R.H. BAND SAW SHARPENER
FILING ROOM PLAN
OVER HEAD
BAND HEAD SAW, DOUBLE CUT BAND, BAND RESAW, GANG, CIRCULAR & CUT OFF SAWS
90X50
MACHINERY COMPANY OF AMERICA.
BIG RAPIDS, MICH. U.S.A.


VISE
SWAGE ANVIL GRINDER
TOOL ROOM
TABLE
LAP GRINDER
BENCH
CIRCULAR SWAGE BAR WITH BENCH ATTACHMENT
GANG SAW ANVIL-LEVELING BLOCK AND VISE
GANG SAW SHARPENER
CIRCULAR SAW ANVIL
GANG SAW STRETCHER
SHEAR
ENGINE
RIP & CROSS CUT SHARPENER
BRAZING TABLE WITH LEGS
CIRCULAR SAW SET
HAND GUMMER
BENCH GRINDER
FORGE
WALL BRACKETS AND ROLLS
OPEN DOWN CLAMP
OPEN DOWN CLAMP
STRETCHER WITH RETOOTHER
OVERHEAD RACKS FOR EXTRA SAWS
ANVIL
LEVELING BLOCK
WALL BRACKETS AND ROLLS
R.H. BAND SAW SHARPENER
L.H. BAND SAW SHARPENER
R.H. MILL
L.H. MILL
FILING ROOM PLAN
OVER HEAD
DOUBLE BAND, GANG & CIRCULAR CUT OFF SAWS
72 X 50
MACHINERY COMPANY OF AMERICA
BIG RAPIDS, MICH. U.S.A.

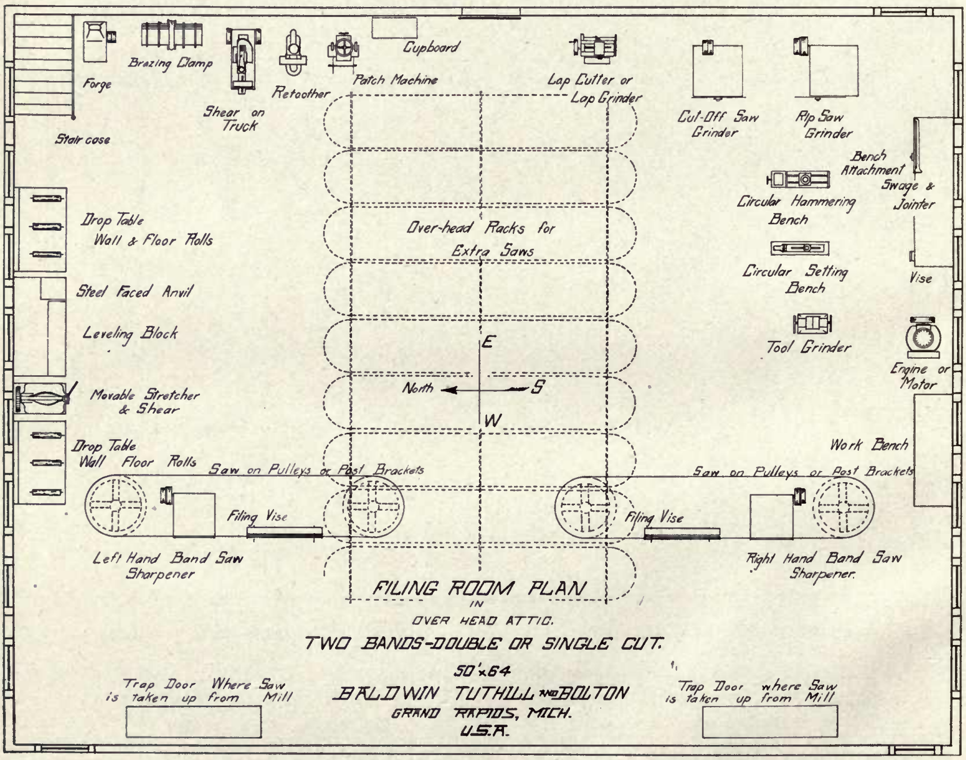


FILING ROOM PLAN
GROUND FLOOR
SINGLE BAND & BAND RESAW, RIP & CROSS CUT CIRCULAR SAWS
30X40
MACHINERY COMPANY OF AMERICA.
BIG RAPIDS, MICH. U.S.A.

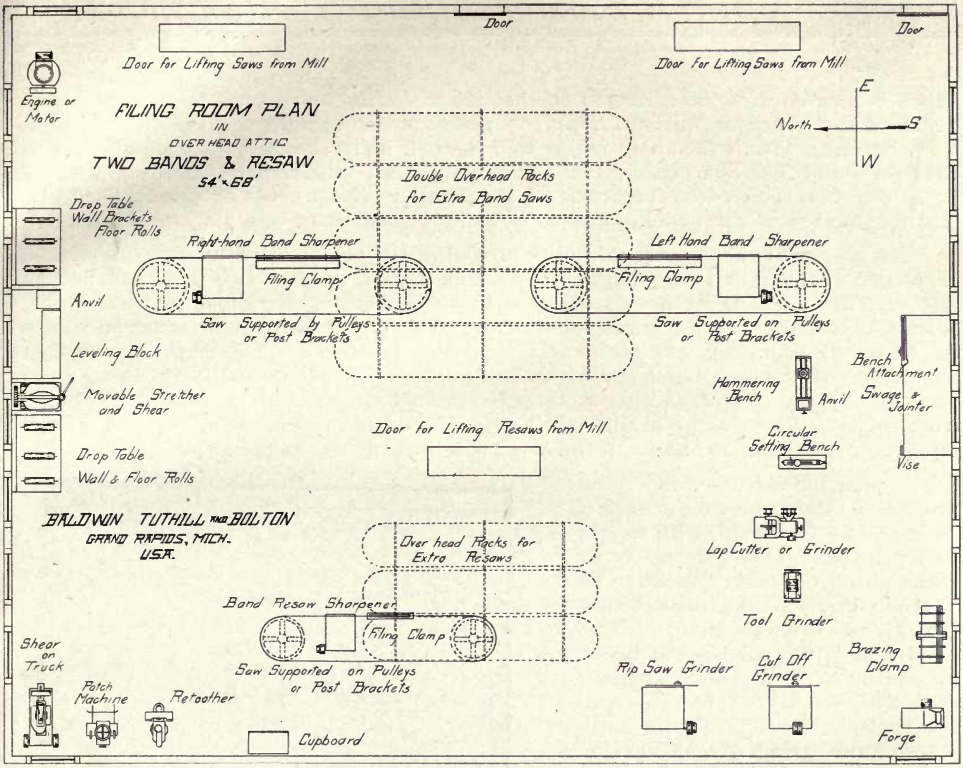

CIRCULAR SAW VISE & SWAGE BENCH
CIRCULAR SAW FILING CLAMP & JOINTER
BENCH ATTACHMENT
CIRCULAR SAW HAMMERING BENCH & ANVIL
DRAGSAW ANVIL
DRAGSAW LEVELING BLOCK
SHINGLE SAW SHARPENERS
OVERHEAD TROLLEY TO CONVEY THE SAWS TO & FROM THE MILL
26' X 40'
RIP & CROSS CUT SAW SHARPENER FOR LARGE CUT OFF SAWS
DRAG SAW HAND GUMMER
SLIDING DOOR TO MILL
AUTOMATIC KNIFE GRINDER
TWO SHELF MOVABLE TRUCK
KNIFE BALANCE
24' X 56'
VISE
WORK BENCH
AUTOMATIC RIP & CROSS CUT SHARPENER
UPPER PLAN
SHINGLE MILL FILING ROOM
FOR
SHINGLE-RIP & CROSS CUT & DRAG SAWS
MACHINERY COMPANY OF AMERICA
BIG RAPIDS, MICH. U.S.A.
LOWER PLAN
KNIFE GRINDING ROOM PLAN
FOR TAKING CARE OF
KNIFES CROSS CUT SAWS
MACHINERY COMPANY OF AMERICA.
BIG RAPIDS, MICH. U.S.A.

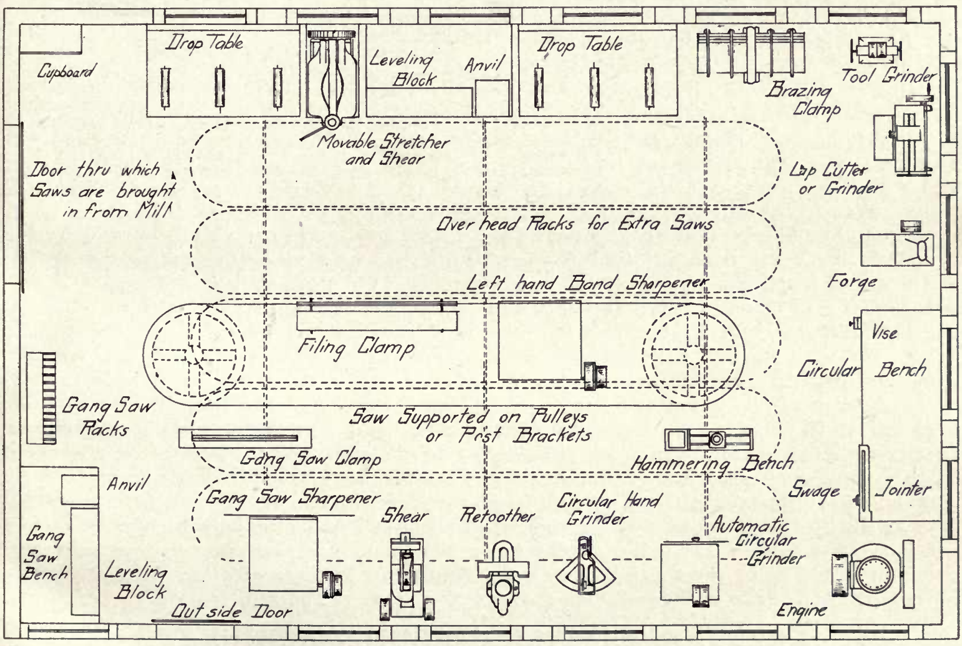


Forge
Cupboard
Engine or Motor
Shear on Truck
Door
Brazing Clamp
Cut-off Grinder
Gang Saw Sharpener
Gang Saw Racks
Stair Case
Gang Saw Stretcher
Band Saw Patch Machine (Portable)
Retoother (Portable)
Overhead Racks for Extra Saws
Gang Saw Filing Clamp
Leveling Block
Bench
Anvil
Drop Table Floor & Wall Rolls
Circular Hammering Bench
Bench Attachment Jointer & Swage
Anvil
Circular Setting Bench
Circular Saw Bench
Levelling Block
Vise
Tool Grinder
Lap Grinder
Movable Stretcher and Shear
Drop Table Floor & Wall Rolls
Saw on Pulleys or Post Brackets
Saw on Pulleys or Post Brackets
Filing Vise
Filing Vise
Left Hand Band Saw Sharpener
Right Hand Band Saw Sharpener
E
North
S
W
BALDWIN TUTHILL AND BOLTON
GRAND RAPIDS, MICH.
U.S.A.
FILING ROOM PLAN
IN
OVER HEAD ATTIC
TWO BANDS & GANG
55' x 70'
Trap Door where Saw is taken up from Mill
Trap Door where Saw is taken up from Mill



Cupboard
Brazing Clamp
Forge
Patch Machine
Lap Cutter or Lap Grinder
Retoother
Shear on Truck
Cut-Off Saw Grinder
Rip Saw Grinder
Stair case
Bench Attachment Swage & Jointer
Circular Hammering Bench
Drop Table Wall & Floor Rolls
Over-head Racks for Extra Saws
Circular Setting Bench
Vise
Steel Faced Anvil
Tool Grinder
Leveling Block
E
North
S
W
Engine or Motor
Movable Stretcher & Shear
Drop Table Wall Floor Rolls
Work Bench
Saw on Pulleys or Post Brackets
Saw on Pulleys or Post Brackets
Filing Vise
Filing Vise
Left Hand Band Saw Sharpener
Right Hand Band Saw Sharpener.
FILING ROOM PLAN
IN
OVER HEAD ATTIC.
TWO BANDS-DOUBLE OR SINGLE CUT.
50' x 64
Trap Door Where Saw is taken up from Mill
BALDWIN TUTHILL AND BOLTON
GRAND RAPIDS, MICH.
U.S.A.
Trap Door where Saw is taken up from Mill



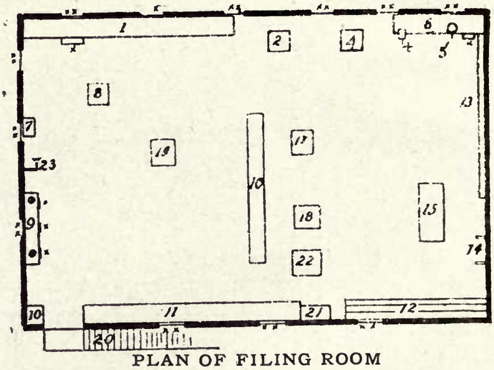


FILING ROOM PLAN
GROUND FLOOR
SINGLE BAND & GANG
24' x 36

BALDWIN TUTHILL AND BOLTON
GRAND RAPIDS, MICH.
U.S.A.

bench is located must be arranged so that it can be lightened or darkened to suit the bench work. When the sides of filing room have plenty of light, a sky-light is unnecessary, but otherwise if the room is not well lighted, there should be a sky-light directly over the Band Saw Sharpeners, as it is of the greatest importance that the filer should be able to observe closely the action of the wheel in the process of grinding, and this is true, whether in sharpening saws or in grinding laps or in grinding machine knives.

The racks for the saws should be arranged in the center of room, and there should be plenty of them, and they ought to be made double, so that two saws can be hung one over the other, those not used regularly, being hung above those that are in daily service, unless there is plenty of space for the latter to permit of their being laid out on the floor. If fitting up wheels, or an idler pulley be used for handling the saw when being swaged or sidedressed, these can be located in connection with the Band Sharpeners practically as well as separately, which would necessitate the shifting of the saw from the Sharpener to the fitting up wheels. In general, it will save time and space to do all of the work that relates to the saw teeth without shifting the saw.



PLAN OF FILING ROOM

1—Band resaw grinder. 2—Automatic knife grinder. 3—Circular saw grinder. 4—Vise. 5—Filing clamps. 6—Bench. 7—Closet for clothes. 8—Belt lacing machine. 9—Brazing clamps. 10—Supply closet. 11—Work bench. 12—Belt shelves. 13—Circular saw rack. 14—Band saw pegs. 15—Engine, 8 h. p. 16—Band saw stretcher. 17—Radiator. 18—Forge. 19—Lap grinder. 20—Stairway. 21—Bench. 22—Trap door. 23—Gas jet and glue pot. X—Drawers. XX—Windows.

The plan for factory filing room illustrated shows a room 30 feet wide and 29 feet deep, with height 14 to 18 feet. There are six large windows on the front and three on the side, besides some on the back that give an indirect light. In the front and left corner is the bench on which the band resaw sharpener sets. This bench has a large drawer for tools, etc. Next is the automatic knife grinder, and next to that is the circular saw sharpener for circular rips and cut-offs. In the front right hand corner is a bench 7 feet long and 2½ feet wide. On this is a vise and circular saw filing clamp, also a saw set. On the left a brazing clamp, gas jet, glue pot, wire belt lacing machine and a clothes closet. On the right end is a rack for all the circular saws, matcher knives, collars, and pegs for unused saws. On the right end and center is an 8 H. P. Vertical engine for driving the filing room machinery, and in the center of the room is a forge, radiator and saw stretcher. On the left end and center is the lap grinder and retoother. In the back and left corner is a locker for supplies, such as belting, fasteners, rivets, glue, babbitt, wire lace, rawhide, etc. Next is the main work bench, 10 feet long and 2¼ feet wide on which belts may be repaired or any similar work performed. There is also a smaller bench for odd ends of belting and shelves for holding belting, chain belts, arbors, pegs, ropes, etc. A large step ladder and an ordinary 16-foot ladder are also worth having at hand. In addition to the machines specified, there are some which are necessary and convenient according to the character of the plant, such as a tool room grinder, a cutter head grinder, knife balance, belt clamps, emery dust exhauster, narrow band saw filer, setter, brazer and fitting up rig. Having such a filing room, well lighted from without and equipped with gas or incandescent lights within and with all the necessary machines and tools for perfect and economical fitting of saws and knives, good results are certain with any man as filer at all competent to take charge of such an important part of the mill work.

ERECTION OF FILING ROOM MACHINERY

When filing room machines are first received, if they have been shipped any distance on skids or crates, dirt and grit are likely to accumulate in transit. In order to remove this, the tools should be very carefully cleaned with respect to bearings and sliding surfaces. Moreover, all machines on which emery wheels are used, if not already provided with dust guards, exhausters for withdrawing the emery dust or other appliances for the protection of the wearing surfaces should be covered over with some form of guard or shield made of tin, sheet iron or leather.

It is observed in general practice that some sharpeners, knifegrinders, lap grinders, etc., are used but a few months when lost motion follows from wear of the bearings. It is the duty of manufacturers to safeguard their machines in this respect, but if the machines are bare of such features it is necessary for the operator to make up as fully as possible for the defect. But cleanliness after being put to use and perfect lubrication are up to the user.

Another feature of importance is the foundation or floor on which machines are placed. A saw fitting machine that is subjected to constant vibration arising from the machinery or the shock of log loader or turner, can never afford the fine service or have the life of a machine that is solidly placed on a floor free from vibration. It is astonishing that millmen or filers will tolerate the conditions in this respect that exist in some mills, conditions that involve direct daily losses arising from results that fall short of the best. Whatever expense that is contracted in stiffening or strengthening or rebuilding a poor filing room into a good one will abundantly repay the extra cost. Careful leveling of the machines after being placed in position is imperative. Use a level that is accurate and sensitive, and a straight edge that is straight. With these the machine can be tested until known to be correct. The countershaft, if any is used, should also be level and in straight alignment with the main shaft. One of the most important things connected with the starting of a new machine, and the one which is most often neglected, is to see that the machine is well lubricated with good oil. The very best oil is the cheapest, and should be used in generous quantities, particularly for the first few weeks the machine is running. Another is to see that no boxes are too tight. While it is our custom to speed machines for a preliminary test before shipment, yet it is manifest that such test cannot subject the machines to the same character of work as in the mills, and hence the operator should be on the lookout for heat and undue tightness in slides or boxes. If careful attention to the above details is practiced little or no trouble will result in operation of machine unless it arises from improper adjustment for the work in hand.

Speaking about adjustment suggests the remark that manufacturers are sometimes unjustly criticised by men whose chief recommendation is their lack of mechanical skill and ability to operate or adjust a machine properly for the work in hand. We know that our machines are all capable of adjustment or adaptation to the usual varying requirements of mills and factories and if they fail to work to the satisfaction of the user it arises from faulty adjustment or operation.

A swage or sharpener that works well in hundreds of mills, no two of which perhaps carry the same style of teeth and among which there are to be found all the varying shapes for different woods and general requirements that characterize saw work, should be capable and is capable of doing good work in the hands of every operator who properly adjusts it.

This emphasizes the desirability of customers always sending in a templet showing the style of teeth with whatever other information they can convey regarding their special use of the machine or tool. There are customers that order a machine and leave it to the maker to adjust same intuitively for the local use. Later on if the operator lacks sufficient skill to secure desired results from his adjustments, the machine may be condemned.

A customer should take it for granted that a standardized machine in general use is capable of affording satisfactory results, and ought not hastily to condemn it, but rather by study, the use of common sense or special inquiry, proceed by slight and carefully made changes and adjustments, to adapt the machine to the point where it pleases in its work.

A very good suggestion for a young saw filer is to pick up all possible information concerning millwright work, the setting up and operation of the various mill machines, taking a job as a helper whenever repair work is under way. Learn to read blueprints so as to understand all of the details they convey. Always make yourself generally useful to your employers. Work overtime, deliberately, and without pay, if circumstances warrant. Very few people ever lost anything by doing some work or service based on good will or the desire to be helpful. The man who gets washed up, with his coat and hat and dinner pail in hand ready for a quick getaway, may make progress rapidly but the odds are against him.

Saw mills and factories that change saw filers frequently are apt to have sawing and filing machinery that is badly run down, in need of repair, or very likely an insufficient equipment. Such plant operator or the supervision may urge quantity and quality of output and will usually ascribe unsatisfactory results to lack of skill on the part of the filer, oftentimes unjustly. The frequent employment of saw filers each retained for only a short time, is an almost certain demonstration that conditions exist beyond the capacity or ability of the filer, individually, to remedy, and in such case it should suggest that an immediate study of the plant equipment should be undertaken, with reference to its condition and sufficiency.

The close co-operation of manager, superintendent, foreman, sawyer and filer, will be found to exist in a plant where 100 per cent efficiency is realized.

Most sawmill operators in the United States prefer large output to saving in saw kerf. Indeed some mills in their desire for quantity output, permit the sawing of lumber of bad quality in the form of so-called miscuts, bullheads, bad edges, etc., where a mill owner in England, North or Middle Europe would use a very thin saw, possibly still fitted with spring set, operating at a slow speed and feed, but making lumber to size and so well cut that in some cases resurfacing seems almost unnecessary.

BURNED MACHINERY

It is rarely worth while to repair filing room machinery that has passed through a fire simply because the castings employed in most filing room machines are of a comparatively light framework type, easily distorted by heat and it becomes a difficult or impossible task to reconstruct such machines for efficient, satisfactory service. The repair bill will always seem excessive and good workmanship has far less chance, than when a machine is being assembled from newly machined castings, free from distortion. A burned machine rebuilt, will never be a credit to its manufacturer, and the delays and losses incident to its further operation, are a bad offset to the somewhat higher cost of a brand new machine of latest design and improved manufacture.

The points for consideration should be: age and condition of the burned machine; character and amount of steel parts in its makeup; will the cost of new parts, labor, babbitt, painting, crating and freight, approach the cost of a new machine. In most cases it is well to scrap a machine that has passed through a fire and start with new.

THE INTRODUCTION OF LABOR SAVING MACHINES FOR FILING ROOM WORK

One of the most marked phases of the developing conditions in the introduction of labor saving machinery, in so far as this concerns the sawmill, woodworking and kindred trades, is the urgent demand coming from plant operators for automatic machines or up-to-date hand operated machines for performing most efficiently the numerous processes that relate to the upkeep of circular saws, machine knives, cutter heads, etc., and it is an interesting fact that this demand is manifesting itself in many different countries, that is, it is not limited to the United States and Canada, in which mill and factory operations in the wood trades have been most developed in the form of moderate size and large capacity plants.

Indeed, the shortage of skilled labor and the uncertainty as to permanent engagement on the part of skilled men has subjected many establishments to a great handicap in keeping the filing rooms manned properly, and this doubtless has much to do with the developing demand for improved appliances already referred to.

It is not true that an inexperienced, unskilled man can take up the operation of a more or less complicated machine for saws or knives and hope to get the best results from the start off, nor is it true that such men, even if they readily master the operation and use of such machines can come to know all there is about the detail of expert saw work, without a somewhat long time observation and experience; but, it is true that such men can accomplish far better results than can unskilled men without suitable appliances.

The average filing room of the better class sawmills has for many years been fairly well equipped with a machine or tool for each purpose, although often times such appliances by reason of long time use and deterioration are incapable of affording good results, no matter how skillful the operator; and naturally in the hands of men that are not mechanically clever and constantly alert to get the best out of their filing room equipment, rather poor fitting and a low output as regards quality and quantity results. But, in woodworking plants, such as furniture factories, box shops, planing mills, car shops, ship yards, pattern shops, and so on, in large variety, there has not been a marked tendency until recent years toward the introduction of any machine or tool for filing room practice that the management could avoid purchasing, even though here and there are to be found such plants of large size that are splendidly equipped and with filing room machines in charge of expert men, whose results are beyond criticism.

But, now there seems to be an awakening, if it may be so called, on the part of mills, factories and shops to the absolute necessity of proper equipment for swaging, sidedressing, sharpening, tensioning, levelling, toothing, shearing, lap grinding, filing, setting, knife grinding and balancing, band wheel grinding, etc.

There are a lot of different processes that relate variously to the care of band saws ranging all the way from ⅛ inch to 20 inches wide, to circular saws ranging from very fine teeth on slitter saws only a few inches in diameter, up to the large coarse teeth of heavy gauge saws ranging up to 96 inches diameter, to gang or frame saws of a wide range in dimensions, and to machine knives from the thin, high speed steel knives of short lengths up to shear blades 1½ inches thick, in lengths up to 10 to 14 feet.

Take the case of a scroll band saw less than 1 inch wide with a thousand or more teeth. What sort of a chance has an unskilled saw man to keep up such a saw as regards setting, filing, straightening, brazing etc., unless he has the proper appliances for fast and accurate work. The only answer is that he cannot by any possibility keep up with the requirements, even in a plant of small size, and if the man be expert and capable of setting and filing by hand, what is there about hand work that recommends itself when the task is so laborious and such a puttering one. The hand worker may be well intentioned and immensely energetic, but he cannot proceed advantageously with such work in a place where there are many saws to be kept in condition.

It may be observed in the discussions appearing in various technical publications, particularly those that touch upon saw practice, that practical men sometimes argue against machine work in fitting. It is hardly worth while to argue with anyone on a question of this kind, because it is a waste of time for any man, skilled or unskilled, to bother with hand work on any process where machine work is practicable, and if machine work is not practicable, or if it proves unsatisfactory, it is due to one of two things, that the condition of the saws to start with make the operation of an automatic machine impossible, because of the wide variations in shape of teeth, spacings, gauge or width of saw, or that the operator is ignorant, prejudiced or incapable of getting the saws "in tune" with the filer or setter, or whatever the machine may be.

There are plants that want such men, have them and continue to employ them, and they are obviously quite within their rights in so doing, but everyone will admit that the saw or knife is the business beginning in all lumber manufacture or woodworking, and that only by having the cutting tools fitted in the best possible manner can the plant operator get an output that is worth while, both as regards quantity and quality.

The average woodworking plant has such a variety of saw and knife fitting to be kept up, viz., scroll bands, rip saws, resaws or circular rips and crosscut knives, cutters, bits, etc., that it is only by having these different processes under way simultaneously, several operations going on with the man in charge using his head, wherever possible, instead of his hands, or to put it differently, using his head for the adjustment and operation of automatic machines and his hands for the operation of hand operated machines or such tools as must be hand operated, that he can keep up with his day's work and keep the manufacturing machines supplied with the necessary equipment.

In a well equipped filing room the visitor will commonly see a number of different operations going on at the same time, and if well equipped, it is only in the large plants that more than one man will be required.

It should not be considered by any saw filer a matter of personal credit that he makes no request or an infrequent request for machines or tools as a means to greater efficiency in his work.

There are filers who pride themselves on going without the common indispensable necessities, for what reason it is not apparent, because a man does not better himself or his employer in this way. It does not matter excepting in degree whether a filer receives 25 cents per hour or one dollar per hour for his services, according to the importance of the plant and the job, because the pay is usually fairly well related to the importance of the job and the sort of service rendered, but it matters a great deal whether the man on the job, big or little, does a man's work, by which is meant keeps up all the work there is, properly, or whether he is never up with, possibly not in sight of the reasonable demands on the filing room, as a result of which the whole operation lags and scores of men are held back in their output through no inefficiency of their own.

A plant operator might save five hundred dollars or one thousand dollars by lack of needful equipment and waste this or a larger sum on wages paid to inefficient filing room help, not to mention the loss of thousands of dollars, because the production of the entire plant is held down waiting for saws or knives or from operating saws or knives when dulled or otherwise inefficient.

TIME SAVING IN FACTORY FILING ROOMS

There are two important results to be attained, one, the saving of time of the practical filer; the other, the saving of time in machine operation, no matter whether in scroll band sawing, band resawing, ripping, crosscutting, planing, surfacing, jointing, or otherwise.

In plants fully equipped, time saving may be sometimes effected by a better arrangement of the machines; in plants partially and poorly equipped, time saving may be effected by adding such automatic or hand machines as will obviously lend themselves to better results.

The big chance for improvement naturally centers itself around the jobs of filing and sharpening or otherwise fitting of the small factory and shop saws. Too many saw filers and factory operators still persistently adhere to the old, slow and tediously laborious processes of hand work, continuing to file fine tooth saws having three, four or more points to the inch with a triangular file and priding themselves in thinking that this is the only proper and successful method.

Automatic, mechanically perfected machines now accomplish these different processes with a speed, precision and perfection nothing short of wonderful to those witnessing the accomplishment for the first few times, machines that are impossible of the variation in results arising from hand work and that soon overcome the imperfections of hand work.

Oil stone grinders for tool, chisel and gouge sharpening, will sharpen such tools in a moment, perfectly, saving a large amount of time compared to the old hand methods; band filers will sharpen small band saws finishing 50 or more teeth per minute; automatic emery wheel sharpeners for band rips, resaws, and circular rips and crosscuts, will sharpen 25 or more teeth per minute and these machines may be operated at the same time, carrying all of the work expeditiously, uniformly and insuring the fitting of each saw so that each tooth will do its proportionate part of the cutting, doing away largely with the tendency to cracking of the blades, and producing smoothly sawn stock on the fastest feeds, with gullets shaped properly to suit the character of the stock being sawed. Familiarity with and skill in the use of such machines secure better pay to the practical man and better and faster sawing secures better profit to the plant operator. The man who condemns such machines nowadays betrays his ignorance or lack of ability to properly care for and manipulate same or self pride in doing work in the most slow and laborious manner.

EFFICIENCY IN THE FILING ROOM

Why not efficiency in the filing room, the same as in a high-class model metal working or other type of manufacturing plant.

Marked efficiency in filing room work will result from attention to some or all of the following matters:

(1) Location of filing room with particular regard to complete freedom from vibration. Closeness of filing room to mill or sawing machinery is important but of less importance than the matter of solidity or rigidity of the filing room and freedom from vibration of the machines contained in it.

(2) The power whether it may be applied to the grinding or sharpening machinery, must be steady to secure the best results. In sawmills it often happens that the saw, running at high speed and starting a heavy cut, will slow down the engine abruptly, of itself, or in conjunction with the other steam loads that are constantly changing; while conversely, a lessening of the load on the engine or boiler capacity, may cause an abrupt speeding up. Such abrupt change immediately occasions a serious condition in the filing room, affecting the speeds of grinding wheels very unfavorably. A grinding wheel run too fast is apt to burn or caseharden the saws or knives; if run too slow it wears out without performing a proper amount of grinding.

In such case the bad speed conditions may be improved by the use of a separate engine for filing room power or by the use of individual or group motor drive, preferably with a variable speed control.

(3) Purchase of proper grinding wheels.

Grinding wheels should never be bought at random. Saw sharpening, knife and tool grinding and similar operations, are very important operations, a fact not properly recognized by many plant operators and overlooked by some buyers.

It is true that grits and grades for grinding wheels as produced by the various wheel makers are now well standardized so that if a purchase is made with careful regard to the local speeds and grinding requirements, good results are fairly certain, but the trouble comes from the fact that in too many cases wheels are ordered at random without information as to local conditions, or the need for urgent delivery necessitates the shipment of wheels of proper size but improper grain and grade, from broken stocks, with wrong arbor hole, face, etc., so that the customer while paying regular price, is not suitably supplied because of his own negligence in properly anticipating his requirements with wheels wisely selected.

There is really no excuse for the use of poor grinding wheels, because manufacturers of sharpening and grinding machinery and the wheel manufacturers likewise, are always ready to recommend with careful regard to long time experience and a desire to supply each customer efficiently, and most manufacturers of grinding machinery carry a complete stock of wheels, in all sizes, shapes and arbor holes, and in make-up the best suited to usual requirements, for prompt replacement on customer's order.

(4) Undue wear of spindles, bearings, slides, and cams.

All working parts of dry grinding machines are peculiarly susceptible to wear from emery dust and steel particles, and every attention should be paid by the machine operator to keeping machines free from dust, properly lubricated and it may be mentioned that factory inspection or the modern impulse in the direction of complete equipment, is inducing the installation of dust collecting hoods and exhaust systems in many establishments, not only because such procedure pays, by adding to the life of the machines, but also conserves the filer's health.

(5) Wear and repair.

Since the abrasive grit wears working surfaces rapidly, it follows that frequent inspection should be made of arbor bearings, sliding surfaces, face of cams or forms, and of all idlers and bearing studs or pins. Lost motion in grinding wheel or feed mechanism may in this way be avoided or kept at a minimum; so also the danger of breakage of the grinding wheel due to vibration in bearings or because of end play. Loss of life or serious accidents from the above causes sometimes occur.

Cams, idler bearings, studs and pins, no matter how carefully hardened, are liable to wear, changing the regular or normal action of the grinding wheel, and producing a burning or case hardening at the points of teeth or base of gullet.

Such parts if worn to an extent or in a manner that interferes with exact operation, can be readily replaced by the manufacturer, promptly on order.

BALANCED SAW FILERS

Every saw filer should endeavor to keep himself in balance by which is meant that he should not place undue emphasis on one part or process in saw fitting and ignore or slight some other process, equally or highly important to good results.

It is a fact, however, that some filers put their main work and skill on swaging or shaping or sharpening to the exclusion or neglect of proper attention to leveling, tensioning, brazing, etc.

Some keep up their swages and neglect their sharpeners, hammers, and gauges; others neglect their anvils or leveling blocks or saw stretcher rolls; others the face of the band wheels, training of the band wheels, condition of carriage, track, etc., but it must be kept constantly in mind that all of the above and other important elements cut figure in results and constant attention must be paid to all.

ORIGINALITY IN SAW FILERS

It is a well known fact that there is no absolute standard of practice in saw fitting or to put it differently there are numerous very highly skilled and successful filers whose every day methods or manner of doing things differ radically. But these men produce what may be called a harmonious blend in the form of successful results, and the secret of their success is mainly due to their originality and the application of common sense founded on their experiences. Originality often overcomes difficulties for which there is no standard rule and indeed difficulties that could not be overcome if there were a standard rule. The conditions that arise in saw work are about as numerous as the days and the mills themselves, and every filer has individual problems thus coming up which must be solved either by the exercise of common sense or by guess work and chance.

Advice even though freely given by some highly skilled man, may not prove useful, simply because there is a peculiar combination of local conditions, which must be observed and given heed to.

Bad advice may be given, indeed it is sometimes deliberately given, and the original man is the one who weighs all of the elements that go to make up his problem and then does the thing that his best judgment dictates. If he makes a mistake under such conditions, he profits by the experience and avoids it next time.

CONSERVATION OF TIME IN THE FILING ROOM

The conservation of time in a filing room having a large number or variety of saws in use, is highly important. In a small mill or factory, one man, not working busily all of the time, can keep up the filing room work. He will perform the various processes. with a view to keeping up with the requirements, but if the sawing equipment and amount of work is increased or if the plant is large to start with, the use of time in the most intelligent and cumulative way, becomes essential.

It is therefore very important that the filing room machines shall be well located and so positioned with reference to each other, that several processes may be carried on at the same time, without undue lack of attention to each. In the case of a new plant, intelligent planning of the filing room and location of the machinery, is imperative and particularly so, if additional equipment is contemplated later on.

The following description relates to a mill filing room in which the head filer and one helper keep up the saws for two double cut bands, trimmer, slasher, deck saw, and other small circulars, shingle and lath saws; and from the planing mill a 7-inch resaw, a 4-inch rip saw, and several small circulars.

The filing room equipment comprises two double cut band sharpeners, two sharpeners respectively for the 7 and 4-inch bands, a large automatic sharpener for the large saws which range up to 84-inch—the deck saw, a swage and shaper for each saw, besides the other machines such as stretchers, lap grinder, shear, etc. The reason that a swage and shaper is had for each saw, is that the loss of time that would be spent in readjustment of these tools, when passing from one saw to another, would soon pay for the extra tools, and the work both in amount and variety makes necessary the employment of every machine or appliance that will facilitate results. In this mill the filers are ably assisted by the sawyers, who try to avoid making extra work for the filers, either deliberately or needlessly.

System in the filing room is the constant watchword. The large bands, cutting pine and cypress are changed twice daily. Each saw is swaged every third run and benched once a week. The log bands are kept up mainly by the head filer while the other work is done mainly by the helper. The system in vogue contemplates that no two bands shall be swaged or benched at a time, and only two saws are employed on a mill, except in case of accident. This lessens the handling of the saws and enables better study and care and maintenance of the saws in regular use.

The saws are regularly ground four times round after new swaging and three times round when resharpening. During the second time round, the filer watches the sharpening as it proceeds, carefully inspecting each tooth, marking any that show defective and that may require special hand treatment. If one saw needs brazing, sharpening of another saw will at the same time be in process, although after once round, the sharpener will be stopped if necessary, until personal attention can be given the work during the second time round.

By careful planning of time, a piece of saw can be brazed into a saw, between "runs," if occasion requires. Of course, quick work like this necessitates readiness for use of all essential items. That is the short piece of saw, the forge, shear, lap grinder, solder, brazing compound, etc., are all in readiness to serve.

This same policy of readiness is constantly applied to all machines and tools. For example, if a job of swaging or shaping is in progress, this is no time to stop work to repair the swage or shaper, or if sharpening is in progress, one should not have to stop work to replace a broken belt.

The working tools and machines should be kept up "between times," and if a defect is noticed, whether due to wear, breakage, faulty adjustment, or otherwise, it is usually an easy matter to remedy such defect with small expenditure of time and effort, on discovery, and manifestly far better than to permit the condition to pass from bad to worse.

In keeping up the round saws, the helper starts one saw sharpening, while swaging or setting another. At times four of the sharpeners are operating at once, and by having a sharpener for each class of saws, very little time is needed for adjustment when changing from one saw to another or from one set of saws to another set.

The planing mill bands can be very easily kept up in the time after the sawmill changes are made. A band resaw, if given careful handling, will hold its tension much longer than a log band. Keen, sharp teeth, with good corners have a great deal to do with successful band resaw operation. The employer has found that the employment of two good men, backed up with a suitable outfit of filing room machines, brings better results in that the different sawing machines are practically never down for want of saws, the saw expense is minimized, while the wages paid are such as encourages and justify the filers to faithful, efficient work and to the attainment of results not commonly met with.

Too much attention cannot be given the swage, shaper and sharpener, as a very little wear or lost motion will produce an imperfectly fitted tooth. Making the tooth right with sharpener and file, after a faulty swage and shaper have been used on it, involves a distinct loss in efficiency, time and expense of saw steel.

Common sense, fair mechanical ability and hard work, are essentials in a saw filer.

THE PASSING OF HAND WORK

The processes of filing and sharpening have now reached such a degree of perfection that hand work has largely become a thing of the past in all up-to-date plants where any number of saws are in use.

Now one seldom sees even a scroll band saw filed by hand. The same remark applies similarly to circular saws. Automatic circular saw sharpeners in numerous capacities and fitted variously for rip saws only or for both rip and crosscut saws, are in extensive use, having reached a stage of marvelous development and efficiency and found to be practically indispensable in mills and factories of every size and description. The filing of fine tooth saws for first-class factory service, has been heretofore accomplished only by the most expert filers, and even then their work was never perfect. But now this most difficult and painstaking work is handled successfully and rapidly, with an accuracy, precision and speed, that effects an immense saving in time, labor and files.

An automatic emery wheel sharpener permits the use of saws of harder or higher temper, saws tempered too hard to file, the teeth of which will hold a cutting edge longer and therefore require less frequent sharpening. The use of such hard saws in factories where much glued-up work is sawed and trimmed, is particularly beneficial. Among other advantages are the rounding gullets that result, the keeping of the saws in perfect round, thus doing away with the need for jointing, which is often wastefully done, while the strain of cutting is reduced to an absolute minimum, because the spacing, shape, and bevels on the teeth are alike, thus permitting a heavier and faster sawing with the same power and effort.

OLD AGE AND MACHINE UPKEEP

Machines will wear out but life and usefulness is in direct relation to upkeep and repair. Old age is a long way off from the machine that is always repaired at the first sign of wear.

Lubrication is the first and most important item. Never let a bearing or sliding surface run dry. Keep the machine clean. Never allow an accumulation of dirt, grease, emery dust, etc., to collect. It is easier to clean a machine with a broom or brush or piece of waste daily, than with a shovel once a month or once a year, and in no part of a mill, factory or shop, should dirt and dust be less tolerable than in a filing room. Whitewash and paint, thorough sweepings and even an occasional scrubbing out, is always within the realm of possibility.

The time to repair a machine is before repairs are needed.

A dull saw will consume far more power than a sharp one. Every moment that a machine is operated out of first-class condition involves a direct loss to the business. Most men are naturally neglectful of repair jobs. A need for repair, perfectly obvious while a machine is working, is too often forgotten when the machine is idle and opportunity for repair available.

It adds to the appearance of a filing room to have all machines painted a uniform color and touched up from time to time.

Few realize the wear on a belt incident to machines and shafting being out of line.

Need for repairs that may be called to the attention of a superintendent or foreman are often overlooked and forgotten.

It is a good plan to provide the machine operators with a suitable printed card or repair ticket, on which may be reported any existing defect in each machine, with date lines for time of report and completion of the repair.

Anyway, no matter how you do it, keep up your machines by constant attention to the following suggestive details:

Sharpener; idlers, cams, pins, studs and sliding surfaces, true, with no wear and consequent lost motion. Spindle snug, no end play, and tight bearings, wheel, square with saw and centered over it.

Swage; die, anvil and clamps, unworn and in proper adjustment; all essential parts square with each other. Bite or contact of die with face of tooth not too long, spread widest at the point.

Shaper and pressure dies properly beveled and both dies, oppositely, exactly alike. Properly set with regard to tooth stop. Action of lever not such as to bend the tooth while being shaped.

Stretcher; rolls practically level with surface of bench. No bending of saw upward or downward in or out of rolls. Rolls same diameter, same segment grind, same speed in revolution. Properly sharp to open the saw without excessive pressure.

Straight edges, straight. Have them reground when worn.

Leveling block, level. If dished in spots have it refaced.

Anvil flat or slightly crowned for circular saws.

Tension gauges true to segment. Must be reground at intervals.

Hammers properly faced, not too sharp; not too flat; not too heavy.

Brazing clamp; three screw for ample and uniform pressure. Irons true face and of sufficient length to insure an even bearing across full width of saw when pressure is applied.

Silver solder; .00275 or .003 thick, not brittle. Perfectly cleaned.

Brazing compound that will remove every trace of impurity, such as grease, oil or moisture or dirt marks left by finger imprints.

Laps, level, of even width, uniform tapering thickness, free from oil, grease or the soil and moisture from the hands.

Band wheels; faced dead flat or very slightly crowned. Same diameter and same circumference by actual test on both edges.

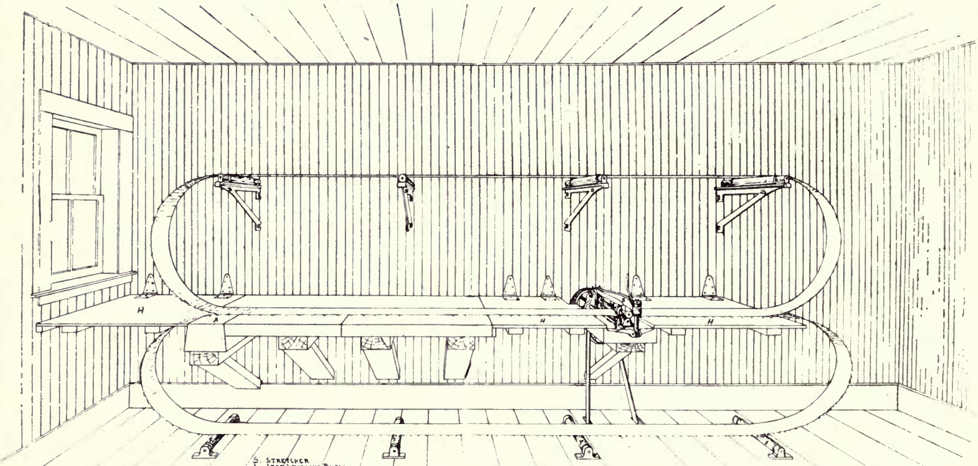
Saw guide; of wood or a bearing metal least calculated to heat or mark the saw and set to guide the saw without undue contact.

ERECTION OF STRETCHER AND HAMMERING BENCH

The saw hammering bench should be built at one side of the filing room and placed preferably to secure a north or east light on the end of bench faced when testing the saw. For log band saws, the bench should be from 14 to 16 feet long; for band resaws, from 8 to 10 feet long. A very convenient addition to the bench for use when the saw is on the upper brackets above the bench to permit of working the inside of saw, consists of a pair of drop leaves from 4 to 6 feet long at each end of bench, hinged to the wall or studding, to permit of being raised up or dropped down to lengthen out the bench as occasion may require. These may have a leg or support, hinged to the outer edge of under side to drop down out of the way when the shelf is not in use. The bench may be erected with the stretcher placed near either the right or left hand end, with anvil and leveling block placed in proper relative position. Avoid placing the stretcher so that there will be opportunity for an abrupt bend of saw downward, as this may cause the rolls to dish the saw. The saw must lie flat on bench as it feeds through the rolls in process of tensioning. Next to stretcher there may be a portable or hinged section in bench about 4 feet long, such that it can be lifted out when testing tension.

This opening permits of bending saw down or of testing it by its sag, which is less laborious than lifting it off the bench. The manner of testing for "fast" and "loose" in a band saw blade is about the same as in a circular saw. The blade is sprung up or down under the straight edge, which should be of the same (or greater) length as the width of the blade and held straight across the blade. Taking hold of the blade a portion is raised and tested in the sag in front. The open places drop away from the straight edge and the fast places come up to it. If the edges of the saw are longer than the body of the blade, they will drop down away from the straight edge, and if shorter the body of the blade will drop away or show open. A three corner block from 4 to 14 inches long and 4 inches across the corners may also be used to spring or crown the saw in this straight edge test, only in such test the action is reversed, as the loose comes up and the fast comes down. This latter test is really important, as the band is likely to have dished spots or bends across the blade, which would deceive the unskilled filer if only the lifting test is used.

For wide, heavy gauge log band saws a pair of idler pulleys may be mounted at ends of bench, to facilitate the movement of the saw. A small horizontal roller, mounted on a vertical shaft, for operation by foot lever, will greatly facilitate the upward lift or bend of a wide and heavy saw blade, while testing the tension.



BENCH FOR LEVELING AND TENSIONING

Next to the open space referred to above should be placed a leveling block from 4 to 6 feet long, of proper width to suit the saw, and at the end of this should be the anvil, three or more brackets placed equidistant, about 3 feet above the bench, supporting idle rollers of wood, or a set of special brackets above bench, and another set mounted on the floor, are requisite for the convenient handling of the saw over and under the bench.

The top of the stretcher roll should be about 3 feet above the floor, and if no portable section is built in the bench, the leveling block may be placed close up to the stretcher with the surface of board about one-eighth of an inch below the face of the rolls, and the anvil on the same level next to the leveling board. The rolls should not be allowed to run when not in use, as any unnecessary rubbing against the surface of the saw will tend to wear and impair their face. The face of the rolls and the machine should be kept oiled.

The etching illustrates one plan for the erection of a saw hammering bench and the location of the stretcher, anvil, leveling block, etc. There is nothing arbitrary regarding the relative location of the stretcher or of the anvil and leveling block with respect thereto, and in some filing rooms an opposite arrangement is followed. The relative position of the tools will depend upon whether the filer works right or left handed, and, referring to the etching, some filers would wish the window at opposite end of bench. It is perhaps advisable to have a window at each end, each provided with a dark curtain, so that one can face either direction, as may be most convenient.

A BAND SAW LEVELING AND TENSIONING OUTFIT

A band saw outfit for leveling and tensioning should comprise a saw stretcher, three or four wall brackets, four or five floor rolls, an anvil, an iron leveling block, a doghead and cross-face hammer of suitable weight for the gauges of saws in use (some also use a twist-face hammer), a back gauge from 4 to 10 feet long, either straight or preferably concaved to suit the crown carried on back of saw, and a set of straight edges and tension gauges in lengths to suit the widths of saws in use.

The above tools are, without exception, articles that are essential to any properly equipped filing room and should be furnished by the operator of the mill. In addition there are a number of small tools that every filer ought to have at hand and if not furnished by his employer, he ought to personally own them. Among these may be mentioned a wire gauge, speed indicator, emery wheel dresser, upset swage, sawset, sawset gauge, file side-dresser, jointer, etc. Some filers furnish their own hammers, straight edges and tension gauges, or even the swage and swage shaper, preferring to own their own tools, or have them at hand for use, in case of possible need, though the filing room is fully equipped with everything of the sort. Every filing room ought to be provided with a locker, in which all small tools may be kept securely when not required for use by the man in charge, and the use of the filing room and its contents, as a tool room by every one around the plant, should be prohibited.

TESTING FOR TENSION IN CONNECTION WITH THE USE OF BAND RESAW STRETCHER

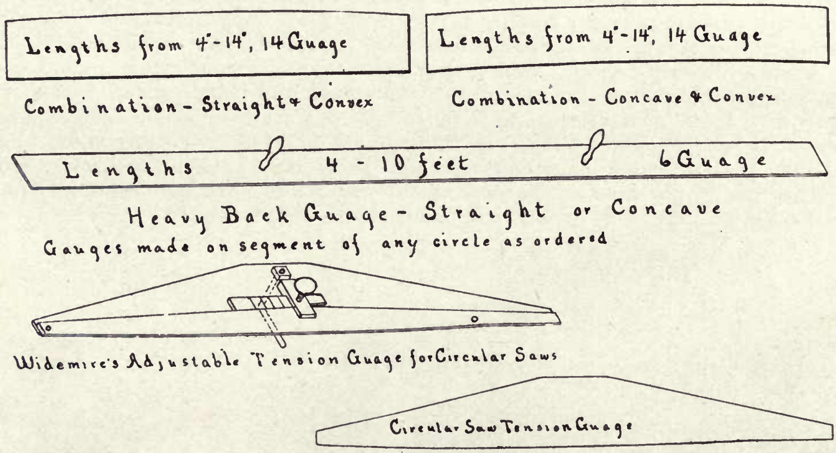
TENSION GAUGES AND BACK GAUGES

All saw filers need tension gauges for the purpose of securing a more uniform tension than is likely to result from the application of straight edge and the eye test, and while the degree of the tension employed by different filers on different saws must necessarily be variable, there are some general truths that may serve as guides to those after information.

For log band saws ranging from 8 to 16 inches wide the tension gauges are ground variously on segments of circles ranging from 30 to 66 feet diameter, but the segments that suit the majority of filers are of circles about 35 to 55 feet diameter, the gauge being usually made from 14-gauge tempered steel.

For band saws ranging 4 to 8 inches wide the degree of the tension is usually somewhat more than for log bands, say segments of circles from 26 to 35 feet diameter. As manufacturers of tension gauges it is a matter of indifference on what segment we grind, and we very much prefer to be instructed on what segment to furnish gauges, if customer can instruct. In the absence of specific instructions, we furnish gauges according to length on true segments such as are commonly employed. Some filers carry their tension practically from edge to edge of saw; others carry a strip of saw 1 inch wide, more or less, on the toothed edge, and a strip ½ inch wide, more or less, on the back edge, these strips serving as a sort of tire for the saw. Some filers employ several gauges, varying in length to suit the different widths of saws or the gradual wear. Thus for a 12-inch an 11-inch gauge will be used, and when the saw wears to 11½ inches a 10½-inch gauge will be used, the tire carried on narrower saws being relatively less than on wider ones. These variations in methods indicate the individual experience of men watchful of results.

TENSION GAUGES, BACK GAUGES AND STRAIGHT EDGES FOR BANDS, GANGS, CIRCULARS AND RESAWS



We furnish straight edges any length from 4 to 72 inches, made from 14-gauge polished band saw steel, combination straight edge and tension gauges 4 to 20 inches long, combination convex and concave tension gauges 4 to 20 inches long, all on segments as ordered; back gauges with edge straight or concaved to order, 4, 5 or 6 feet long, in 14-gauge polished band saw steel about 4 inches wide at center, tapering to 2 inches wide at ends or in lengths from 4 to 10 feet from 7-gauge spring steel about 2 inches wide, the longer back gauges being furnished with handle, if so ordered. If you run some crown in back edge of saw, as, for example, from 1/64 to 1/32-inch in from 5 to 6 feet, the use of a concave back gauge to suit your requirements will afford better satisfaction, in that it will enable you to work out the back more uniformly than will result from the use of a straight back gauge.

STRAIGHT EDGES

We furnish Straight Edges made from polished tempered 14-gauge steel, one edge only available for use, in lengths from 4 to 72 inches.

Combination Back Gauge and Straight Edge

Most band saw filers run crown in the back of their saws and if so a concave back gauge is necessary to equalize the expansion throughout the back of saw. The amount of this expansion is variable according to local conditions and individual ideas, and in the absence of specific instruction in order, we make these gauges to usual standards.

One of the most desirable types of Back Gauges that we manufacture is made of 7-gauge spring steel, with one edge straight, the other edge concaved to order, and besides serving to secure the proper and uniform expansion of the back of saw, the straight edge side of gauge will prove highly useful for other purposes.

We furnish Combination Back Gauges 4, 5, 6, 7, 8, 9 or 10 feet long as required, made from spring steel, one edge straight, the other concaved as ordered, to serve as a correct measure for the crown run in back of saw. These long gauges may be furnished with two handles, if so desired.

We furnish Back Gauges made from 14-gauge steel, one edge only available for use, straight or concaved to order, in lengths 4, 5 and 6 feet.

SEGMENT GRIND FOR TENSION GAUGES

Averaging the practice of saw filers, it may be said that band saws of the following widths can be run successfully tensioned to the segments of circles of the following diameters: 4 or 5-inch saws from 26 to 32 feet, 6-inch saws from 28 to 35 feet, 8-inch saws from 30 to 38 feet, 10-inch saws from 34 to 42 feet, 12-inch saws from 40 to 44 feet, 14-inch saws from 45 to 50 feet.

TENSION GAUGE TEMPLET

We have some demand from saw works and band filers for Tension Gauge Templets, which differ in no particular respect from the regular tension gauges except that they are designed to serve as a templet only to enable the user to true up his working gauges from time to time as they wear out of true through use.

STEEL HAMMERS FOR SAW WORKS AND FILING ROOMS

We have furnished many thousands of saw hammers from regular stock sizes, and made many to order, special in shape or grind, to suit drawings or patterns submitted with order. We undertake to meet any clearly defined requirement in a satisfactory manner.

Our hammers are all finely ground and polished; mounted with handle; made to order any weight 1 to 9 lbs. Specify style of hammer, weight and number of each style required. Handle will weigh from 4 to 6 ounces and the weight specified means the approximate weight of hammer with handle. A large and well assorted stock of hammers always on hand, enables us to fill orders with hammers that will weigh within a few ounces of any specified weight. We do not undertake to fill orders with absolutely exact weights.

There are five different types of hammers employed in saw work, known variously as the doghead, cross-face, twist-face, combination and swaging, the first four for hammering purposes, the fifth used with a swage bar. For practical purposes the doghead and cross-face hammers are sufficient, the twist-face and combination being in little demand. The doghead is used in tensioning. The cross-face and twist-face for leveling the saw, that is, for removing lumps, bends, twists or similar distortions of the plate. The combination is made with a doghead on one end and a peen running with the handle on the other end. The doghead is also known as the round-face hammer. Our hammers are mounted with handle, and will be nickel-plated and etched or stamped with the owner's name when so required.

Hammers should be bought with special regard to their weight and shape of face, both of which have much to do with their fitness for work. Hammers have both a use and an abuse. Heavy hammers, such as are commonly used for circular saws from 5 to 8 gauge, are too heavy for bands or band resaws. Indeed the regular band saw hammers are considered by careful filers too heavy for fine work on band saws, and many use light finishing hammers weighing not over two pounds or so, and find their use much more satisfactory. Especially is this the case where filers have a good stretcher for their work in tensioning. In such case there is very little leveling to do after the rolling, and the light hammers accomplish the work best.

We recommend as follows:
Circular Hammers—Weight mounted, from 3 to 5 pounds.
Band or Gang Hammers—Weight mounted, from 2 to 3 pounds.
Light Finishing Hammers—Weight mounted, from 2 to 2½ pounds.
Band Resaw Hammers—Weight mounted, from 2 to 2½ pounds.

FILER'S SAW TOOLS

Swaging Hammers in sizes ¾, ⅞ and 1 inch.

Cross-face Hammers, long and cross peen, 1½ to 10 pounds.

Doghead Hammers, round face, 1½ to 10 pounds.

Combination Hammers, round face and long peen, 1½ to 10 pounds.

Twist-face Hammers, two twist peens, 1½ to 10 pounds.

Saw Anvils, flat or crown, chilled face, in numerous sizes.

Iron Leveling Blocks, in numerous sizes or to order.

A filing room may be better equipped with sets of hammers in several weights, the cost of these being inconsiderable, than for the saws to be abused by the use of unduly heavy hammers, with which the work of hammering may degenerate into a mere "pounding" or marking of the saws. This is particularly true in woodworking plants, where band resaws or thin circulars are employed, and where it sometimes happens that the filers are men who are either beginners or are at least not sufficiently far enough along in the art to be classed as amateurs.

All of the above is in direction of making it possible to level and hammer saws with the least liability of marking or denting them, and at the same time of having them perfectly leveled, tensioned and expanded on the back edge. The filer who does not look closely to all these details is not the best filer, nor is he the filer who has the interests of his employer in mind, because the utmost care in the above details tends not only to make it possible to run saws with much less liability to crack, but also makes it possible to run them on a lighter swage, or, in other words, a lighter kerf, and to make smoother lumber and more of it.

SAW ANVILS FOR SAW WORK AND FILING ROOMS

We furnish anvils in many different sizes, but the sizes in general demand are made with face variously 5 x 8, 6 x 10, 8 x 12, 10 x 12, 12 x 14 or 12 x 16, etc.

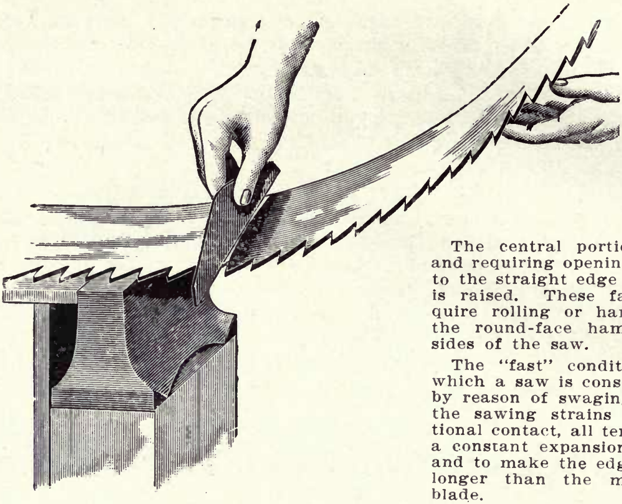
THE LEVELING BLOCK

The leveling block is preferably of iron, surfaced four sides, in size to suit the saws in use. For narrow or medium width band resaws we supply blocks that are either 6 x 48 x 3 or 8 x 48 x 3 inches. For log bands the block may be 10, 12 or 14 inches wide, 48, 60 or 72 inches long, and 3, 4, 5 or 6 inches thick as preferred. As the constant hammering on an iron surface tends to make it convex, it is desirable that leveling blocks shall be occasionally turned end for end and also turned over.

SAW TERMS, "FAST, LOOSE AND STIFF" PLACES

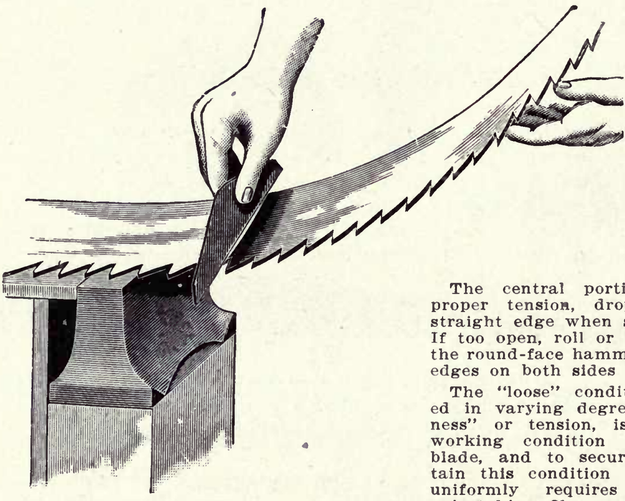
A "fast" place is one not open enough, but is convex, and stands up toward straight edge. A "stiff" place is without tension or perfectly flat, the central parts of saw conform to straight edge. See cuts.

A "loose" place is too open, or is concave and saw drops away from straight edge. Such places will show the same on both sides of saw, whereas a lump will show only on one side. An experimental knowledge of these terms and their appearance in saw, may be obtained by hammering a strip of band saw, say three feet long. First make the saw flat or "stiff" by hammering down the lumps on leveling block. Then test with straight edge for "fast" and "loose" places. Having located a "fast" place, you will notice that it shows on both sides of the saw similar to the manner in which a lump shows when the saw is lying flat. Remove the "fast" by use of the round-face hammer, working on both sides of the blade, and testing often with the short straight edge. A loose spot will show high on both sides, but a lump will show high on one side only and hollow on the other. Be careful at all times to keep the edges true. Next take out the "loose" with the same hammer until you have the piece of plate flat or "stiff" throughout. Now proceed to open or tension the saw until it shows the required amount of drop from the straight edge, which is usually about $\frac{1}{16}$ of an inch in a 10-inch saw, or until it conforms to the curve of the tension gauge. The greatest opening should be in the center of the saw, decreasing gradually to within about 1½ inches from the toothed edge, and about 1 inch from the back edge, varying a little according to the work to be performed. Some run the tension as close to edge as possible.



The central portion being fast and requiring opening up, is drawn to the straight edge when the saw is raised. These fast places require rolling or hammering with the round-face hammer on both sides of the saw.

The "fast" condition is one to which a saw is constantly tending by reason of swaging, sharpening, the sawing strains or even frictional contact, all tending to cause a constant expansion of the steel, and to make the edges of the saw longer than the middle of the blade.

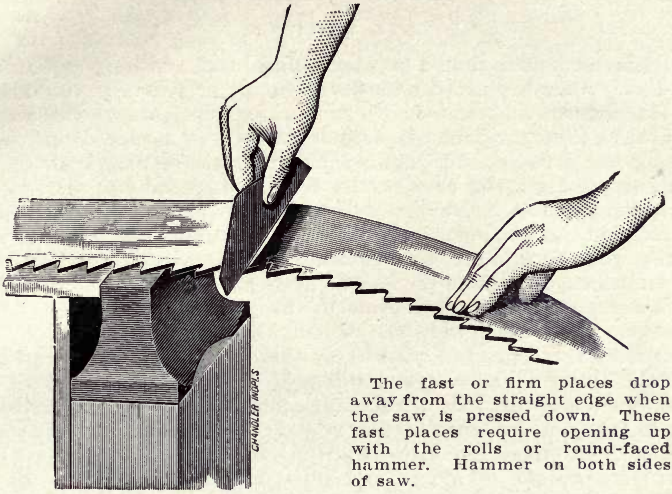


The central portion being in proper tension, drops from the straight edge when saw is raised. If too open, roll or hammer with the round-face hammer along both edges on both sides of the saw.

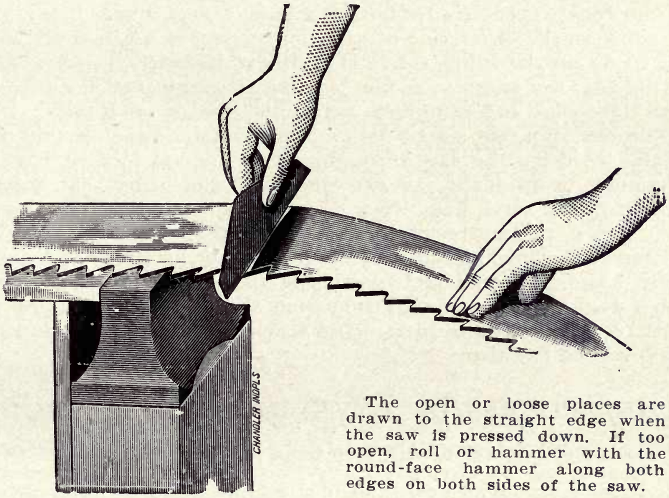
The "loose" condition illustrated in varying degrees of "looseness" or tension, is the correct working condition for the saw blade, and to secure and maintain this condition correctly and uniformly requires a skillful, painstaking filer.

Be careful not to get the saw too open. To insure the saw traveling on the wheels without any lateral motion, the tension must be perfectly uniform throughout the entire blade. The proper amount of tension varies according to the feed of the mill and the face of the wheel whether perfectly flat or slightly crowned. But $\frac{1}{16}$ to $\frac{1}{32}$ of an inch on a saw 10 to 12 inches wide, is the amount generally used. The use of a tension gauge, with one edge crowned to the amount of tension desired, is essential in securing uniformity of tension. When testing with tension gauge place the saw on anvil as when hammering, hold the tension gauge squarely across the blade at arm's length, and if the saw has been properly adjusted it will conform throughout its length to the crown of the gauge. To reduce the tension of saw or stiffen the blade, hammer gently along the back and toothed edges of saw, taking care not to strike nearer than a quarter of an inch from the edge of throat. To increase the tension or "open" the saw, hammer gently through the central portions of saw. See cut of Hammer Blows.

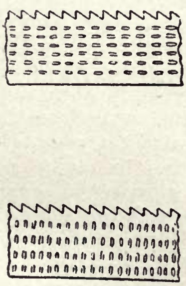
But every well equipped band filing room has a saw stretcher and having a saw stretcher, the hammers simply prepare for and supplement its work.



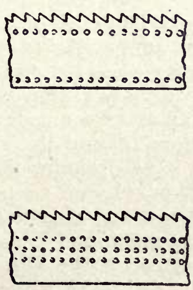
The fast or firm places drop away from the straight edge when the saw is pressed down. These fast places require opening up with the rolls or round-faced hammer. Hammer on both sides of saw.



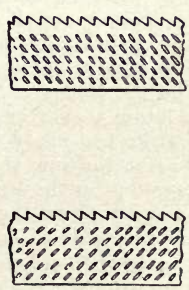
The open or loose places are drawn to the straight edge when the saw is pressed down. If too open, roll or hammer with the round-face hammer along both edges on both sides of the saw.



Long-faced and cross-faced blows



Blows to remove the "loose" or the "fast"



Cross-faced "twist" and long-faced "twist" blows

USE OF HAMMERS

A. J. BURTON

The cross-face hammer should be used only to take out long and cross-faced twists, lumps or ridges. Always place the blows on lumps or twists in the direction in which they run. Do not use the cross-face hammer for tensioning. Do not hit too heavy blows and always keep the face of hammer smooth so as not to cut or mar the saw. For tensioning use a 2½-pound doghead hammer with the face as sharp as possible, but not too sharp. I get the best results from a doghead hammer, by using a wood roller, 2-inch diameter by 16 inches long, set in two pieces of 2 x 8, 10 inches long, so that it will roll and not get out of place. Place this under the saw and it will keep the saw up, so that you can find the bend or drop, and you can thus always test it the same. With the tension gauge examine for stiff or loose places. Place the blows on saw where gauge shows darkness till saw conforms to the gauge all the way around the saw on both sides alike. If too much light shows under gauge, place a few light blows on each edge, ¼ inch from the edge, and then likely there will be a little lump or a stiff place; but a few light blows equalize it and this will prevent the saw from cracking. If a loose spot shows under one half of the gauge and a tight spot under the other half, do not attempt to take out the loose first or you throw the back of saw out or in; but take out the stiff and quite likely the loose will run into the stiff with a few light blows and be all right. If it should not do so and still continues loose, three or four blows on each side will take out the loose and not affect the back. Go over the saw in this way until the tension shows equal on both sides. Always hammer from center to edge instead of from edge to center. Do not hit a blow except where it is needed or you will make extra work on the other side of saw; but if care is taken there will be very little if any work to do on the other side. Do not use hammers too heavy for band saws. Do not use the doghead hammer on the leveling block but find the ridges and twists by taking the straight edge and running it across the saw on anvil only. Do not place too many blows on one spot, but scatter them. This equalizes the tension more evenly and is not so liable to drive the saw through. It is a good idea to have a three-pound cross-face hammer to use if the saw gets pulled off and badly bent, for the face will be larger than that of the small hammer and not so liable to fill the saw with small lumps in taking out twists, as may result if a small hammer be used. Always use the small cross-face hammer for finishing up. Do not allow your hammers to be used on anything else but saws. Take pains to detect every little lump that may show under gauge, if you tension with a doghead hammer. By removing all such lumps, making the saw perfect under the gauge, it will require little or no leveling, for if the tension is alike on both sides, the saw will be flat also.

THE PROCESS OF LEVELING AND TENSIONING

A band saw must be level or flat, free from lumps, bends, ridges, twists, etc.

Suppose there are a lot of new saws in the filing room to commence on. In taking the saws out of the case, be careful not to bend the plate or knock the corners off the teeth. Put saws on hammering bench and with straight edge held lengthwise of the saw, look it over and if you find any lumps, take the light cross-face hammer, say a two-pound, and knock down all the lumps all the way around the saw with the long face, being careful not to hit too heavy so as to mar or cut the saw. Be sure to strike directly on the lumps and not to hit a blow except where it needs it. You may as well place the blow a quarter of a mile away as a quarter of an inch away from the lumps. Do not strike too many blows without testing the saw with straight edge. If you do you will drive the saw through and it will require time and labor to get it back. Next put the saw up on the brackets over bench and go over the inside in the same manner. Always commence on the outside of saw and always finish up on the outside or log side. A beginner is liable to do a little too much and if so he will leave the last side worked on, a little dished, and it is much better for the saw to be dished into the log than out of the log, although it should not be dished or turned over at all, but perfectly flat on both sides. After you have gone over the saw in this manner, go over again and apply the straight edge crosswise on the inside of saw. This will show you the ridges or lumps running lengthwise of the saw. Stand in front of the leveling board or anvil and with the cross-face of the hammer, knock down any lumps that may be found, using care not to hit too heavy so as to make a dent in the plate. After going over the saw on the inside in this manner, put the saw down, and go over the outside in the same way. If you do this work with care you will have a saw with a straight toothed edge and a flat surface. You can test the saw with straight edge on an angle, first one way and then the other. If the lump runs one way and there is light the other way, trace its direction and extent, and remove it by hammering the way the lump or ridge runs on the side you find it. This work will be done on the leveling block, using a cross-face or twist-face hammer. Avoid marking or denting the plate. Then turn the saw and hammer the same on that side. To find twists the leveling bench must be perfectly level. Hammer both sides of the saw alike. Do not attempt to use the doghead hammer for leveling or the cross-face hammer for tensioning, and remember that in hammer work it is better to go over the saw several times lightly than to be obliged to undo too heavy work. The thorough and skillful removal of lumps, bends and twists taxes the filer's skill, and the degree of his success in such work is really a measure of his ability as an expert sawman.

Among different causes for the formation of twists may be mentioned the case of a saw running off the wheels or breaking on the wheels. Or the saw may be bent while being put in or taken out of the case, or when put on or taken off the wheels. Or a twist may be rolled in a saw if the rolls do not tread perfectly or the saw does not run square with the rolls of stretcher. Bent places tend to stiffen the saw at the bend and may require some opening as well as leveling. If the bend is slight it may be removed by bending the saw by hand or by lever pressure, in the opposite direction, and it is well to set the saw slightly and then give it a few slight blows to make it straight. Then the bend will not recur at that place. If the saw is very badly bent or sprung, the bend may be heated with a spirit lamp until the saw fries and then bent back. If your saw, as it lies on the floor, shows tendency to twist or lop over it indicates a twist. A little of this may not occasion special trouble, but when your saw twists toward a figure 8, due to a line twist running its entire length, you are in trouble. The line twist deviates but little from a parallel with the edges of a saw. In hammering to remove a twist, you must place your blows in line with the twist and not transversely. Hammer down the edges and there will be little to do in the center. Twists sometimes show cross-face in one place and long-face in another. These are bad, if overlooked, because in running, the saw will dodge when they pass the cut. A long-faced twist will run in the log, and a cross-faced twist will run out of the log on a R. H. mill and transversely on a L. H. mill.

Now take a drop level or tension gauge.

Hold the gauge in the right hand and put the left under the saw 2½ or 3 feet from your right hand and with chalk, mark the saw where the drop level or gauge shows darkness. Then with the saw stretcher, roll the saw lightly the distance the drop level shows the saw to be stiff, and repeat until the saw conforms to the drop level from one edge to the other. After thus going over the saw and making it fit the drop level all around, examine the saw on leveling block with straight edge to see if it has been dished at all. If it has, you will have to level it again with the cross-face hammer, but if you have a good stretcher it will not dish the saw unless you use too much pressure. Never allow the saw to pass through the rolls bent up or down, unless you wish to bend your saw. You now have a saw straight and flat with a good even tension all around it. Next look at the back of saw. Use a back gauge about 5 to 6 feet long, concaved $\frac{1}{32}$-inch in the entire length. Mark every place where the gauge does not fit the saw and roll the saw about 1½ inch from the back edge, from mark to mark, but never longer at one time than the length of the back gauge. If the back edge of the saw is up to a tight fit to the back gauge, good, but if not, look at the tension, and if you have opened the saw any, roll next time ½ inch nearer to the edge, but if the saw is stiffer, roll ½ inch nearer the center. By following this method, you can draw the back without altering the tension and with practice you can make a perfect running saw and do all the tensioning with the stretcher. Always look over the saw with tension gauge after you have put in the "back," to be sure you have no tight or loose spots. If the saw is too loose, roll very lightly along both edges; by so doing you will not change the back. Then equalize the tension with the stretcher and see that the saw is level, flat and straight, with good even tension and a good back. The saw is now ready to put on the sharpener. If you follow these instructions you will have a saw that will stay on the wheels without oscillating, and that will stand heavy feed.

Before putting saw on a new or unknown mill you should examine the mill and see that the boxes are all right and that there is no lost motion. Line the face of lower wheel parallel with the V track and line top wheel with lower wheel. Put on the saw and tilt upper wheel until the saw runs ¾-inch off the top wheel. Be sure to do this with the tilt device. Do not use the crossline as it throws the saw in a twist so that it will rub against one guide more than the other, and probably cause it to crystalize and crack, besides causing undue wear on the face of wheels.

Always have the tension even, whatever the drop or amount of tension used may be. Do not open the saw too near the front edge as it may crack in the gullet. Do not leave the front edge too stiff or firm as the saw will snake in a hard log and go back on the wheels. Some filers leave their saws tight for 1½ inches from toothed edge, in order to avoid cracks, but I do not think this is the best way. If a saw shows tendency to crack in front with the tension I have been using, I change the tension to a larger circle, which gives a little less tension, but I let the tension run from one edge to the other, on a perfect circle, except that I leave a ½-inch strip on the toothed edge, so that the level will show dark for ½ inch and then light from there to the back edge. For hardwood and heavy feeds, a saw requires more tension than for soft woods and light feed. Be sure to have the saw straight edgewise, for it will stand one-third more feed. For example, you cannot drive a bent nail in hard wood, but straighten it and you can easily drive it. The band saw is similar and with the edges straight, will cut better with less liability to dodge. Always run a little back or convexity in the back edge of saw, about $\frac{1}{32}$ in 5 or 6 feet, and if the saw is properly put up, it will run without oscillation and present a true cutting edge, and not drive back in cut. If the wheels are crowning, open the saw a little more where it rests on the wheels.

If wheels are in good shape and in perfect line even less crown is found sufficient.

As previously stated, the object in crowning the back edge is to make the toothed edge stiff or tight under strain, as the toothed edge stretches more than the back edge, besides having to withstand the cutting strain, while the action of the emery wheel in sharpening and gumming tends to stretch the front edge and to make the back hollow. As the tension goes in the hollow places can be worked out at the same time, by rolling more or less closely to one edge or the other. If the rolls are properly used very little leveling is necessary.

A saw too open near the edges, that is, dropping away from the straight edge too abruptly, is likely to make straight cuts if the tension is evenly put in, but it is more likely to chatter in the cut and to crack on the edges than if the tension is less open.

There are filers who recommend that a strip of the blade an inch or more wide at each edge should come up flat against the straight edge, and show absolutely no tension. The advantage of this is not generally conceded, as it is difficult to get a saw in this condition with any show of evenness, and without leaving fast places near the edges, a condition in which no saw will run and do good work.

A band saw stiff or without tension would track to the middle of crowned wheels, as they were run during the first experimental stage, but with tension the conditions are changed and the first point of contact is at the edges, one edge balancing the other. For this reason the straight faced wheels are the best and the saws do not run back and require a "back-stop" wheel, as was the case with the crowned wheels.

Examine the saw as it comes off the mill and if any tight or loose spots, or any long or cross-face lumps appear, take them out. By going over the saws frequently you haven't so much work to do at any one time, and you have better cutting saws with less tendency to crack.

In this manner a saw should run from six to nine months without cracks, and if cracks occur they are probably due to faults of the filer. Sometimes our best sawmakers make a saw that may either crack or have a tendency for the teeth to split, or that cannot be tensioned to run without making snaky lumber. In such case, as the character of the saw can usually be promptly discovered, its condition should be immediately reported to the maker. Saw makers should not be expected to send out saws to be used from three to six months and then condemned. If defects existing in saws when new from the factory are not promptly reported, the fault lies with the filer.

Don't try to lead the saw with the guides. Don't set the guides too tight. They should be set true to saw with a clearance of about the thickness of writing paper on each side. If the saw does not then run straight, it must be dished or swaged too heavy on one side, or the grinder does not grind squarely, or the track is not in line with saw, or the wheels are not in line, or the face of wheels are not flat in proper shape, or the tension is uneven in the saw. Look carefully to the fitting and tensioning of your saws at all times, but see that the mill is always in good order.

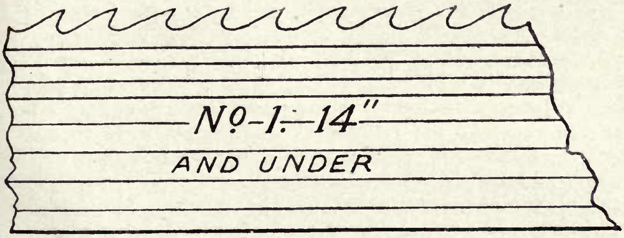
The best mills and the best sawyers meet with accidents and saws get pulled off and twisted or bent, which makes extra work for the filer, but it must be put up with. In such a case, go to work, but take it easy, and have some one help you. Take a block 8 or 10 inches deep, and with a lever or pike about 3 x 4 used as a pry, bend the saw back to place. Always apply the lever across the saw the way the bend runs. That is, if the bend is square across the saw, use the lever the same way, but if it runs at an angle from one edge to the other, this makes a twist, and you must set the block so as to press with lever directly on the ridge or twist, and in this way you can bend it back nearly as well as ever. After this, a little work with the cross-face hammer, placing all blows with the long way of blow parallel with the lump or twist, will remove it. Never attempt to level a saw that has no tension in it, but go over it with the stretcher and put in some tension and you can then level your saw perfectly.

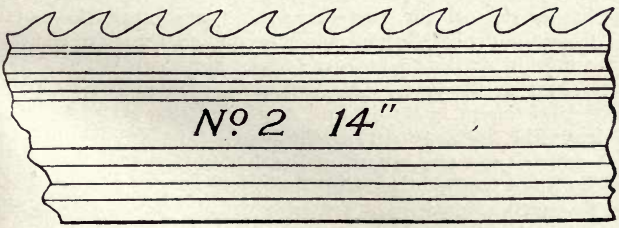
A saw will not crack if the tension is even throughout the plate, but if put up with tight or loose spots, vibration will occur, which is ruinous to the life and cutting efficiency of the saw .

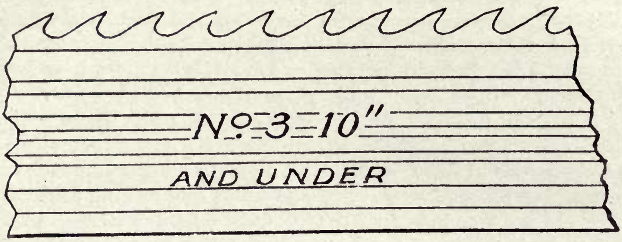
ROLLING IN TENSION WITH STRETCHER

E. L. MASON

Many object to having the center of their saws tensioned high on account of wearing the center of the wheels, on the assumption that they will have to be reground oftener. But if the edges are tight, do they not wear off the edges of the wheels? And will it not take just as much grinding to get them true again, as though they were in the center of the wheels? Is it not pretty hard to roll a 14-inch saw to true tension and have it lay smoothly on the leveling block? I roll them anywhere they need it, but am rather shy of the centers; they will drop from tension gauge in the center when lying flat, but try them on the ends and they do not show nearly as much tension. I have seen a filer roll a saw from one extreme edge to the other, but could never gain anything in the way of tension by running closer than 1 inch to the edges, as closer than that always lets out tension instead of putting it in. The sketch shows the way I place my tension for different widths of saws. The lines show where I roll.







No. 2 is for 14-inch saws. No. 1 for 12-inch saws. I run the roll clear around the saw first, and even up small spots that may need it after finishing rolling around. I use the roll entirely in tensioning, using a hammer only for leveling. Of course, these lines must be varied some in order to keep even tension, but they show where the tension is deepest. No. 2 works well on any width of saw in hardwood, but in narrow saws for soft timber No. 3 is better.

REMOVAL OF TWIST

N. L. BOTTEN

Figure 1 below is supposed to represent a saw as it rests on the floor with a long-faced twist, which is hard to tell until you have applied the tension gauge as in figure 2. Put the saw on the bench and apply the tension gauge the same as you would in testing tension, only instead of holding the gauge straight across the blade, hold it diagonally or at an angle of about 45 degrees. When the gauge is held parallel with the twist the blade will drop from the gauge in center and show light under gauge same as in figure 3 in cut, and when gauge is applied at a right angle to twist, or straight across the twist, as in figure 4, the blade will touch the center of gauge and drop away at either end. By trying the gauge in this way the operator will soon find out which way the twist runs, or rather the angle of the twist. A better way would be to drop the tension throughout 8 or 10 feet of the blade and test it with straight edge in the same way that I have suggested with the tension gauge. Although the latter plan is the best, I would prefer the templet test on a tensioned saw, for it is less work and close enough for all practical purposes. When I find one of my saws in a continuous or line twist I first find out which way the twist runs and at which angle, by rolling the saw along on the floor and by lopping it over from side to side. I then place it on the bench and go over it on both sides with the cross-face hammer, hammering, of course, as near parallel with the twist as possible. If once over does not remove the twist I go over it again until the twist is removed. If the twist is real bad I hammer clear out to the edge, but if it is a light twist, I do not hammer close enough to edge to remove the tension. Sometimes a saw will get twisted throughout 8 or 10 feet of the blade only, and when it does it is harder to remove than a continuous twist. These short twists are harder to locate, and I dare say that there are fully one-half the filers who cannot properly locate the beginning and ending of a short twist. One good way to find out a short twist is to roll the saw along the floor until the twisted portion of the saw is in the bend at the end. The end of the saw where the twist is, will lop over and try to assume the shape of a letter "S," while the other end will lay straight and plumb. Now, having found the twist, roll the saw along the floor until the twisted portion of the saw is on the floor underneath about midway; when the saw is in this position it will lay straight throughout, with no sign of a twist. Next roll the saw along until it commences to lop over again at the end. As soon as it commences to lop over the least bit, stop, roll the saw back again one foot and mark the saw with a piece of chalk where it commences to leave the floor in forming the bend. Say No. 5 in diagram. No. 1 marks that point; that is where the twist begins, or, rather, one end of the twisted portion of the saw. Having found one end of the twisted portion of the saw, it is easy enough to find the other end by testing for it in other end of saw. After this is done

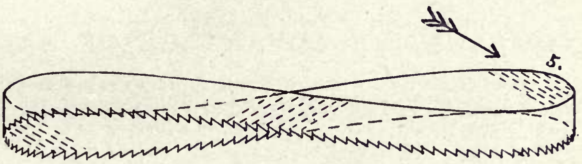
No. 2.

place the saw on the bench, and it is easy enough with the tension gauge test to tell the exact point where the twist begins and the angle of the twist. In order to find a twist in this manner the tension must be uniform throughout the saw.

LONG AND SHORT FACED TWISTS

A. J. BURTON

There are two kinds of twists that are liable, through accident, to get into a band saw, known as long and short faced. The hand of the saw has nothing to do with the twist, as there may be long or cross-faced twists get in R. or L. saws. If you have a saw that is running and doing very good work, but when taken off mill and placed on floor will not stand up, but has an inclination to fall over in the shape of a figure "8," this may be a long or cross-faced twist, as the case may be, and half the filers in the country don't know which it is. Now, it is impossible for a doctor to cure a patient unless he knows the disease. So it is with filers. Unless you know the kind of twist your saw has, you cannot take it out. But if you will remember that whichever way the top of the saw falls, shows the way the twist runs, you will not make a mistake. For example, lay your saw on the floor. Then stand at the middle of the saw with the teeth from you, and if the left hand end of the saw falls toward you and the right hand end falls from you, it is a cross-faced twist. But if the left hand end falls from you and the right hand end toward you, it is a long-faced twist. (Every time.) Such twists usually run all the way around the saw and if the saw is flat with good even back and tension, it will not hurt the cutting capacity of the saw, only that the saw will rather lie down than stand up when on floor or bench. But if you will follow the instructions here laid down, you can take out such a twist without a blow with the hammer, for if the top part of the left hand end falls toward you, pick it up and get on the bottom part with your feet close to the left hand end. With your hands press hard over the opposite way. Let some one hold the other end up for you and continue to roll the saw, moving your feet say two inches at a time with an even pressure with your hands till you go all around the saw. If you use care to do it right you will be surprised to see the saw stand up again as straight as a new saw without the use of a hammer. The reverse of the above for a cross-faced twist will remove that also. Now don't forget that when you stand with the back edge of the saw to you, that if the left hand end falls to you, it is a cross-faced twist, and if from you, a long-faced twist. Sketch No. 1 shows long-faced twist, and for cross-faced twist, saw will fall at the top toward the arrow or in opposite direction from that shown in cut. Now to remove this long-faced twist, pick up saw with hands and place feet on bottom, having some one hold up the other end. Then roll saw, marking with chalk to show you when you get around. Repeat this and with a little brains and practice, you will soon take out a long or cross-faced twist and make your saw stand up nearly as well as ever. It will be well for you to put it on the bench to see if you have put in any short bends or lumps. If so, you must remove them with the cross-faced hammer, taking care always to have the long way of the hammer blows running in the directions of the lump or twist and always bear in mind that you cannot hammer the high corner of a twist down, but you can raise the low corner up. Every one knows that a hammer blow must be put directly on a lump or ridge to remove it.



No. 1.

USE OF SAW STRETCHER FOR REMOVAL OF TWISTS

We are informed by a practical worker that with practice and a careful watching of results he believes a filer can do almost anything with a stretcher except to level small lumps, and that if a saw gets dished from an accident, he makes it a practice to roll out the dish instead of hammering it out and finds this much easier and quicker. This may be done by mounting a small pulley on a short shaft or piece of pipe. Fasten one end of pipe in a box on side of room as close to stretcher as the diameter of pulley will allow. Then put the pulley on the shaft or pipe, with one end in the box you have made for it and hold the other end in your hand. If the saw wants drawing up in the center, place the pulley on top of saw, then bearing down on shaft in your hand, start your roll in the center of saw. Roll clear around, then about 2 inches at each side of this center rolling. Better look at saw after rolling, for it may come up more easily than you expect. If the center needs drawing down, push the pulley under the saw and push upward on the saw, rolling as before. If this puts in too much tension, take it out on back edge of saw, with saw lying level when being rolled; but if a double edge saw, take it out on each edge alike. The above process can be accomplished without any complicated arrangement and more easily than by hammering.

COMPARATIVE ADVANTAGE OF HAMMERS AND STRETCHER

While the use of hammers is indispensable in the proper leveling and tensioning of band saws, the use of the stretcher for the work for which it is adapted, is very superior to hammer work.

With a good stretcher, rolls properly shaped, you stretch uniformly every particle of steel affected. The roll leaves no marks upon the blade as does the hammer, which may ultimately result in crystalized spots that crack and break, require a braze, and rapidly destroy the life of the saw. Saws tensioned with the hammer are often spotted with places that have never been stretched even after the saw has run for months, hence a portion of the steel must be stretched more than necessary, because of the portions not stretched at all. This condition is unlikely to exist if a stretcher is used. The stretcher is a great time saver, for an expert filer can put up a saw in from one-fourth to one-half the time required in hammer work. You can roll any section in a saw from one inch to the entire length. Commonly the filer takes a short place as a section two or three feet long, and rolls that where required. Using the stretcher the final work of leveling is reduced to a minimum. There is little use for the hammer unless the saw is kinked or twisted. The argument in favor of a stretcher instead of hammer for tensioning is all on the side of a good machine, but all on the side of the hammers, if a poor machine. Millmen should not buy a poor cheap stretcher when they can obtain a machine of the highest superiority. The time that some filers spend in hammering their saws might be better spent in working up the points of the teeth into a better condition for cutting. They hammer unnecessarily, and point with pride to their saws, remarking that they keep them well hammered, overlooking the bright spots which shine like silver dollars the entire length of the blade. Before using the hammer, you must know where and how to use it. Then every blow struck counts and serves a purpose. It is not necessarily a mark of industry in a filer that he is constantly hammering or fussing with his saws. Really good mechanics never work hard. Too much hammering takes the life out of a band saw. Never make indentations with the hammer which will bruise or crush the steel. It causes crystallization and destroys tensibility. Avoid unnecessary blows. Have a reason for every stroke of hammer and try to place it in the right spot every time. The roller is far superior to hammer work for the uses to which the roll is properly suited. There are many filers that through careful watching of their saws, and proper use of roll, rarely have occasion to use the hammer. Some filers say they have no use for a roll, preferring hammer work. This may be so in some individual cases, but the cause of such condition can be traced either to the fact that the filer is not familiar with a roll, or has used one some time that was not properly made and ground and consequently gave results the reverse of beneficial. However, this is no disparagement of the principle but simply of the individual defective machine. When through rolling, you should carefully examine saw on leveling board, and give a finishing touch with hammer to any spots that do not show uniformity of tension.

The use of the rolls in tensioning is less likely to dish the saw than the use of the doghead hammer, if the rolls are of even diameter, track and travel together and the saw runs straight through rolls. If one roll is sharper than the other or if the saw is bent as it passes through the rolls, the saw will be apt to dish away from the flattest or broadest faced roll, and a very little dishing becomes objectionable. Too much tension in the saw will also cause the roll to dish the saw. In machines with the upper roll an idler, if the upper roll does not travel freely, or if the saw is gummed or greasy, the upper roll may stop or slip, which will dish the saw. Hence for large, heavy gauge or hard saws that require immense power to tension them properly, a machine with geared rolls is unquestionably the best; while for band resaws the gearing of rolls is a less essential requisite to an efficient machine.

USE OF SAW STRETCHER

The amount of needful pressure of rolls depends upon the degree of the fast or loose places and must be learned by results from actual use of the machine. After a few trials one can learn to properly estimate the pressure required to suit the work.

To remove a "fast" place find its aproximate area and shape. Roll the spot, beginning at side next center of saw and apply roll at small intervals. If the "fast" is not removed, go over the surface again, rolling on lines not previously touched. If the roll does not remove the "fast" place readily, examine for a lump which may have been overlooked.

To remove loose places first test the back of saw with long straight edge. If straight or showing proper tension apply roll to both edges of saw about one inch or so from edge, and diminish pressure inward. For a loose spot with back hollowing you will apply roll only to back side of saw. Usually a slight pressure of roll will remove a loose spot. It is essential to have the toothed edge of saw tighter than any other part, and to accomplish this without materially affecting the uniformity of tension, roll the saw a little longer on the back edge. The back of saw should show a slight uniform convexity along its entire length, when tested with the long straight edge. Tilt upper wheel forward enough to make saw have as strong a pressure on wheel at back edge as at front edge. This will leave that part of the saw between the wheels with a tight toothed edge without subjecting it to that undue strain brought about by making tooth edge tightest by an all tilt movement of upper wheel. Hollow places in back of saw are caused by undue expansion of the tooth edge, due to heat from friction or too rapid feed. Apply long straight edge, and if back shows hollowing, note the extent of the curvature. Roll the saw slightly over this surface up near to edge and inward toward center, diminishing the pressure inward so as to not change the tension. Having made the back true to straight edge or uniformly convex by tensioning, you can bring both edges parallel by jointing when you fit the saw. If the back is too convex roll near the toothed edge. It is an extremely nice process to determine just how close the tension shall approach to the edges of saw and especially to the edge of teeth. If the saw has too wide a strip on the toothed edge to sustain the tension, dodging is apt to result. If the tension approaches too near to edge of teeth fracture will result. Trouble is often caused by saws shifting on the wheels or running back against the rollers. This may be in the saw or in the wheels. If the saw shifts it is generally too loose on the back. A perfectly flat faced wheel requires less crown of back edge than a crowning wheel. Too much tension may cause a saw to run out or in the log.

The makers of band mills do not crown their wheels to the extent that they did some years ago and are agreed that perfectly flat wheels are the best. Crowned wheels may give excellent results if the saw is properly fitted to them, but the best modern practice favors flat wheels both for output and life of the saws. Apart from practical experience, reflection suggests that the least amount of crown there is in a band wheel, the less tension is necessary, which means less hammering and rolling and less tendency to crack. If the saw when strained and running is not straight across the full blade, but stands convex and concave with the full strain of the machine, it will always run to the concave side. This dodging may also be caused by not properly leveling the blade after tensioning with stretcher, especially if the work of the roll is imperfect. Proper tension allows the blade to lie flat on leveling board. If it does not lie thus, take straight edge and place it squarely across the saw and you can easily locate the high spots and the reason why the saw runs to one side. In some instances during the process of swaging the swage dies or clamps may turn the teeth to one side, or may swage more heavily on one side, and so cause the saw to lead off. Or the sharpener may not grind perfectly square. The emery wheel must stand directly with the center in a straight line over the saw, or saw tooth will be ground out of square, making one side of tooth longer than the other, and causing the saw to lead to the long side of teeth.

A snaky saw either needs more tension or an equalized tension, as a saw not open enough, or with fast and loose spots, will snake. Also a saw with too long spacings or with teeth too long or too slim, will snake, unless run with extreme tension, which jeopardizes the life of saw, as a saw with too much tension will soon crack.

Whatever causes a heating of the saw in any form or place tends to bring about a dished form, and the longer the condition remains unabated, the more pronounced will the dish become. The saw must lie flat on leveling block before the stretcher can perform its work of tensioning properly. If a saw has too much tension, it tends to assume a dished form, and in such case a stretcher, unless properly used to remove the extra tension, would aggravate the trouble. But you must have a certain amount of tension in a saw in order to level it properly, as a saw without tension cannot be leveled.

TENSION—WHAT IT IS AND HOW TO OBTAIN IT

Tension in a saw is a preparation of the saw to do a specific work by compensating in advance for certain conditions known to arise during the operation of sawing. During the hardening and tempering processes, according to the thinness of the blade, it runs in various forms of bends and twists; in band saws it often deviates from a true line flatwise, edges still remaining parallel, but having run in a serpentine form. It is the work of the expert sawmaker to correct these inequalities arising during the process of manufacture. The saw is also susceptible to modifications in form arising from its use in the mill, and it is the work of the expert saw filer to correct such inequalities thus arising during use.

The tensioning of a band saw ought to be more easily understood and reduced to a system than the tensioning of a circular, for the reason that band saws are, for the most part run of an even width, with the same relative tension, whatever the width, while the circular saw varies with different diameters, speeds and conditions of use. In a band saw, by a constant and proper use of the straight edge and tension gauge, the drop may be regulated to a nicety. An able filer, as a result of study and investigation should arrive at a condition for the fitting of his saws, to suit the particular band mill and the work in hand, that should continue practically uniform. A filer that is able to keep his saws in condition to accomplish uniform and satisfactory results, is entitled to and may expect good remuneration for his effort, while his employer may likewise expect a proper daily average output.

Tension in band saws signifies the expansion of the metal throughout the central portions of the blade so as to stretch the outside edges and particularly the back edge, so that the saw when strained on the wheels will be the tightest on the cutting edge, and stiff throughout its width. Centrifugal force does not enter into the problem of bands as it does in circulars, nor does the speed of the saw have much to do with the tension, although it has much to do with the work and life of the saw, as either too much or not enough speed will have a similar influence in inducing cracks.

If a band saw were placed on the wheels flat or without tension, it would, when strained up, be long on the edge; that is, the middle of the blade would be stiff and the edges loose, conditions not favorable for band sawing, for with the back edge short and the toothed edge long, the saw will dodge and run in and out, making wavy lumber. The strength of the blade will not make the saw run in a straight line. It must be tensioned to the work, and it should be understood that band resaws ranging from 17 to 24 gauge are much lighter and more delicate and require in every way finer manipulation than do the 14 or 15 gauge log band saws. The degree of the tension will vary acording to the face of the wheels, whether flat or crowning, and if the power is strong and the feed fast, the tension must be wide open and the saw will assume a snaky appearance as it rests on the supports to sharpener. By some log saws are not tensioned closer than up to an inch or an inch and a half of the points of the teeth, for the greater thickness and rigidity of the blade supports the teeth unless they are poorly fitted. But in the case of the band resaw the tight or shortest portion of the blade must extend right up to the teeth, and if it is an inch or so away, an obstruction in the form of a knot or otherwise would probably cause the teeth to swerve from a straight line and saw snaking. In short, for band resaws you must tension practically from edge to edge, must avoid the use of the hammer just as much as possible, except for removing lumps or twists, and must depend upon the stretcher whenever possible. The degree of the tension throughout the blade with respect to relative distance from the edges must be the same. If it is not, the saw will flutter in the guides, which is a fruitful source of cracks.

If there are portions of the blade that have been expanded too much, or if there are lumps or bunches in the surface of the saw, the result is an uneven strain and a vibration caused by the saw, in its revolution, striking against the guides. This constant succession of blows occurring from 300 to 400 times a minute will cause a crystallization of the saw at the spot, from which a crack will presently result.

People are sometimes astonished that this cracking should occur through the central portions of the blade, these being expanded or hammered the most, and consequently being most loose and subjected to the least strain, but the probable explanation is that the continued striking of the saw or portions of it against the guides causes a disintegration of the steel and the consequent fracture.

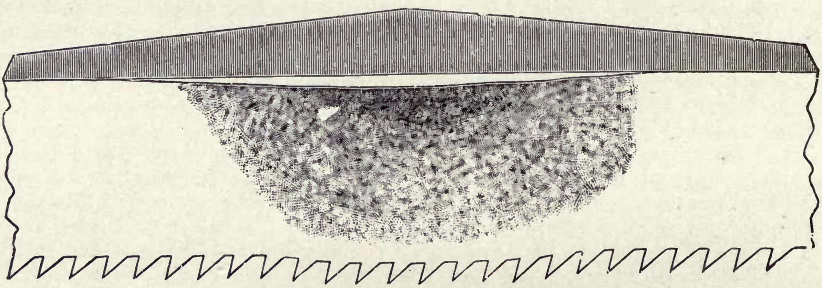
A general rule for the amount of tension is that all widths of band saws should be given all the tension the blade will stand and yet lie flat on the leveling block, but not enough to drop through and assume a wavy outline. The expert filer will only modify this rule to suit the wheels, the speed and feed and the timber being sawed. In this connection it may be proper to suggest that the sawmakers will do well to bring the character of their tensioning closely to the special requirements of each customer, and orders for saws should be given and taken with full regard to these requirements. Band saws rarely come from the shop with sufficient tension to do good work. It is exceptional for a skilled filer to receive a saw new from the maker which can be put on the mill and run successfully without first looking it over and revising or increasing the tension. The unpracticed filer or millman is apt to believe that a saw new from the shop must be perfectly tensioned, and, in fact, the order often specifies, "must be fitted to run." Such a saw thus received by such operators will be put on the mill, the mill run on the "throw her wide open plan," and the result is, the saw runs badly, ruins a lot of lumber, is subjected to unusual strain, cracks appear, sometimes dozens of them on the back edge, and the saw and the sawmaker are blamed for the unsatisfactory results. With respect to tension, it is evident that if the product of one sawmaker excels that of another, it must arise from the fact that he more nearly fits the saw to suit the requirements of the mill on which it is to run. While it is absurd to suppose that the sawmaker can adapt his saws to all the varying conditions found in the mills or that he can furnish "a good saw" on order, the saw agent and manufacturer should have the fullest possible understanding as to the work in hand.

After long experience the filer comes to know the condition of his saw or any part of it by the way it feels, somewhat similar to the shake test of a circular. He should use a tension gauge or "drop level" for testing the tension or drop of the saw from edge to edge and every part of the blade should conform to it. The tension gauge is usually the segment of a true circle, although some have the curve flattened a little for an inch to an inch and a half at each end.

One successful band saw filer who has charge of a two-band resaw filing room states that he has adopted the following rule for the crown of his tension gauges: A circle whose diameter is four times the number of inches in width, in feet, that is for a 12-inch saw would use a gauge crowned on the segment of a 48-foot circle; for an 8-inch saw, one crowned on the segment of a 32-foot circle, for a 10 to 11-inch saw, a gauge on the segment of a 44-foot circle. He also has a templet for the gauges, so that when one wears it can be trued up. He always rolls his saws first, finishing up with a doghead hammer, then levels down from the inside and finishes up on the outside with a long-faced hammer. He notices one objection to the saws as they come from the shop in that they show too much tension near the edges with a narrow strip in the center, instead of being tensioned on a true circle. When a saw is hammered like that the only way to keep it from cracking is to take out the surplus tension and put more in the center, for if you open up the center of the saw to a true circle you have too much tension.

To secure the proper action of the saw teeth, the toothed edge of the saw should be the shortest or firmest. The tendency of the saw while in operation, and as a result of the processes of sharpening and swaging, is toward a "fast" condition, that is, an expansion of the edges longer than the central portions. This tendency must be constantly counteracted by the processes of hammering or rolling for tension, whereby the central portions of the saw are expanded and made longer than the edges, and the back edge made longer than the toothed edge, in various degrees. The weight or strain used on the mill, is calculated to create a frictional contact between the saw blade, which is simply a belt of steel, and the band wheels, sufficient to overcome the resistance of the lumber to the action of the saw in the cut, and this forcing apart of the wheels by the strain on the mill exerts a strain on the saw which is greatest on the toothed edge, because the remainder of the saw has been given more tension or expansion. In the process of sawing there is added to the above longitudinal strain on the saw, a lateral strain, due to the feed of the timber to the saw, and this feed must be directly proportioned to the excess of strain in the toothed edge over the remainder of saw, or the saw will not cut to a line. The sawyer must so direct the feed that this lateral strain of the saw in the cut shall not exceed the longitudinal strain of the cutting edge, or in other words must vary the feed according to the size and clearness of the stock being sawed. It will also be apparent that the prevention of cracks, or the preservation of the life of the saw, must depend very largely upon the avoidance of all unnecessary strains upon the saw whether longitudinal or lateral.

A band saw running on a mechanically straight line is much more efficient than one running on an irresponsible wave line. When the saw is properly tensioned, if you apply a straight edge to the back of saw, longitudinally, the saw shows convex, and if



EXPANDING THE BACK EDGE

applied to side of saw it will show flat all along the blade. Place the saw upon the mill under the strain, and it becomes a straight belt of steel, with the toothed edge so tight that it is supposed to cut to a line. It doesn't always do so, however, as many a lumber pile testifies.

The exercise of care each day and the close examination of the saw as it comes off the mill, marks the successful filer. The special work each time may be little, but it is the "stitch in time." It means an ultimate saving of time and of saws. Look for the fast spots. Make sure the tooth side is not convex. So doing, the work of fitting is reduced to a minimum unless you strike iron or stone, or have a saw pulled off the wheels.

Band saws are bound to stretch on the toothed edge, and when so stretched are likely to crack. In testing the edges lay the saw flat on leveling bench, test the back with straight edge or back gauge, and if a hollow spot is found, use the round face hammer, or the rolls, along the section thus requiring expansions, being careful to not take out the tension, which you will do if you work along the edge without going into the body of the saw. If you use a hammer, use it so as to avoid any marks or indentations. Have the back of the saw touch the straight edge throughout, or better still, have the back full or convex. Thus the tooth edge being the shortest edge, when subjected to strain is drawn tight or straight and passes through the cut on a line, whereas, if longer than the back edge, it would tend to wave or kink, thus causing a constant vibration of the blade.

In applying the straight edge, mark only the highest spots, being careful to mark directly on these lumps. A straight edge, in testing tension, should not be rocked or leaned, but applied as nearly square as possible. A north or east light is best, and light should strike saw from but one direction.

The tension in a circular saw is like the tire on a wagon, it holds and steadies the inner portions. It is somewhat similar in the case of a band saw. The reason why the back edge may be slightly longer than the front is that the strain of the weights on mill, and the friction arising from the saw in cut, which is 50 per cent or more, greater on the front edge than on the back, causes heat which expands the blade to a certain degree, and more on front than back. If this difference in length of the two edges is made equal to the expansion of the saw in operation, then the saw will cut to a line and with no tendency to crack. But if you get the back too long, so that the expansion of the toothed edge cannot compensate for this, then the front will crack as it cannot stretch enough. If you could examine the saw in operation at full speed, you would find little or no tension apparent, because the heat draws the tension and makes an even strain on the full blade. Both filer and sawyer have to do with the preservation of tension. The sawyer should see that the guide is neither too tight nor too loose after each changing. The guide must be in perfect line with the carriage or feed roller. Sometimes a chip falls between the guide and the saw, and wedges in so tightly that it cannot be removed until the saw is brought to a standstill. Before this can be done, the saw will be in bad condition. The tension is out and it may be cracked or spoiled entirely.

THE SAW STRETCHER

The saw stretcher is a good business proposition for every operator of a sawmill or woodworking plant in which are employed log bands from 4 to 20 inches wide, band resaws from 2 to 10 inches wide or gangs from 3 to 8 inches wide, with saws ranging in gauge from 12 to 24. Throughout the United States and Canada, in the saw shops and the mill filing rooms, the saw stretcher is almost everywhere found in use, giving perfect satisfaction if a perfect machine. Abroad the stretcher is less well known, although it is bound to come rapidly into use, for each good machine marketed abroad prepares the way for further orders as its efficiency becomes demonstrated.

There is, perhaps, no machine that affords greater satisfaction and real help in time and labor saving both to skilled and unskilled operators, that will last so long and serve so well, and that is so little liable to cause trouble by reason of wear, lost motion or getting out of adjustment, for a stretcher once properly built, with abundant material strength, heavy roll shafts and properly hardened rolls, arranged to track and travel together, can hardly fail to work satisfactorily unless the rolls wear flat or are of different convexities or not properly aligned.

It is quite unnecessary to argue the merits of a saw stretcher to operators of log band or gang saws, because the machine is so generally employed; but to operators of band resaws and pony gangs we feel justified in specially recommending the stretcher and advising its purchase. A stretcher for saws ranging 17 to 24 gauge is far more essential than for log band saws, for the tensioning of thin saws is a very delicate process and perfect tensioning is essential to a small kerf and perfectly resawed material.

The stretcher properly used makes possible the use of the thinnest blades, and as many of the filers who take up band resaw fitting have not had extensive or, perhaps, any practice, the stretcher greatly facilitates their work and saves time. The stretcher, used in accordance with directions, will enable a filer to expand the back of saw, roll in the required tension and keep it in the best condition for work so far as the expansion is concerned, and thus prevent to the greatest extent the formations of lumps, bends, twists, etc., so that leveling or tensioning with hammers will require but little time. In general practice, the less hammer work the longer the life of the saws, and this is especially true if the filer is not expert at hammering.

It pays to have your saws evenly and perfectly tensioned, free from hammer marks, free from oscillation on the wheels, running in a straight line instead of hammering the guides, with consequent crystallization and cracking, thick and thin lumber, frequent changes and loss of time of the workmen.

WHAT A GOOD STRETCHER WILL DO

It renders the use of hammers almost unnecessary.
It prevents crystallization, cracking, brazing.
It makes no hammer marks.
It prolongs the life of saws.
It economizes saw bills.
It affects all parts of the saws uniformly according to pressure exerted.
It saves the filer both time and labor. Stretcher work to hammer work is in proportion of 1 to 3 or 4.
It restores quickly and uniformly the tension lost by the strain of too rapid feed.
It affords straight running saws that cut to a line.
It soon pays for itself by increased quantity and quality of output.
It makes possible the use of the thinnest blades, thus saving saw kerf and money.
It does not require a skilled filer to operate it.
It enables the unskilled filer to prolong the life of his saws.
It is a machine that is now considered by millmen, factory operators and filers to be indispensable to the perfect tensioning of bands, gangs, resaws and ripsaws.

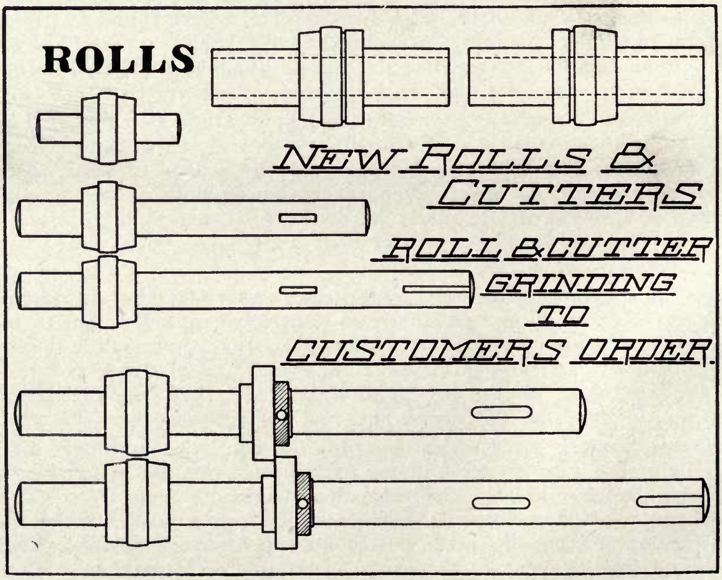
Our extensive sale of these machines throughout the United States, Canada and foreign countries, our numerous testimonials, and our knowledge of the requirements and high-grade construction, are all guarantees that we can please you.

If you question the merit of the machine, buy one and you will be convinced.

The cost is a mere trifle compared with the increased life and efficiency of your saws.

You can't afford to defer the purchase of a machine if not equipped.

REGRINDING OF STRETCHER ROLLS AND CUTTERS



All stretcher rolls tend to wear flat and out of true from continuous use.

If hardened unevenly the tendency to impairment is increased.

Dishing and an uneven expansion of the saw, tending to the formation of cracks, snaky lines and miscut stock, are certain results, besides a great increase in labor on the part of the saw filer.

The only remedy is a regrinding or a renewal of the rolls.

We are splendidly equipped to regrind rolls promptly and perfectly to uniform diameter and convexity, either on standard segments or specially sharp or flat as customer may instruct.

Box up or burlap your rolls and send them to us by parcel post, express or freight, with full instruction as to the circle grind desired and we will execute the work promptly. We grind rolls true to any required circle.

In most cases, rolls ought to be reground at least once yearly.

We have reground the rolls from practically every size and type of stretcher in use, also truing up the bearings when so instructed and the results to our customers have been eminently satisfactory.

You lose efficiency and money every day you continue the use of a poor type of stretcher or of impaired rolls.

Extra Sets of Rolls

Many plant operators keep constantly on hand an extra set of rolls for emergency use or while their other set is away for regrinding.

We can furnish extra sets of rolls and shafts for any of our own stretchers from stock for prompt shipment.

We can furnish rolls of solid tool steel, properly finished and ground, for any size or type of stretcher, regular or special as required, for early shipment after receipt of order.

Rotary Cutters, Toothing Dies, Shear Blades

We furnish rotary cutters to order or regrind old ones promptly.

We make toothing dies for stretcher or punch press use and furnish shear blades for shearing or crosscutting machines.

The investment cost for keeping good machines for these various processes, in perfect condition, is comparatively small. The cost of not so doing is comparatively large, and we invite mill and woodworking plant operators to avail themselves of our facilities with full confidence in being well and satisfactorily supplied.

QUALITY IN A SAW STRETCHER

Both the stretcher and doghead hammer serve a purpose in tensioning and neither the machine nor the tool needs justification, and it is no indication of the ability of any man to disparage either. This remark refers more especially to the saw stretcher, and arises from the fact that occasionally one meets a man who is prejudiced against the use of stretcher. Traced to its cause, such a prejudice will be found to arise either from ignorance of the merits of the machine or to the use or the attempt to use at some time a stretcher, which, by reason of faulty construction, was incapable of affording satisfactory service. But this is simply a fault of the machine or the operator, and not of the principle. The stretcher and the doghead hammer are each an instrument for the expansion of the blade, the former accomplishing its work by rolling, the latter by a succession of blows. And a proper expansion of the blades, both in location and degree, comprises all there is of tensioning. In simplicity the use of the stretcher expands such portions of the blade as feed through the rolls, in greater or less degree, according to the pressure exerted by the operator, which may vary at will. It expands with practical uniformity the steel subjected to pressure. It does not cut or mark the steel or prepare the way for crystallization, as does the hammer. It expands all portions subjected to pressure instead of the particular portions struck, as does the hammer. Hence, when finished, the saw consists of a uniform expansion instead of a patchwork of expanded and unexpanded spots. The pressure exerted by the rolls may be enormous if the machine is of powerful construction, which presupposes a heavy powerful frame work with heavy roll shafts and properly hardened rolls. Of course, the gauge of the saw has much to do with the requirement in this respect, for a 20-gauge resaw stretches or expands with vastly less pressure than a 14-gauge log band. You may also similarly expand the blade with a doghead hammer, striking one blow after another, but to accomplish the same result as the stretcher you must strike an endless number of blows of similar force, or varied similarly in degree as the pressure of rolls is varied. This is well nigh impossible even for the most expert, and it is for this reason that the stretcher work surpasses hammer work, for it expands the steel uniformly and the hammer does not. Hammer marks, which arise from a "pounding" rather than a "hammering" of the saws by men unfamiliar with or inexpert in the use of the hammer, are among the most common causes of cracking and brazing and impairment of the life of the saws.

But it may be said that if one does not understand the successful use of the hammer, he cannot successfully use the stretcher. It does not follow, for it may be observed every day in practice that filers almost wholly unfamiliar with band saw operation or fitting, take up the fitting of delicate band saws varying from 17 to 20 gauge, and get along quite successfully if equipped with a stretcher, while if not, they have almost constant trouble from the cracking and breaking of saws. It may also be said that if there are hard and soft places in a saw, they will not yield alike to the pressure of the rolls. True, but the straight edge or tension gauge discloses the character of the surface of the saw just as readily for the stretcher as for the hammer, and points the way for further expansion by one device or the other. There may be a place where one can use the hammer quite as effectively or perhaps more effectively than the stretcher, and if so, use it. It is simply a question of securing the finest tensioning by the handiest and quickest method. The saw stretcher is the next friend of thin saws, inexpert filers, band resaw operators in particular, and log band and gang saw operators in general. What you can do with the doghead hammer you can in general do better with the stretcher, and what you do not do with the stretcher should be done with a hammer of light weight. A "pounding" of saws almost certainly results from the use of hammers too heavy for the gauge of saws in use.

The requirements essential in a good saw stretching machine have been indicated and a machine defective in the requirements mentioned will not be serviceable. A poor stretcher may, if the roll shafts are not in line or the rolls do not track properly, roll in a twist. If the rolls are not properly ground or do not travel together, or work loose on the shafts, it may dish the saw. If the rolls are loose on the shafts or the shafts loose in the boxes, or if the frame work or roll shafts are too light, there will result lost motion, imperfect application of power, and consequent uneven tensioning. If the rolls are not perfectly tempered, their surface will soon be impaired, causing inferior or unsatisfactory results. If there is not easy powerful pressure, it subjects the filer to unnecessary labor. A good stretcher is a pleasure and a constant source of advantage. A poor stretcher is unusable and any attempt to use it is likely to increase rather than lessen one's labor. There are thousands of mills and shops in the United States possessing stretchers. But there are mills having inferior, inefficient machines, and some mills having no machines, and such mills are not getting the results, either in lumber manufacture or life of saws, that they would get should they add an efficient stretcher to their filing room outfit. Every maker of band saws in the United States uses one or more saw stretchers in his works and finds them indispensable; every maker of band or band resaw mills recommends the use of a stretcher to his customers and recognizes that the successful operation of his mill depends largely upon saws well tensioned, to which a stretcher is a prime essential; every progressive mill man, factory operator and saw filer using band saws has bought, will buy or wants a good stretcher.

KEEPING A SAW STRETCHER IN ORDER

Rolls properly ground, that track and travel together, are essential elements in a saw stretcher. Of course perfect rolls cannot make up for a poorly designed or constructed frame work or for lost motion, but if the rolls dish the saw, it is an indication that one or the other roll is imperfectly ground or soft or worn more or less, or that the rolls do not travel or track together, or that the roll shafts are not in perfect alignment. If the cause of the trouble lies in the face of the rolls, by reason of their uneven diameter, or wear or being ground on different segments, the remedy is to send them in for an accurate regrinding. Should the rolls not act easily on the saw, with the exercise of ordinary pressure, it is an indication that they are too flat for the temper of the saws in use, and the remedy is to have them reground on the segment of a smaller circle. Moreover, it pays to have the rolls reground from time to time and kept in the best condition, as the cost of the work is a mere trifle in comparison with the beneficial results that follow the use of perfect rolls.

Where the rolls are out of true, and to dispense with them would at times work a serious inconvenience, a temporary improvement in their shape may be effected by the use of a piece of emery cloth.

If the rolls dish the saw downwards—that is leave the hollow side up—place a strip of emery cloth between the rolls, with the emery side of the cloth up; start the machine, and gradually close the rolls until the emery acts on the upper roll, at the same time holding the emery cloth so that it will not feed through, thus surfacing the upper roll, making it more nearly flat. If the roll dishes the saw upward, reverse the cloth. By a little experimenting the tendency to dish the saw will be partially or wholly overcome, although it will be apparent that if the rolls are already too flat to act on saw with the pressure obtainable, the only thing to do is to have them both reground to a proper convex surface.

In passing from this subject of leveling and tensioning, we cannot do better than to quote the opinions or describe the practice of a number of different filers, indicative of presumably successful practice in each particular case, and also that there are "many men of many minds."

SOME TESTIMONY FROM PRACTICAL MEN

"I think a back gauge for a band or band resaw should be concaved 1/32-inch in 5½ feet."

"I prefer a convexity of 1/64-inch in 5 feet."

"Some filers run a crowning back, some a straight back; some prefer a crowning wheel, some a flat wheel; I prefer a straight wheel and a straight back. I run the tension like this: On the tooth edge a strip 1 inch wide and on the back edge ½ inch wide, left dark, with most light in center of saw."

"I am taking care of band resaws, two 6-inch and one 3-inch machines. Two of the machines have flat wheels, the other crowned wheels. We run 20-gauge saws and cut anything that comes along. I have cracks occasionally, but they all occur with the one machine. When the wheels of that machine are reground flat, I expect the cracking to cease."

"I do not think the tilting of the upper wheel removes the advantage arising from a crowned back."

"I use a concave-convex gauge endeavoring so to tension my saw that it fits one edge when on bench and the other edge on end of saw. I also look the tension over carefully on inside of saw, for it may show more tension toward one edge or the other than it showed on the other side of saw at corresponding spot."

"My experience is that a saw will do better with a wide tire on the back; instead of having a tire 1½ inches wide in front and ½ inch on back make it 2 or 2½ inches wide on back and 1¼ inches wide in front."

"For a hard saw on flat faced wheels I carry a very light tension within 2 inches from front edge and from ¾ to 1 inch from back edge. On a soft saw I carry the tension a little closer to front edge, say 1½ inch, with no difference on back edge. My idea for this is that the harder the saw the less liable it is to dish and the more liable it is to crack, compared to a soft saw, if the tension is carried on each precisely the same. I carry just a little deeper tension than the crown of my wheel, always making sure that it is deep enough on front edge to give that part of the saw which is traveling on front edge of wheel a solid bearing."

"I advise every filer to use a tension gauge as it is well nigh impossible for the eye unassisted by anything except a straight edge, to test and equalize the tension to the proper degree throughout the length of a saw."

"I tension band resaws up to ¾-inch of tooth edge and clear to the back edge."

"I straighten a badly twisted saw on floor by means of levers and blocks until it is sufficiently flat to lie on bench and stand hammering."

"Don't fall into the error of expecting too much of the tension and consider too little the style and shape of the teeth and their perfect fitting. Tension is very important but it is not the whole thing. If I find the face of a wheel is crowned I note the location of the highest crown and carry the most tension in the saw at that point, the only point is that the crown may not be true, and I roll my saw to fit the crown as it exists. I have found that too much tension is possible as well as too little. Too much tension also tends more to excessive cracking and breaking of saw than too little tension, especially when the sawyer is one who has not learned to feed carefully when entering the cut."

"When tensioning wide bands be sure to have tension in the center before you work out toward the edges, otherwise you will roll out toward edge and will not change the looks of the tension until you happen to work at the center, will then find yourself in trouble by having too much tension. For wide saws I like short tension gauges or straight edges about 4 inches long. Be sure that the third of saw toward tooth edge has as much tension as the third towards the back edge."

"I locate a line twist by stretching saw on sharpener wheels, letting it hang loosely without being strained up."

"Tension for band resaws 6 to 8 inches wide, 19 gauge and thinner, should not be closer than ¾-inch to tooth edge and ½-inch to back edge. A saw tensioned at these distances from the edge with the stretcher will show under tension level as though tensioned from edge to edge. Tensioning closer than this has a tendency to stiffen the saw especially after it has once been run."

"Saws 6 to 8 inches wide, 19 to 20 gauge, may be 1/32 crowning in 7 feet, or anything less than this amount even up to a straight edge. For crowning wheels more tension is required than for flat wheels. If tension is carried too near to edge there is danger of cracking on edge. The stretcher is designed only to expand a saw longitudinally. It is not designed to remove bends and twists and in fact if improperly used, or if the rolls are not in perfect alignment and similarly crowned, may intensify them. When taking new saws from case don't immediately put them on mill or start to roll them, but first examine carefully throughout and see if the leveling is perfect. It not infrequently happens that a saw is distorted by being coiled or bent into the narrow confines of the case and may need some preliminary work before rolling or running."

"Sawmakers in their smithing processes depend very largely on the hammer, and it occasionally happens that they send out saws with too much tension, and if you go on the assumption that a saw right from the works must be right and must stand more work than can result from your own experience and fitting, very likely you will develop some edge cracks or ruin it in the first few days."

"The band resaw, excellent and profitable machine that it is, is at a great disadvantage in comparison to a circular, unless the filing room is provided with the machine and tool outfit necessary to keep the saws in order. The half careless fitting that will sometimes pass on a circular resaw is a dead failure on a band. A case is known where a filer for a 6-inch band had no other tools than a set of files to keep up the sharpening and gumming. A change of filers was all that saved the machine from total condemnation and being thrown back on the maker's hands. The new filer knew what was necessary in the way of equipment, insisted upon its purchase, and the machine has been running with the best of results since the saw fitting outfit was introduced."

"Use straight edge and be sure that your tension gauges are ground true. It is more important that they shall be true segments than exactly a 36 or a 40 foot circle segment or some other size."

"On an 8-inch pony band mill, cutting pine, hemlock and frozen hardwood, I tension the 16-gauge saws to 32-foot circle, letting the central portion of saw drop until light shows under gauge and always keep an eye on loose or tight spots near the edges of my saw, and I carry 4 to 4½ inches of hook in an 8-inch saw, with not too high backs to teeth and plenty of throat room for dust for pine, but a trifle less for hardwood. These saws run with 3.500 pounds strain."

"Always be careful when you are putting in or expanding the back edge of saw that you do not let out the tension in some places while putting in more in other places."

"I employ an extra set of gauges, straight, concave and convex, that I use for no purpose except as templets whereby I can true up the gauges that I regularly use. I compare my regular gauges frequently with the templets, and if they show wear I true them up and always have them in perfect order. Too many filers are employing gauges which are unreliable and which lead them into continual errors in both their leveling and tensioning. A man can't work close with poor or inaccurate tools."

"There is no doubt that band saws can be tensioned too high, although it is also fair to say that different mills seem to require different degrees of tension. Some filers tension so high that their saws have to be weighted on bench when being level, but such saws will not do so good work as those that will lie flat without weights. Tension up to the verge of flapping but not beyond."

"The great majority of filers use a tension gauge the face of which is a true circle and tension their saws as nearly as practicable to fit the gauge from edge to edge. As a matter of fact when tensioning this way there will be a strip on either edge almost 1 inch wide that has little or no tension, that is to say tested with a short 2 or 2½-inch straight edge, there will be little light show."

"The great majority of filers crown the back of saw, and with better results than follows the use of a straight back, but in this matter of crown it is obvious that unless the crown is put in uniformly, the saw may be in possibly worse condition than if run with straight back, because of the varying strains at different parts of the blade. The only perfect test is by the use of a back gauge. If you want to run a straight back you want a straight back gauge; if a crowned back, a concave back gauge, concaved anywhere from 1/64 to 1/16-inch in say 5 or 6 feet of length. Most filing rooms are equipped with such gauges and all need them exceedingly."

"Run thin saws, with teeth sharp, good shape, and spend less time in exercise with the hammer and anvil."

"No filer's efforts can amount to much if they are not seconded by the sawyer, the latter can queer the best kind of saw fitting by being careless in the alignment of his machine, by overcrowding, improper adjustment of the guides, etc."

"Band saws that are evenly tensioned and well leveled will take an even strain on both edges, providing the wheels are in proper alignment. If the saw has a center strain, this too will have a strong bearing on the wheels, but it is well understood that the edges must be the shorter parts of the blade. It is obvious that the strain of the cutting edge, the tendency of the toothed edge to open or expand, as a result of sharpening with emery wheel, and the very fact that the edge is serrated and so more liable to expansion under strain than the not serrated back edge, all make expansion of the back edge seem preferable to its being run straight. It is true that some filers get fair or good results without crowning the back, but the majority do not. As to the degree or amount of the crown, this may range all the way from 1/64 to 4/64 in 5 feet. 1/32-inch for a 10-inch saw seems to afford good results."

"The less hammer work that is put upon a saw, aside from what is necessary to correct distortions of the blade, the better off the saw will be. The practice of rolling a saw affecting every part of the blade in a line parallel to that traveled by the saw when rolled originally in the rolling mill, and later when run on the saw mill, is common sense, successful practice and cannot be too much commended."

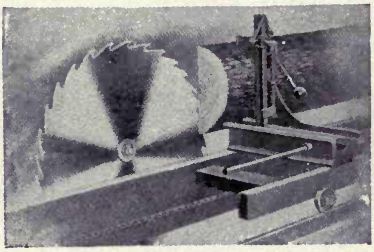
"The practice of hammering the saw whenever it comes off the mill, filling it with dents or hammer marks, and many of these blows placed with little effect in remedying the work of the saw, cannot be too much condemned"

Some mill owners are trying to teach a filer the art because he can be had cheap, and figure that a saving of from 50 cents to $2 or so per day is just like finding the money. It is a well demonstrated fact that no man ever made money out of cheap saw filing, for the extra saws and miscut lumber makes a large balance against the petty saving in wages.

The amount of tension a saw will stand is variable, for some saws may be given a high tension and run well with no more tendency to crack than another carrying little more than half as much tension. Thus there are filers using tension gauges ground on 50-foot segments, others on 32-foot segments and perhaps less, this on 10 or 12-inch bands, and in both extremes good results follow. It is perhaps an objection to high tension that when put in, the sawyer may feed the saw beyond the strength of the steel, so that a cracking or breaking up of the blade follows.

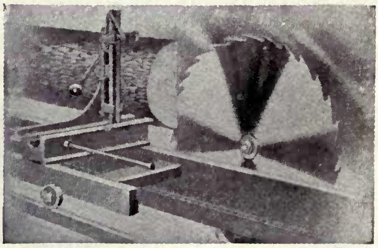
THE GAUGE OF SAWS IN FRACTIONS OF AN INCH AND MILLIMETERS

Gauge	Fraction Inch	Thousandths Inch	Millimeters	Gauge	Fraction Inch	Thousandths Inch	Millimeters
1	5/16 Scant	.300	7.62	16	1/16 Full	.065	1.65
2	9/32	.284	7.21	17	1/16 Scant	.058	1.47
3	1/4 Full	.259	6.57	18	3/64	.049	1.24
4	15/64	.238	6.04	19	....	.042	1.06
5	7/32	.220	5.59	20	....	.035	.89
6	13/64	.203	5.18	21	1/32	.032	.81
7	3/16 Scant	.180	4.57	22	....	.028	.71
8	5/32 Full	.165	4.19	23	....	.025	.64
9	5/32 Scant	.148	3.76	24	....	.022	.56
10	1/8 Full	.134	3.40	25	....	.020	.51
11	1/8 Scant	.120	3.05	26	....	.018	.46
12	7/64	.109	2.77	27	1/64	.016	.41
13	3/32	.095	2.41	28	....	.014	.36
14	5/64 Full	.083	2.10	29	....	.013	.33
15	5/64 Scant	.072	1.82	30	....	.012	.30



L. H. SAW

Hand of Circular Saws



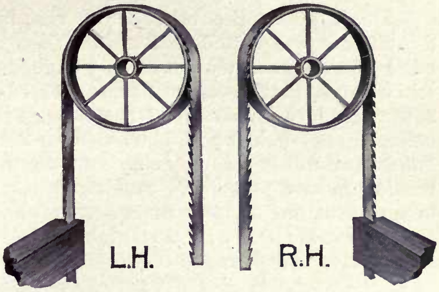
R. H. SAW

Order Band Sharpener in Hand to Suit Your Band Saws

It is regular practice for the band saw to surround the sharpener if saws in only one hand are to be sharpened. If both R. H. and L. H. band saws are in use and one sharpener only is required, you can order the sharpener equipped both R. H. and L. H., in which case one hand of saw will be supported about the sharpener and the other hand of saw will be supported out in front of sharpener, during the process of sharpening. With each of our Band Sharpeners, we state the hand of sharpener illustrated, and with the explanation that follows there is no reason for any customer to make a mistake in ordering from us.

The Hand of a Single-Cut Band Sharpener

As you face a log band mill, if the log feeds through on the L. H. side, it is a L. H. mill and requires a L. H. Band Sharpener; if it feeds through on the R. H. side it is a R. H. Mill and requires a R. H. Band Sharpener.



The Hand of a Double-Cut Band Sharpener

The double-cutting log band saw is in effect a R. and L. band saw combined and the Double-Cut Band Sharpener is equipped both R. and L. H. However, the sharpener itself can be furnished in whichever hand is preferred by the operator.

The Hand of a Band Resaw Sharpener

As you face a band resaw mill, if the lumber feeds through the rolls on the L. H. side it is a L. H. mill and the saw requires a L. H. Resaw Sharpener; if it feeds through the rolls on the R. H. side, it is a R. H. mill and the saw requires a R. H. Resaw Sharpener.

TENSION AND TIRE

One filer has very happily illustrated his idea of tension by comparing it to a stream of water, deepest in the center and growing gradually shallower until depth disappears at the banks. Conversely one might declare that tire is somewhat like the stream of water, the tire gradually changing into tension or increasing looseness, to a maximum at the center of the blade.

If there is a spot in a blade that is not more than 1½ inches long, that needs to be hammered or rolled, roll it, for the roll leaves no mark while the hammer does.

You can have too much or not enough or irregular tension. But whatever the degree may be, it is absolutely necessary that it be uniform throughout the saw.

Dishing of a band saw is sometimes caused from the fact that the saw does not lie flat on the bench, that is, it sags down from the face of the roll. Be sure to support the saw level with the face of roll on each side and if dishing continues, it must be due to one of three things, (1) that the rolls do not travel together, (2) that the rolls are not of uniform diameter and segment grind, or (3) that they do not travel in unison.

It has been found that a tension gauge of usual length to suit the width of a saw, when applied at a braze which has been rolled and hammered to fit the gauge, may not correctly reflect the actual condition of the tension at that part, and that if tested with a short tension gauge, say one 4 inches long, applied along he braze, it may show the test with the long gauge to have been incorrect. In other words the short gauge may show, when applied on both sides of the braze on front and back edge, that there are tight places under the teeth and also inside the back edge. It is therefore well to have a short gauge for close testing rather than to depend wholly upon a long gauge, as some filers do.

A tire if employed, should preferably not be a tight place under the edges, but rather a "flat" place, that is a neutral place where the steel is neither longer nor shorter throughout its entire width. From the inside edge of the tire the tension should gradually deepen toward the center and there be the deepest. Practically a tire is a section on edge of saw to take up strain off the extreme edge as a means to prevent the formation of cracks, and it is an interesting fact that some filers get excellent running saws with a very narrow tire, while others get the same result with a comparatively wide tire.

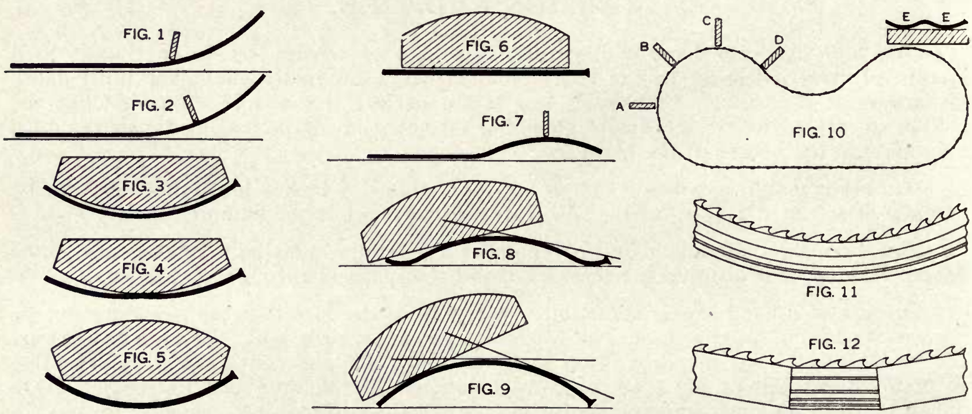
Don't make the mistake of running broader tires than necessary. A 15-gauge 8-inch saw was rolled to within 1 inch of each edge and showed tension from edge to edge when tested with tension gauge, but appeared flat for 1½ inches from each edge, when the saw was raised up and tested with a straight edge rocked across. The same saw with a ⅞-inch tire on the front edge and a ¾-inch tire on the back edge, would, other things being equal, have done better work. Too much tire is a weakness in a band saw, and is closely related to the most difficult part of band saw fitting. Too much tension in one place will pull down another place, making appear to be tension, what is not tension. Tight places that cannot be detected with the tension gauge, can usually be located with a straight edge, which should be applied on the rise, to the body of the saw and likewise to the edges.

A reduction of the width of the tire by rolling will bring to light many tight spots in the central parts and the rolling out of these is likely to produce too much tension, and also to let out the crown. Rolling to take out tension requires care to keep from stretching too much on the extreme edge.

SOME POINTS ON TENSION

By R. C. LEIBE

Tension plays an important part in the proper running of a band saw, therefore we should strive for perfection in this line. Ordinary tension, or "to fit the gauge," is generally relied upon, but to go farther into the matter the following drawings should



"Should prove valuable to those not far advanced in this important work."

prove valuable to those not far advanced in this important work. Many filers have tensioned their saws to fit the gauge perfectly and had them otherwise fitted well, yet they would snake, dodge, cut rough, etc. The causes are: False tension, unnoticed tight center line, improper crowning, leveling from outside of saw only, and other seemingly small points, which are in reality the "life" of the saw, and if overlooked will cause much trouble.

To explain the drawings, Fig. 1 represents a band saw on the hammering bench, with a section lifted up to get the "drop." The end view of a tension gauge above it is shown, held at an angle, only the edge coming in contact with the saw. This is improper and will lead one to think the tension is as deep as the gauge. Set the same gauge upright, as shown in Fig. 2, and it will ride in the center. The gauge should always be held square with edge of saw to get results.

Fig. 3 shows an end view of the same gauge, also the saw tensioned to fit it. The gauge rests lightly upon the saw and this would seem perfect tension, but on pressing down firmly on the gauge it will be seen to ride in the center, as shown at Fig. 4. That means a tight center and a snaky-running saw, because the tight center will be practically the same, once the saw is placed on the mill and strained up. The center will get too much strain and the edges too little, which gives the saw a chance to twist about in the act of snaking.

This tight place may appear in the middle or it may appear in the quarters, but the remedy is the same. To overcome it, roll or stretch the tight place and apply the gauge as before, giving it pressure to see if the tight place has disappeared. Then apply the supreme test, which will remove any doubt—see Fig. 5, which shows the gauge with straight edge side down and resting on the saw so as to get the full drop of tension. Hold the saw in position shown in Fig. 1, hold gauge as in Fig. 2, and add pressure on the straight edge until it comes down flat, as in Fig. 6. This will take quite a little pressure, but if there is the least tight place in the center or in either quarter, it will be seen at once. Once the straight edge comes down flat, you have the height of perfection in tension; this will result in deep tension also.

Fig. 7 shows edge view of a saw on hammering bench, lifted up from underneath and straight edge held on top of it to find false tension. Fig. 8 is the end view of same saw held as in Fig. 7. Nine times out of ten it will be found that a straight edge, held thus, will show this condition. The edges are tight some 2 inches from edge of saw. The straight edge is seen touching the extreme edge, also touching the quarter. This condition causes dodging. It is often overlooked in the tensioning and is best discovered by the method shown in Fig. 8. Sometimes it is found the edges are alright and the false tension is found in center; that is, the center shows flat under straight edge. This will not be found if the saw is first treated as in Figs. 4, 5 and 6. Fig. 9 shows the saw made right.

In Fig. 10 is seen a band saw on the floor, the middle sagging down from weight. This tightens the edges of saw at the ends, and if there is a tight line in the center, sideways, by holding the straight edge as shown at A, B and C, the result will be seen as at E E. Fig. 11 shows the proper way of crowning; the crowning throughout the entire blade is even and on a gradual curve.

Fig. 12 shows the old way of crowning. Such a method is injurious to the blade, as a part of saw is expanded on the back edge, while part is left slightly straight, or cut in slightly.

BAND SAW TENSIONING

H. F. GEORGE

First of all, see that your tools are of the best and in first-class condition, for it is impossible for a man to do good work with poor tools, and where you find a man using poor tools not in proper shape for the work he is doing, you will find his work of the same class.

During my twenty years' experience in the care of band saws ranging from 4 to 16 inches in width, I have tried many ways of tensioning with the result that I spent many days of doing and undoing my work, to say nothing of the many sleepless nights I have spent.

In the past ten years I have used the following system on 12-inch saws, 14-gauge, 2-inch space teeth, cutting all kinds of timber, summer and winter, including pine, hemlock, spruce, basswood and maple with the best of results.

I use for leveling a straight edge 6 inches long, a tension gauge 6 inches long ground to 45-foot circle, 2½ pound cross-face hammer and a 5-foot back gauge concaved to $\frac{1}{32}$.

I prefer short tension and straight edge, for with this length of straight edge you can level more evenly and without the danger of dishing your saw, and with short tension gauges you can place tension much more evenly and at the same time carry more and have saw lay perfectly flat.

I always carry all the tension the saw will take and lay flat on leveling slab. Some saws will of course carry more tension than others.

The system I use may be a little hard for a new beginner but after a little time he will be able to work faster and more accurately.

To begin, lay saw on hammering bench and level first on outside of the saw using a 6-inch straight edge crosswise and lengthwise to locate the lumps and ridges and then at different angles to locate the twists, if any, using the cross-face hammer for this leveling, I find it best to work each place lightly and go over it often, in this way producing much more even work.

After going over the outside of the saw in this way go over the inside in like manner.

Now, with saw ready for tension, I work three foot lengths at a time using a 6-inch, 45-foot tension gauge.

First, draw gauge over center of blade and pick out the uneven places being very careful not to overdo this operation. After doing this place the saw on leveling slab and level if necessary and then start your tension by drawing gauge along front half of the blade and then the back half and work these so they will show light under the gauge from one end to the other on both sides of center working each side as though you were working a 6-inch saw and not going any closer than 1 inch from either edge.

This operation will show when finished a little light under tension gauge on both sides of center and by drawing gauge along center of blade you will find it does not show any light but should not be tight. If it is, roll the saw lightly until it just fits the gauge.

Do not use any pressure on tension gauge with this method of tensioning but be sure to hold gauge straight up and down. Care must be taken not to work too much on either side of center at one time but work both sides and center at the same time, in other words work a little on all three and bring all three down at once, and in this way you will not get either half too open or center too tight.

This method will give almost a true circle if worked right and by using a 12-inch tension gauge of the same circle for final test you will find the tension to show a clear drop from one edge to the other, and with light pressure the saw will show a slight center line which in a wide saw will have a tendency to stiffen the saw when on the mill. Of course your wheels on band mill must be ground flat to obtain the best results from tension as described.

Next with back gauge even up the back. After your saws are in this condition you can tension and roll in your back at the same time and avoid going around the saw a second time.

If you have been careful in keeping your saw level during this operation you will find very little work in giving it the final leveling which is of course the most important operation, as the saw must be perfectly level so as not to lead either way. Level inside of saw first and outside last. This will allow saw to stand up better and in hard woods it will be less apt to dodge out of log.

If you want to go further with this system of tensioning you can get a more perfect saw by using a gauge 6 inches long concaved to 40-foot circle. Test your saw by shoving the blade up through and work the saw with roller until saw will come up through on both sides of center and drop down to convex gauge of 45-foot circle with a little light showing under gauge.

When I have time I use this test and find it very good especially in frozen timber.

There is much to be said with regard to tensioning saws and it is a little hard to make another understand one's own way of doing things, but I hope I have made my method clear. The fitting of saws for the manufacture of good lumber is just as important a factor as having good timber for making good lumber and you cannot make good lumber without both conditions are properly met.

As regards arrangement of band saw hammering bench, my preference is to locate the stretcher at left hand end, the anvil next and the leveling block next, with an open space of perhaps 10 feet to the left of stretcher, then a window with curtain at left hand side of room and another window with curtain behind the bench properly located to afford good lights on my work. With this arrangement I am able to level my saws almost entirely with the use of stretcher by raising or bearing down as the saw passes between the rolls.

Then by taking straight edge and going over saw lengthwise marking the saw where it is dished and by just putting enough pressure on rolls to draw saw through you can by raising up or bearing down as the case may be take your dish completely out, and saw will require very little work with a hammer and your saw will be free from hammer marks.

Second, take a saw that has been turned over on the edge which often happens by dodging out of the log, you can roll the saw perfectly flat without the use of hammer and if very careful to use just enough pressure to carry the saw through between the rolls you will not draw out any tension or affect the back of the saw. I do not care how much a saw is dished either in or out of the log, I can remove all of it with the use of the hammer only, as a means for removing such lumps as will occur from an accident of this kind.

Another very convenient attachment may be added to the hammering bench that will save lots of work and time especially in mills where large and heavy bands are used. I have seen a number of them in the West and some in the East where they are using 14-inch saws or even 12-inch blades.

First place a leveling block and anvil on floor directly under the leveling block and anvil on hammering bench. Have it perfectly level and in line with the bench. Have rollers or platform on each end to support the saw and keep level with anvil. Then cut hole in the floor directly in front, and same length as this floor bench, about 2 feet wide and with supports or hangers drop a platform just low enough to bring you in the proper position to level the saw. A good plan is to make this in the form of a box with door to cover the hole when not leveling saw. With this arrangement it is not necessary to have rolls or supports above as the floor bench will serve when leveling the inside of saw.

MISCELLANEOUS POINTERS

A band saw is more likely to crack on the tooth than on the back edge because it has double the strain at times, while in the cut, and it is continually subject to heating by grinding wheel or overheating as a result of excessive grinding.

A band saw may appear loose on either side of lap after a new braze has been made due to the fact that the lap having been left fast or tight tends to cause the steel on either side to corrugate or buckle, but this can be readily overcome by hammering the fast out of the joint until the spot is restored to normal condition.

The greater the number of teeth in a saw, the greater will be the consumption of power, because of the greater number of teeth in the cut at any given moment. The longer the spacing the greater will be the tendency to crack, because of the greater cutting strain on each tooth.

If the saw appears to run twisted it indicates that the guides are not properly lined with saw or that cross line is being used or that the band wheels are not in line with each other. If you wish a band saw to run back on the wheels, tip the top from the sawyer whereupon the saw will run to the low side if the wheels are square with each other.

If you wish to know whether a band saw is too open when the strain is on, tap the saw while running over face of wheel with hammer and if it sounds hollow it is a good indication that it is too open. Another indication is center cracks or cracking on edge, or when saw shows a tendency to run forward or backward on wheels without any apparent cause.

Tension in a soft saw works out more quickly and such a saw must be hammered more frequently for tension, and the carrying of a wider tire will help to hold the tension.

Wavy or washboard sawing may be caused by teeth that are too long or too slim, or both, or by the extreme edge of saw being too long; or may be caused by too small gullet outline for the feed.

Bull-heading, that is the making of a crook or twist in sawing as the saw enters a log, may usually be ascribed to the saw having some lead out of the log or to the mill being out of line with the track, or to the saw being led too much from the hammering, or to the feeding of the saw teeth, or by the sawyer hitting the cut too hard.

If the saw tends to run in or out during the last two to six inches of the cut, it may be caused by the offset, or by the sawyer feeding too hard, especially in butt cuts.

Rough lumber may be due to poor hammering or uneven set, or swage, or to corners broken off the teeth, or to the saw not being properly leveled on the rim, or in the case of a band saw to the braze not being properly dressed, leveled and tensioned, but the principal cause, other conditions being favorable, is poor side-filing or swage shaping.

If a band saw shows tendency to flop or rattle on the back, it may indicate that the back is too long in spots or too open, or irregularly fitted, or that the wheels are out of true, or that the wheel bearings are loose.

If a band saw shows tendency to crowd back on the band wheel, this may suggest insufficient hook for the amount of feed carried, or that the back of saw is hollowing, or that there is too much tension in the saw so that it will not fit the face of wheels properly, or that there is not enough tension, or not enough strain, or that the throat run for dust is too small, or that the saw is dull, or that the lower shaft is loose in the boxes.

The reason why a band saw that is properly convex or expanded on the back will do better work, is that with the top edge of the upper wheel tipped toward the sawyer, the saw will have to stretch before it can run back appreciably on the wheel.

In order to determine the proper strain on a band saw, first of all put the saw in good condition, properly fitted as regards the teeth and proper hammering.

See that the face of wheels are free and clean from saw dust, pitch, etc., carry a fair average feed and then put on strain to an amount such that the saw steadies down properly between the guides.

Saw dust and pitch tend to stick to wheels in ridges or lines all way around the wheel wherever the tension is greatest.

A loose spot in the center of a band saw tends to crack more quickly than a tight spot, because it has a chance to buckle when running over the wheel. A lump that always drops through on lifting the saw and that shows high when saw is lying on bench, is a loose spot, and must be taken out at once.

Having the band saw long or convex on the back throws more strain on the cutting edge so that the saw is less liable to crack on the back. Moreover, the saw will run with less hook and there will be a less tendency for it to crowd back on the wheel.

It sometimes happens that a band saw while being rolled will tend to shove through or dish. This may be due to the saw being too high or too low with reference to the face of the Stretcher Rolls, or to its being dished one way or the other before rolling, or to one roll being sharper than the other, or of larger diameter than the other, or to the rolls not being positioned properly face to face, or to the fact that the rolls do not travel in unison.

If a file is used for finishing the bevels on saw preparatory to brazing, it should be a 12-inch to 16-inch single cut bastard file or one ⅞-inch square.

Most filers draw file the surface of the lap before brazing, as this tends to produce the best surface for a perfect braze, but in such case one should not file the end of the saw to a feather edge; rather leave it somewhat blunt so that there will be sufficient stock to dress off when surfacing the braze.

A band saw left on the wheel should have the strain reduced to permit of a free contraction of the blade in cooling.

Pointing the teeth with a file after the automatic sharpener is undesirable if the machine is in good working condition.

Nothing is gained in sharpening by forcing the wheel to the saw. A light cut, whatever the wheel will cut away freely, should be the limit. If a saw has several cracks so that its efficiency is impaired, shear off the teeth or enough of the blade so that upon retoothing the cracks will disappear. If you check the cracks by punching with a cold chisel or a punch made for the purpose instead of a center punch.

After punching a crack, examine saw with tension gauge, as punching tends to make saw more open and this may need to be drawn out by rolling on each edge until the tension is again uniform.

A center crack should be hammered the same as the rest of the saw and punched at both ends, and on both sides of the saw carefully, and if this be properly done further trouble will in most cases be avoided. Such center cracks usually come from a very loose spot or a lump that hits the saw guide and soon becomes case hardened. Band saws stretch both from continuous use and from hammering. If the saw is too open, hammer or roll near the edges, and if not open enough hammer or roll along the central portion.

The cracking or breaking away of a saw at braze may be due either to the braze being too thick so that when the rolls pass over this part the pressure exerted is greater and greater expansion results. Moreover, a braze is usually softer unless carefully hardened, and it bends more easily than the other portions.

The tendency of a band saw to run in, may be due either to the saw being dished toward the log or being led by filing or grinding or sidedressing, or because of too much lead in the track of mill, or because of a long twist running toward the log. The same conditions existing oppositely will similarly cause a tendency for the saw to run out.

Band saws break perhaps more frequently at the braze than at any other part, and this may be due to the fact that it is softer and that the tension gets out more quickly, or to indentations made by the hammer if the steel is less hard or too thick, and thin spots due to uneven dressing with file or to tight and loose spots, or undue thickness, or to tension carried close to the edge.

Other things being equal a band saw will crowd back more quickly on flat face than on round wheels.

If the saw is too stiff on rim, it will tend to snake and dodge in hard spots.

If a saw in operation continually strikes the guides or slips on the wheels, this will cause crystallization.

A burned spot appears tight when it is actually loose. This is because the spot is held, so to speak, in a frame and the more the spot is burned, the harder it is to get through. A band saw concave on back will not hold its place on the wheels and crowds back more easily.

A rounding edge on the back of a band saw is preferable to a square edge, because it will travel over the hardened steel back rest of sharpener more readily, is less likely to get burred up and less difficult to handle with the hands. However, a square edge on back of saw when tested for expansion of back will show the actual condition more readily than if the edge is rounded.

The cause for a saw pulling off the wheels while sawing is usually due to too much hook or to looseness of the shaft in the lower boxes.

An accumulation of saw dust and dirt on hub and spokes of band wheels tends to increase vibration.

Breaking off of the corners of teeth may be caused by too much swage and excessive pressure on the sides of teeth in swage shaping so as to break the fiber of the steel, or to too short a swaging, or to insufficient strength or support for the corner, or to case hardening of teeth, or to defects in the saw steel itself.

A band saw may tend to run forward at one time and run backward at another. If the tension has been pulled out of the front half of saw and back half remains normal, this will cause heating and the saw will run back and forth. Another possible cause is dish on band wheels which often occurs in the sawing of wet logs in winter or in the cutting of any kind of pitchy timber.

If in cleaning off pitch and saw dust from face of wheel, you clean the back of wheel only, saw may tend to run forward, and if you clean front of wheel, the saw may tend to run backward.

Special attention should be paid continually to the condition of each braze in a band saw, because as a rule the temper differs from the other parts of the blade, the braze being usually softer although sometimes harder, and more liable to bend and consequently too open as result of operation.

A narrow band saw will tend to crowd back more easily than a wide one, because of the less bearing surface or less strain.

If a band saw shows a tendency to kick on the wheels, test carefully the back and make sure that it is properly expanded to fit the back gauge.

If you have occasion to open up a braze it can be done by applying hot brazing irons or by use of a slim cold chisel.

It used to be the rule to give a band saw ⅛-inch lead in about 16 feet, but most practical men now prefer no lead in mill or track, but if there be any variation either way, the lead should be properly into the log.

It is a good plan to wipe off a saw using a piece of cloth or waste saturated in kerosene oil before putting on the sharpener to remove any collection of gum, pitch or other substance that may adhere.

It is undesirable to use an upset on a band or gang saw.

Case hardened spots can be removed from a band saw braze by laying a hot iron across the lap. Remove the iron when the color passes blue.

Sometimes after brazing, the lap will show open at some spots, due variously to gas forming if borax is used, or to lumpy irons that do not afford a firm, even pressure on every part of the surface of the braze, or to grease or similar spots from impurities, or to improper preparation of the lap before brazing, or to use of inferior silver solder.

Hollow backs that result on band saw teeth in the grinding process are due to the fact that the swage is not put properly forward and that more grinding is done on face than back of saw.

The adjustment of a swage should be such that the point and face of tooth where swaged shall be if anything set forward slightly, in no case set back, because the latter will necessitate undue grinding on face with a tendency by so much to run the hook out of the saw.

If using a swage that will not tip forward far enough for proper swaging, better discard it and buy a more improved tool. A difficulty can, however, be remedied temporarily by striking the back of tooth at point a light tap with a hammer after swaging, using proper anvil support for front of tooth and being careful not to bend the tooth either way.

Among the different causes for cracking of band saws may be mentioned: imperfectly adjusted guides; uneven tension; back of saw too long or too short; undue cross alignment of wheel; insufficient throat run; crowding the saw against the back guards; too much tension; tension too close to edge; excessive speed; case hardening of gullets; adherence of gum or dust to face of wheels; crystallization from heavy hammering; hard contact with guides; marking face of saw with sharp faced hammers; undue vibration of saw caused either by condition of saw or wheel; sharp angles in the gullets; rarely, faulty manufacture.

Improper swaging and swage shaping may result from the saw teeth being slightly twisted or pulled over by the strain put upon the swage or shaper levers. Hence, such tools equipped with a short operating lever affording central operating control are obviously better calculated to leave the teeth perfectly straight.

A band saw braze not properly dressed, leveled and tensioned such that it is continually striking the guides will ultimately give way.

Undue heating of the band saw may be caused by slivers caught between the saw and guides, or by slivers and saw dust accumulating between the hood and wheels, thus causing a wheel to heat, or from a lack of sufficient set, or from crowding out, or too light guides, or slipping from the lower wheel.

Thin band saws require more careful, exacting treatment than saws of heavier gauge.

Hammer a braze slightly less open than the rest of the saw plate; thus if the saw is hammered to a 36-foot segment, hammer the braze to say 38-foot segment.

Saws run with teeth extremely dull will obviously not cut a proper clearance and the closing of the grain or fibre against the saw produces heat at base of tooth, and is likely to start small cracks.

The use of water on the wheels tends to keep them free from gum, dust and pitch, and will to a certain extent keep the saw cool.

A log band or band resaw should run true without any oscillation.

Hollow places in back of saw are caused by undue expansion of the tooth edge, due to heat from friction in a too rapid feed.

Shifting of saw may be caused by its being too loose, or too open on the back, or by wheels not properly positioned, or by saw dust and pitch on face of wheel, or by the lower shaft being loose in its bearing.

Snaking is due to insufficient tension or an unequalized tension, or to long spacing, or with teeth too long or too slim, or with too much tire on the tooth edge.

In principle a saw with fifty teeth properly swaged will cut faster, smoother and be more efficient in every way than a saw with one hundred teeth fitted with spring set.

Do not attempt to lead the saw with the guides. Guides should not be adjusted tightly against the saw when the latter is strained on the wheels. It is well to adjust the guides after saw has run for a time. Adjust the guides so that they will barely touch the saw, then adjust the slab side guides first, being careful not to bring them against the saw. Next adjust the log side guides similarly.

Any binding or undue frictional contact will be a sure cause for case hardening or crystallization of the steel. Frictionless metal for guides should be employed.

A long face twist will lead a band saw into the log on a right hand mill and transversely on a left hand mill. If a band saw resting on the floor shows a tendency to creep, it indicates that the saw is more open in one place than another.

A burr or rough edge on side of teeth, the result of hard grinding is a certain cause for undue wear upon the face of the band mill wheel. Also any accumulation of gum, pitch, dust, sand, etc., will similarly produce wear, and every effort must be put forth to do away with such a condition.

If a band mill wheel needs grinding oftener than once a year, it is almost certainly due to lack of care in the above details.

If a band saw or a band resaw shows a tendency to run back on the wheel when the mill stops and to run ahead when the mill starts up, it is generally caused by play in the lower boxes, the strain of the saw just about balancing the lower wheel so that when the power is shut off, the momentum of the saw being greater than that of the other machines, it does not need the strain of the belt to pull it, thus letting the lost motion of the pulley and of the shaft go to the top.

A steam pipe with a rubber hose attached is sometimes used to blow away dust, pitch and dirt from band wheel, edgers and similar machines.

It is sometimes observed that old band saws will stand up and do better work than brand new saws. This may be because the old saws long in use have been more carefully fitted to suit the condition of the band wheel, mill, etc., and the tension has been worked in with particular reference thereto.

Shifting of the band saw on the wheels indicates that the wheels are in some way defective, either coated with gum or foreign matter that is accumulated, or with saw dust, or that the wheel shaft is loose in its bearing, or that the saws are too open.

Lower band wheels wear faster than the upper owing to the great tendency of gum, dirt and saw dust to accumulate on face of wheel.

If a double cutting band saw crowds both ways while sawing, it indicates that the center is too open or that it does not have a sufficient amount of hook, and remedies should be applied accordingly.

Band saws are liable to break about an inch away from the braze at a point where the normal temper meets the temper of the brazed section. Endeavor should always be made to harden the braze so that it will correspond as nearly as possible to the normal temper of the saw. A band saw braze can be readily hardened by heating brazing irons to a good bright red, then with the saw raised up above the leveling block rub the irons on the surface of the saw until the braze is heated to a dull red, then drop saw on the cold leveling block applying a cold iron on top of the braze and fan until cool.

A band resaw operated with teeth too fine is apt to plaster the side of the board with saw dust and cause heating of saw. The coarser the dust the better will the teeth tend to discharge it from the cut, especially in coarse grained woods. Hence the majority of band resaw operators have teeth spaced 1½ inches to 1¾ inches from point to point, and for general sawing in a variety of woods, 1¾ inches gives very good results.

Saw dust will also plaster on side of board if the saw is being run with too much swage or set.

A saw showing tendency to crowd back because of dullness should be immediately taken off the mill for refitting.

Among the advantages for band resaw as a supplement to a log band mill may be mentioned the smaller kerf, lighter power required in operation, besides saving of steam for operation of the steam feed and carriage, fewer men, smaller floor space required for operation.

Keep the straining device properly oiled at all times.

Care should be used in starting a band mill, because the saw is in effect a steel belt and must overcome the inertia of the upper band wheel so that if suddenly started, cracking or undue strain is liable.

CLEANING GUM FROM BAND SAW TEETH

A good method if troubled with gum collecting on the sides of the saw teeth is to swab the sides of the saw with kerosene oil as it begins to slow down for a stop and then hold a square edged stick of hardwood carefully on the lower guide and against the sides of the teeth as they pass.

In general, the most work in leveling is done on the front quarter of the saw and as constant hammering tends to raise the metal in this part of the block, the block must be reversed or turned end for end or resurfaced at intervals, according to its developing conditions.

A level leveling block is imperative.

A saw should be leveled and tensioned so that it will lie flat on leveling block regardless of which side of saw is up.

After use of roll always test with a straight edge for dish in the plate. It is often necessary to turn the saw over and hammer down some spot that was not there before rolling.

Holding a saw too high as it feeds through the rolls will cause dishing. A too abrupt dropping away of the saw after passing through the rolls will cause dishing. Driving lumps or ridges through with a too sharp hammer face or with too heavy a hammer, will cause trouble.

A well leveled saw will run with less swage or set than is required for a saw that is lumpy. There should be a direct relation between set or swaging and the perfection of the leveling. Avoid too wide points. Do not have the face of the swaging extend down too far on face of tooth or they will have a wedge effect as soon as the tooth dulls and becomes narrow at point. Look out for uneven tires and uneven tension.

Spacing is an important factor in sawing results. Teeth spaced 1 inch, compared with 1½-inch or longer spacing, will do better work if run at a slower speed.

Too much hook in band saw teeth, especially if near the swaged point, will powder the saw dust, in kiln dried stock. A reduction of the hook will usually throw the dust straight down and overcome the trouble.

A crack that is as deep as 1 inch should be patched or brazed at once. Take no chances on a crack or a bad, uneven braze.

The grind on face of a doghead hammer should be such that a blow struck on the oiled surface of a saw will leave a mark about ½ inch diameter and the mark of a cross-face hammer should measure about ¾ x ⅜-inch.

Among causes for the breakage of corners on saw teeth may be mentioned: swage on one side, a too light corner, a too wide swaging with consequent excessive shaping which breaks the fibre of the steel, a corner too light for the timber or knots, and defective steel.

A band saw with a long back will vibrate in the cut.

Vibration in lower band wheel may be due to saw dust and dirt accumulated on face of wheel or to wear of the boxes, such that when the saw is strained, the wheel lifts and vibrates.

Every saw filer needs a speed indicator, with which to test the speed of pulleys, emery wheels, etc.

No lazy man will make a good saw filer. Some filers allow their saws to go on for a dozen runs before putting them on the bench. The best way is to go over the saw every time it comes off, testing with back gauge, straight edge and tension gauge. This is on the principle that a stitch in time saves nine.

When sharpening, the heaviest cut should be taken on the first round, grinding more lightly the second time and barely touching the saw the third time round.

For kiln dried yellow pine, use plenty of hook, teeth well backed up for strength and short, with a long straight throat.

When looking for trouble in band saw operation, don't forget to look very carefully to the question whether the teeth and gullets are of the best shape for the sawing conditions. A saw soon dulls in hard kiln dried stock and if insufficient hook is not carried, the strain on the cutting edge will soon pull out the tension. It is very important to keep the dust guard close to the saw to prevent accumulation of dust between face of wheel and saw, as this will tend to cause the saw to work forward on the wheels.

Among the causes for crowding back of saw on the wheels may be mentioned: lack of hook or backs too high, running the saw when very dull, especially in heavy timber, body of saw fitted improperly, with a great many lumps on the wheel side, or body of saw dished to the wheels, improperly ground wheels, or wheels out of alignment with each other; a gummed up or slow working straining device, or one that is otherwise faulty.

Case hardening of the saw on back edge is more apt to start edge cracks than is case hardening at bottom of gullets to start cracks on the front edge. Another reason for cracking on front edge is due to the action of the sawyer allowing the log to strike the saw too hard at start of cut. So also crowding the saw too hard may cause this trouble.

Saws that lead badly or are being constantly crowded against the guide at some point on the width, may easily develop cracks in bunches, and the trouble will be aggravated if the guides are made of metal that is too hard. Saws that oscillate badly on the wheels—that is with crooked backs—will sometimes have a number of fractures close together. Generally these will occur at the point where the crown is the greatest or least or none at all. A crooked back should not be tolerated. Under such conditions, the saw is being constantly subjected to an overstrain at one part and to a constant buckling at another.

Use a tension gauge 3 or 4 inches long, of the regular curvature, to test front part of saw. Leave no stiff spots at rim or in the center of the saw either. Test both sides. This will necessitate some rolling on the back, which is very important in making a saw stay on straight wheels, but don't roll nearer than 1¼ inch from front edge unless you have to reduce crown or an exceptionally stiff tire. Give the back $\frac{1}{32}$-inch in 5 feet. Level saws carefully on the inside to make them fit the wheels well. Give the teeth enough hook to make the saw jump ahead on the wheels about ⅛-inch as it enters the end of the log. Increase gradually until you get the required amount.

It is no more desirable for a band saw to pull forward on the wheels when sharp than it is for a saw to crowd backward when dull. If an extreme hook is carried, it may happen that in order to make the teeth strong enough to stand up without chattering in the cut, that the backs will be made too high so that when the first edge after sharpening has dulled, the backs of the points will rub the timber, and thus stand only a short run before resharpening.

Saw dust cut from frozen timber chambers better at a speed slower than is employed for most band saws. A speed of 8,000 is ample and for hardwood 500 less is better. At such a speed a greater proportion of the dust will be removed from the cut, while the sawyer will be able to carry a heavier feed per revolution of the saw, which means coarser saw dust, that will carry away more freely. There are mills with a speed for winter sawing not above 7,000 feet, that maintain a good record for quantity and quality even in mixed timber and subject to the most severe winter weather conditions, while the output of the mill remains at normal. A short faced swaging is preferable for winter sawing.

GULLET OUTLINES FOR BAND SAW TEETH

All band sharpeners are capable of adjustment to an extreme variety of shapes of teeth, which vary in spacing from point to point, in depth of gullet, hook and pitch and in shape of back and base of tooth. Each of these shapes is capable of variation in all these respects so that it is easily possible for any operator of one of our sharpeners to adapt the machine to sharpen the outline that seems best adapted to his particular use.

It is important in shaping teeth to have plenty of hook so that the teeth will cut, a round gullet and plenty of strength, and the faster the feed, the more throat room will be required to chamber the dust. In some cases the teeth have a greater cutting capacity than the tension will stand, so that the filer commences to change the shape of the teeth experimentally and gets them into such shape that the sharpener would have to be a contortionist to follow the outline.

There have been filers before now who appeared to be mildly insane on this matter of shape and in their reaching out for the impossible.

There is perhaps no conceivable shape of tooth that has not been already tried out by one or another and many of these outlines have been abandoned as impracticable, but there is a happy medium in saw teeth that may be quite safely observed by every one, and so having selected a style of tooth that is commonly employed by those sawing similar woods under similar working conditions, one that can be easily produced and maintained with the automatic sharpener, it is better to let well enough alone than to struggle for the difficult or the unattainable.

Saw filers familiar with the use of an automatic sharpener rarely have trouble in adjusting the machine to produce their ideal teeth; but in the case of a man not already familiar with sharpener operation it is highly important that a templet of the teeth in use be furnished in connection with the order to permit adjustment specially before shipment. Indeed it is difficult to adjust any sharpener before shipment to produce exactly any particular gullet outline and slight changes in the shape or thickness of the wheel, or in the shape and position of the forms that affect the general outline of tooth, or in other less important respects, are usually necessary after the sharpener has been put to work. It is practice to adjust and test each of our sharpeners and adapt the machine in every way possible to the individual customer's requirement if properly made known to us.

In a mill, the same general outline is commonly maintained subject to the slight variations incident to swaging, sharpening or the stripping of teeth by iron or gravel. Hence in a mill the adjustment of a band sharpener is essentially simple.

On the other hand, the conditions in a saw factory are much more complex because of the numerous shapes of dies employed in toothing new saws in line with varying requirements, and so the test of a sharpener in a saw factory is a severe one because the machine must sharpen the varying shapes of teeth as they come along and the matter of ready or convenient adjustment is an important consideration.

A tooth suitable for spring set is not suitable for swaging and vice versa, and whatever trouble occurs when first adopting the swage, shaper and sharpener, is largely traceable to this fact. This remark mainly applies to foreign operators who are still using spring set and hand methods in fitting, and we especially invite correspondence from all such.

AUTOMATIC SAW SHARPENING MACHINES

The efficiency of our automatic saw sharpening machines is perhaps best demonstrated by the enormous number of them in use in all parts of the world, giving the greatest possible satisfaction. The sharpening done in this way is incomparably superior to work done by hand sharpening for the reason that a saw sharpened by hand or with a crude machine can never show anything like the accuracy obtained from the automatic, which no amount of skill can replace. By the use of an automatic, circular saws are kept always in perfect round and log bands, band resaws, frame or gang saws are kept of uniform width. The form of the teeth can be maintained alike throughout the entire use of the saw, and any desired shape of tooth can be attained as may be best suited to the character of the wood itself and the sawing equipment.

Saws sharpened automatically can be turned out in finished form more quickly, more cheaply and in better condition for cutting, than when sharpened by the most skillful saw filer working by hand. The adjustment of an automatic sharpener can be easily and quickly made and the manner of adjustment can be readily understood by any fairly competent man. All the automatic movements are accomplished by hardened cams and idlers which act on each other without undue thrust or vibration.

The movements that distinguish an automatic sharpener from a hand sharpener are the upward and downward movement of the emery wheel and the feeding around of the saw, tooth after tooth. These movements must be carefully timed with respect to each other and the adjustments, taken in connection with the outline of the cams that govern the shape of the tooth, make it possible to produce any desirable gullet outline, both as regards hook, pitch of the back, and general shape of the back of tooth, and base of gullet.

The results that follow the use of automatic sharpeners are as follows: A clean cut, economy of power, smooth and rapid sawing, a minimum saw kerf. A considerable saving in wages and files results from the substitution of the cheaper, quicker and more accurate grinding emery wheel. Circular saws continue perfectly round in form, and a slight brush with an emery wheel on an automatic machine serves to sharpen all of the teeth when dulled. In a factory or mill where no expert saw filer is employed whose work is limited to the care of the saws, the automatic machine will enable the foreman or engineer or millwright or whoever may have to keep up the saws, to do a first-class job of sharpening with a distinct saving in time over hand work, so that the labor cost of the work will be the lowest possible.

It should be understood that one of the very important factors that govern the successful work on an automatic sharpener or a planer knife grinder, is the character of the sharpening or grinding wheel, and we will undertake to furnish our customers with repeat orders for wheels that in makeup and cutting qualities can be recommended as almost universally satisfactory.

THE SHAPES AND SHARPENING OF BAND SAW TEETH

There are many different shapes of band saw teeth, for just as there are no two faces that are exactly alike, there are no two saw filers who adopt and maintain the same unvarying shapes of teeth on their saws. Hence we cannot emphasize too strongly the importance of always sending with an order for any machine required to work on saw teeth, an exact templet, drawing or rubbing on paper, showing the outline of tooth in use or the outline it is desired the machine shall produce. We can then furnish the machine or tool to meet the requirement approximately, or if this is impossible, can avoid shipment. We are fully as desirous to avoid the shipment of a machine unsuited to a customer's conditions or requirements as he can be to avoid the purchase of such a machine.

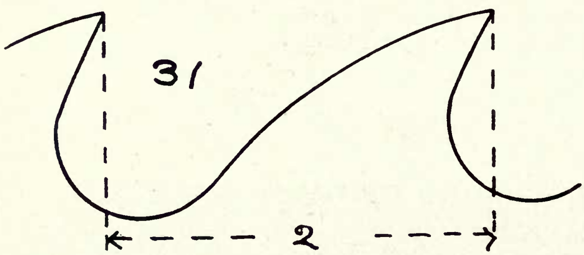
Our sharpeners, swages and shapers are capable of adjustment to an extreme variety of shapes and can undoubtedly be adjusted to all ordinary requirements, but there are extremes in shapes of teeth to which they cannot be adapted, and there are also men who by reason of unfamiliarity with such machines or lack of mechanical skill, may have difficulty or even fail of success in their use, and it is to avoid all such contingencies that we endeavor to meet each requirement specially and thus better serve our customers.

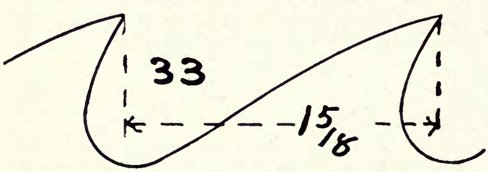
Again we sometimes receive an order as follows: "Ship me at once a Band Retoother and Shear"—unaccompanied by any templet or description of gullet. It is impossible to fill such an order intelligently, but if a templet accompanies the order we will shape the dies to suit and the saws when made up or retoothed will have the outline carried regularly by the customer, and but little sharpening makes them ready for use.

There is no "standard" shape for band saw teeth. There are hundreds of possible variations in spacing or hook or depth of gullet or pitch of the back, all of which affect the outline, but there are outlines which are practical and satisfactory, and which are approximated by most operators.

Some filers adopt a tooth medium in all respects and use it successfully on all varieties of stock that offers for resawing or log sawing. The utility of abnormal shapes is doubtful. A gullet that can be produced and maintained by the natural wear of the wheel without undue dressing will serve as well as one that cannot be maintained except by constant dressing of wheel. The gullet depends on the thickness of emery wheel, which may be 3/8, 1/2, 3/4, 7/8 or 1 inch, as required, on whether the edge of wheel is rounded or beveled and upon the action of the forms that control the travel of the wheel. The wheel may be straight or concave face, the latter being preferred by filers whose sharpeners are not adapted to afford much hook. The wheels for sharpening band saws are made usually of 46 emery or of a mixture grading up toward 60, rarely anything coarser than 46. The grade of hardness is of utmost importance and should depend directly on the speed at which the wheel is run. A sharpener swinging a 12 or 14-inch wheel should have three speeds for emery wheel to better adapt the speed of wheel to its hardness or to increase the speed as the wheel wears smaller. Many soft wheels are worn out in a day or condemned on trial that would serve satisfactorily if run faster. Proper attention to this matter of speeds for emery wheels by millmen and filers will save much unnecessary expense for wheels and improve unsatisfactory sharpening.

There is a happy medium in saw teeth that will serve most purposes, that can be readily made, and that can be varied as deemed necessary to suit particular requirements in spacing, hook or depth. This outline is fairly illustrated by templets 31 and 33, the former being used successfully on 14½ inch x 60 foot band saws run in British Columbia fir and spruce; the latter on 12 inch x 45 foot bands and in different mills used variously on white and Norway pine, hemlock, cottonwood, elm, ash, sycamore, honey locust, white maple, walnut, basswood, wild cherry, frozen red spruce, yellow pine, balsam fir, sap pine and mountain white pine. Of this tooth the user, C. R. Wisdom, Quincy, Ill., says: "It is, with the proper clearance for the kind of wood being sawed, a free and easy cutter and is stiff enough to cut anything, but if I were filing in the real cork pine, free from boom plugs, gravel, spikes, etc., I should run the saw about 11,000 feet per minute and carry a 2 inch spacing 1 inch deep and about the same shape. The principal thing in shaping saw teeth is to have plenty of hook so that the teeth will cut, a round gullet and plenty of strength, and the faster the feed, the more saw dust or throat room for tooth. In most cases the teeth have a larger capacity than the tension, and then the filer commences changing the teeth the first thing and gets them into such shape that the grinder has to be a contortionist to follow the lines.





HOOK IN BAND SAWS

The more hook the greater the cutting ability of the band saw and the less motive power is required. Too much hook could not be given a saw if the question of cutting is alone considered. What makes the excessive hook detrimental or hazardous to the safety of the machine is the tendency for teeth with extreme hook to feed too rapidly. More hook can be given to the circular than to the band as the circular being round has a tendency to throw or push the stock from it somewhat irrespective of the hook. But the band saw, acting at right angles, has more of a tendency to draw the wood toward it. In the case of a band saw with no hook the action of the teeth would be not so much one of cutting as of scraping or splitting. Hardwoods require less hook than soft woods, and of the soft woods those that are stringy or fibrous require the most hook. Some of the most successful saw filers make no distinction in hook in cutting hard or soft woods, but run the same tooth with apparently equal success. In general practice, however, the hook used on saws for hardwood is from one-fourth to one-third and in some cases one-half. As regards the efficiency of the saw in different woods, a good deal depends upon having the saw fitted with proper swage and sidedress, kept properly sharp, properly slim and throated, and the feed not too fast. Very thin band saws are run successfully in resawing the hardest woods such as kiln-dried oak, etc., but the teeth must be finely fitted and the stock properly fed. The action of saw teeth is identical with that of a chisel, and just as a woodworker learns to present his chisel at the right angle to the wood, to cut the best, so must the saw fitter learn at what angle his saw teeth are best calculated to cut as regards hook. There should be no such thing as scraping or tearing, through imperfect hook or dullness. A dull saw takes much more power than a sharp one, because its operation is not clean cutting.

There is a general tendency on the part of band saw filers to run maximum hook in their saws. This may be done without impairing the strength of the tooth to the extent that it will chatter or vibrate in the cut, by allowing the hook to run down the face of the tooth about a quarter of an inch and then drop away from the hook line on a gradual curve, forming a nice round throat, which enables a saw to cut easy on big feed. The back of tooth must be made sufficiently full or rounding to give plenty of strength to point of tooth and you must avoid long teeth on short spacings. For a tooth with extreme hook, and for a large round gullet, a spacing of 1¾ or 2 inches or more is good. This long space enables you to build up the back of tooth properly, because with the greater space between the points, the backs can be kept higher without diminishing the throat room and thus more hook is secured without weakening the teeth. The amount of hook in wide band saws varies greatly as commonly run, and is governed somewhat by the timber being sawed and the feed carried. But there are those that want extreme hook and their efforts in this direction have been thwarted in a measure because the construction of sharpeners has rendered it impossible to further tilt the head for extra hook, and still have the machine continue to operate successfully. In deference to this circumstance we have designed our present machines to give extreme hook. Moreover the construction of the machines renders their operation equally successful when head is thus set, as when set at a less extreme tilt. Given a saw properly tensioned and running true on the wheels when out of the cut, or running idle, but tending to run back on the wheels, as soon as it enters the log, it indicates a need of more hook and you can increase the hook up to the point where the saw runs uniform. In like manner if saw runs ahead on the wheels when in the cut it is an indication of too much hook, and you may properly consider the reduction of same.

STYLE OF THE THROAT

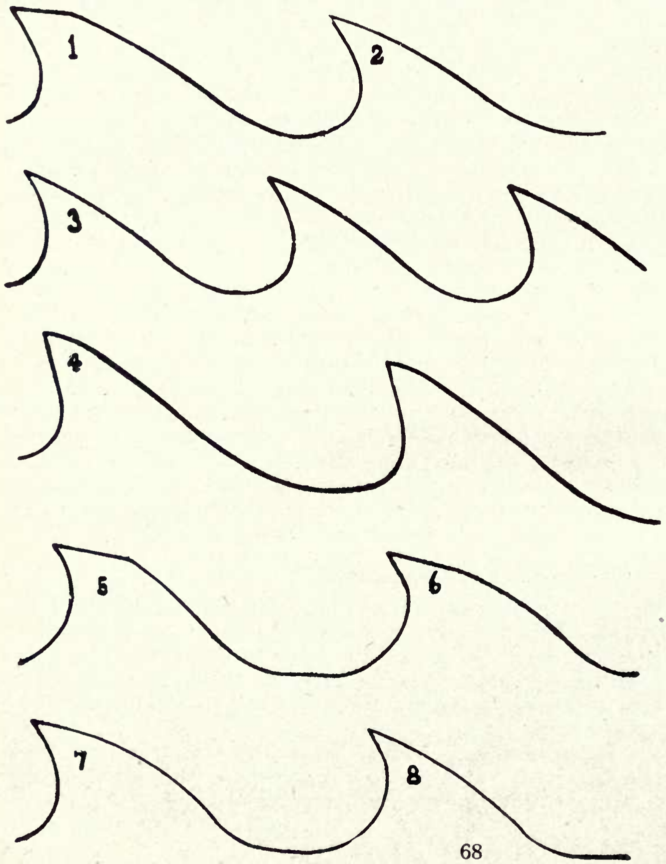
The styles of the throats run are almost as various as the mills, for there are few mills that run precisely the same. The thickness of the emery wheel, the shape of its face, its wearing qualities, the spacing of the teeth, etc., all affect to some extent the shape of the throat. The form of the cam that gives shape to the back of the tooth controls the general outline of the tooth, and the filer must look to this mainly if he wishes to change the shape of the back.

It has been customary on sharpeners to use either a hardwood or cast iron form for shaping the throat. In such case, if you wish to change the outline of the form, you must either reshape the surface of form or put on a new form.

The teeth should have throat room enough to receive and discharge all the dust with ease; if not, the saw will throw dust up with its return motion, and will be likely to snake and crack. In any wood, saws from 7 to 12 inches wide, and from 14 to 17 gauge, should have the spacing 1½ or 1¾ inch, and the tooth ⅝ of an inch deep with a ⅝ or ¾ inch circle on face of gullet, so that the dust will curve around easily and discharge as soon as it gets below the cut. The hook should be governed by the pitch of the back of tooth. I apply the word hook to the face of tooth, and the word pitch to the back of tooth. Now the more you raise the back of tooth so as to make it point straight down the wood, the greater pitch you have and the easier the saw will cut and the more hook you can carry. But if the back of tooth is low, you cannot carry much hook, for if you do the teeth will be too slim and will vibrate, causing the saw to snake in the cut. In such a case, in order to make the saw cut straight, don't diminish the hook, but raise the back, thus making the tooth stiffer, and it will not only stop the teeth from vibrating, but will also make the saw cut much easier and faster. If the back of tooth is low, do not use over four inches hook in a 10-inch saw; but if the back is up so that it is nearly pointing down the cut, then use 6 or 7 inches hook in fast feed, but use large throat.

Don't use over 8-gauge swaging in a 14-gauge saw in soft woods and not over 9-gauge swaging in hardwood or frozen timber and not over 9-gauge swaging in a 16-gauge saw in soft wood and not over 11 to 10-gauge in hardwoods.

The spacing must not in any case be too short so that the teeth will not properly pocket or carry out the dust. Moreover, it is extremely important to avoid short or long teeth in your saw, as manifestly a saw with teeth of a length, each doing its share of cutting, will do the best work, and in such case a saw perfectly fitted may have a longer spacing than if but part of the teeth cut. Keep your saws jointed.



[The cut illustrates the shapes of teeth I find to give the best results. (1) is the easiest and fastest cutting tooth I have ever used on a band saw. It has 8¾ inches hook at cutting point on a 10-inch saw. With straight edge resting on points of teeth the line of back strikes $\frac{3}{16}$ of an inch below the point of the next tooth. I use (2) daily in soft woods; (3) in hemlock and oak. (4) is a good tooth for hardwoods or knotty logs as it is thick on the point. (5) with longer spacing is a good tooth for white oak or other hardwoods. (6) is a good tooth for almost any kind of wood and is easily made. (7) has a different curve in gullet and is a good tooth for hemlock. (8) is slimmer and is a good tooth for soft pine.]

It is impossible to suggest that any particular style of tooth is best adapted to any particular wood, for the reason that all shapes of teeth are apparently used with success in different woods. Expert users of Band Resaws find that for boxboard work not over 12 inches wide, a spacing of 1⅝ is satisfactory. In work demanding a minimum saw kerf and a moderate speed for saw, as in sawing picture backing, etc., a 2-inch spacing is found good. The same is true of resawing panel stock and hardwoods. Kiln-dried hardwood, such as oak, hard maple, etc., tends to dull the saw very rapidly unless the feed is well regulated, and it is well to have the saw stand a fair feed instead of simply allowing it to rub the dust away. Careful feeding of the saw in kiln-dried hardwoods will enable the saw to do good work in cutting considerable stock, where feeding without exercise of careful judgment may dull the saw in a few minutes.

One of the most extensive users of Band Resaws in the United States, resawing pine, has found 1½-inch spacing, ½ hook and tooth ⅜ long, the best specifications for 6-inch saws, and this spacing preferable to 1¾.

BAND SAW SHARPENING

Finely sharpened teeth are essential to the best results in band sawing, and the comparative merits of emery wheels and files, together with the practical details pertaining to the operation of sharpening machines, are good subjects for consideration. An automatic sharpener is an indispensable machine for band work, but very much depends upon the construction and adjustments of the machine itself, as to the quality of the work it performs. The rapid introduction of band and resaw mills has called for the careful exercise of inventive genius, in the perfection of band sharpeners, as well as for the exercise of the best mechanical skill and the use of the best material in their manufacture.

In band saw sharpeners the requirement is for a machine abundantly heavy, strong and rigid for saws within its capacity, and for a machine with its essential working parts not only very adjustable, but very exact working as adjusted. You cannot get a machine too heavy or too well built; you can very easily get a machine too light and too poorly built that will show lost motion, almost from the start, uneven feed of saw, which means uneven grinding and the continued use of which is bound to work a loss to the operator. Any millman having a poor sharpener in use can well afford to set it aside if it is within his power to secure a better one. We offer our sharpeners as representative of the best construction, adjustments, weight, strength, rigidity, and fine machine tool finish, and as perfectly efficient and satisfactory working when properly handled and of proper size for the saws to be sharpened. It is better to order a sharpener a size larger than you require than one a size smaller, such that you must continually tax its capacity. All wearing surfaces are hand scraped to a bearing, with takeups for wear. Every feature of improvement found desirable from our own operation of the machines or that of the practical filers, is added.

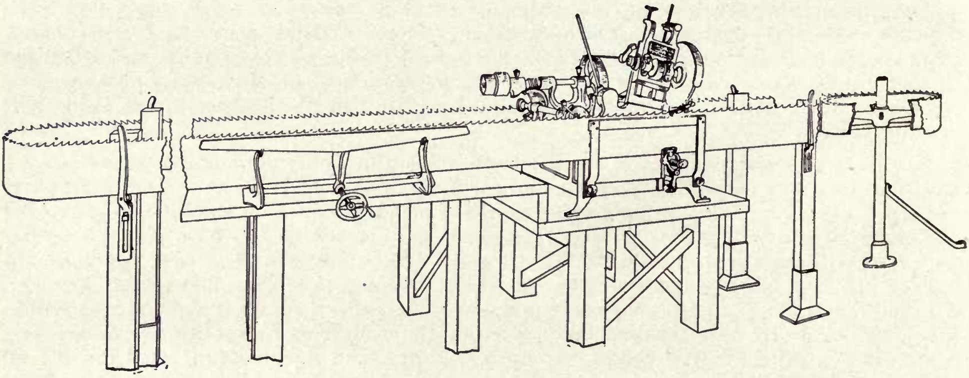
Our sharpeners are built with a slide head carrying an emery wheel operated by tooth form. As the saw is pushed forward by the feed finger, the tooth form raises the head to conform with back of tooth, and as the feed finger recedes, the head drops gently into the throat, allowing the emery wheel to reach the bottom of the throat as the saw is again pushed forward. There is little possibility of grinding a depression or of case hardening the saw at base of tooth. The sharpeners operate with a slow motion over the back of tooth and a relatively quick motion into the throat, whereby the greatest amount of work can be accomplished in one circuit of the saw.

A sharpener should be bolted firmly to the floor or to a substantial bench support if it is of size for band resaws, that the machine may be free from vibration.

BAND RESAW SHARPENERS

Our Band Resaw Sharpeners have for many years enjoyed an exceptional demand from operators of Band Rip and Band Resaws. These Sharpeners were at an early date adopted by Band Resaw Manufacturers as the most desirable machines for sharpening the saws used in their mills, it being a well recognized fact that the success of the mill depends directly on the fitting of the saws and that an exact working sharpener is a prime requisite. Some band resaw manufacturers expressly advise their customers that if they cannot afford the outlay necessary for filing room tools and a suitable place in which to fit the saws, that it will be better not to go to the expense of putting in a sawing machine, as they will only make trouble for themselves and the maker of the resaw, if not suitably equipped in the filing room. The sharpener is one of the absolutely indispensable machines no matter what the width of the saws or how rarely used and in buying a band resaw sharpener, the only question that should govern is, "What is the best type of sharpener for my requirements?" We shall be glad to recommend to any inquiring customer which of our machines will best suit the variety of his work. We offer band sharpeners in some number of sizes and styles, as regards the equipment supplied and our machines have the endorsement of makers of band resawing machines and saw makers.

Our band resaw sharpeners are finished in an exceptionally attractive manner. The filer when he first sets up the machine is impressed with the fact that it is finely made and finished. The adjustments are all simple and readily gotten at, and he very naturally takes pride in keeping up the machine in its originally fine condition and in sharpening his saws in a first-class manner. There have been thousands of these machines marketed and they are the standard of excellence throughout the United States and foreign countries.



The cut shows plan for the erection of a No. 3 Sharpener using post brackets and an idle pulley at one end.

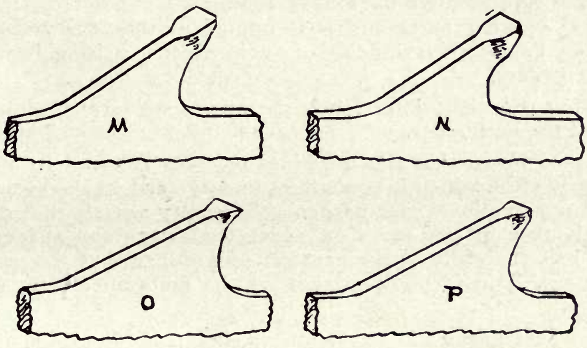
The gullet outlines employed on band rip or resaws vary exceedingly both as to spacing, hook, shape of the back and base line; but no matter what shape of tooth is desired, the very convenient adjustments on our sharpeners make it easily possible to obtain it and this fact has contributed to the popularity of these machines in no small degree, both in the United States and in foreign countries.

All band resaws should be automatically sharpened with an emery wheel, providing the spacing of teeth is ½ inch or more from point to point, such that an emery wheel may be used, and the width of the saw 1½-inch or more.

The use of a file for sharpening band saws, whether operated by hand or in an automatic filing machine, is unwise and unprofitable, except in the case of the narrow saws having fine teeth and angular gullets, such that the use of an emery wheel is impossible. Hence for all practical purposes, the automatic band saw filer is limited in its use to the scroll bands, and the automatic emery wheel sharpener, to all types of band rip or resaws, ranging from 1½ or 2 inches wide up to saws 20 inches wide, as used variously in factories or log saw mills. Moreover with scarcely an exception all band rip or resaws capable of being automatically sharpened with an emery wheel are also capable of being swaged with a machine swage, and should always be so fitted, as the use of a swaged tooth is unquestionably superior to any form of spring set or half swage, half set, as sometimes employed. Factory operators employing narrow band rip or resaws, have been somewhat slow to adopt the sharpener and swage, more from lack of familiarity with the machines and knowledge of their utility, than from any other reason, but such customers are quick to see the advantages of these machines when once introduced, and to express regret at not having adopted them sooner. All establishments employing scroll bands and band resaws require two distinct sets of filing room appliances, one for each class of saws.

KEEPING A BAND SHARPENER IN ORDER

In the operation and keeping in order of an automatic sharpener, there are some points to be observed that do not always occur to every saw filer, and more careful attention to which will prove beneficial. All automatic sharpeners employ one or more idlers or small rollers running on a revolving or sliding form. These will in time wear out of true, more particularly at the center where they fit the pin or bearing and as a rule the hole or the pin will wear more on one side than another, thus making the hole or the pin, as the case may be, eccentric. Hence unless new rollers or new pins are put in from time to time as necessary, there will result an inaccuracy in the movement of the impaired part, that will materially lessen the uniform working of the sharpener An automatic sharpener will work unsatisfactorily if the saw is not adjusted or the feed finger so shaped that its point of contact on face of tooth is always the same. The contact should not be too low on face of tooth but should come at a point where the shape of the tooth does not change. The outline of gullet is liable to change as the wheel wears, or from the dressing of wheel, and an accurate or perfectly uniform shape cannot be maintained at bottom of gullet. Close attention should be given frequently to all bearings and slides of sharpener; everything should at all times be kept clean and snug fit, properly oiled. End play in the arbor and feed mechanism must be looked for when uneven feeding and grinding occurs. In some cases trouble comes from not having the saw itself properly supported and steadied to sharpener, that is from a swaying in or out of saw between the clamp and the end supports in line with front of sharpener.



M N. File Side Dressing.

O P. Swage Shaping or Pressure Side Dressing

In some cases the clamp for saw on sharpener will be found to spring sidewise when the saw feeds forward. This may arise from too much pressure of clamp against saw, or from a lack of strength in the frame work of the clamp itself. The result of the defect is a drawback of the saw when the pawl recedes, which will be exaggerated at any part of the saw that is less perfectly leveled, all of which produces an uneven grinding. In some filing rooms the sharpener is to be found caked over with emery dust and dirt, indicating a total absence of attempt to keep either the machine or the filing room clean.

With such lack of care on the part of the operator of the machine, a sure mark of his shiftlessness, the efficiency of the machine cannot be otherwise than short.

Referring to the sketch of teeth marked M N O P, which illustrate full swage, the tooth marked O represents the ideal shape both in swaging and sidedressing. The cutting edge of tooth should alone come in contact with the wood, and this cutting edge requires clearance both downward and backward from the point. This double taper clearance can be secured only by sidedressing with a swage shaper or pressure sidedresser. Tooth M shows a swaging extending too far down the face of the tooth and illustrates the work of a file sidedresser. And while it has clearance in the direction of the feed of the board, it has not proper clearance backward or in the direction of the descent of the saw. If this tooth strikes sand, gravel or a hard knot and drops a corner, as in N, a portion of the corner would still project almost as far as the original corner. This broken corner of the tooth, coming in contact with a hard knot or fuzzy, fibrous wood, would be crowded to one side and a wave line in sawing will result. If tooth O drops a corner and becomes like P, it would reduce the spread of tooth on that side by so much. The tooth would pass clear of the knot or fuzz, and the following teeth, being still cutting to line, would be likely to cut their way straight. It demonstrates that the corner of the teeth should at all times be kept as nearly like a needle point as will stand, and as sharp as possible, so as to cut clean, smooth and to a line in any kind of wood.

Swage Shapers are variously made in sizes and styles to suit all kinds of bands, band resaws, gangs, circulars, etc., and are used successfully on saws ranging from the heaviest to the lightest gauge. Their efficiency is testified to by a very extensive sale.

We emphasize the need for the most explicit information in connection with orders for repair parts for swages, shapers, stretchers, retoothers, shears, lap cutters and patch cutters. We catalog many types and sizes of these machines and in connection we give price lists of the more important parts likely to be required which will be of great assistance to saw filers in making up orders. Our catalog name or style number of the tool with the style number of the parts required should always be given, but if this cannot be done, give the dimensions of the parts required with sketch, if convenient. Some of the swages and shapers have been changed a number of times both in style and in size of the working parts and it is important that every customer make his requirements clearly known to save delay or avoid expense arising from mistakes in the filling of indefinite orders.

It is impossible to furnish better repair parts than we furnish either as regards the quality of the steel or the temper.

All practical men know that the machines or tools referred to above are in daily use on tempered saw steel, which is sometimes unduly hard when received from the saw manufacturer and is sometimes case hardened by emery wheels that do not cut freely. This is particularly true of saw teeth on which the swage and shaper are being constantly used, and it is therefore of the greatest importance that the practical man shall see to it that the saw is in a condition that will be favorable to the life and working efficiency of the tool.

If the emery wheel burns the saw teeth, it should be discarded for a free cutting wheel. If the saw is unusually hard it should be annealed with a hot brazing iron before milling a lap or a patch groove. If shearing or retoothing, the saw should be supported horizontally between the dies, to avoid buckling the plate and breakage or chipping of the dies. No one should attempt to shear a band saw with the edge of his stretcher rolls, unless willing to incur the expense of a new set of rolls to replace the possible breakage.

In perhaps 99 times out of a 100, the breakage of dies, anvils and cutters is not due to defects either in steel or temper, but solely to careless adjustments or undue strains for which there is no reasonable excuse.

The unskilled or careless workman does not safeguard his tools. He subjects them to undue strains and if a die chips or breaks, he condemns the tool, or the steel or the temper, without concern as to his proper adjustment and handling. We therefore urge upon all practical men the exercise of good judgment in the handling of these tools, and upon the less skilled filers, the need of a thorough understanding of the principles that govern the adjustment and use of all filing room tools.

When one considers the number of teeth on a single band saw and the large number of times a saw may be swaged and sidedressed satisfactorily with a single set of dies, in ordinary practice, the wonder is not that the dies wear out and need replacing but that they serve so long.

There are, however, limitations in the adaptation of any swage. A large die will not work in a small gullet, nor will a small die be strong enough to swage a heavy gauge saw, nor will the same swage serve for a wide range in the gauge of saws.

SWAGING

Swaging is the process whereby the point of tooth is spread out sufficiently to cut a kerf wider than the gauge of the blade. It is variously accomplished by the aid of an upset, bar and hammer, or machine swage, hand or automatic, which will either press out or roll out the steel, making the tooth the widest at the point. On a band saw or a band resaw, the upset or swage bar is now never used, unless to touch up a few teeth, requiring a little more spread or a corner brought out, as a result of gravel or iron. An eccentric swage is indispensable to band or resaw fitting, owing to the number of teeth to be fitted, ranging in number from 200 to 400 or more, according to length and spacing of saw. The swaging may be accomplished at speed of from 20 to 40 teeth per minute, according to the expertness of the operator. The teeth must be sharpened alike, or must be as nearly duplicates as possible, to secure uniform results in swaging. It is obvious that a swage will act more on a blunt than on a slim tooth, and it is the business of the filer to shape the teeth with sufficient stock at point to enable the swage to act properly in throwing out the corners. Swages are made adjustable to act on teeth of all ordinary shapes, whether slim or blunt. The die operates upon the tooth by a rolling or eccentric draw of die toward point of tooth.

Essentials in band saw fitting are an evenly, squarely set swaging, to afford proper clearance for the timber being sawed, a back taper sidedressing, and teeth evenly spaced, with proper hook and back, and uniform in size.

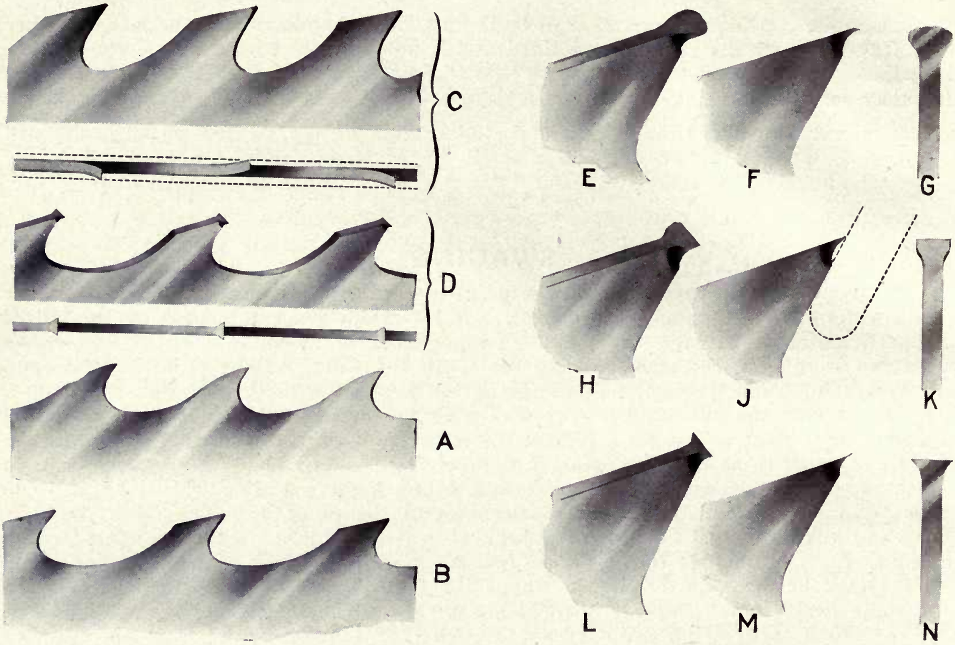
The practice of running a full swaged tooth in preference to any form of spring set, on all band or gang saws, capable of being swaged, is practically universal in the United States and Canada and is meeting with rapid introduction in Europe, Australia, New Zealand and indeed in all countries where sawmilling or woodworking is actively carried on.

A swaged tooth, with each corner cutting, will do nearly double the work in comparison with a tool fitted with spring set. Hence if you are running with spring set, you had better straighten the teeth, or if using short spacings, remove every other tooth, and then swage, sidedress and sharpen the teeth uniformly and you will find the saws will cut faster, smoother and better in every way than they previously did.

Abroad, the use of spring set teeth has been common in the past on the theory that a saw thus fitted will cut smooth, consume little power and require less care and skill in fitting. But even abroad the adoption of the tooth properly swaged and sidedressed is becoming general and it will be but a few years at most when the swaged tooth will be used everywhere by all except those operating in a most limited way.

A 16 to 17-gauge log band saw and band rip or resaws, even more than the heavier gauged log band saws, requires a swaged and finely fitted tooth, owing to the thickness of the saw and the particularly fine work that is usually required from such saws, especially on valuable woods.

The shapes of band saw teeth used abroad where spring set has been employed, are such as naturally result from the use of spring set, with very little hook used, and with the back high and angular to afford maximum strength to teeth that scrape rather than chisel out the saw dust. Hence when adopting the American Sharpener, Swage and Shaper, it is necessary to modify the shape of the tooth somewhat to permit of satisfactory results. More hook must be put in the teeth, as much or more than is indicated by the outlines preceding, according to the kind of timber being sawed. The angular



back of tooth so common abroad, should be reduced, that is a well rounded back similar to figure A is preferable. A spacing from point to point of 1½ inches or say about 37 millimeters is usually satisfactory. As you increase the amount of hook, you must fill up the back, but endeavor to maintain a well rounded outline both at base of gullet and on back of tooth. There is no standard gullet outline, but most operators in the United States and Canada maintain a shape similar to Fig. A with spacing 1½, 1⅝, 1¾ inch or more from point to point, according to the width of saw and the timber being cut.

Now with respect to the swaging, do not attempt to get full swage at one operation in a tooth not previously swaged. It can be done but it subjects the tooth and the swaging dies to an undue strain. It is best after the first swaging to point the teeth with a file or grind around once with the sharpener and the second swaging will spread the tooth properly, affording a good strong corner that can be easily maintained by swaging every third or fourth run of the saw. Do not allow the swaging to be well worn out before again swaging. The sharpener, swage and shaper should be used carefully with respect to each other. Each assists the other in the direction of perfectly shaped teeth.

Figures E, F and G show teeth as they may have been left by the swage. Some filers swage the teeth just to a point, that is without any wasting of the steel. But this is not always possible and if the steel is drawn forward so that a light cut of the emery wheel on face of tooth as in Fig. J will finish the tooth, the bit of steel wasted at point of tooth is unimportant. Figures K and L show teeth fairly well swaged and side-dressed. The swaging may be light or heavy and the corner long or short according to the timber being sawed or the preference of the saw filer or doctor. It is possible to produce any desired shape to a tooth as regards swaging and sidedressing, that is practicable. We catalog some number of swages and shapers for each of which there is demand, carry them all in stock and supply as ordered. Mill operators or saw filers who are not familiar with the different tools will do well to describe their saws as regards gullet outline and range in gauge, and we will then quote or supply dependable tools well suited to the saws in use.

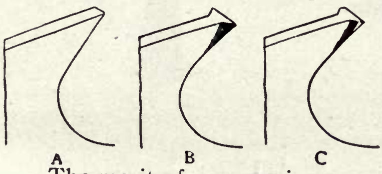
SWAGE SHAPERS OR PRESSURE SIDEDRESSERS FOR BANDS, GANGS, CIRCULARS AND RESAWS

The sidedressing of a band, gang or band resaw has much to do with the saw cutting straight and smooth. For each tooth must stand straight and have a perfect clearance at the point, with sharp, keen cutting corners. The point, or cutting edge of tooth, should be the widest, with taper down and back from point for perfect clearance. This prevents friction in the cut, which tends to heat the saw and affect its tension. Having the saw properly sidedressed, very thin saws can be run successfully, cutting a minimum kerf on a maximum feed and output.

Expert saw filers are coming more and more to use the swage shaper wholly for sidedressing purposes, and while a side file may be used by some with results satisfactory on saws of 12 to 16-gauge, the side file will not do for light gauged saws. For band resaws a shaper is considered indispensable.

The Swage Shaper or Pressure Side Dresser dispenses with the use of the side file. The tool is used similarly to an eccentric hand swage, resting over point of tooth and operated by a single lever, to force the sidedressing dies together. The shaper completes the work of the swage, and by its use the swaged tooth may be pressed into perfect and uniform shape. A pair of dies press upon the sides of the swaged tooth, compressing the swaging to any desired gauge and tapering the tooth downward and backward from point, making a perfect clearance, with face and point always the widest. This is the ideal way to sidedress a saw tooth. The shaper saves the steel instead of filing it away. It tends to keep the teeth straight and in line, evens the swaging, leaves a good body to the tooth for subsequent swaging and it is rapid in operation, sidedressing from 30 to 40 teeth per minute, as commonly used by saw filers. It is worth while to aim for the best possible results in swaging and sidedressing, as you will thus have fewer bad cuts, fewer saws come off, and less work in hammering and tensioning. Our Swage Shapers are now used in thousands of mills and factories, on all kinds of band and gang saws, and are indispensable to perfect sidedressing.

DIRECTIONS FOR USE—Swage your saws. Next start your automatic sharpener and grind around once to remove any burr or feather edge on face of tooth. Next sidedress the teeth with shaper. Then finish sharpening. **Never use Shaper on Newly Swaged Teeth Until Once Sharpened.**

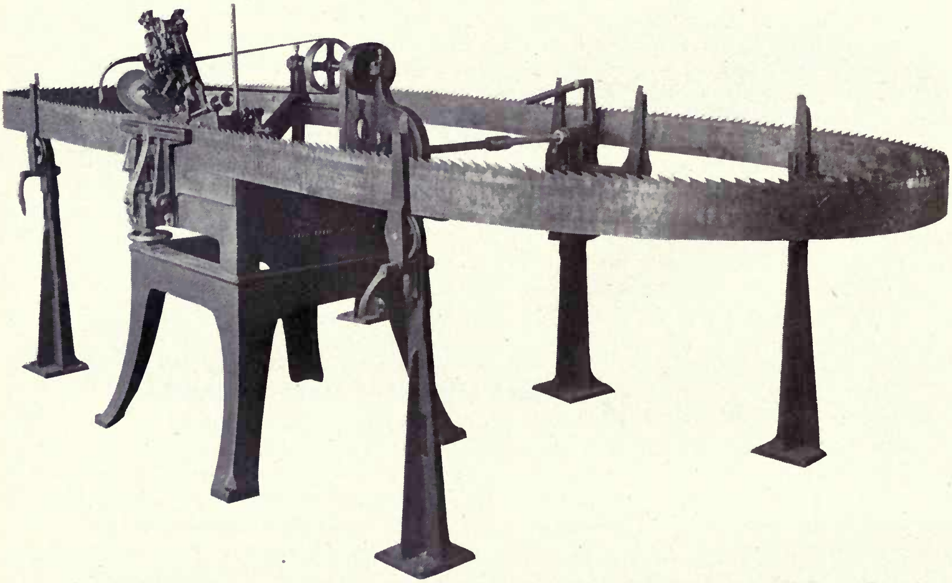


A shows a tooth without swaging, B a tooth that has been swaged but not sidedressed with the swage shaper, and C a tooth that has been sidedressed with the shaper, tapering the tooth downward and backward from point to afford a perfect clearance.

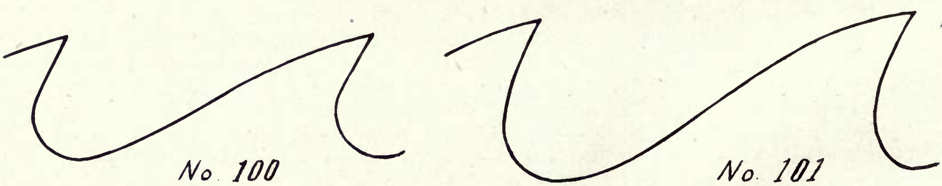
The merit of a swage is properly measured only by its efficiency in swaging without tending to fracture the steel, its wearing qualities, its simplicity and convenience of adjustment to varying styles of teeth, and its comparative cost. The severe work of a swage in working tempered steel of various degrees of hardness and sometimes showing a trace of case hardening from effect of emery wheel, and the great number of teeth that it is expected to spread out, requires that the dies shall be of special quality and temper. The steel must be of the very finest and must be tempered by an expert familiar with requirements. The purchaser of a swage should consider evident quality more important than price. All agree that the face of tooth is the cutting side and that the corner of tooth should taper down and back from point, and face swaging tends to make this ideal shaped tooth. But the shaping of the teeth has much to do with their cutting and clearing qualities.

It is essential that an eccentric swage shall combine lightness and convenience with great strength, that the working parts shall be sufficiently small to work successfully on very short teeth and thin-gauged saws, that it shall spread the steel without tendency to fracture the tooth or break the dies, that it shall be readily adjustable to teeth of varying lengths and shapes ranging from little to extreme hook, that it shall be adjustable to a long or short and a light or heavy swaging, according to the requirements of the timber, and that it shall spread the teeth square and true. It is evident that a swage will act on the teeth as it finds them. It cannot swage perfectly a tooth that has previously been imperfectly swaged until the tooth has been balanced or trued up. The back of tooth must be regulated with respect to the hook, a lower back for teeth with little hook, a higher back for teeth with extreme hook. Soft, fibrous woods like cottonwood, etc., require teeth with extreme hook, while hardwoods are usually sawn with much less hook. It is the business of the filer to make the sharpener shape the teeth with special reference to the timber being sawed, and with proper stock at point to enable the swage to act properly in throwing out the corners. The swage and sharpener should be adjusted to work together, and if such is the case the most satisfactory results will follow.

Swage and sidedress your saws to run well on a minimum kerf. It may require more careful and frequent fitting, but the saving results justify your extra effort. Some band saws cut almost 3/16 that would run better on 1/8, and many band saws are capable of being run on narrower swaging than is customary. You should run your saws to make lumber, not sawdust. Some of the swages in use either do not give enough swage and so require upsetting, or give too much, making a spread down face of tooth of the same width throughout, so that it tends to scrape and heat and also wear dull at point.



8-Inch R. H. Band Saw Sharpener Equipped with Adjustable Iron Stand Post Brackets and Back Feed Pawl



Band Saw Gullet outlines illustrated above or modified in a manner to suit local sawing conditions, are recommended.

All types and sizes of Automatic Band Saw Sharpeners contemplate the saws shall regularly surround the sharpener, and be supported preferably on a set of four to six adjustable post brackets with a back feed pawl operating at rear of machine, oppositely to the movement of the feed pawl at front of machine, which feeds each tooth ahead to the grinding wheel.

The post bracket supports for the smaller band resaw sharpeners are designed for mounting on 2 x 4 wood uprights, two of which are to be mounted in line with the front of sharpener, at suitable distances, say three feet away, more or less, according to the length of the saw, two more at similar distances from the machine in line with the back feed pawl, and two more in line with the back feed pawl, but close to same.

A band sharpener should be ordered preferably to suit the hand of band saw in use, a left hand sharpener for a left hand saw, and vice-versa.

It is, however, possible and necessary where both right and left hand saws are employed, to support the saw out in front of the sharpener with supports suitably arranged therefor. In plants that employ both left hand and right hand band saws it is common practice to employ sharpeners equipped both left hand and right hand, unless the number of saws employed make it preferable to order two separate sharpeners, one for left hand, and the other for right hand saws.

The back pawl and post bracket system is better culculated to produce an exact uniform feed movement, and the greatest perfection or accuracy in grinding the gullet outline.

Large heavy type band sharpeners for wider band resaws, or heavy log band saws are provided with all iron stand adjustable post brackets, which afford greater rigidity, and more convenience in adjustment for heavy duty requirements.

This remark also applies with reference to the back feed pawl device.

A right hand and left hand band sharpener is equipped with suitable floor shaft, with additional feed pawl, and suitable operating mechanism so that in connection with extra post bracket supports, both left hand and right hand saws may be sharpened. It is usually considered unimportant in which hand a band sharpener shall be supplied if ordered for both left and right hand saws.

The use of adjustable pulleys ranging in diameter from two feet up to four or five feet, and equipped with iron stands, or designed for mounting on a suitable wood bench, or similar support, is less common than was the case years ago, although some operators of band resaws from four to eight inches wide order such pulley supports in preference to the post bracket and back feed pawl system. Indeed, a set of adjustable pulleys are of convenience and advantage for use in fitting-up purposes, in connection with swaging, sidedressing, etc., and may be located apart from the saw sharpener so that swaging, sidedressing, etc., may be performed on one saw while another is being sharpened.

When adjustable pulleys are mounted in connection with the sharpener it is considered preferable to locate the pulley from which the saw feeds to the grinding wheel, somewhat farther away from the machine than the other, and the saw ought not to be strained on the pulleys to an extent such that it may tend to climb or lift on the rim of either pulley as might happen, especially if as result of long use and wear a tilting of either pulley should result. Carelessness in this regard has sometimes caused uneven inaccurate feeding, and uneven grinding of certain teeth, some being ground unduly owing to the improper feed movement, and others being ground lightly, or not touched at all, as the wheel descends the face of the tooth, and in such case uneven grinding of the back of tooth will also result.

It is, therefore, a matter of primary importance that the saw shall be properly supported about the sharpener, and every attention paid to uniformity and accuracy of the feed movement, in so far as the supporting mechanism is concerned. The supports must be at proper height, or properly lined with the saw rest on front of sharpener. In some cases an idle pulley is mounted at one end of saw to serve for pulling the saw around through the machine if the sharpening, swaging, sidedressing, etc., is all done at one place.

Band resaw sharpeners of the bench type can be inexpensively mounted on a wooden bench or table constructed by the customer at mill, and made of suitable height so the line of the saw teeth will be say, about 40 inches above the floor.

The saw rest for back of saw on front of sharpener should be so adjusted that the feed pawl will be just enough higher than the bottom of the gullet to allow it to ride on the steel supporting shoe, or pawl plate. The saw clamp extending across the front of the sharpener should be adjusted to clamp the saw with an easy tension, but still allow it to feed forward freely with no tendency to bind. It will be obvious that a saw having lumps, ridges, twists, or any similar distortions will not feed through the saw clamp with perfect facility, and hence it is important that the saw shall be kept at all times properly level to facilitate the feed movement. Undue clamping of a distorted saw will almost certainly affect the feed movement, and cause uneven grinding. Care should also be taken that the shape of the feed pawl where it engages with the face of the tooth, and also the face of tooth shall be such as will not tend to cause a lifting of the saw during the feeding process. If the engagement of the feed pawl with the face of all teeth is not uniform, uneven feeding of certain teeth, and uneven grinding will result.

Adjust the feed finger so that it will have enough travel to accommodate the longest spacing employed. Thus the travel of the pawl will always exceed the tooth outline to be sharpened. The stroke of the feed pawl is adjustable by changing the position of the sliding block in the eccentric, and each type of sharpener will afford as wide a range in feed pawl movement as needful for all usual requirements of saws within rated capacity.

First of all before permitting the grinding wheel to descend into the gullet, see to it that the feed pawl pushes the face of the tooth to a position for proper contact with the side of grinding wheel, and that the downward movement of the grinding wheel into the gullet is just right, so that there shall be no undue grinding of the face of the tooth or bottom of gullet.

Pull the belt by hand, closely watching the movement of the saw and emery wheel, and you can then determine what further adjustments are necessary.

It is of great importance that the idlers which contact with the tooth form, also the idler pins, and also all slides shall be kept properly free from emery dust and particles of steel, and also well lubricated to prevent wear and lost motion. The slides are provided with gibs for taking up wear, and if wear occurs to an extent that interferes seriously with the accuracy of the grind, in such case the slide surfaces ought to be remachined or rescraped to afford a perfect bearing, and not allowed to pass from bad to worse until the efficiency of the sharpener is so impaired that uniform sharpening cannot result.

It is an unfortunate fact that many filers are careless in this regard, permitting the working parts of sharpener to become covered over with emery dust, exercising none of the simplest precautions, which the character of the machine and its work make imperative, if long life and satisfactory use are to be had. We, therefore, urge upon every factory superintendent, foreman, and saw filer that special attention be paid to these matters so that under fair working conditions the various filing room machines employed for sharpening and grinding will afford accurate and satisfactory service for a long term of years with little or no expense for repairs.

Most band saws ranging from four to eight inches wide have teeth spaced about 1½ inches from point to point, rarely less than 1¼ inches and rarely more than 1¾ inches. The depth of gullet will vary according to the width of saw, and spacing from point to point, being rarely less than ⅜-inch, and rarely more than ⅝-inch. The teeth on band saws employed for hard woods or for the miscellaneous resawing both hard and soft woods usually have about 2½ to 3-inch hook in a 6-inch saw. If used exclusively for sawing soft fibrous woods, a greater amount of hook may be employed, say 3½ inches or more in a 6-inch saw. There are practically no American band saws run with spring set, and the tendency of band saw operators in all countries is strongly in the direction of the adoption of swaged teeth. If a saw is run with spring set, but little hook is necessary, and in such case a lower back may be employed. But if the amount of hook is increased, the height of the back must also increase to afford proper strength, and this explains why American band saw teeth show considerable hook, and a well rounded back and gullet so as to afford proper strength, and also a proper amount of throat room for the saw dust.

Band saws ranging from 10 to 20 inches wide, have teeth spaced from 1½-inch up to 3 inches from point to point. The wider saws, particularly those employed on the Pacific Coast, variously single and double cutting, range from 15 to 11-gauge, and have gullets of exceptional size, 2½ to 3 inches from point to point, with depth 1 to 1¼-inch, for the sharpening of which a grinding wheel of ⅞ or 1 inch thickness may be employed. The construction of the single and double cut sharpeners employed for sharpening such saws, is very heavy and massive, and the mechanism differs somewhat from that employed on the smaller capacity sharpeners, but the general principles that concern adjustment and operation are essentially the same. Special direction circulars for adjustment of the particular types may be obtained on request.

Each type of band sharpener is adjustable for all usual requirements. The emery wheel head may be tilted to varying angles to afford the desired amount of hook on front side of tooth. Similarly the shape of the tooth form may be changed to properly fill up the back while the movement of the cutting edge of the grinding wheel can be so timed with reference to the movement of the feed pawl as to afford a well rounded gullet outline. Radical changes in adjustment should not be made by anyone unfamiliar with the methods or theory of adjustment to produce a definite result.. Each change should be made gradually with a view to a gradual change of the tooth outline from its existing shape to the desired shape, during a series of sharpenings. For example: if the hook is increased, the back must be filled up to compensate, but neither change can be accomplished in a day, or in a few days, but will take some period of time. The same remark applies when first putting a sharpener at work on a saw that has previously been hand filed, or that may be brand new from the factory, but with a gullet outline that requires some change to better meet the local sawing conditions. In such case set the machine so that it will sharpen the face of tooth, and gradually make such further changes in adjustment as are necessary to cause the grinding wheel to produce the desired outline at base of gullet, and on back of tooth.

Light and frequent grinding is very much to be preferred.

A newly swaged saw must first be sharpened so that the teeth will all be of uniform length, and any surplus steel at point of tooth drawn ahead during the swaging process will be ground off. The saw should next be sidedressed with a swage shaper, and then given a final sharpening.

We recommend the Metcalf Emery Wheel Dresser as the most efficient dresser on the market for saw sharpening wheels. It will quickly produce a perfect round, bevel or V edge on the hardest wheel or bring up fresh particles of the abrasive, if wheel shows tendency to glaze over.

Be sure to maintain sufficient clearance on band saw teeth in frozen timber. The dust tends to bake on top of tooth, if the back is kept too high, and a difference of only $\frac{1}{16}$-inch in the clearance may make all the difference between a straight, easy cutting saw and one that is liable to heat on the tooth edge and crowd back.

Having attained a perfectly satisfactory gullet outline and clearance on back of tooth maintain it, and the best way to do this is to file out a steel templet that will just fill the gullet. By occasional testing of the gullets with such templet, you can instantly determine whether you are maintaining the hook and whether the pitch and shape of the back is changing. The eye test or the application of straight edge on points as a measure for clearance will not measure the changing outline incident to continued sharpening and wear of grinding wheels so effectively as will the test of gullet with steel templet.

The thickness and shape on edge of emery wheels must be properly relative to the spacing and general shape of gullet outlines that are being employed.

A resaw with spacing 1¼ to 1½-inch requires a wheel ⅜ or ½ inch thick; a 1¾-inch spacing requires a wheel ⅝-inch thick; a 2-inch spacing requires a wheel ¾-inch thick; a 2½ to 3-inch spacing requires a wheel 1 inch or more thick. In each case the wheel must be properly dressed with round or bevel edge or a combination of the two to properly fill and shape the gullet and the shape of the wheel must be carefully maintained by frequent dressing. The natural wear of the wheel may change the outline of the gullet unless closely watched, with a tendency for the back of tooth to fill up and thus lessen the clearance or for the hook to run out.

The bearings in the feed and head lifting levers on automatic sharpeners if of cast iron, without bushings of steel, bronze or babbitt, will after long use, wear oblong. Such levers may be put in good condition by reboring and the employment of some suitably hardened bushing to overcome lost motion.

FAULTY SHARPENER OPERATION

Among conditions that may affect unfavorably the operation of a saw sharpener, the following are important: saw improperly supported or strained on post brackets or pulleys, in a manner that will produce a bind in the feed operation; rest for back of saw worn, grooved or V shape; burr on back of saw; lost motion in feed pawl bearing or feed pawl lever bearing; wear in the ways of the emery wheel head; emery wheel spindle loose in its bearings; back lash between sharpener and pulleys; lumps, bends, twist or similar distortions in the blade or gum or pitch coated on side of saw or face of saw clamp; saw clamp too loose or too rigid in its bearing against face of saw; lap not properly dressed, leveled and tensioned; high spots on back of saw; accumulation of emery dust, gum or other matter on main front; wear of main front under wheel to an extent that may cause grinding out of square.

BREAKAGE OF WHEELS ON SHARPENER

Breakage of wheels on an automatic sharpener is usually caused by wheel descending on point of tooth or striking feed pawl, or from an undue lateral strain against face or back of tooth due to improper feed adjustment. All wheels are tested at a speed double normal, so that breakage rarely occurs from excessive speed. Special care in adjustment must be taken in the case of a deep narrow gullet with high back or the wheel may strike the pawl before it can recede out of the way. Excessive vibration, fracture or cracking of wheel before being put to use, too small flanges, too large arbor hole for the arbor, uneven teeth caused by hand filing, uneven gullets as regards width or pitch on back, are all possible and occasional causes for wheel breakage. Water or oil soaked wheels are objectionable.

METHODS OF EQUALIZING SPACINGS

As a result of hand filing or the use of crude equipment for gumming or sharpening, the spacings on small circulars, scroll band saws, band rips and band resaws, is very apt to become irregular, particularly so on saws having medium or short spacings, that is to say, rather fine teeth. Such saws when first put on an automatic filer or sharpener, present problems especially to the man who is not familiar with automatic machine operation and who does not know how to favor the saw teeth by gradually working down the high spots, even though some of the teeth may not be touched with file or emery wheel for a time, until practical uniformity in width or diameter has been arrived at and the marked inequalities fairly well overcome.

Remember this, that the sharpener takes the saw as it finds it, and must necessarily hit high spots hard and not touch low spots at all, and there is no way that a sharpener can be made to follow the outlines of all saw teeth until they are uniform.

Two methods of feeding the teeth on saws unevenly spaced are variously employed. In some cases, and if practicable the most effective method, the sharpener or filer is adjusted so that the feed pawl will engage in the gullet being sharpened. This contemplates that the emery wheel must lift out of the gullet to a sufficient height, so that the pawl may feed ahead and engage the face of the tooth just ground on face, without striking the rising wheel. This requires a fine adjustment and quick movement at the right moment and sometimes a wheel will be broken before the adjustment is successfully made and the desired uniformity of spacing and gullet outline attained.

The other method is to adjust the machine so that the pawl will engage with the face of the second tooth ahead instead of with the face of the tooth next ahead of the one being ground, and works out satisfactorily in the case of saws that can be thus treated. Where the pawl engages with the second tooth ahead, this does away with the danger of striking the side of grinding wheel before it rises high enough to be out of the way.

As to which method or whether either of the above methods may be employed in a particular case, depends upon local conditions as regards the type of machine used, the range in pawl movement, the size, shape and action of the lifting cam for grinding wheel and the proper timing of the machine mechanism to produce the desired result.

Excellent results and the overcoming of bad variations, are attained in practice in many instances, following the above methods.

THE RELATION BETWEEN SWAGE AND AUTOMATIC SHARPENER

BY FRANKLYN HAYES

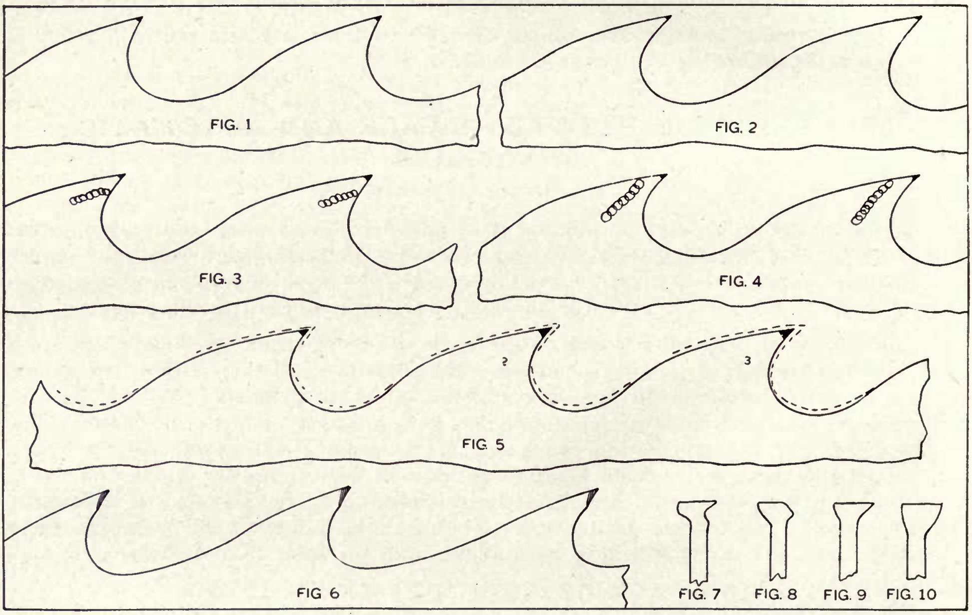
In the numerous articles on alignment of mill, tension of saws, and various other things concerning the filing-room business, I do not think the vital relation between the eccentric swage and automatic band saw grinder has been mentioned, or how much the efficiency of the saws depends on the joint working of these two machines.

Take, to begin with, the losing of the backs of teeth; there are many beginners that have this trouble. It might be caused by the adjustment of the swage being wrong, or by too short a stroke of the feed-finger of the automatic grinder. If by the latter it will be easily detected by those who understand the working elements of the machine, as the wheel will invariably grind every spot on the back of the tooth, and the gullet, just where the curve starts from front to gullet, will keep filling up worse and worse each time the saw is ground, caused by the short-stroke finger jerking the saw ahead before the wheel has time to do its work. The tooth, in this case, will look something like Fig. 1, and the wheel will drag hard all through the balance of the throat and all of the back.

The beginner will naturally ease the wheel up on the back and hit harder on the face, thinking (I suppose) that he will give the back a chance to grow and get that filled part out of the gullet, but there is where he fools himself. While grinding light on the back he is not going down fast enough in the throat, but by hitting hard on the face he is cutting the tooth back all the while. That is, at the point the wheel gets a good hearty "dig" at this section in its downward course, but that short-stroke finger jerks the tooth away, so that the front part of throat is not ground back faster, like the point is. We must get down in the body of the saw as fast (if not faster) as we grind back on the face, if we expect to hold the body of tooth. A grinder, when working right, should allow the wheel to linger long enough in the throat to lightly clean the whole throat to precisely the shape of the wheel.

Fig. 2 is a good representation of a band saw tooth. To procure it, the swage should pull the stock well forward and the stroke of the feed-finger should be lengthened so that when it drops back for the next tooth it should back up over two-thirds of the tooth space. The wheel, in dropping, should lightly clip the face of the swaged part, and not touch the face again until in the throat (that is, the first time after fresh swage), and gradually grind more of the face each time around. The grinder will regulate this itself without changing the finger stop, when in good working order.

Now, let's go back to the wheel we left in the throat. It should hesitate there for an instant while the finger is traveling from the back of tooth it backed up to, back to the face of the one it is to push with. The wheel should now rise just a fraction of a second before the saw starts to move, just enough so that it will skip about ½ to ¾-inch of the back from the throat up. This allows the throat to keep the shape of the wheel, and also allows the back to grow. You can tell by the clampscrew rings if you are grinding back faster than down. If the grinder is grinding faster on the face than in the throat it will show the clampscrew rings, like Fig. 3, but when grinding right or about equal back and down, the clampscrew rings will look something like Fig. 4. The dotted lines on Fig. 5 show about where the wheel should touch in order to keep the tooth building into shape all the time. Tooth No. 1 shows the first grinding, No. 2 the second and No. 3 the third.



"The efficiency of the saw depends to a great extent on the joint working of the eccentric swage and automatic grinder."

There is another feature about the grinder that causes the section of the throat just below the face to fill up, and that is end-play in the arbor, assisted by a long throat that does not fit the wheel. The wheel, after passing up the back, is naturally crowded up so the end-play is at the upper end of arbor, and when it drops it gets pushed back again as it strikes the point of tooth and grinds that back, but the receded wheel does not get a chance to grind the front of throat out, on account of the long throat having nothing in the back part to crowd the wheel to its work on the front part. If the throat is the exact shape and size of the wheel, it will gently push the wheel up against the front part of throat during that short period when the wheel hesitates in the throat. Right here is where a spring attachment on the end of arbor helps considerably—just strong enough to gently hold the collar up against the boxing, but still releasing in case (by accident) the wheel hits a tooth too hard.

We also have the back that is lost by the swage not pulling forward enough. Here is a trouble that, if not remedied, will soon be the cause of losing the teeth altogether. It is usually on account of the block of the swage not being tilted forward enough, or the tail-piece dropped too much, so that it tips the block back. The operator generally does this to gain stock, which he loses sometimes by dull clampscrews or too short a face on the anvil. The point will be tipped back so he will have to grind so hard on the face and light on the back, in order to get it to face up, that he soon has a tooth like Fig. 6—and getting worse with each grinding. Note the stock running down the face only, instead of forming a shoulder on the back of tooth.

To remedy this, tip the block well forward in the frame, or if the block is not movable on the swage in use, then raise the tail-piece so as to let the swage tip well forward. Put a pretty long face on anvil and adjust it so the die lever's stroke will end way over forward. Grind just hard enough on the face to face up nicely and "bog it to her" on the back, being sure to have a long enough stroke on feed-finger to allow the wheel plenty of time in throat, and it will be only a few days until there will be a big improvement toward a good tooth again.

Another feature where the cause is easily misplaced is, the wheel striking hard on the face at intervals of, say, every third to sixth or seventh tooth, and occasionally burning the points on the back. A person can easily make the mistake of thinking this is in the swage, but it is generally caused by a flat place on the roller that runs on the finger-cam, or the form-cam, either, for that matter. The finger-cam roller is the most liable to get those flat places, as it is subject to a harder strain than the other roller. The wheel will hit the face hard when the flat place on the roller is on the cam just at the time the finger is the stop. This might not happen at times, for maybe a dozen or so teeth, and then it might happen for two or three teeth in succession. This flat place is caused by the roller pin getting dry and stopping long enough to allow the cam to wear a flat spot. I have also known the cam to be loose on the shaft, just enough so it could hardly be detected with the eye, and would have the same result—that is, hitting some teeth harder than others.

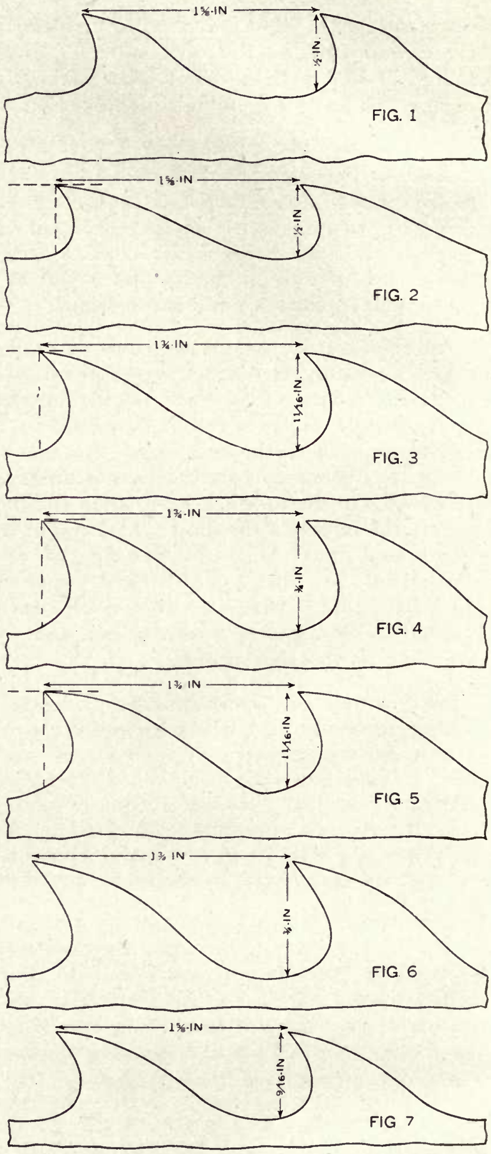
Next comes the overbalancing of teeth, which can be caused by the grinder not grinding square or by the swage pulling to one side. If the arbor sets squarely over the saw and the eccentric die and swage anvil are both square, this trouble will never exist. If caused by the grinder not being square, the tooth will look from the back and top something like Fig. 7, but if caused by the swage anvil not being ground square it will look something like Fig. 8. When everything is square and right it will look about like Fig. 9, or, if a heavy shoulder is wanted, like Fig. 10. Of course these teeth are not as accurate as might be, but they will explain the idea.

In case of the stock being heavy on one side, like Figs. 7 and 8, they can be balanced in a short time by grinding the anvil so it will show a little light (when tried with a square) on the side where it comes to bear on the tooth where the stock is lacking, as the working of the die, in connection with the anvil, throws the steel toward the open part of the anvil. As soon as this balances the stock enough to get the missing corner out, the anvil should again be ground square, otherwise the same trouble will show on the opposite side of tooth.

If any trouble is had in getting the grinder to grind square, it is well to look to the guide-plate or the face of the casting where the saw feeds through between the clamp and machine. Sometimes this will become worn in spots, so that while the arbor shows square with the guide-plate at the point where the straight edge is applied for a test, it might be worn just under the wheel, so the saw bends just enough to throw the tooth that is being ground, out of line. This little thing sometimes is very deceiving and requires close scrutiny to detect it. If this plate is detachable it should be taken off and planed perfectly straight and true. If not removable, it can be trued up fairly well with a file, by using a little patience and time. This worn spot invariably comes on all grinders, being caused by the loose emery sifting down between the grinder and saw and the movement of saw thereby gradually cutting the metal away. I have known several little things similar to this to be the undoing of an otherwise good man. Sometimes the little, insignificant things cause big troubles.

Herewith are some sketches (actual size) which will perhaps help some filers to get the teeth on their saws back in proper condition. It is easy for teeth to lose their shape, and this happens so gradually that the finer details are often overlooked. A well-shaped tooth is just as important as proper tension.

Fig. 1 shows teeth badly out of shape, caused by the filer grinding back on the tooth faster than down on the backs. Note the throats, also where the throats were before this grinding was done. This shows how easily the teeth can get in this condition unless closely watched. Fig. 2 is my favorite tooth for resaws up to 8 inches wide, 16-gauge. It is easily adapted to both soft and hardwoods; the sketch shows it for pine and soft wood sawing, with a full swage. For hardwood the only changes are a little less pitch and a narrow, long, pointed swage. I find that 1⅝-inch space is best for all woods, and ½ to ⅝-inch depth of tooth answers all requirements. Note the dotted lines; plenty of clearance of back. The other teeth shown are from fast-cutting log bands. They are good cutters in both soft and hardwood, the only changes needed for hardwood being those mentioned above, viz., less pitch and less swage. Fig. 3 shows teeth from a saw 12 inches wide, 14-gauge, 1¾-inch spacing and 1⅛-inch depth of tooth. This type of tooth I consider my best for mixed woods. It is good in pine alone, but will not stand the feed that Fig. 4 will, which has larger throat room for saw dust.



"The finer details are often overlooked"

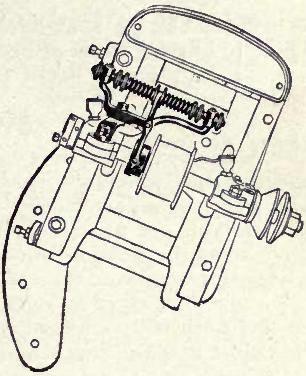
Fig. 4 represents all that can be asked of a fast-cutting tooth for softwoods. Dotted lines show good clearance, hook, spacing, and a strong back. The throat depth is ¾-inch, with 1¾-inch spacing, which makes a cutting tooth instead of the well-known scraper. With less pitch and swage it is good in oak. Fig. 5 is nearly like Fig. 4, but note the higher back and less depth of throat. This style is good in frozen timber and makes a good all-round tooth for soft woods. It resists spikes and iron of all kinds much better than the other teeth outlined. If you are sawing rafted logs, full of nails, spikes and iron, you will find that this tooth will stand more punishment without breaking out than any other. Fig. 6 is a tooth to avoid; note the slimness; this tooth will chatter in the cut. Fig. 7 is all that can be desired for hardwoods alone, short and strong.

THE SEEK ARBOR ATTACHMENT FOR BAND SAW SHARPENER

The function of the Seek arbor attachment is to hold the inclined emery wheel arbor up in place and to take up the small amount of end play allowed in arbor by means of spring tension rather than by rigid tight collars.

The spring tension prevents the wheel from hitting the face of saw too hard, that is, it prevents the wheel from oscillating sideways and digging in too deep, thus blueing the points of the teeth on the upward stroke.

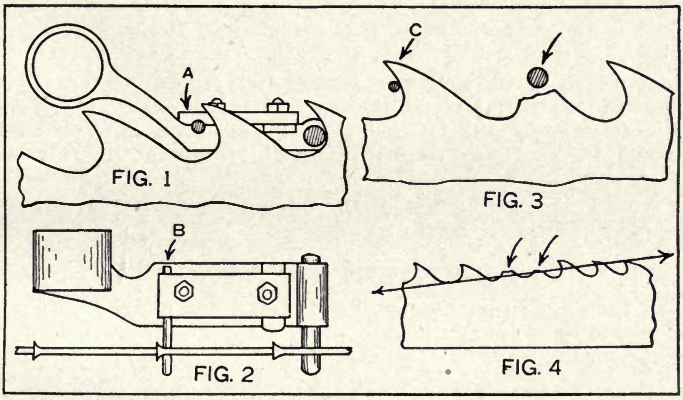
The attachment is especially useful in leaving the tooth in the best condition for swaging. The collar that attaches to the emery wheel is fitted with ball bearings, making the attachment more sensitive and reducing the friction on the only wearing point. The device effects an important saving in grinding wheels, files, saws, and adds materially to the life and efficiency of the swage and shaper dies. It can be supplied on order for either R. or L. H. Band Sharpeners.



EXTRA FEED FINGER FOR SHARPENER

Band, gang and circular saw sharpeners and small saw filers are regularly manufactured with only one feed pawl, but it sometimes happens that a tooth is broken out, in which case when this part of the saw comes around to the feed pawl, the feed movement ceases and in the case of a band saw, the back feed pawl will continue to feed until there is a bind of the saw around the post brackets and the good teeth near the grinding wheel may also be impaired to an extent that a braze or patch will become necessary.

Because of this circumstance, a filing room will occasionally be found where the filer has fitted a supplemental pawl, adjustable or rigid as may be suitable for the local conditions, whereby a tooth next behind the broken tooth may be engaged and the normal feed for the spacing maintained.



"Does not interfere with the main feed-finger unless bad teeth come around"

The accompanying illustration illustrates a device of this kind, showing engagement of the regular feed pawl with perfect tooth and how the supplemental pawl is set back ¼ inch or so from face of the next tooth so that it will not interfere or cause trouble unless a missing tooth comes along, in which case it will engage with the sound tooth behind and push the saw along, making the saw grind down evenly until the defective teeth gradually come up to proper height. The several illustrations will be readily understood. If two teeth are broken out, the extra pawl must be set for proper engagement to suit this condition. Fig. 4 shows how a spiked saw may be made to cut smooth lumber in spite of teeth stripped out. Merely shorten the teeth back of those missing as shown by line at angle. There are instances of wide bands from which as many as three teeth have been stripped, that would still cut smoothly by resort to this expedient. Three teeth broken out, with spacing of 1¾ inch between points makes a space of missing teeth of over 6 inches in length. The sound of the saw when in the cut will not be pleasant but it saves cutting the saw and the stubs will soon develop into cutting teeth.

SWAGING OF BAND SAWS

A band swage should be adjusted so as not to produce a too-shallow or too-short faced swage, which will cause the teeth to quickly lose their pitch on back very quickly and become hollow and ill-looking on back. The adjustment should also be so that the die will not engage so far down the face of tooth that the point will spread less wide than the portion of face lower down. Both of these evils may be remedied by grinding a longer or shorter working surface as the case may be, on swage anvil. Most filers now employ a rather long faced spread and with swage adjusted so that the point of the tooth will be pulled slightly forward so that the front of tooth will square up the first time past the sharpener.

The jaws of the swage shaper should never be ground to make the points of the teeth improperly flaring. Irregular grinding by sharpener is often caused by frequent readjustment of the emery wheel head or of the stop for the feed pawl. A worn feed pawl with grooved face, the result of long continued use without redressing, will also lead to irregular feeding and grinding. Don't change the position of the grinding wheel or stop every time a tooth fails to grind.

Some filers recommend for winter sawing a reduction of the set or swage carried, a slight letting down of the tension, and also of the crown on back. With less tension it is easier to keep the saw perfectly leveled, which is essential in order to operate with a light swage, successfully. In such case one can also go out nearer the edges with tension without danger of fracture from overstraining.

An extra amount of hook, more especially on the extreme point, is also beneficial and the swaging should be strong with a longer face.

A proper grind on face of anvil will permit the swage die to engage lower down on face of tooth to secure the above result. Similarly it may be necessary to change slightly the angle of the shaper jaws so that the sides of the lengthened swaging may be properly sidedressed and the increased strength of the swaging preserved.

Other things being equal, a longer spacing for frozen winter sawing than for summer sawing, will be preferable, and there are filers who have cut off the upper half of every other tooth on saws with 1½-inch spacing, thus using in effect a 3-inch spacing for winter, allowing the shortened teeth to gradually fill up and return to service in the spring.

The same remark as to reduction of the amount of swage carried on band saws applies similarly to circulars for winter sawing.

ADJUSTMENT OF SWAGE

Fig. 1 shows the anvil in position on back of saw tooth, and, if the saw has good pitch, will give a good light swage. Should a longer swage suit your needs better, grind the anvil as shown in Fig. 2; in fact, a longer bevel, which causes the swage die to get

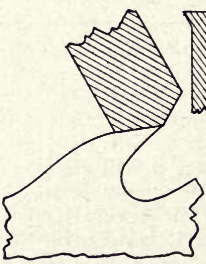


Fig. 1

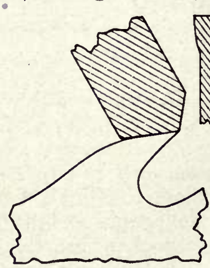


Fig. 2

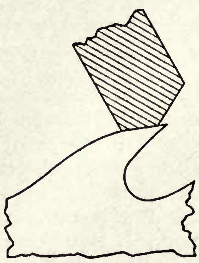


Fig. 3

a lower hold, owing to the saw point extending farther forward. Fig. 3 shows the bevel too short, which causes the point to be turned upward. This is a bad condition and will ruin the teeth in a short time.

Straight fast cutting saws must be properly fitted as regards leveling, tensioning and expansion of back, but the teeth must be quite right also. One trouble that is sometimes found to exist, is an almost invisible crumbling of the points. Close examination will reveal tiny notches in the cutting edge and particles from the corners will be gone. The loss of a few corners, even though the impairment is not apparently serious, will cause "leading" of saw and lower the quality of the manufacture. Such breaking away of edges is often brought about by uneven swaging which means careless swaging, as a result of which, the corners being worked unduly, first outward by the swage die, and then backward by the shaper jaws, fracture and readily break away in knots or hard sawing. Of course crumbling of corners is certain to occur from grit or gravel in the log, and may occur from unduly high temper of saw or as result of case hardening while sharpening. Marking of the sides of saw teeth with the clamping jaws should be avoided by adjusting the swage so that the point line is not in the line of the marking made by the ends of the clamping screws. The throat line should not run in these marks, either. If the swage is not one that can be adjusted to prevent this trouble, better replace it.

ESSENTIALS TO GOOD SWAGING AND SHAPING OF TEETH

No swage or shaper can do good, even, uniform work on a saw having teeth irregular or uneven. A swage or shaper takes a saw tooth just as it is, and the results will be uniform or lacking in uniformity, according as the teeth are. If the teeth are uneven, it will be necessary to swage and sharpen the saw several times, before uniformity of results can be obtained.

When swaging a new saw or one having little or no swaging on the teeth, the same stroke or pull of the eccentric die on the face of tooth, that would afford the right spread for a normally swaged tooth, will spread naked teeth but little, simply because there is not enough stock on face and sides of tooth, to produce a proper swaging.

A saw with no or but little swaging, can under some conditions of sawing be properly swaged at two operations, grinding out most of the impression made by the die, after each swaging, but if a heavy, wide spread and strong corner is required, the saw must be swaged at least three times, grinding out the impress of die, each time. As a rule, no one should use an upset swage on a saw tooth as it tends to bend the teeth as well as shorten them unevenly, throwing them out of balance so that swaging to one side or the other is bound to result.

Standard saw swages are built in a highly standardized way, machined to templet, drilled in jigs, and the essential working parts finished accurately to size and of approved shape or form, so that when assembled, the anvil, die and faces of the clamps are properly squared and positioned with reference to each other, and all such parts when replaced on account of wear, will work similarly subject to proper adjustments.

However, perfect construction of a swage or shaper in all essential working parts, will not overcome defects in the saw teeth, resulting from improper sharpening or some form of hand work.

For example, if one or a lot of teeth become sprung or bent sidewise from any cause in connection with actual sawing or the handling of the saw when off the mill, it is important that all such teeth be straightened and they must be sprung back farther than just "straight," because the steel will have become unduly compressed on one side and porous on the other, leaving the tooth weak in the direction toward which it was bent before, in which case it will be apt to bend back to its former position. Such tooth should be bent over beyond a straight position and then bent back to straight, to make same entirely normal.

Pitch or gum or saw dust often collects on the sides of the teeth, which should always be carefully cleaned off before swaging. Otherwise the face of the clamp screws will fill up to an extent that may cause the tooth to be sprung in the clamping process, out of square.

Again, if the grinding wheel is out of square with the saw, or if the center of the grinding wheel is not directly over the center of the saw, a bevel grinding of the tooth will result which will cause the teeth to swage to one side. In order to grind square, test the sharpener as follows: with the saw blade in normal position held by the saw clamp, ready for sharpening, place a long straight edge against the side of the saw extending up past the emery wheel arbor and hold a piece of saw of the same gauge as on machine, against the straight edge in front of arbor. If the emery wheel is properly set, the small piece of saw will line exactly with the center of the arbor.

An emery wheel head, that is badly worn and out of square or that does not bring the center of the wheel directly over the center of saw, will be a source of endless trouble and a new head or the necessary repair of the worn parts, should be immediately arranged for.

A remachining or rescraping of the slides, rebabbitting of the arbor, resetting of the head on the main front, dressing of bolt holes or insertion of new gibs or thin shims of tin, paper or otherwise, may variously be necessary, depending upon the manner of construction of the head and the extent of the wear.

But do not on any account allow bad conditions to continue. Also test the relation of the arbor to saw in all positions of the head, upward and downward, according to the diameter of the wheel when new and worn down, because the head might show right in one position and wrong in another position. For example if the wheel end of the arbor is properly centered over saw, but the opposite end of arbor is not, in such case the tooth may test square on back but not square on face.

A slight variation from square of a saw tooth, if not promptly corrected, will tend to a worse condition.

If the saw has struck iron or gravel and the corners of the teeth have become damaged, the opposite corners should be filed off before swaging to put the teeth in balance, so that in further swaging the corners will spread evenly. It is absolutely imperative that the teeth be kept square on face and back, with corners evenly balanced and in all respects straight, for the best results in swaging.

Swage shapers are made variously with one stationary and one moving die, the latter operated by a lever at side of tool, or with both pressure dies operated simultaneously by a single yoked lever. The latter construction with both dies moving is better calculated to keep the teeth straight. The dies should be adjusted to center the tooth, regardless of gauge, with the center of the tooth stop, so that as the dies come together, the pressure will come alike on both sides of the swaged tooth. The face of the dies must be ground exactly alike as regards angle or degree of the bevels; otherwise the steel will draw to the side of least resistance and the corners after shaping will not be in balance.

Should the teeth bend sidewise during the swaging process and then be straightened or balanced, the impression of die in face of tooth ought to be ground out before swaging again as the die mark on face of tooth whether bent before or as a result of swaging, will not be square if the teeth are straightened afterward.

The adjustment of any of the essential working parts of a swage or shaper should be very slight in degree at a time, carefully watching the result of the adjustment when swaging the next tooth, and thus making such further slight change in adjustment as may be necessary.

If the amount or character of the swaging or shaping of the teeth changes appreciably, this will indicate that the shape of the tooth or the amount of the stock in the tooth subject to the action of swaging or shaping dies, has changed, due to change in the hook or back of tooth as result of grinding or to other conditions, the cause and remedy for which should be readily ascertained.

The filling up of the throat due to loss of hook, will have a more marked effect in swaging according to the size and shape of the swaging die. A large die reaches down farther on face of tooth in the swaging process, makes a deeper impression, and a wider and heavier corner. A die as large as possible is preferable for soft, fibrous woods, when not frozen, being better adapted to clean the cut and steady the teeth in crossgrained or knotty cuts. It also forms a tooth, from which more can be ground off on back without grinding out the die mark on face, thus assisting in maintaining full backs. It also leaves a good swaging on face for reswaging purposes, when sawing logs having the bark filled with sand or gravel, thus causing loss of corners or undue wear.

It will be readily obvious that the sharpener, swage and shaper and likewise whatever hand fitting may be done on the teeth whether with an upset, swage bar or spring set or by pointing with a file, must be done with each machine in the best working condition and with each process performed with careful regard to the other processes. This requires a nicety in fitting that marks the difference between a good filer and a poor one.

USE OF A TOO LARGE AND POWERFUL SWAGE

It is bad practice to use a swage for 13, 14 or 15-gauge saws on 18 or thinner saws. Of the two usages, a swage too light for the work is preferable to one too heavy. With too light a swage breakage and delay may occur but material damage to the saw being swaged is unlikely. But with a heavy gauge swage used, the clamps grip the tooth too far back from point and buckling is apt to result. Hard clamping is apt to stretch the steel or mark same injuriously, leading to crumbling of the corners, when the swaging has worked back to the clamp marks. Hard clamping is also likely to impart a twist to the tooth, giving the tooth and blade a tendency to turn away from the side of tooth most deeply marked, and it naturally follows that a saw will lead to that side when in the cut.

SWAGING

Saw Swages are sometimes met with that have the clamp screw holes drilled slightly out of square, in which case it will help if the stationary clamp screw is backed out as far as the anvil will permit, as a means to prevent or lessen the tendency of the teeth to be thrown to one side.

Swaging to one side may also be caused if the center of emery wheel is not directly over saw.

In some cases the wear on end of clamp screws will be uneven and the teeth or corrugations may chip or break away in a manner that will tend to spring the teeth and throw the swaging.

Again the wear on face of anvil may be such as to throw the swaging. Immediately upon the appearance of any difficulty of this kind, all of the working parts, such as swaging die, anvil, clamps, emery wheel head, etc., should be examined carefully to determine where the trouble lies and then corrected. Spare repair parts for swage and shaper should always be kept on hand and substitution made when necessary. In cases of this kind the only thing to do is to locate the exact nature of the difficulty and apply the exact remedy, rather than to experiment with some make-shift or wait until the conditions have passed from bad to worse and cannot easily be remedied.

A band swage should be adjusted so that it will pull the points properly forward leaving the minimum grind for emery wheel when facing. Some filers employ a grinding wheel of finer grain for facing the points after swaging, than is customarily employed, this finer grained wheel not cutting so fast or so free as would a coarser wheel, thus leaving a finer and keener cutting edge. It is claimed that a saw thus sharpened with a fine grained wheel will run in clean timber for from one-half to an hour longer before dulling, than will the same saw sharpened with a comparatively coarse grained wheel. Try this out experimentally for yourself. Another result likely to be attained by the use of a fine grained wheel is a more nearly perfect uniformity of the teeth as regards height, length, shape, etc. If the sharpener does not work to a nicety, remedy this entirely or so far as possible. Under such conditions hand pointing of teeth with a file, unless some of the teeth have been up against foreign matter, can be dispensed with.

CAUSES FOR ONE-SIDED SWAGING

Points not ground squarely on face and back; swage anvil not ground true; or a swage anvil that has worn out of true; worn swage die or die bearings; clamp screw that does not clamp squarely by reason of wear or fracture; shaper jaws not properly adjusted; filing the points by hand out of square; points that have been worn out of balance by grit, gravel, etc. Thin saws are more difficult to swage squarely because of the greater tendency for the tooth to buckle if all conditions are not just right.

In swaging, if the tooth is too blunt or the swage takes too long or deep a bite on the tooth, this may cause a buckling or uneven spread of the steel.

If a saw is swaged out of square the saw will tend to lead toward the side that has the most swage.

Cracking of band saws has been overcome by the simple expedient of widening the bottom of gullet, thus doing away with a narrow angular gullet with the strain coming always in one spot as the saw bends and straightens in running over the wheels, also by slowing down the speed from 10,000 feet per minute to 8,500.

The "flutter" of the saw between the guides is caused by the lower guides clamping the saw, and is a prolific cause of bullheads and cracks, the former because it holds the saw as the shock of contact occurs and increases the overthrow of the top wheel. The flutter of saw above the guide is caused by the clamping of that guide and although it makes vibration and causes cracks, it does not make bullheads like the other, between the guides. High speed is another cause of bullheads and cracks, because of the greater shock of contact than occurs where the speed is lower. But perhaps the most prolific cause of cracks is crossline in the mill, than training the saw with the tilt. You should get the mill as square as brain, eye and nerve can make it and then a maximum strain can be put on with no hazard.

TWISTS IN BAND SAWS

Twists are in general, bends at one angle or another or are those arising from distorted tension. Bend twists are alike except in the degree of their angles.

A twist caused by distorted tension is removed by the ordinary process of leveling and tensioning and expansion of the back edge.

It is a somewhat difficult matter to find the real angle of the bend, especially so for a beginner. The affected part of the blade should be made as nearly level as possible with light leveling; after which use the tension gauge with pressure at all angles across the blade, trying to find the angle of the twist. Work from both sides, with the bend turned down on the leveling block. Rock the gauge on the bend observing at what point it bears hardest on both edges. If this does not show the angle, next turn the bend upward on the block and find what point on either edge is raised higher and compare this with what appeared on the opposite side. Hammer the bend, carefully observing the effect on the saw but do not hammer too much as you may pass from one bad condition into another. Avoid getting in too much tension as this is a decided disadvantage in removal of twists.

Among causes for twisted saws may be mentioned the pulling of saw off mill by accident, overheating as a result of running saw with too little swage for proper clearance and saws that have been run with a tight splinter in the guide, may lop over at opposite ends when lying on the floor, indicating a twist, perhaps small in degree but one that runs all the way round the saw.

Leveling with a hammer whose long peen is not in line with hammer body or handle, due to improper punching of the hammer hole or improper hanging, is also a fruitful cause of the saw taking on the form of a figure 8. So also hammering with the face of hammer held on a slight diagonal instead of straight is a possible cause. Beginners in hammering who are not trained in the use of a cross-face hammer, may very easily fall into error and be wholly unconscious of it.

The saw must be hammered all the way round if it needs it, diagonally the other way, following the time honored method of removing a twist, until it no longer lops over. Suppose the saw as you face it, lops toward you at the right hand end and away from you at the left hand end. In such case locate the hammer lines, say one blow to each inch with straight peen hammer. Begin on the edge nearest you and run diagonally across the saw from right to left. Hammer very lightly, placing the hammer lines about 2 inches apart. Then turn the saw over on the bench, and hammer around on the inside, crossing your diagonal hammer lines with those of the outside, and hammer very lightly here. Be closely watchful of results, and if the saw still lops over, go over it again, placing the diagonal hammer marks between the others. The weight of the hammer blows must be determined by experience and observation and one can easily turn the twist the other way, by undue or improper hammering.

After straightening the saw, level both sides both ways of the plate, and then put in the proper amount of tension and expansion of back. Avoid broad tires and if found at any part of the saw, narrow them down to proper width. Finally after tensioning, test to see whether the saw is still level and if more leveling is necessary, again test for tension, until the saw can be pronounced the most perfect possible.

THE FRONT EDGE OF A BAND SAW

The front is the important edge. Other parts of the blade may be slighted more or less but if the front edge is slighted or neglected, there is apt to be trouble from bullheads, snaky lumber, cracks, leading of saw, shifting of saw on wheels, loss of tension and of crown on the back.

Before overhauling the tire in a band saw, see that the crown in back is about right, level all lumps, equalize the tension, and have it show light under the tension gauge from edge to edge of saw. Then with a 3-inch straight edge, level the front of saw, working both sides and see that all teeth are straight with saw. Hammer first one side and then the other until no lumps can be found. Make the tension show light under the short gauge up to within ½ inch for an 8-inch saw and when the saw is bent upwards or downwards and the straight edge applied crosswise, the front edge of saw should show flat from ⅞ to 1⅛-inch from bottom of gullets. It is seldom necessary to roll nearer than 1 inch of bottom of gullet; indeed 1¼ or 1½ inch is often better. don't roll too heavily or put in too much tension near the front edge or the saw will be liable to crack and bullhead. If you roll too closely toward the front edge you may take out the tension and also take out too much crown from the back edge, besides the band mill wheels will tend to pull out the tension if you roll too near the edge. The front edge of saw should project about ½ inch beyond the edge of wheels when running. One-half of the unrolled inch or so of steel rests on the wheels, while the other half extends forward from them.

If the front edge of saw is carried too far back on the wheels, the tension does not hold well and the saw will be easily crowded back, especially when sawing pitchy lumber, and this causes the pitch to stick on the front edges of the wheels. If the tilt of the upper wheel causes the saw to run ahead at the top, shift one or both wheel shafts until the saw is trained properly.

Be sure that the crown on the back is true or the front edge will not have an even bearing on the wheels. Moreover in such case, a part of the saw will have the most work to do, thus throwing an uneven strain on the front. If a saw oscillates and you have failed to find the cause of the trouble in your bench work, mark the back of saw just before changing, holding a piece of red or blue chalk carefully as the saw runs, so that the full place in the back will be marked.

About 95 per cent of the cracks are caused by too much or too little tension in the section from 1 to 1½ inches from the front edge. No saw will do good work unless this portion is properly leveled and tensioned. It is not possible to judge the condition of this portion of the blade without making use of a short gauge. Sometimes a stiff or fast place near the front edge will cause a very rough cut which is not permissible in mahogany or similar choice woods. Care should also be taken not to screw up too high on the straining device. Excessive cracking in band rip saws is often due to this cause.

REMOVAL OF A "STIFF" PLACE IN A BAND SAW

In many cases a stiff place is a direct result of improper bench work, but if it is a bend either straight across the blade or on a diagonal, it may be due to an accident in operation. Level the spot in the usual way and likewise tension it with the gauge held lightly in the natural sag of the saw. Next bear down a little on the gauge and roll at the point at which the gauge rides if it does ride. If more tension results than will flatten out of the saw's own weight, hold the sag upward and rock a straight edge across it to see whether it is flat, or stiff under the tires; if it is, rolling out this stiffness will probably bring the tension about right. The saw should be tested all the way across with straight edge, with the saw on the rise and all portions should show proper expansion. Test very carefully all ways for twists or diagonal bends which always distort the tension. Of course filers of limited experience must work very carefully on twists or they may impair rather than better the condition of the saw.

THE WIDTH AND GAUGE OF BAND SAWS

Among the large and progressive lumber manufacturers of the United States there has been a constant effort toward the approximation of the cutting capacity of their band mills to the work of a high-grade circular. In following out this plan, the width of the saws has been steadily increased so that now the band saws in common use are from 10 to 12 inches wide, and in many cases 14 inches wide, in place of the narrow 6 to 8-inch saws used a few years since. These wide band saws are commonly 14 or 15-gauge. The wide saws are best calculated to stand the strain of very rapid feed, but when compared to 10-inch saws are open to the objection of increased weight and labor in handling, increased cost, and without much longer life unless handled very skillfully. Common experience demonstrates that the life of a band saw is pretty well gone when worn down from 1½ to 2 inches, if not sooner ruined entirely.

Some Pacific Coast mills employ saws 16, 18 or 20 inches wide, with teeth spaced up to 3 inches from point to point and with a gullet almost 1½ inches deep, such a sawtooth resembling in all respects that on a circular saw, and undoubtedly such a saw, properly fitted and fed, will make lumber rapidly, but it will never meet with general adoption. Most of the double cutting band saws are now made 12 inches wide, it having been found in practice that such width is practically as efficient and more economical than the 14-inch width.

Band Resaws as now used range from 17 to 24-gauge and from 2 to 10 inches wide. The lighter mills operated in woodworking establishments for resawing, use saws from 3½ to 6 inches wide and from 19 to 22-gauge. In the sawmills where the introduction of the band resaws as an adjunct to the log band or circular saw, is becoming very popular, the mills are heavier, and speeded to feed from 80 to 200 feet per minute. Being subjected to hard work, the saws are 15 to 17-gauge, and from 5 to 10 inches wide. The possibilities of the Band Resaw as an aid in sawmills are immense, and there is no doubt that every extensive lumber manufacturer will do well to carefully investigate its saving qualities in reduced saw kerf and labor cost and in improved excellence of product.

Band Resaw practice suggests that a ⅜-inch length of tooth on an 18-gauge saw, a $\frac{5}{16}$-inch on a 20-gauge saw, and ¼-inch tooth on saws still thinner will work successfully. The shape of the throat must be such as to avoid any sharp angle in gullet and must afford as large a chamber as possible for saw dust. The hook carried on resaws is about the same as that used on band saws for log sawing. It will vary somewhat according to the timber, being less on hardwoods and perhaps most on cottonwood, where the hook used is often extreme. The tendency with all makers of Band Resaw Mills is to increase the strength and capacity of their mills, to use wider saws, and to approximate the work of the resaw in every way to the work of the band mill, and very satisfactory results have already been achieved in this direction. The band saw mill, whether large or small, is the mill of the present and of the future.

THE BRAZING OF BAND SAWS

The cutting of saw preparatory to making the laps, can be most easily accomplished with a Crosscutting Shear, which is designed for use on saws of any gauge or width. The machine makes a perfectly clean, smooth, straight edge cut at one stroke, without buckling the plate. Having the saw thus cut in two, you will lay out the lap on opposite ends of saw with square and scratch awl. A ⅝-inch lap is suitable for either log bands or band resaws, although some filers prefer ¾ or ⅞ laps for wide bands.

The lap may be prepared by the use of a lap grinder or a lap cutter. The preparation of lap by hand is a method too tedious to be in general use, because it is difficult to file a lap by hand and do such fine, accurate work as is essential, to say nothing of the time and files required. Most important is the expense and loss of time arising from defective brazing, which is a considerable item where hand work is depended on.

The final result to be secured is a perfect weld that shall become an integral part of the saw. The first essential to this is that the two joints on opposite sides of the saw shall be beveled to a perfect fit, of exact widths, with ends square and the bevels true and of even thickness throughout. A lap thus prepared will afford an almost invisible joint and the saw will be left smooth and uniform in gauge. If the laps do not fit together perfectly no joint or only an imperfect one, will result in the low places. Every filer should give the greatest attention to this matter of uniform bevels.

Regardless of whether a Lap Cutter or an Emery Wheel Grinder is used in making a bevel or lap, there are many filers who insist that the bevels ought to be draw-filed before brazing, and if you draw-file, it is well to lay hot brazing irons across the laps, removing them when the color in the saw has passed a blue, so that if there be any hardness resulting from the use of cutter or emery wheel, it will be removed. Using a single cut bastard file 12 to 16 inches long for draw-filing, a few strokes will remove any marks left by the wheel or cutter, and you can then take the file by the handle with the right hand and grasp it a few inches away with the left hand and draw the lower part of the file along the bevel crosswise of the saw, being particular to secure a flat bevel. Marks thus made by the file afford a good surface for brazing. Do not leave a feather edge on the end of the bevel, but file to a blunt edge, leaving sufficient stock to trim after brazing. After draw-filing, apply the straight edge both ways of the bevel and also across the saw to see that it is straight and square. Do not touch the bevel with your fingers. On another page, reference is made to Brazing Compound, which is probably the best brazing fluid on the market. Every filing room ought to be equipped with a heavy pair of tongs for handling the brazing irons. It is very important that the irons, especially the side which rests against saw, shall be perfectly flat and free from scale, and after they are taken from the fire, the irons should be cleaned with a strong, sharp scraper. Be sure to apply the irons square across the saw to avoid twist. It will be readily obvious that a high heat is necessary for the irons, because unless they are quickly scraped and applied to the braze, they may not retain enough heat to make a perfect braze and so merely solder the joint so that it is liable to come apart when at work. The irons when taken off the fire may be also at welding heat and may be a bright red when applied. If you have trouble about the braze holding, it is most likely to be due to a lack of heat in the irons sufficient to heat the steel properly, although poor solder or the use of a Brazing Clamp that is lacking in power, or that does not insure an even pressure against the surface of the lap may affect results unfavorably. After full pressure is applied to the brazing irons, release the side clamps. It is well to leave the irons on the saw for one minute before they become black on the outside. Then release the clamp and remove the irons.

LAP GRINDER OR LAP CUTTER

In considering the comparative merits of a lap cutter and a lap grinder, which differ so radically in the manner they prepare the lap, something may be said in favor of each machine, but each machine is in extensive use, and each has its advocates amongst the practical users.

Using a lap grinder, the rapidity of the cut depends on the adaptation or cutting qualities of the emery wheel. If it cuts freely without glazing or filling up with particles of steel, it will cut rapidly and with little liability of heating or case hardening the saw and a well surfaced lap will result. A coarse wheel should be used and we recommend lap grinding wheels of 30 or 36 emery. The ordinary saw sharpening wheel of 46 to 60 emery is not suitable, because of the fineness of the grain. The final grinding should be a very light feed for the purpose of securing a smooth, true surface, without burning. Before clamping the end of saw on machine, it ought to be carefully leveled so that it will lie perfectly flat on the platen or table of grinder, and the clamp on machine must clamp the saw close to the lap. Otherwise if the saw is not perfectly leveled and any parts of it stand up unduly, the bevels will not result of even thickness and there will be thin spots in the lap that will not weld or weld perfectly. The emery wheel cuts everything that stands up to it, and cannot be depended on to press the saw down flat.

Under favorable conditions a lap cutter will make a more perfect bevel than a grinder and in less time. But a primary condition to the success of a cutter is that the saw shall not be unduly hard or case hardened. Our lap machines are supplied with spiral cutters made of the very best steel, expertly tempered, and on saws of ordinary hardness will mill laps in a very satisfactory manner. But any one at all familiar with milling machine practice, knows that there is a limit to the hardness of the steel that a cutter can work, and that when the limit is passed the teeth of cutter will either chip or rub away, and in either case an unsatisfactory lap will result. In all cases, good lard oil or some efficient cutting solution must be used on the lap, and in no case should a filer attempt to cut laps on a hard saw, without first annealing the saw with a hot brazing iron. A cutter working on steel capable of being milled successfully, will make a very smooth, true surface, as the action of the cutter tends to force the saw plate firmly down upon the platen, so as to mill the surface of uniform thickness, and in the case of a saw not perfectly level, it is apparent that a cutter would effect a better surface than a grinder, as regards uniform thickness. In this connection it may be observed that no one need expect that the cutter or emery wheel will follow the exact line of scratch awl made for marking the width of lap, owing to possible variations in the gauge of the plate, although the bevels will be in effect uniform. Many filers drawfile the lap, using a single cut mill bastard file. Drawfile to a feather edge, then file the edge square and finally test the lap both lengthwise and crosswise with straight edge, to be sure that you have a perfect surface.

Some filers object to the use of oil in connection with a lap cutter, and for this reason prefer the emery grinder, but as every lap must be carefully cleaned, no matter whether filed or ground or milled, the objection to the lard oil is more imaginary than real. Moreover any lap can be cleaned with acid or what is better, by the use of Brazing Compound, the best known compound for this service.

Every particle of dirt or grease or oil must be removed before brazing and the silver solder should also be cleansed in the same manner. A good solder is essential, and we can furnish promptly solder in ½, ⅝, ¾, ⅞ and 1¼-inch widths, and .003 thick. This solder is the best quality obtainable and is therefore the most economical to use.

THE BRAZING CLAMP

A brazing clamp that is at once powerful, quick and convenient, is an absolute necessity in every filing room, and there is probably no machine for filing room use that has been so liable to breakage, or that has caused more lost time. A great number and variety of these machines have been put on the market by different manufacturers. We manufacture ten sizes, for saws from 3 to 20 inches wide. Each style, according to size, is abundantly heavy and powerful, being for all practical purposes, unbreakable, fitted with rest to suit irons of varying thickness, efficient side clamps and powerful main clamps, well calculated to secure a uniformity of pressure across the entire surface of the braze.

Brazing irons for wide band saws are commonly made of 1 x 2-inch iron, and those for band resaws of ⅝ or ¾ x 1 or 1½-inch iron.

Place the scarfed ends of band saw on the Brazing Table with the back edge against the back of brazing clamp or up to the lines planed on table for use in the brazing of saws narrower than the capacity of the machine. Have the center of lap directly over the center of irons when in position. Slip the irons in position one over and one under the saw and squarely across the surface of the lap, and arrange the main brazing clamp so that saw when clamped will lie level with table, and so that full pressure can be instantly applied when the hot irons are in place.

Some authorities recommend covering the laps with a thin borax paste to serve as a flux. Such a paste may be prepared by burning some borax in a pan over a slow fire, frequently stirring it to allow all gases to escape, then pulverize as fine as possible. Put it in a glass and pour in enough clean water to make a paste, but not too thick. Apply this well to both laps. Another plan well recommended is to make the borax quite thin with water, heat it boiling hot and apply it in that condition. It thus spreads evenly over the surface and always sticks to the place. Others prefer sprinkling a little of the dry powdered borax over the joint before the hot irons are applied. Lump borax is best, powdered as used.

Cut a strip of silver solder, best quality, thin and flexible, the same size as lap or a bit larger, and clean this in the same manner as the laps, being careful to remove every trace of dirt or grease. Place the solder carefully between the laps, applying irons and pressure carefully so as not to disturb position of solder.

THE FORGE AND HEATING IRONS

The uniform and proper heating of the irons is very important, and for this use we recommend our special band saw brazing forge, the base of which has tuyure irons so arranged as to uniformly distribute the heat. The irons must be kept clean and free from scale, and the surfaces kept parallel and true. Heat the irons to a bright red in a charcoal, coke or bark fire. Some prefer a more intense—almost a white heat. The heating should be accomplished slowly and evenly, taking care not to burn the irons. When the irons are at the proper heat scrape all the scale from the sides to be applied to saw, and apply them centrally over and under the lap and squarely across, to avoid a twist. Apply pressure on main clamps quickly and then loosen the side clamps to relieve the strain on the body of saw. As the irons cool, tighten the main clamp from time to time. Allow the irons to remain on saw until black. This will leave sufficient temper in the saw to hold the tension when hammered and prevent the portion of the saw just brazed from becoming too hard. Do not remove the irons too soon or attempt to cool the saw with a dash of water, as this may render it brittle. The closer the scarfed ends fit, the surface of irons being true and the pressure of clamp uniform over the surface of the braze, the less solder will remain in the joint, the better it will hold, and the more invisible will it be. The operator who can make a braze that cannot be found without close examination, is a past master in the work. If the saw is a 14-gauge, dress the lap to a 15-gauge and you will not have any cracked brazes.

BAND SAW BRAZING AND THE FITTING OF LAPS

A. J. BURTON

Make the lap ⅝-inch, using a machine as you can make a better job than with file, and much quicker. I have ground both laps on a 10-inch, 14-gauge saw, in 11 minutes. After grinding the laps, place the saw in brazing clamp, and if you run "back" in the saw, push the saw along and set the back guides up so that when the braze is made, the back will be the same along the lap as it is in the rest of the saw. Attention to this will save time and labor in drawing out the back. Clean the lap and silver solder thoroughly. Do not use silver solder too thin as it will not flux as well as it should 3/1000 of an inch is the best thickness. With this solder I can make a perfect braze so that when it is dressed there will only be a small streak across the saw about the size of a silk thread, and my brazes hold well and are about as hard or stiff as any other part of the saw and will not bend when going around the sharpener as is so common with shop brazes. A braze that bends easily is sure to break about one inch from the lap, and you will not know the reason it gave way; but if you were to consider the number of times it has been bent and straightened, you would see that this continued bending causes crystallization in the saw at the place where the extreme edges of the irons were applied.

You cannot make a good braze with irons too heavy, for they don't clamp evenly, hold the heat too long, burn the steel and burn the life out of the solder, and frequently the braze will open up before the saw is in condition to go to the mill. Irons 1½ or 1¾ x ¾ thick are the best. Steel makes a better material for brazing irons than iron, for steel does not scale like iron and takes the heat more evenly. But if cast iron can be had it is better still. The irons should be heated slowly in a charcoal fire, as this is not so apt to burn the irons and cause them to scale, as soft coal. One of the forges designed especially for band saw brazing should be used, for it is almost fire proof and it has a long blast so that the irons can be heated their entire length without burning them. Heat the irons to a good light red, not a white heat, or the irons will scale and be smaller in some places than others, and the braze will miss. A common cherry red will not do but a light cherry red is O. K. Clean all the scale off the irons after they are hot, by scraping them across the edge of the forge. When the irons are ready, drop or pour acid on the lap until it is wet, then put on the irons square across, and clamp. Take the irons off as soon as they turn to a dark red or about the time the red turns blue. Then remove the saw from the clamp and fan it with a shingle or paper for a minute and you will see the saw taking temper again and it will not twist and curl up as it will if the irons are left until cold. Leaving the irons on until cold makes a soft lap.

After the braze is cold, pour on a little lard oil and rub lengthwise of the saw with a piece of No. 1 emery cloth, not sand paper, until all the black and rust are off. Clean with a file all lumps or surplus solder of saw that may run out, but do not file the laps. Then roll the braze, commencing in the center of saw and rolling toward both edges. Do not roll the saw except on the surface of braze where the irons were applied. Roll every half inch until you reach both edges. Then roll in the center until the saw becomes stiff, for the saw is fast after being brazed. Then level with cross-face hammer. Then clamp the saw lightly between the rolls, and put a block 8 inches deep, under the braze, on leveling table, and put a weight on the other end of saw. Hold this down and the saw will bend over the block and be easy to dress. Use a 10 or 12-inch file, and file lengthwise of the saw and you will not leave any mark or scratch as you will if you file crosswise of the saw, and a deep scratch will cause a crack in the saw at the spot in a short time. Do not leave the lap too thick or lumpy or dress it too thin, for if you do it will not last. If you take pains to make a good braze and dress and roll it properly, it will last as long as the saw. After the lap is dressed and leveled, roll in the tension as in the rest of the saw and make the back true.

BAND SAW BRAZING

H. F. GEORGE

First, place saw on hammering bench, marking where braze is to be made, then take out the tension for about 10 inches on either side of markings and after leveling on both sides the saw is ready to cut in two.

The laps for saws 6 inches wide should be ½ inch wide, for saws 8 to 10 inches should be ⅝-inch wide and for 12 inches and wider should be ¾-inch, which will make a very strong braze for different widths of saw, and with the automatic lap grinders now in use properly used, it is not necessary to finish with a file as the adjustments are so fine on these machines that one can grind the laps to a very thin edge and perfectly square in every way.

Before placing saw on brazing bench in position for brazing, examine the saw the full length of table and see that back guides are all up against saw so that after braze is made you will have same length of back as the rest of the saw and will require very little work in finishing up the back at the point where braze is made.

After braze is somewhat cooled off but still warm to the touch I begin rolling out the braze, starting in the center and rolling out to each edge, continuing this operation to the point where saw will lie perfectly flat on bench without tension, doing all of the work possible with a stretcher, by raising up or bearing down on saw while passing between rolls to take out the dish, using the hammer just as little as possible, for leveling both sides of the blade. After the braze is in this condition it is then ready to file on both sides, then ready for the final tension and leveling.

I think it advisable to carry just a little less tension in the braze than in the rest of the blade. I temper the braze by placing the saw on the hammering bench supported on either end with a block about 6 inches thick, then drawing a brazing iron backwards and forwards along the braze until it is brought to a straw color, then pulling the saw around so braze is placed in the end and left to cool off. After braze is completely cooled off I place it back on the hammering bench and if dished in either way remove this with a saw stretcher and level perfectly on both sides.

MISCELLANEOUS SUGGESTIONS

When laying out laps, it is better to line same with a lead pencil than to use a scratch awl. Any heavy scratch on a saw has a tendency to start a crack, unless removed by filing.

A band saw lap must be properly leveled before grinding as the emery wheel cuts away whatever stands up to it and cannot be depended on to press the saw flat as does a milling cutter. Hence if saw does not lie perfectly flat on the platen, the bevel will not be of even thickness and there will be spots that will not weld securely.

If the lap grinder wheel is dirty or greasy it may be washed with carbon bisulphide, benzine or gasoline so it will make clean laps, unless you prefer to redress them with a file. Very coarse grained, soft and fast cutting wheels are preferable for lap grinding, as made by the silicate process, because these wheels do not case harden and oxidize the steel so much as the others. Oxidation or coloring of the steel from heat, prevents the solder from sticking so well. The coarse wheels make a rough lap, thereby giving a better surface for the solder to adhere to Keep the grinding wheel dressed clean while finishing the laps to be sure there will be no case hardening.

To protect laps from dirt and injury prior to brazing, fold pieces of clean, dry paper over them, then drive slotted pieces of wood over the paper. Cut the slots with a hand saw, lengthwise of the pieces, which should be longer than the width of the saws and of any suitable thickness. This will prevent finger marks on the lap which will affect the braze because moisture from the skin will cause rust on polished steel in a short time.

If a lap has been made by milling with a lap cutter, every particle of lard oil used must be eliminated by use of a brazing compound or effective acid agent to completely eliminate the oil.

DRAW FILING BAND SAW LAPS

In grinding laps there is usually some glaze left on the surface, no matter how good a cutter the grinding wheel is. The glaze may show in numerous small bright or shiny spots. This is merely case hardening of the saw in a mild form, although not showing "blue" as is the case in extreme case hardening resulting from grinding too hard. Many filers consider it correct practice after lap grinding to drawfile the surface of the laps, using a new sharp file, free from dirt or grease, until the whole surface of the lap is refaced, with the file scratches extending across the saw and with all glazed spots removed.

HARDENING BAND SAW BRAZES

There are some band saw filers who consider it good practice to harden their brazes, and we will quote below the practice of a number of these men as described in their own language. It will be observed that the method is about the same in the different processes described.

"A band saw braze may be hardened by taking a piece of flat iron about 1 x 2½ inches in size and heating it to a good bright red, then with saw on leveling block propped up with sticks to keep it off the block, rub the hot iron over the surface of braze until it is heated to a dull red, then quickly drop the saw on leveling block, put a cold iron on top of it, thus suddenly cooling it, and the braze will be no more likely to bend than the rest of the saw and will last much longer than a braze not so treated."

"After the braze is properly fitted, tensioned, etc., take a short iron about the same size as you use for brazing, and make it about 6 inches long. Bend it in the shape of a part of a small circle, say of 8 or 10 foot diameter, and heat the iron to a cherry red. Lay the saw on hammering bench, holding the saw up a little, and pass the iron back and forth over the inside of blade, until it turns to a straw color, leaving a strip on both edges, not tempering too close to the extreme edges as your saw is liable to crack in the braze if you do. This operation should be performed as quickly as possible. Then run the saw around so that the braze comes exactly in the end of plate, soon as you can, after the tempering is done and still hot, as in doing this it will cool in its natural position."

"It will be found necessary to level the braze on the inside, as the heat will dish the braze a little. This process should be done every three or four months, it being only a temporary process in the art of tempering and will not last permanently. Soft brazes can easily be overcome if a person will exercise a little care and not leave the iron on too long. A braze that will bend when the saw is being handled on the bench should be tempered again. Some brazes are made too soft by using too heavy irons and having to apply them several times, in order to get the braze to hold; for every time the saw is subjected to these conditions, just so much softer the braze is apt to be, as the extreme heating of the saw burns the life out of the steel and leaves the braze practically without any strength at this point. Sometimes the flux used for brazing purposes will leave a soft braze, no matter how you try to guard against it. Borax used in certain form, will do this very thing, still a great many filers will not use anything but borax for brazing."

"In the process of hardening a braze considerable care is necessary in the process to avoid too great a heat, as otherwise blue spots will result."

"My method is to lay the saw on bench on top with braze over leveling slab. The braze is first tensioned, leveled, etc., after which I raise it say 3 or 4 inches by putting blocks under saw on each side of braze, then holding an iron say 1 x 2, 3 or 4 inches longer than width of saw, heated to a bright red, the full length under the braze and far enough below same—say from ½ to 1 inch—so that it takes about two minutes for the straw color to show on inside of saw. More or less moving back and forth and up and down of the iron is necessary to produce the straw color over full width of saw, after which remove blocks and allow braze to lie on leveling slab, placing a straight faced anvil face down on same, as quickly as possible, allowing it to remain there until cold. Since following this method I have found a marked difference in the tendency of my brazes to open or crack, as a result of constant bending and straightening of the saw on the mill, which like annealed wire, will ultimately disintegrate the fiber of the steel."

"The most successful plan I have found is not a 'temper' but a 'stiffening,' by tensioning a little more each side of braze, with very little tension for about a 4-inch strip where the braze is discolored. Since adopting this method I have very little trouble with bent brazes. As high tension tends to produce a limber blade, it naturally follows that a short space with little tension will be more rigid or stiffer than the more highly tensioned parts on either side."

"For hardening a braze I find the use of a gasoline blow torch better than the use of hot irons, for with this I get an evener heat without the danger of getting too much in any one place. If the torch works well it will not discolor the steel and the color can be easily seen."

"After I have dressed and tensioned the braze, I put it on the leveling block or near the middle of the bench ,and place a block of wood or piece of iron on each side of braze to raise it off the table 1 or 2 inches. I then throw a torch flame from one edge of braze to the other, until it assumes a blue color, heating the saw evenly as possible. When the braze is a nice blue color, I pull out the pieces that keep the saw up off the bench, and allow it to lie flat on leveling block. I then place a small anvil or block of iron directly on braze and let it cool. I dress the braze one gauge thinner than balance of saw, and find that a braze so fitted will neither bend nor break."

B. T. & B. BRAZING COMPOUND FOR SAW SHOPS OR THE MILL FILING ROOM

Price per 4 oz. bottle...$2.50

Parcel Post and insurance prepayment to points in the United States or Canada, 15 cents net additional.

This brazing compound is a chemical preparation of remarkable efficiency for cleaning laps and silver solder preparatory to the brazing of band saws.

It is in general use by saw makers and saw filers for use on band resaws and wide log band saws.

Once a user always a user.

It is inexpensive, free from tendency to deteriorate if kept tightly corked, and proves an important and valuable aid to successful brazing. Saw filers generally are very enthusiastic in its praise and many sawmill operators order in lots of three to six bottles at a time.

We strongly recommend this compound for general use.

DIRECTIONS

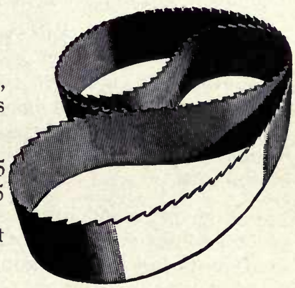
After preparing the laps on ends of saw, drawfile if case hardened. Clean the laps and solder with the compound to remove oil or dirt and wipe dry with a clean cloth or waste. After clamping saw in position, pour on compound so as to thoroughly moisten the silver solder and laps. Complete the braze in usual manner, being particular to have the irons true on face and free from scale. Subject to the exercise of proper care a fast, firm braze is sure to result.

M. C. of A. Brand Silver Solder

Widths regularly carried in stock: ½, ⅝, ¾, ⅞ and 1¼-inch. Special widths rolled to order.

Per oz..$1.75
In 6 oz. or larger lots. Per oz.......... 1.65

Prepayment by express or parcel post will be charged at cost.



Most customers employ our ½ to ⅝-inch solder for brazing band resaws from 3 to 6 or 8 inches wide, and ⅝, ¾ or ⅞-inch solder for log bands ranging from 10 to 20 inches wide. We recommend 1¼-inch solder for brazing in patches in connection with our Patch Machine.

We specialize in the sale of strictly first quality silver solder. The price per ounce is rather less important than the making of perfect brazes that hold, and since an ounce of solder will serve for from 6 to 15 brazes, according to the width of the saws in use, the saving of a cent a braze by buying a cheap, brittle alloy is not an economy when it involves the risk of losing the braze and all the labor put on it.

M. C. of A. Silver Solder is furnished in metal boxes bearing our imprint and will not deteriorate.

We strongly recommend it to saw makers, saw repair shops, and for use in all filing rooms.

Domestic or export orders for any size or quantity can be filled promptly.

CRACKS IN BAND SAWS

Front cracks in band saws may arise from allowing the wheels to wear off rounding at the front, or from tracking the saw too far off the front, either of which will leave the front edge unsupported; from case hardening the throats of the teeth by use of a grinding wheel unduly hard or running at too high a speed or fed too rapidly to the saw; from cross-lining the wheels, which is neither proper nor permissible; and from improper tension, with the saw too open or "fast" just below the teeth.

Center cracks, in line 2 to 3 inches back from points of teeth, are usually caused by tracking the saw too far forward or by a rounded front edge on wheels, or both. Center cracks may also be caused by spots in the saw being too open or by the blade being too open all around, causing it to vibrate every time it goes round the wheels, straightening and bending four times at each round trip; or by reason of lumps or spots, too "open," striking against the liners of the guides, especially when the guides are closely adjusted.

When the tension is evenly distributed throughout the blade, it will not crack at center or edge, even though it may not be open enough to stand heavy feed without snaking.

Each filer must determine for himself when he has a proper amount of tension to stand the feed and the sawyer also should exercise his best judgment, and regulate his feed properly to suit the power, tension and general fitting of the saw so as to produce quantity without sacrifice of quality.

Band saw steel is now made of high quality but there are several tests that may be applied to saw steel, if the action of the saw raises any question as to its quality. The teeth must stand the action of the swage, working properly; must hold their corners after shaping, in all kinds of timber and hold the cutting edge for a reasonable amount of sawing. The blade must hold its tension against a reasonable amount of strain, indefinitely, and against the possible heat and expansion from sharpening for a reasonable time, although the grinding at base of gullet is bound to let down the tension ultimately, no matter how carefully or properly done.

If saw teeth stand swaging and hold the corners without crumbling, the steel is evidently not too hard. If the teeth hold their edge and the blade its tension under reasonable service and conditions, it is evident that the blade is not too soft and barring accidents and incompetency, a 12-inch 14-gauge saw on 8-foot wheels should never crack within a reasonable lifetime, and should wear down to at least 10 or even 8 inches in width, or until it becomes too narrow to stand the feed, up to the capacity of the mill.

It is not good practice to put a narrow 14-gauge blade, that has previously been run on 8-foot wheels onto smaller wheels, but if the blade is ground down to 15-gauge for 7-foot wheels or 17-gauge for 6-foot wheels, it should afford good continuous service.

POSSIBLE CAUSES FOR CRACKING AND BREAKING OF BAND SAWS

(Enumerated without regard to relative importance.)

Poor steel or steel of uneven temper or hardened on either edge during the process of parallel grinding in manufacture.

Case hardening the gullet with emery wheel in sharpening.

Filing or grinding sharp angles at base of gullet.

Too much or too little tension.

Tension unevenly distributed.

Improper hammering or "pounding" of saw causing marks or dents.

Excessive use of hammers as a result of "no stretcher" or a "poor stretcher."

Braze not properly dressed, leveled and tensioned, or started by careless handling on or off mill.

Leaving file marks on saw or thick and thin spots when dressing the braze.

Uneven and improper expansion of the back edge, a result of "no stretcher."

Irregular and uneven teeth causing undue strain at spots.

Forcing the steel unduly and too rapidly in swaging and shaping, as a result of improper adjustment of swage and shaper, and "too much swage."

Accumulation of gummy, dirty, incrustated and rusty patches on the face of the band wheels, causing uneven strain.

Use of the saw when the teeth are too dull.

Undue feeding beyond the tensile strength of the blade as a result of "letting her go for all she's worth." Such feeding will quite surely find the weak spots and cause cracks, for the molecules become disintegrated and their cohesion ceases.

Chips, saw dust or other substances dropping between the saw and lower pulley.

Running saws on wheels out of alignment or with face out of true; loose in their bearings, or canted so as to run the saw hard against the back guide, or too small diameter for the gauge of the blade.

Hardening of the saw at braze.

Having saw pulled off wheels.

Neglect to relieve the wheel tension when saw is idle. Running saw under too great strain.

Unsuitable guide pins or guides improperly set.

Carriage and track out of alignment with mill.

The reason for and by natural inference the correction so far as may be of the causes that lead up to cracks or breakage, are subjects that interest sawmakers, sawmill operators and saw filers. It is frequently charged to sawmakers that fractures are generally caused mainly by poor steel, or steel of uneven temper, but the cause generally lies apart from the saw plate.

The steel used in the manufacture of band saws is among the best, toughest and most costly of any used in the woodworking industries. No manufacturer can afford to ruin his reputation by sending out saws of an inferior quality and if a saw does not do good work, it will not be amiss for the filer to first see that he has personally committed no errors of omission or commission in his saw fitting before condemning the blade. A fracture will soon occur in the best made band saw if run with uneven tension. Many saws have already been ruined by uneven tension and doubtless many more will be, as beginners are found in every band saw country, and even the more expert filers may overlook a fast place and find a crack presently as a result. The saw filer must always be observant to see that his saws have uniform tension, proper pitch to prevent crowding back on the wheels, wheels properly aligned, perfectly square or balanced swaging, perfect sidedressing, just the requisite amount of clearance to suit the wood being sawed, rounded gullets, and saws sharp with the points free from glaze or case hardening.

It is evident that band saw steel is tough steel, from the fact that 12-inch band saws, 14-gauge, have been tested for tensile strength on a Riehl testing machine, and showed an average tensile strength of 150,000 pounds or over 12,000 pounds per square inch. This being true one may wonder why a band saw with only from two to four tons strain will crack so frequently. This is probably explained by the fact that the strain comes mainly on the toothed edge of the saw, which when run at a speed of 8,000 to 10,000 feet per minute, causes the slack side of the saw to vibrate materially, the amount of vibration varying under a given speed, according to the uniformity of tension of the saw blade, balance and rigidity of mill, and stability of its foundation. This vibration causes a strain that can hardly be estimated. But that it adds a strain is undisputed, and strain is greater with the greater speed for the mill. Vibration being such a factor in the causes for bad results in band saw work, it follows that particular attention should be given to the wheels and their shafts, the journals and boxes; the wheels must be round and in perfect balance and the shafts must run free in their boxes with no lost motion. Sawyers occasionally complain that their saws which have been doing good work and giving satisfaction, commence to crack and finally break. This fact is not so surprising when you consider the immense tensile strain the saw is subject to while running, and the immense number of times in a day that the saw is bent and straightened in running over the wheels, all of which tend to cause disintegration of the saw and subsequent cracks.

It is usually the case in the mills in which the saws are speeded above 10,000 feet per minute, that the filers are very expert in fitting for such high speeds, or the life of the saw is short and the saw bill large. As between different mills there is wide difference in the saw bill, some expending double the amount that others do for new saws, owing to the frequent breakages. The tensioning of high speed saws must be very fine and even, otherwise cracks and many of them appear, long before the saw is worn down to a point where it is too narrow to stand the strain of the feed. As between different saws there is occasionally found some difference in the quality of the steel, which affects their life, notwithstanding the utmost care on the part of the maker.

It is sometimes observed that new band saws fresh from the factory, if put on the mill and run without examination, show a tendency to crack in numerous places on the back edge. This is probably due to the manufacturer having left a strip along the edge which is subjected to extreme strain under the action of heavy feed. Such saws may usually be made good by shearing off a narrow strip along the edge, retoothing, and then revising the tension. Some millmen and some filers expect that their new saws shall come to the mill in perfect condition to run. Having received new saws they immediately subject them to the most severe tests, and should they fail to meet these tests, the saw is thrown back upon the maker as worthless, and perhaps ruined. This is not just, nor is it fair to suppose that a sawmaker at a distance, unfamiliar with the special individual conditions that are so apt to characterize every mill, can always put up a saw that will be adapted to the work with no refitting or retensioning. You may suppose that the sawmakers are infallible, but it is likely that they would prefer you to give them the benefit of a doubt as to this. It is a well known fact that sawmakers turn out mainly good saws; that none are exempt from some poor ones; but their efforts deserve fair treatment, to say the least.

In high speed saws it is apt to happen that vibration is increased with speed, distortion of tension is increased by vibration and fracture of saw by both. Besides high speed and the attendant vibration being a cause for fracture, there is an added cause, the constant impact of the saw against the wheels, the constant bending and straightening, the constant tensile and torsional strain of the saw, all working in conjunction with the defects that may exist in the blade itself, either by fitting or innate defects, and it is a wonder that band saws endure so well.

Hence there are those who think that wheels speeded not over 7,000 to 8,000 feet per minute will do more and better work at less relative expense than when run at a higher speed.

There are two things to be considered in the successful operation of a mill; namely, quantity of output and quality of output. And while the quantity of output of one mill may be increased over the output of another mill, by high speed, big feed, and saw teeth shaped especially as regards long spacing, extreme hook, and large gullet to chamber the dust, yet it often happens that the mill with the lesser output manufactures its lumber so much better that it is more profitable to its operator. The mill with a "record" is not the one that has turned out under forced pressure, a large amount of poorly manufactured lumber in one hour, or a ten hours' run; but rather the mill that day in and out for the season makes a good record of well-made lumber. A big one day record is a will-o'-the-whisp that beguiles millmen but does not profit them.

If the tension approaches too near the edge of teeth, fracture may result. If a saw has fast and loose spots in it, the tendency to crack is largely increased, the fast spot cracking from undue tensile strain, and the loose spot from constant buckling of surplus metal.

Avoid sharp gullets to the teeth; this concentrates the bend of the saw as it runs over the wheels too much at one point. Use as long a gullet as practicable with no sharp corners or abrupt angles.

Teeth that are too long chatter in the cut and sometimes cause fractures by throwing undue strain on the blade at the root of the teeth. Never let the saw come in contact with the back guard wheel as case hardening is bound to ensue, from which cracks will surely result. In case saw is forced against the guard wheels and case hardened, remove the glaze at once by holding a piece of soft emery wheel against the back edge while saw is slowly running, or by draw filing.

Another cause of fracture is that the guide pins are sometimes depended on to support the saw. A saw striking or vibrating constantly against the guides is very liable to fracture. If you depend upon perfect saw fitting rather than the guide pins to support the saw you will have less actual labor in caring for saws and few, if any, cracks or breakages. If saw rattles or vibrates when placed upon the wheels in operation you must look to the tension or strain of the saw to correct this or a cracked saw will surely result. The saw may have been tensioned too much in spots. The strain placed upon the wheels is not sufficient to bring the blade true or to straighten out the portions which have been unduly expanded and these lumps strike the guides, crystallize the saw and fractures start in the center of the blade as this is the portion that usually receives the most hammering or rolling. It may seem strange that these cracks occur in the center of the blade where there is apparently the least strain or where saw is most loose, but such is the case. Uneven tension will cause cracks in the center of blade.

ADJUSTMENT AND CONSTRUCTION OF BAND SAW GUIDES

The guides for supporting the saw blade must be properly fitted and adjusted and the column carrying the upper guides must stand exactly parallel with the saw blades. While the guides are a necessary adjunct to the mill, yet the saw should run practically independent of the guides. The back guide should never be used except as a measure of safety. If the column carrying the upper guide be not nicely aligned, the saw will come in contact with the upper guides either on wide or narrow lumber, as the case may be. The saw must not vibrate against the guides. Keep the wheels perfectly aligned; the crosshead carefully adjusted to see that it is free to move up and down and thus retain an even strain on the blade; the feed rolls aligned with the saw blade, and the whole machine examined to see that all parts are nicely in balance to avoid all tremble or vibration. Having the above points attended to, if the saw fails to do good work, it will be found that it is not perfectly tensioned or perfectly fitted, and the fault of this is chargeable either to a lack of a good filing room equipment, or to a lack of skill in its use on the part of the filer.

Set the guides so you can see a fair light between them and saw. The closeness of the guides to saw must depend somewhat on the fineness of the tension. If the saw is perfectly leveled, it will run on a narrower opening of guides than if it contain lumps, twists, etc. Guides are variously made of steel, hardened babbitt, wood, etc. Steel or babbitt guides are most commonly used. Wood guides are open to several objections, that if water is used on saw they are not reliable, and they are more liable to heat the saw. If the guides are set too close, the laps in band saw may strike against them and cause a crack to start at this point. It is well to dress lap a trifle thinner than the regular gauge of saw.

FEEDING THE SAW

Feed all the saw will stand and feed uniformly, according to the cut. This is a matter of judgment and education.

The matter of feed is an important item in the successful running and life of the saws. The good sawyer is the one who will get all the lumber out of a log there is in it at a rate of speed up to the capacity of the mill and not strain the machine or saw in so doing. Let the feed get away for only an instant and a fracture is almost sure to result.

There is a limit to all powers of resistance and endurance. The pressure of the feed while expanding and making fast the teeth crowds the openness of the tension to a dished form, causing the saw to come in contact with the side of the kerf, producing heat which, as is natural with steel, draws toward the point of friction, gets more dished and loose, and becomes rigid. The teeth now seek one side. It matters not how perfectly the saw may have been adjusted in tension or in sharpness, it is powerless to resist under these conditions and is apt to crack on the edges or in the body.

Overfeeding the saw has the tendency to force the saw back on the wheels, to unduly strain it and lengthen the toothed edge, and so cause a vibratory or wavy line, and may have the effect of forcing against the back guide and working considerable injury.

EFFECT OF DULL SAWS

A normal feed has the same effect upon a dull saw as feeding a well sharpened saw beyond its capacity. Watch springs break and yet the strain on them is comparatively light, being all in one direction, but here is the mainspring of the mill being wound and unwound thousands of times daily. There is a bending and a straightening in two directions a thousand times per minute. Were it not that saws are sometimes run when entirely too dull for good service, there would be no occasion to urge the importance of keeping the saws sharp. There are filers who think it good practice to swage very heavily right up to the limit of ductility of the steel, and then get just as many runs out of the saw as possible. Thus 14-gauge saws are sometimes swaged out to 6-gauge or an even ¼ inch, but such practice will hardly recommend itself unless the character of the timber requires an exceptionally wide set. Better swage to 9 or 8-gauge, swage frequently and lightly each time, and a saw thus swaged and kept sharp will be the most satisfactory in its operation. Frequent swaging is usually possible and easy, and the corners can be kept out full and uniform.

INSUFFICIENT OR IRREGULAR SET

While it is desirable for the saving in saw kerf, to run with as little set as possible, yet there must be sufficient clearance to escape the grain or fibre of the wood, which closing at the sides and base of the teeth, produces heat, and this if in undue degree, causes expansion resulting in a wave motion, likely at any time to start small cracks at base of teeth if there are weak or case hardened spots.

RUNNING WITH TOO MUCH SWAGE

An extreme amount of swaging increases the tensile strain upon the saw. The proper amount of swaging varies according to the timber being sawed; hardwoods requiring the least set, and soft or fibrous woods requiring more. A clearance of 4 to 5 gauges is usually considered sufficient by most filers and few make a greater distinction than 1 gauge of set as between hard or soft woods. It is a well known fact that many run their saws without distinction upon all classes of stock that approach the saw, and there are mills that cut a dozen different kinds of wood almost daily, with relatively equal success. The final fitting of circular saws differs greatly in different parts of the country, according to the timber being cut and the class of the logs. Seven-gauge circulars are most commonly used, running on from ¼-inch to $\frac{5}{32}$-inch set. Some of the Southern and Pacific Coast mills run 5 or 6-gauge saws, and in the latter section run a set of from ⅜-inch to ½-inch. The saws in use for hardwoods vary from 8 to 11-gauge and are run variously on from $\frac{3}{16}$ to ¼-inch set. Gang saws in common use vary from 11 to 16-gauge; log band saws from 14 to 16-gauge; rift gang saws from 15 to 18-gauge; band resaws from 18 to 22-gauge.

RUNNING SAW UNDER TOO HEAVY STRAIN

The tensile strain should only be enough to prevent slipping of saw on lower wheel, for no amount of strain will make an irregularly tensioned or poorly aligned saw make good lumber, but will instead bring more strain on every part of the mill and cause the saw to crack much sooner. The large capacity, good mills now rarely exceed a strain of 5,000 pounds. The saws should be slackened after use, which will permit of the free contraction of the blades on cooling down after work. Some claim that more saws are broken from insufficient strain than overstraining, because in the former case, the saw, by dodging is brought in violent contact with the guides, and is thus crystallized and made ready to crack.

Every filer should endeavor to have full knowledge of the working conditions of each saw, and should examine each blade carefully as it comes off the wheels, and be careful to see that the mill is in good order, for if it vibrates or the wheels are not true, all efforts to make saws run well will fail. With so many different band mills to select from, most of them with good records, and built properly proportioned and with the metal so distributed in the machine that the saw can be strained up to the proper point without springing or distorting any part and have an ample margin of strength to stand the additional strain put on it by vibration, the buyer of a new mill may confidently expect to get good value in his purchase. It is always well, however, to make sure that the "talking points" are also "running points."

HANGING THE SAW

Have the upper and lower wheels in line; place saw on wheels with teeth projecting in front of face of wheel; raise upper wheel, hanging proper weight on tension lever; turn the wheels slowly by hand and with the tilt lever train the saw to proper position, with teeth projecting ½-inch to ¾-inch beyond the edge of the wheel. Having saw thus properly adjusted on wheel secure the shaft in this position and do not further adjust it vertically so long as this saw is in use. As the saw becomes dull or tends to crowd back on wheels, you can counteract this by the use of the crossline lever; but a very slight adjustment of this is all that should be attempted or you will cause your saw to run in a twist. The better plan is to take saw off and resharpen or refit it, if it does not stay in place on the wheels.

All practical men are well agreed that the crossline should never be used except for lining the wheels unless in case of accident, the sawyer makes use of it to temporarily hold the saw on mill, as where a sliver or piece of bark lodges in the guides and tends to throw the saw. The use of the crossline puts your saw in a twist, and this is one of the main things to avoid.

THE REPAIR OF CRACKED BAND SAWS

A complete outfit for Lap Making, Brazing and Patching band saws will comprise a Shearing and Crosscutting Machine, Brazing Clamps, Lap Grinder or Lap Cutter, Patch Machine, Special Brazing Forge, Brazing Compound and Silver Solder.

Having cracked saws three things are desirable: (1) discovery of the cause, (2) application of a remedy, and (3) the repair of the crack. The foreman, millwright, sawyer and filer must look to the cause and remedy but the filer alone is concerned with the repair of the crack. If the cause of the crack has its origin in the filing room and arises from improper sharpening, swaging, side dressing, tensioning or brazing, the operation of the machine or the process of fitting must be improved and if the trouble arises from a machine worn out or improperly constructed or from the absence of any machine at all for the process, it is a short sighted mill or factory operator who will allow such conditions to continue.

The repair of the crack must involve either a braze or a patch. If the crack is not of such location or extent as to render it necessary to cut the saw in two, prepare laps and make a full width braze; then we call the attention of all not fully or satisfactorily equipped for these processes to our Shearing, Lap Cutting or Grinding and Brazing Machines, made in several sizes to suit the needs of both log band and band resaw operators.

PATCH MACHINE

Every owner and filer of band saws has to contend with cracks starting on the back or toothed edge, and there are few band filing rooms in which there are not from one to six or more saws on the racks in disuse, not because these saws are necessarily worthless, but because the cracks render them unsafe to run for good work on the usual feed, and because there is at hand no simple, convenient and successful device for patching cracks and restoring the life of the saw.

Our Patch Machine and the process both have merit and will recommend themselves to every millman and filer who wishes to preserve the life of the saws and by so doing simplify the tensioning and insure a maximum feed. Every crack or new braze tends to weaken and shorten the saws by so much, and a number of cracks and brazes ordinarily involve a further expenditure for new saws.

If you have a saw with a crack that extends inward from either edge far enough to weaken the saw, it should be patched at once, thus restoring in large measure its integral character. This is far better than to permit the crack to extend further and necessitate the cutting and brazing of the saw its entire width. It is a much easier and quicker process to prepare the saw for a patch an inch long, more or less, than to prepare two laps the width of saw. It is easier to straighten up a patch than a braze, as you have only an eighth to a sixteenth as much surface. In brazing on a patch, the heated irons are applied only over the surface of a patch, and no other portions of the blade are affected in the process. As a result the saw becomes almost or quite as good as new at the weak spot. New teeth can be brazed in, if occasion requires.

The method of patching therefore suggests a distinct saving in time, labor and material, together with the preservation of the life of the saw.

Look over your old saws. The repairing of one saw will pay for the machine twice over.

The sole purpose of the patch machine is to mill the groove or seat for the patch. This is a short and simple process. The saw, patch and solder are to be cleaned with Brazing Compound or suitable acid in ordinary manner. The patch strips require no fitting other than cutting to proper length. There is nothing about patch brazing that differs from full width brazing except that you must hold the patch properly in place. The proper exercise of care in this is entirely foreign to the patch machine itself, and if a saw filer fails in this part of the work, he can blame only himself. Many filers are using the machine successfully on log bands and band resaws of all gauges in common use, and there is no more question about the efficiency of a patch machine than of a swage, sharpener, stretcher or any other essential filing room equipment.

PREPARATION OF GROOVE FOR PATCH

The patching of cracks involves two processes: (1) the cutting or milling of groove or seat to receive the patch along the line of crack, this being accomplished by the patch machine; and (2) the brazing in of the patch, furnished with the machine and shaped ready to fit the groove perfectly and in gauge to suit the saws in use, whether log bands or the lightest band resaws. The cutter mills the groove, starting from either edge of saw required, the machine being operated and the cutter fed by hand power. A groove can be cut at the rate of an inch every five minutes at an ordinary speed, and should be cut on the inside of saw. The machine is intended to make it possible to check and repair cracks before they extend far into the saw, so as to impair its life or feeding qualities; and as the patch applied is only an inch long, more or less, instead of a braze from 6 to 14 inches wide, you save the cutting in two and consequent shortening of the saw, the time and labor required to prepare the laps and to fit and straighten a full width braze, and you restore the strength of the saw at the crack, and render effective, saws already impaired or fast becoming so, and hence soon likely to be condemned.

Use a good lard oil when cutting the groove, and if the saw is extremely hard or case hardened, the steel may be annealed at the crack with hot blacksmith tongs, to avoid liability of injury to the cutter. Run the cutter forward, never backward.

METHOD OF PATCH BRAZING

Patch Brazing requires a little more skill and practice than it does to make a lap, but practice will make you perfect, and after you have brazed in a few you will much prefer patching to cutting and brazing a saw all the way across.

1. First, place your saw above on the hammering bench, flatten down perfectly the part where the saw is cracked. If crack runs in straight, place your try-square across the blade directly over the center of crack and mark or draw a line. Should the crack vary either way, draw two lines, marking them on either side, so as to bring the crack as near the center of two lines as possible.

2. Determine the depth of crack and draw another line parallel with the blade 5 or 6 inches, so you can tell how far to mill in to remove all broken fibres of crack.

3. Clamp saw down firmly on the bench and as near level as possible. Place your patch machine on the saw directly over the crack, so that the milling tool comes in center and in dead line with the line across the blade, using caution to get the machine as near square on the saw as possible. This will aid you in getting both bevels the same and in removing the crack directly under the base of tool.

4. Clamp down your machine perfectly solid, tighten up face plate so as not to allow any side action to the machine while milling out the crack.

5. After you have milled in so that the tool comes in line and corresponds with your line drawn parallel of the plate, and you are satisfied you have the crack all milled out, turn back your milling tool and remove the machine.

6. Wipe off the groove on lower and upper parts of blade. Take a 6 or 8-inch file and with the point file down any little rough spots of the groove left by milling.

7. You can't get a patch to stick unless your groove is perfect, as the solder will run to the lower places and leave an imperfect patch.

8. Clean the groove, also the patch, with a little Brazing Compound, and wipe dry with a clean white cloth.

9. Cut a strip of solder a little longer than the groove. If you have none wide enough, use two pieces. Flatten them down as near flat as possible and clean with emery cloth or a little Brazing Compound.

10. Circle the ends of solder to correspond with the circle end of patch. By doing this you can tell exactly just how far to place your patch in, as you can see end of groove.

11. Place your saw in the brazing clamp and heat your irons on point. Dampen the groove with Brazing Compound, also the patch. Place in your solder, putting in patch directly over the groove, having the circle end a little flush with circle end of groove, leaving the head of brazing clamp turned back.

12. Whittle down thin a piece of soft wood (white pine preferred) 5 or 6 inches long, placing same parallel over the patch, and clamp down tight. This will hold your patch in place while applying the irons and will in no way interfere with the operation, as the extreme heat of the upper iron will burn it up almost immediately and leave the plate bare.

13. Place in the lower iron to extreme end of patch, drive up the wedge or under clamp and apply the top iron as quick as possible, leaving the head of brazing clamp thrown back until both irons are applied. You can place the top iron on without difficulty, placing the point down, first holding the outer end steady and bringing it down over the patch and over the lower iron. Pull down the head of vise part and clamp quickly. Leave irons on till they turn blue, but don't handle the saw until it cools off. File off the surplus solder, roll in a little tension from inside and flatten down. Tension same as other part of blade. Put patches on the inside, as they will last much longer and give better satisfaction.

CROSSCUTTING, SHEARING AND RETOOTHING BAND SAWS

If you have a saw with a number of cracks on the front edge, do not cut the saw and make a new braze, unless a long crack appears that cannot be repaired with a patch. Shear off the teeth or enough of the plate so that the retoothing will take out most of the cracks and it does not matter if the new set of teeth do not remove all the cracks, as any remaining can be punched at extreme depth of crack on each side of saw, or checked with crack drill.

The same shear practice applies in the case of the saw having the teeth in whole or part damaged or stripped off as a result of having struck iron or gravel in the logs.

The shearing of the saw lengthwise may be accomplished with the cutters on stretcher or with the long cut shearing machine or with the shearing dies in connection with retoother and shear, according to the equipment at hand.

When retoothing, the saw must be supported across the dies horizontally so that the bending of the plate will have no tendency to strain the dies and so cause them to crumble on the edges. The dies must have a proper amount of shear so that they will punch clean, smooth and with ease. Keep the punch sharp and use oil as needful.

Have the spacer work on the tooth to be cut so that the teeth will be evenly spaced. If the spacer does not work on the tooth being cut, the first tooth will come right, the next will be a little off and so on till the spacing becomes irregular.

A 44-foot log band saw having teeth spaced 1½-inch can be sheared in 10 to 15 minutes or less, according to your equipment for the purpose, and it can be retoothed in half an hour and when retoothed it will run and cut much better than one with a lot of brazes in it.

If you have no stretcher cutters or a long cut shearing machine, then we can furnish a retoother equipped with dies for shearing lengthwise, and indeed many of these machines are ordered as a combined retoother and shear, even if other facilities are at hand for shearing lengthwise.

A Retoother is used generally in sawmill and woodworking plant filing rooms and in saw repair shops or saw works that make up saws from polished tempered plate bought in the coil. The machine works with ease and if the dies are made up to templet furnished by customer, the gullet outline after toothing, will be the precise outline that the operator maintains and no special grinding with the automatic sharpener will be necessary to bring the tooth to the desired shape.

We cannot recommend these machines too highly because they invariably please and with proper care the dies will stand up for long and hard usage.

No one but a saw filer, who, after a slow, laborious use of a cold chisel and hammer, has finally succeeded in cutting a saw in two or in squaring an end or in cutting down a strip to braze in, preparatory to lap making, or in cutting down a saw preparatory to retoothing, can perfectly appreciate the time and labor saving qualities of an efficient Shearing and Crosscutting Machine. But all of these processes have to be resorted to with greater or less frequency in every fitting room, and it should be evident to every operator that an expenditure for such a machine will yield a good income on the investment.

In deference to an urgent demand for a heavy, powerful and long-clip shear adapted both to cross-cutting a saw at one stroke, preparatory to lap grinding, and to shearing either the back or toothed edge of a band or gang saw, we have machines in several sizes which cannot fail to please the most critical. The guide for saw for shearing crosswise, may be quickly shifted to side of machine for use lengthwise. The long stroke insures rapid work, and the dies cut with a perfect shear, making a clean, smooth, straight edge cut without buckling the saw or leaving a burr. Every saw filer and millman appreciating the time, labor and care required in cross-cutting a saw with the use of a chisel or similar device, will agree that this machine is quite indispensable to every filing room. The price is as low as the intrinsic value of the machine will permit, and we can confidently recommend it as one possessing the greatest excellence and utility. Do not allow saw to bend up or down while being cut, as this may cause chipping of edge of shears. The shear blades are of best steel and temper and will stand for long service if not used carelessly. Every filing room needs one, and the machine will be found of the greatest convenience for general use.

Mount machine on solid wood base securely attached to floor, or on truck as preferred.

THE LIFE OF BAND SAWS

A. J. BURTON

The length of time a band saw will run is uncertain and depends much on the care in handling. If the saw is made from good steel well tempered, it will ordinarily last a long time. All sawmakers endeavor to furnish good saws, but the best of them miss it occasionally, and in such case if a saw proves defective, you should report it promptly.

If a saw is all right on receipt from the shop, and if the filer looks it over carefully, putting it in proper shape before running it on the mill, and if he looks it over every second or third time it comes off the wheels and keeps it all the time in proper shape, it will run until worn out, without a crack, and cut at the rate of 50 M per day, if it does not get pulled off the wheels or meet with an accident.

Four saws on a single band mill should run eight or nine months of the year for two years and cut twenty million feet, and if 10-inch when new, should still be 8 or 8½ inches wide. But, if accidents happen, they will not run so long. I have run four saws for five months, cutting from 50 to 55 M per day in hemlock and oak, and they haven't a crack or a blemish, except the loss of two teeth in one, which were knocked out by a stone, and they were worn down only ¼ inch. But saws cutting logs containing iron or stones, or getting pulled off and ill-used in the filing room, or by reckless sawyers, will last and do good work only in proportion to the care and handling they receive. Keep the tension even; the saw flat and straight lengthwise; the crown in back even; use the right amount of swage; do not allow case hardening from any cause; see that the lap is always straight; do not run too long or too slim teeth; see that the mill is in line with track and the wheels in line with each other, and success will follow.

BAND MILL AND CARRIAGE

The matter of keeping mill, carriage and track in perfect condition all of the time is of vital importance. Suppose you have a mill with the drive belt pulling toward the carriage track, the rear end of the lower wheel shaft will wear its way 1/64-inch toward the track in a short time. Then the lower shaft will be 1/64th out of line sidewise, turned out of the log. If sawing gritty logs, the front fourth of the face of the lower wheel will soon wear 1/64th. This will conflict with the wear of the rest of the mill, save for that little on the front fourth of the face of upper wheel. Both bearings of the upper wheel will be worn downward and of the lower wheel, upward. Thus the saw will be running almost straight with the track at the point where it leaves the top wheel, but at the point of contact on the lower wheel, it is turned out of the log in a slight twist, with the uneven wear and consequent distortion constantly on the increase.

The track should be straight and level, and the guide rail should be to the outside, away from the dust and refuse of the mill. The lower wheel shaft should be parallel to the guide rail and should be perfectly level. The top wheel shaft should be parallel to the lower wheel shaft, and the band wheels should line up plumb at the front edges and on the faces next to the carriage.

Grind the faces of the wheels flat and see that the front and back edge of each wheel measures the same in circumference, measuring carefully with a steel tape. See that the straining device works easily and sensitively and avoid excessive strain on the saws.

Another method: Stretch a line the full length of the track which is not covered by the carriage, it being left at the extreme end of track on the end that will carry the carriage the farthest from the band mill. This line should be over the V rail and just high enough to allow a similar line to be stretched across the two edges of the lower band, as near to the center of the wheel as possible. Make sure that this line comes in contact with nothing about the mill but the edges of the rim of the lower band wheel, and run it out over the other line, just barely touching it. Then make a support at each end of the line over the V-rail to hand a plumb bob on. Get these plumb bobs to centering on the inside corner of the V-rail and move the line so it will barely touch the plumb bob lines at each end, and you have this line straight with the V-rail. Then hold a square in the corner formed by the two lines crossing one another and adjust the line that crosses the track until it is square with the one running parallel with the track.

The cross line can be left ¼ to ½ inch free from the rim of the band wheel. Now measure with a rule the distance of the wheel rim to line on both front and back. If they correspond, the mill is square, but if not adjust the wheel until they do. Great care should be taken not to disturb the lines after they are set, as the least fractional part of an inch out will set things wrong. After getting the lower wheel in position, the upper one should be set to correspond with it.

As to lining the saw with the carriage, that is not necessary once the band mill is square with the track. But if the head-blocks need lining with the saw, this can be done by running the carriage past the saw and stopping with each head-block directly opposite saw, in its turn, and measuring from face of block to saw teeth.

HOW TO LINE BAND WHEELS WITH TRACK ADJUSTMENT OF GUIDES

It is taken for granted that the track is straight and level, that the edges of wheels are turned true and the lower wheel shaft perfectly level. Draw a line parallel with the track from one end to the other. Then draw a line across the track above the floor in front of band wheels and square this with the first line. Then from sticks or supports above the upper wheel, let fall two plumb lines at opposite edges of front side or upper wheel, and let these plumb lines fall directly to or at equal distances from the line already stretched across the track. Then by moving one or both ends of lower wheel shaft, square the wheel shaft with the line across the track by having the opposite edges of band wheel at exactly the same distance from the two plumb lines. Then let the cross line swing across until square with track. Adjust the top wheel in similar manner. It is better to have a band saw trained a little in rather than out of the log, but it is best to have it perfectly parallel with the track. Having the wheels properly lined, do not move the cross line again, not even to adjust the saw, but put the saw on the mill, run it slowly, and adjust with the tilt until the saw runs from ¾ to ⅞ of an inch off the front edge of wheels.

If you hammer your saws alike, you will not have to move the tilt again for the season's sawing unless the saw gets hot or meets with an accident, for the saws will all run in the same place if put up alike. Adjust guide carefully. Slack off all four guides from saw. Next set the lower log side guide up to saw, put in a sheet of writing paper between guide and saw, and then screw up guide until the paper will not fall out, but not so hard as to move the saw out of line. Then fasten the guide firmly. Then put in another piece of paper between saw and the board side guide and push the guide hard up and fasten firmly, and if right the paper will pull out tight and will leave a perfectly guided saw without too much or too little clearance. Set the top guide the same way, but be careful not to move the saw out of line when setting the guides. If a band saw is hammered and fitted right and the mill and guides are properly lined, the saw will stand a good feed and cut straight lumber.

TILT AND STRAINING DEVICE

When saws run too slow it is hard to keep them in proper place on the wheels and they are more apt to follow the grain of the wood after running several hours. The straining device pivots must be kept in first-class condition, clean, well oiled and not screwed up so tight that they cannot work freely. On some mills the location of the straining device interferes somewhat with the position of the saw on the wheels. Information should be obtained from the makers of the type of mill in use, as to the weight mechanism. The strain weights and strain on saw must nicely balance on the pivots, just as sensitively as scales.

Each wheel draws or leads the saw in the same direction as the wheel rims are running. It is easy to push or guide a belt where it runs onto a pulley but not where it runs off the pulley. Similarly, if you tilt the top of the wheel forward it will lead the saw forward and conversely, backward. In each case the saw will run on the bottom wheel as directed by the top wheel.

If you place a full back saw on the wheels without any tilt to the top wheel, it will run back. Hence if a saw is properly crowned on the back which means also, properly shortened on the cutting edge, and the top wheel is properly tilted, the saw will be held in place substantially where it will do the best work possible, because under such conditions the edge of the wheel is made to act as a crown to hold the saw properly in place. The short front of the saw leads it backward and the tilted wheel leads it forward, so the saw keeps its path as if traveling on crowned wheels.

If it is desired to crown the band wheels, the proper place to have the crown is about 1¾-inch from the front edge of band wheel, but both edges must have the same circumference.

BAND MILL WHEELS AND BAND WHEEL GRINDING

Log Band and Band Resaw Mill Wheels must be turned and ground on their own shaft and have a standing as well as a running balance. Nearly all mill builders and operators agree that a perfectly flat wheel is best, regardless of the diameter or width of face of wheel, but where crown is used on say a 9-foot wheel with 12-inch face, it should rarely exceed $\frac{1}{32}$-inch, and on wheels of smaller diameter and face, must be proportionately less. The more crown on the wheels the more tension is required in the saw, and the greater is the strain on the saw, and general practice demonstrates that band saws last longer, have a better "set" on the wheels, and will stand a heavier feed if the wheels are perfectly flat face than if they have even a little crown, and it may be accepted as something of a defect in any band mill if it is necessary to resort to much crown in the wheels to keep on the saw.

The lower band wheel wears faster than the upper, owing to the greater tendency for sand, dirt, saw dust, gum, etc., to collect on its face, and the greater wear will be near the tooth edge.

If a saw, by reason of being too narrow or improperly tensioned or improperly lined, should run back on wheels, or if a burr is left by sharpener in grinding, or if the swaging should strike the face of wheels, this would contribute rapidly to the wear. A lumpy saw would likewise cause greater tendency to wear than a saw perfectly leveled. It is obvious that if diameter of front edge of wheel is changed by wear, the strain on the edges of the saw changes, and the back edge may thus be subjected to greater strain, while the front edge will tend to snake. As a result the saw manufactures poor lumber and very likely becomes distorted in tension and begins to crack.

There is no question at all that there is a large loss resulting to many millmen who attempt to run their band wheels under these defective conditions.

It is impossible for any filer, no matter how competent, to overcome, by careful fitting or tensioning of the saws, defects in face of band wheels, and while the economical regrinding of band wheels necessitates the ownership of a band wheel grinder for the purpose, and the expenditure of a certain amount of time and labor, the refacing of wheels when needful will return a large profit on the cost.

The grinding of band mill wheels at the mill is a simple process, but being one to which some millmen have not yet accustomed themselves, by reason of lack of suitable grinding machine, or one which they think can be put off to "a more convenient season," is thus ignored and put off, with an almost certain loss from cracked saws and poorly cut lumber as direct results.

There are occasions when the ownership of a wheel grinder at mill will easily pay for itself in a single using, by saving the expense of a prolonged shut-down and of getting a machine hurriedly. Such ownership also permits and insures a more frequent grinding of wheels. There is probably no band mill whose wheels cannot be improved by grinding at least once a year, and in many cases more frequently.

The band wheel grinder is essential to a complete equipment, and if anyone questions this he need only compare the original cost and the interest on the investment, with the price of a few saws ruined by cracks, or the loss of only a thousand feet per day in output, or but $1.00 per thousand in market value, arising from poor manufacture. It is the old proposition over again, that it pays to spend a dime to make a dollar.

Band Wheel Grinders may be divided into three classes, one class being constructed on the principle of the grinding lathe, requiring power independent of the band mill to run the emery wheel; the second having the emery wheel feathered on its shaft, and driven by frictional contact with face of band wheel; and the third of the abrasive block type. In selecting a machine for this work it should be considered less important to make a temporary saving in first cost and more important to select a heavy, well-built and substantial machine, for the reason that such construction is absolutely essential to freedom from vibration and accurate, smooth grinding. Rigidity and strength in any kind of emery wheel machinery is of the utmost importance, and the machines that possess these features, together with the best mechanical construction, are always the cheapest to buy, even though the highest priced.

USE AND UTILITY OF BAND WHEEL GRINDERS

The very general introduction of Band Resaws, Band Ripsaws, Band Edgers, Pony Band Mills and Crosscutting Band Saws, on which wheels from 44 to 72 inches diameter and from 3 to 8 inches wide are employed, all gradual developments in band sawing practice throughout the United States during the past 25 years and the increase in the size of log band saw mills to a point where wheels up to 11 feet diameter, carrying saws up to 16, 18 or 20 inches wide, are now to a considerable extent employed on the Pacific Coast, have called for the development of band wheel grinders in a number of types and sizes, suitable for the varied requirements in grinding wheels in such a wide variety of diameters and widths of face, that are made variously in belt or motor driven lathe type or abrasive block construction.

Our band wheel grinders have now been in process of manufacture for over 25 years, with a record of sales and satisfaction resulting to users, that justifies a strong recommendation to all plant operators requiring such a machine to place order for one of suitable type and size for the mill or mills in use.

It is now well recognized by all practical millmen and saw filers that the ownership of a band wheel grinder and use whenever the condition of the wheels may require, is all important because the bad effects from the operation of band wheels that are badly worn or out of true on face, are too well known to justify putting off the job as long as possible.

The necessity for band wheel grinding can be kept at a minimum by being careful to have the proper strain used at all times to prevent slippage, by not allowing the scrapers to be set down too hard on the band wheel, by having the cleaning devices as they should be, and by having the band saw properly trained on wheels, all of which properly conditioned will minimize the wear of wheel, at same time doing away with one principal cause for bad running saws. It is only as these various matters are neglected, that undue wear occurs and the consequent more frequent grinding of wheels become necessary.

Band wheels with crown face require that the saws shall be given more tension than for straight-faced wheels, and extra care should be taken in the expansion of the back edge because on a crowning wheel, the saw is not so sensitive to the tilt of the upper wheel. With crowned wheels there is a greater tendency to cracking unless all essential details are in harmony with each other.

Straight-faced wheels need grinding oftener than crowned wheels, because a little wear on the front edge takes the strain away from the front part of the saw where it is most needed. The work face of the wheels also tends to accumulate pitch or gum and saw dust, which may cause the saw to run ahead and crack or run in an uncertain manner, if suitable scrapers are not provided and kept sharp.

In grinding straight-faced wheels it is important to get the same circumference on both edges, although a little fullness on the front will do no harm. But if the steel tape shows a difference of as much as ¼-inch, there will be trouble in keeping the saw in place and probably cracks will occur. Lost motion in lower wheel shaft boxes will make a saw run out of place on straight wheels. The lower shaft must be level; tilt top wheel only; never use cross-line; roll saws up to $1\frac{1}{4}$-inch from bottom of throats and keep from one-third to one-fourth of the unrolled steel extending out over the wheels and both wheels alike.

Band wheels properly ground at suitable intervals save saws, labor in leveling and tensioning, saw kerf, miscut lumber, and a single grinding of the wheels may easily pay for the grinder in improved results.

Our band wheel grinders are recognized as high-class, efficient machines for this service and have been marketed to a large number of saw mill and woodworking plant operators throughout the United States, Canada and other countries.

LATHE TYPE WHEEL GRINDERS

No principle is involved other than that of an ordinary turning or grinding lathe. The work is usually done by the saw filer or millwright or by the mill or factory foreman. First measure the front and back edge of face of band wheel with a steel tape line. A comparison of these measurements will tell you to what extent the back edge is longer than the front edge. A difference of only $\frac{1}{4}$ inch in the circumference of the two edges is plenty enough to cause trouble. The difference is usually more. Knowing what it is you can then judge whether a light or heavy cut will be necessary with the turning tool.

Mount the Band Wheel Grinder on good heavy timbers so that it will not spring. Level the ways of Grinder frame. Place a work board at either side of the saw wheel, drawing a line on board and then measuring from this line to the center of the emery wheel arbor or to the ways of the Grinder, and the machine is bound to be in alignment with band wheel and in correct position for grinding. Whatever slight readjustment of Grinder frame may be necessary can be effected by means of the adjusting screws in feet.

The wheels of the Band Mill should revolve in opposite direction to that of the grinding wheel, and should travel slowly and uniformly, at say 30 feet per minute. It is a mistake to turn the band wheel rapidly, and while the speed recommended above is slow, it is calculated to insure a smoother job of grinding because of the reduced vibration.

The band wheel may be run by any means most convenient to afford the slow movement required. One method is to erect a small shaft, say $1\frac{15}{16}$-inch, with a small friction pulley on one end and a large pulley on the other, driven from the nearest convenient shaft.

The recommended speed for 12-inch grinding wheel is 1500 r. p. m. The grinding wheel should never be fed toward the band wheel faster than it will cut its way freely, and if it shows tendency to fill up or glaze over, it must be carefully dressed.

Most band wheels require regrinding at least once yearly. The wear comes mainly toward the front edge and is caused by dirt, dust, etc., falling between the saw and the lower wheel. The saw ought to be run well back on the wheel, but with the teeth and bottom of gullets off the edge of wheel. The wire edge left on teeth after sharpening will wear the wheel rapidly, and it is a bad condition if the saw shifts to an extent such that the teeth run on the edge of the wheels. In such case wear of wheel will be certain and rapid.

It is a common practice to grind band wheels flat faced, although a little crown is not objectionable, especially on double-cut Band Mill wheels. Crown, if employed on single-cutting Band Mill wheels, should come at center of wheel, but should be limited, because as the saw wears narrow it will naturally tighten on back edge, which is objectionable, and besides the natural wear of the wheels tends to make same crowning. The lateral feed on Band Wheel Grinder naturally adapts the machine for flat face grinding. The direct feed on Grinder makes possible convex grinding, although a concave Template Gauge ought to be employed to insure a perfect convexity on face of wheel.

The journal boxes on Band Mill ought to be covered with cloth or a gunny sack to keep particles of emery dust or steel from working in.

In the final grinding take a very light cut to insure a true surface on band wheels. Line the mill after grinding.

Carry only enough strain to make the saw take a good feed. Too much strain is worse than not enough. Use the tilt for straining the saw on wheels. Use the cross line only for purpose of alignment. Level the lower wheel with the full strain on the saw. If the saw has a tendency to run back on wheels, it is an indication that the lower wheel is either small or the front edge of it is out of level. A saw will run to the low side when the wheel is tilted that way, but will run to the high side if it has one side measuring larger by the tape than the other.

When the crown is near the front edge, it will not interfere with different widths of saws and the wheels will stand for longer service without regrinding. The amount of crown should be slight to start with, because as the front edge of wheel wears, the amount of the crown is thereby increased and the saw will track farther ahead on the wheels. Then the filer will tend to increase the amount of the tension toward front of saw.

Saws suitable for conditions as above described, would not run well on flat faced wheels until retensioned to suit. Crown faced wheels do well on band rip saws 4 inches wide, but as the saws wear down, the amount of crown on back must be increased, to prevent cracking. If the back of the saw runs near the center of the wheel, where the most crown is, $\frac{1}{8}$-inch crown in 4 feet will not prove too much. Otherwise, the cutting edge will show a marked tendency to develop cracks.

The amount of crown on band wheel should rarely if ever amount to as much as $\frac{3}{32}$-inch, because such an amount would call for too much tension in front of saw. Some advise starting the crown about $1\frac{3}{4}$-inch from front edge but no rule can be laid down as regards precise amount or exact location of the crown on a band wheel that should be followed uniformly.

ABRASIVE BLOCK BAND WHEEL GRINDERS

An abrasive block band wheel grinder, as the name suggests, grinds with a frictional contact, the head which carries the abrasive blocks, being mounted in a revolving frame to permit of readjustment as necessary to afford a proper angle of grinding contact. Direct and cross-feed adjustments are provided.

In setting up a band wheel grinder, it is highly important that it be rigidly mounted and correctly aligned. The face of the band wheel should be carefully cleaned so as to remove any gum or dirt that may have accumulated. It is best not to allow the grinding blocks to come in contact with gum, dirt, water, saw dust or other foreign substance which might cause a filling up of the face of the block, with consequent rubbing and heating on the face of the band wheel, and less effective cutting and grinding.

While grinding, use a band saw with the teeth sheared off or have the teeth boxed in to prevent the operator from being cut. Strain the mill as for sawing lumber and make fast the straining device so that it cannot move up or down while the grinding proceeds. The proper rim speed for abrasive block grinding should not exceed 1,500 feet per minute or about one-fifth or one-sixth of normal operating rim speed. In grinding cast iron wheels, the best speed for grinding is obtained by slowing down the engine to run just so it will not stop on the center.

THIN BAND SAWS

Successful operation of thin band saws is mainly a matter of "fineness in their putting up," a proper balance as concerns leveling, tensioning, crowning, toothing, swaging and sidedressing. Perfection in each detail of fitting is vital. The mill, the track, the wheels, everything must be just right.

A band offset on the carriage, a crooked rail, carriage track out of line with the mill, mill out of line with itself, a stiffly working straining apparatus, guides too loose or wrongly set, hitting the log too hard—any of these things can easily work damage to a thin saw or put it out of business.

Different mills and different wheel faces wili require different fitting as regards both tension and crown, especially the latter.

A thin band saw must not flap on the back, which means too much crown. Too much crown means that there is nothing to back up the cutting edge; it is almost as bad as too little crown, which weakens the front. Mills with wheels close together are far better for thin blades than mills whose wheels are far apart.

The bench work demands in particular the filer's most careful attention. Lumps and ridges that would slightly affect a thick saw will seriously affect a thin saw. These must not be half taken out and half driven through to the wheel side of the blade. They must be completely removed. The ridges must be followed carefully with a hammer of correct weight and with face neither too sharp nor to flat.

Bent teeth are to be looked for and expected, for they are sure to occur. Usually the bent teeth will all be bent the same way, which is a principal cause of the leading,—a thin saw characteristic. Such teeth like the rest of the blade should be leveled from the outside, then from the inside, then from the outside again, to make sure they are dead straight.

The light on the hammering bench must come from the right direction, and be neither too dim nor too bright.

So with the tension; always a matter of fineness or accuracy and extreme painstaking.

Tight spots and strips, under the toothed edge are easily caused, that will make "bullheads, snakes," etc.

Some filers test for tension with the gauge lying lightly in the sag of the saw, while others use a lighter gauge and test with a hard pressure. But for thin bands the use of a gauge of proper convexity, lightly pressed upon the saw is recommended. If in rolling out the tight places too much tension shows, this should be reduced, and it is well to test the edges on the rise with a straight edge, in order to better adjust same under the edges of the saw. Every inch of the body of the saw should be opened properly. To roll one line for tension where three or four lines should be rolled, is not sufficient.

Thin saws should be tensioned about all they will stand and keep the plate level. Thin blades conform more readily to the curvature of the wheel and are less likely to crack than saws of heavier gauge. Tires the narrowest possible should be carried, because while this increases the work, it makes for a fine cutting saw. At least half of the front tire should be kept on the wheels when running, otherwise the front quarter will be unduly tightened.

Toothing of thin saws is also highly important. Avoid too much swage, not over four gauges unless the timber is very soft and spongy.

Sharpening, swaging or shaping to one side are three prime causes of leading. If pointing with file is practiced, avoid lessening the pitch of tooth at extreme point. If the points are too long and slender they will bend out of line and chatter in the cut, or may even break off in a hard knot. The backs should be kept as high as possible without rubbing on the timber, as a means to strength. The throats must be nicely rounded with the pitch extending down only far enough to admit of chambering the dust properly.

The braze must not be dressed too much, thereby concentrating the bend, nor too little, thereby facilitating a sharp bend on either side of it. When finishing the braze it is a good plan to test same with calipers, doing the dressing with a surface file, and leveling the joint as the work proceeds.

Finally, all careful attention to detail that may be put upon the fitting of thin saws, should be put upon thicker saws by every filer who takes a pride in his work and aims at perfection.

SYSTEM IN THE FILING ROOM

A wise filer will establish a system as to filing room routine, with reference to examination of saw when it comes off the mill, swaging, sharpening, bench work, etc., so that the various processes will be cared for in an orderly manner, and with the purpose of having as many of them under way at the same time, as practicable.

It is an easy matter to have the automatic sharpeners, both band and circular, the lap grinder, and the stretcher or bench work all under way at the same time. Many filers swage while sharpening, which can readily be done if the filing clamp is located behind the sharpener. If the clamp is in line with the front of sharpener, the swaging process would tend to affect somewhat the feed movement and contact of tooth with grinding wheel. Or the sharpener may be started to pull the saw around while swaging proceeds, not allowing the wheel to grind, and then the grinding and shaping can be completed at the same time. In finishing a saw, it is a good plan to grind the last round with the emery wheel barely tipping the tops of the swage points and touching no other place. This method will take off all the wire edge and little case hardened spots, that cause crumbling to a great extent.

Every filer who works without a well defined plan, will find it an advantage to establish and follow a regular plan with as few variations as possible.

AMOUNT OF HOOK FOR VARIOUS WOODS

What shall be a proper amount of hook for different woods and widths of saws must be determined by the saw filer and sawyer connected with each mill, based on experience and every day results and no tooth outline that is affording satisfactory results ought to be changed experimentally without good assurance of betterment. The following table suggests the number of inches of hook that may be carried on saws of different widths but is not given as a standardized practice, because there is none. Excellent results are obtained in sawing almost every kind of wood, with wide differences in tooth outlines employed.

	Width of Saw						
Nature of Wood	4	5	6	7	8	10	12
Quebracho, hickory, Gaboon, teak	1¾	2¼	2⅝	3	3½	4½	5¼
Mahogany, oak, ash, elm, pitch pine	2½	3	3¾	4½	5	6¼	7½
Poplar and similar woods	2¾	3½	4¼	4¼	5½	7	8¼
Pine and similar soft woods	3¼	4	5	5¾	6½	8	9

Teeth with extreme hook, must have a high back for strength but not too high for suitable clearance.

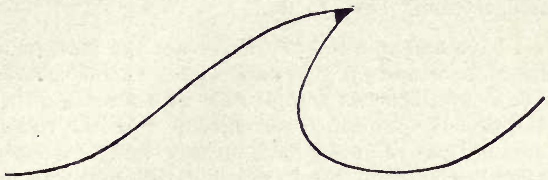
DOUBLE CUTTING BAND SAWS

The double cutting band mill using saws toothed on both edges is no longer a problem, and by some enthusiastic operators is now highly recommended. The saws in use range from 10 to 18 inches wide and it is contemplated that there shall be about two inches of wear on each edge of saw possible under favorable conditions.

The band filers who have taken up the fitting of double cut band saws like the work, although they agree that the double cut band saw requires more careful and finer fitting and tensioning than the single cutting. The wages paid to band filers of superior skill for double cut fitting are generally better than for single cut fitting.

The circumstance that these saws are in most cases 14 inches or more wide, calls for a set of filing room machinery of such capacity and for a number of machines of special adaptation.

For sharpening, mill operators and filers are quite unanimously agreed that the band sharpener should be of a type similar to the ordinary sharpener for single cut bands, designed to sharpen but one side of saw at a time, the saw being supported in the ordinary manner on post brackets and fed by front and back feed finger, the sharpener equipped as a right hand and left hand machine, as the double cutting band saw amounts in effect to a right and left hand saw. For supporting these saws there is provided a set of six special post brackets faced with hardened steel, over which the points of the saw teeth slide. Similar supports are provided on the special feed pawl posts at front and rear of sharpener, and this method of supporting the double cutting saw proves entirely satisfactory in practice, the saw being handled without injury to the teeth.



The filing clamp required for double cutting band saws must be provided with one jaw that will swing open so as to permit the insertion or removal of the saw without injury to the saw teeth. The ordinary type of filing clamp for single cutting band saws not being suitable; in other respects the machines, such as the Swage, Shaper, Stretcher, Brazing Clamp, Lap Grinder, etc., required are equally suitable for either single or double cut band saws.

DOUBLE CUTTING BAND SAWS

N. E. HUFF

Commence with the band mill and line bottom wheel with track, no lead either way; then put top wheel in line with bottom, no crossline, or overhang. The face of wheels should have a very slight and true crown from edge to edge. This done commence saws and see that they are straight, no long or short back. Commence in the extreme center of blade and open them just deep enough to fit nicely over the crown of wheels and have them hug the wheel the hardest, or the most strain, at the extreme edges of the face with a gradual decrease in strain from each edge toward the center. This done put saw on top of bench and level on inside of same that part of saw which is lying on leveling slab by going over it with straight edge, reaching full across width of saw, and level it down so that the most light shows under straight edge in center of blade (where tension is deepest) with a gradual decrease towards the edges, until you come to the tires, which should not show any light under the straight edge. After which again go over this section with straight edge, first on one edge of saw, then on the other, by holding straight edge say two-thirds the way across the blade, looking for and hammering down any small lumps which may appear on the particular edge and which you were unable to locate when holding the straight edge across the entire width of saw. When holding the straight edge two-thirds the way across the blade, the light should not show as deep under it as when holding it across entire width of blade, because when holding it across entire width of blade, both ends of straight edge are resting on the two tires or thickest part of saw, and when holding only two-thirds the way across the blade only one end of straight edge is resting on the tension or thin part of saw. In like manner go over the entire inside of saw, after which put it down on the bench "on the bottom" and go over the outside of saw in the same manner as with the inside, always bearing in mind how much light showed under the straight edge when you were leveling the inside and trying to equalize same when leveling the outside of saw, being especially careful to have no light show under straight edge on either side of saw from where the tension terminates at the edges. If you are not satisfied that you have the saw sufficiently level to insure its doing good work after going over each side, repeat the operation until you are satisfied.

The most important part of bench work is to have saws level. For this work I have a cast iron leveling slab about 3 x 12 inches by 6 feet. This slab has a perfectly straight and level face, both lengthwise and crosswise, and forms a part of my bench. I use a 14-inch straight edge to level by, which I am very particular to see is straight at all times.

When do I put the tension in a saw, or go over it to equalize the tension? Answer, after leveling my saw on the inside the entire length and while leveling the outside, I level a section on the outside and then try the tension gauge on that section. If any tight places appear, I roll them out, after which I again try my straight edge to that particular part to see if in putting in the tension my roller has punched through or pulled up that particular part of saw rolled on. If pulled up, I again level and try tension; if punched through, I mark saw with chalk on the other side at that place, so I may know the cause of lump when I come to level on the other side again, which I would certainly have to do.

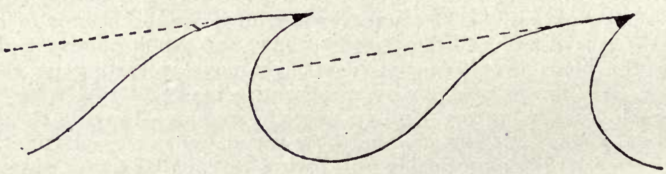
I have had men tell me it was not the fault of the roller that the saw was punched through or pulled up. To others of the same opinion I would advise them to try a saw on a roller which has a top roller with a more crowning face than the bottom, and see if the saw is not pushed through, or with the rollers vice versa, and also notice if the saw is not pulled up. I have my saw lying perfectly flat on the bench (the bench is in perfect line with the top face of bottom roller) when rolling in tension.

In sharpening, a single cut sharpener equipped R. and L. hand is preferable to use of two separate sharpeners, for by using the same machine for sharpening each edge of saw, you are certain to obtain the same shape and hook in the teeth on each edge, consequently both edges, if properly gone over on the bench, ought to stand the same amount of feed. Moreover, in such case your swage will swage alike the teeth on both edges of saw. Always go over a newly swaged saw with a set gauge, making sure that the teeth are all perfectly straight.

FITTING DOUBLE EDGE BANDS

E. L. MASON

In tensioning double edge bands, I use two tensioning gauges if the saw bothers me about staying on the wheels; the short gauge first, then the long one, clear across, from the roots of teeth on one side to the roots of teeth on the other side, each gauge a segment of a 44-foot circle. You will readily see that the short gauge will show differently on the saw than the long one, if they are of the same circle. Six inches is long enough for the straight edge. Level each edge first, the center last. These short gauges are also fine on single cutters. Keep the edges of saw straight. The sharpener has a long straight edge for the saw to run over under the emery wheel, and this helps to keep the saw straight. Run all the hook possible without weakening the tooth. Carry as high a back as possible without having it high enough to strike—about like sketch. Keep the backs so they will follow dotted lines shown.



SHAPE OF DOUBLE CUTTER TEETH

This shape is made with a ¾-inch emery wheel and a wooden form; the iron form that came with machine does not raise the back high enough to suit me. A round edge ¾-inch emery wheel will make this round throat, but the form must raise the emery wheel quickly or you will not have the back high enough. If you tip the wheel to reduce the hook it will also reduce the pitch of the back. Run as little swage as possible according to the kind of timber being sawed, less for hardwood than for hemlock. The harder and closer the grain, the less swage should be used. When you have your saws as nearly perfect as possible, the track must be looked after often and kept straight. Keep the wheels exactly straight with the track, no lead either way, no crossline, the bottom wheel plumb, no tilt either way. This is also the best way I know to run a single cutter, with the exception of the back. A straight back saw will stand just as much feed as a long back, but will be harder to keep up, as it will have to be looked after more often than a long back. If the double cutter runs off the wheel either way, or bothers about holding to the wheels in the cut, the edge that crowds back should be tensioned a little more, as it has not as much tension as the opposite half of the saw. If it crowds both ways in the cut, that is crowds back each way of the cuts, open both halves more and the center less. If this is done right the saw will not crowd either way in any cut. The top wheel being so low down to the cut (the same as the guide on a single cutter) makes the double cutter stand more feed than the single cut mill, without crowding back and without snaking. Be careful to not have to swage one edge many times more than the other or you will have a hollow edge on the side swaged most. Keep your swage in perfect order, or else use two, one for each edge, so that if the die or anvil becomes worn it will not swage one side out and the other side in. By using two different swages, if one swages into the log, the other must swage in also, for if one edge is swaged in and the other out, it will make thick and thin lumber.

THE BAND AND BAND RESAW MILL

The extensive introduction and successful development of both band and band resaw mills are matters of common knowledge, and the modern machines are far superior in construction and quality of work to those earlier introduced. Progressive operators always looking for the best, which insures both quantity and quality of output, frequently discard their old machines and replace with new and consult their interests by so doing.

Among important essentials in the machine may be mentioned the following:

(1) Abundant weight and strength in the main frame to counteract vibration and secure an effective support for the working parts.

(2) Saw wheels of the correct proportion and form carried on shafting, supported by journals of ample size, and perfectly balanced.

(3) Face of wheels ground perfectly true to approved surfaces. Experts differ somewhat in their opinions of what this form should be. Some advise a slight crown, while others advise perfectly flat surfaces, and again others have adopted two forms, grinding the face of the upper wheel slightly different from that of the lower.

(4) Convenient adjustments whereby the perfect alignment and proper sensitive straining of the saw and full control of its position may be secured.

(5) A sensitive, practical and efficient straining device calculated to avoid undue strain upon the saw, leading to cracking and breaking.

(6) Guides that are readily adjustable and that easily permit the admission or removal of the saw. Theoretically the saw should run independent of the guides. If the upper guide column is not nicely aligned the saw will come in contact with the upper guide, either on wide or narrow lumber, as the case may be. One of the main causes of fracture of saws arises from the fact that operators depend too much upon the guide pins to support the saw. More saws are cracked or broken from coming in contact with the guides, or, in other words, striking them violently and vibrating against them, than from any other cause. The material of which the guides are made is variously some anti-friction metal, steel or wood. All of these may be good or bad. The prime essential is for the filer to fit his saws so nicely, both in tensioning and at the cutting points, that the saw will run almost independent of the guides. If he does not do this he will certainly break saw blades.

(7) The top wheel should have three adjustments, viz.: a vertical adjustment for taking off and putting on the saws, whereby both ends of the mandrel are raised simultaneously; a tilting adjustment which provides for the raising or lowering of the rear end of the mandrel and tips the wheel forward or backward accordingly, so as to keep the saw properly strained upon its cutting edge; a crossline adjustment which is accomplished by the sidewise movement of the rear end of mandrel, which admits of bringing the face of upper wheel in a true line with the lower one and makes it possible to run the saw upon any part of the face of wheel; this adjustment is sometimes used in resisting the crowding effect of a rapid feed upon the saw.

(8) A sensitive straining device that will instantly respond to the slightest change in the saw's condition and that is calculated to maintain a perfect and exact tension upon the saw at all times.

The crossline adjustment has three objections. It takes the faces of the upper and lower wheels out of alignment and consequently must put the saw out of alignment; it puts a slight twist in the saw, which must be taken out and the saw aligned by the guides or it will not cut straight. Throwing the saw out of alignment and twisting it and then straightening it again by the guides puts a great strain on the saw and has a tendency to make it crack. The tilting of the upper wheel is not open to the above objection, and if the saw runs forward or backward unduly on the wheels it may be remedied by tilting the upper wheel shaft one way or the other, as required.

(9) Efficient devices for cleaning the saw wheels, by use of oilers, scrapers, brushes, etc. Many a millman has discovered to his cost that an accumulation of gum, pitch, resin, saw dust, etc., on the faces of the wheels not only may cause imperfect work, shifting the saw, etc., but may strain it up to the breaking point.

(10) In band resaws a positive feed mechanism, abundant in power and certain in action.

(11) Wheels of suitable diameter for the width and gauge of saws used, and as close together as the size of the stock to be cut will permit, for short saws are stiffer and require less strain and cost less money. Long saws require more care and are more easily deflected from a true line and more liable to make imperfect cuts.

(12) In a resaw, perfectly adjustable feed rolls.

(13) A machine that can be readily piped to remove the dust.

BAND RESAWS

The general introduction of Band Resaws in place of solid and segmental resaws, indicates a movement that is certain to continue to grow in popularity, and demonstrates the fact that all lumber workers are desirous of saving saw kerf as well as of manufacturing their stock in the best possible manner. For manufacturers of fine lumber who desire to waste as little as possible in saw dust, the band resaw is an exceedingly valuable machine, capable of taking the stock after it has been cut to dimensions by the big band or circular and resawing it into thin stuff with much less waste than is practicable with the large mill. The circular saw in yellow pine cuts close to $\frac{5}{16}$ of an inch, and in hardwoods there are few if any saws that run on less than $\frac{3}{16}$. The band saw runs on from $\frac{3}{16}$ to a scant $\frac{1}{8}$.

Opposed to these is the band resaw with its kerf of from a scant to a full $\frac{1}{16}$. A contrast like this is not entirely true in a factory or a planing mill where a circular resaw is used, but holds good in a less degree. It is evident that the band resaw in sawmills is a machine well worth the consideration of every progressive millman interested in economies and profits. The advantages of band resaws in sawmills arise from the fact that the modern sawmill machinery must be adapted to saw lumber to the best advantage. Gangs have been used extensively, but as now all grades of logs are sawn at once, it is evident that a mode of sawing which would be suitable for one log would ruin another. The log band saw is extensively introduced because it has a large advantage over the circular in the saving of saw kerf, and in like manner the band resaw effects a saving as compared with all other methods. For sawmill use the band resaw is usually placed behind the log mill or between it and the edger, and as the large mill saws two or four inch plank, the resaw converts them into inch boards. A band resaw should handle this stock before it is edged so that in sawing stock from the side of the log each inch board may be edged as wide as possible. The resultant saving is not due to saw kerf only, for by the use of steam niggers, log loaders, etc., there is more or less end play and lost motion in carriage and set works, and it is necessary in sawing a given thickness to allow about $\frac{1}{32}$ of an inch to compensate for this lost motion, and hence for every cut of the band resaw the set works of the large band should be made to save this $\frac{1}{32}$ of an inch lost motion as well as $\frac{1}{16}$ of an inch or nearly this amount, due to the saving in saw kerf, as from 19 to 16-gauge saws are used on the resaw and these need be swaged out only $\frac{1}{16}$ or $\frac{5}{64}$.

For a general resaw on wide material, the band clearly surpasses the circular resaw. Modern machines run saws commonly from 4 to 9 inches wide and are capable of cutting straighter lines on a bigger feed and a smaller kerf than circular resaws.

The band resaw has a number of advantages in that it permits the use of thinner blades, thus saving kerf and money. Blades as thin as 20 to 24-gauge are being used successfully on resaw mills for certain kinds of work. There is a saving in power necessary to drive the saw. The position of the feed rolls permits the successful sawing of warped and twisted boards by straightening them close to the blade where the cutting takes place. The band resaw will cut stock straight or beveling, and, having a variable feed, the feed can be instantly changed to suit the stock being fed. The band resaw is now considered an almost indispensable adjunct in sawmills for doubling up the capacity of the band or circular on a lessened expense for operation and a great saving in saw dust; in furniture factories, for producing backing and panels; in planing mills and box factories, for resawing stock to the desired thicknesses; in carriage and buggy factories, for straight or beveled work; in short, for long timbers or short blocks, for stock perfectly straight, or warped and twisted, the band resaw has a ready and successful adaptation.

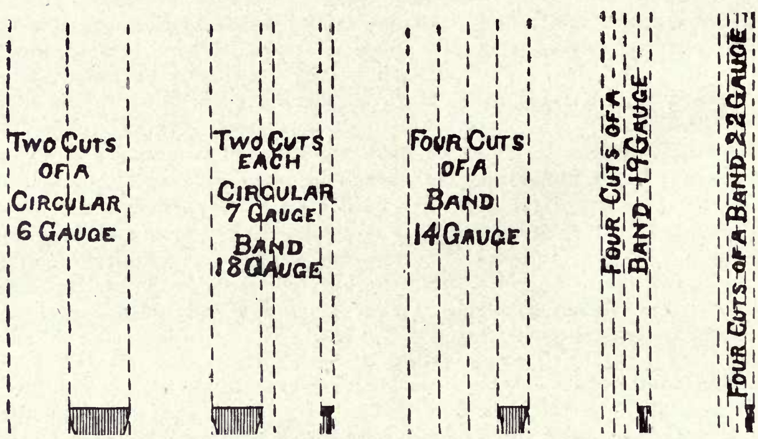
The main requirements in the saws themselves is high temper and tenacity, to which must be added the finest skill in fitting them in the saw shop and filing room, which applies with increasing force as you pass into the thinner gauges of saws. What has been said with reference to the fitting of log band saws applies almost wholly to the band resaw. Teeth perfectly swaged and sidedressed, with proper hook, gullet and spacing for the timber being sawed, and uniformity of tension are essential. These essentials may all be satisfactorily secured by the use of machines and tools designed specially for the purpose.

Lack of properly made and shaped wheels and lack of proper tools with which to care for the saws, are mainly responsible for whatever prejudice or trouble has characterized the use of band resaws in the past. Happily for future operators, the troubles of this sort have been for the most part overcome in mills as now constructed. But no matter how good the mill, the best results in its operation cannot be attained without an efficient filing room equipment.

Mr. E. C. Mershon has computed a table of strains which in his judgment should be given saws of different dimensions, but has found that the strains can be increased 25 per cent for very heavy duty. In computing this table a certain number of pounds per square inch of steel, or rather 1/1000-inch of steel, has been the basis. The narrower blades will stand 10 pounds per 1/1000-inch thickness of steel, but the wider ones will not stand so much, as it is evident that the edges of the saw must stand a given amount whether the saw be wide or narrow, whereas the central portions are not heavily strained; and as a saw, be it wide or narrow, has but two edges, it is evident that the wide saws do not require to be as heavily strained in proportion to their width as the narrow ones.

Table of Minimum Strains Suited to Different Widths and Gauges of Band Saw Blades

THICKNESS		WIDTH 2½ in.	3 in.	3½ in.	4 in.	4½ in.	5 in.	6 in.	7 in.	8 in.	10 in.	12 in.
	Inch	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
21-Ga. and Less....	18/1000 to 32/1000	700	800	900	1000	1150	1250	......	......	......	......	......
19 and 20-Gauge....	35/1000 to 42/1000	900	1000	1100	1200	1350	1500	1800	2100	......	......	......
19-Tight & 18-Ga.	45/1000 to 49/1000	......	......	1300	1450	1600	1800	2100	2500	2800	......	......
17-Gauge..................	58/1000	......	......	......	1700	1900	2100	2500	2800	3200	......	......
16-Gauge..................	65/1000	......	......	......	......	......	2500	2800	3300	4000	4500	......
15-Gauge..................	72/1000	......	......	......	......	......	2800	3300	3900	4500	4400	6500
14-Gauge..................	83/1000	......	......	......	......	......	......	......	4500	5200	6400	7500



The above explains itself. Whether operating a sawmill or other woodworking establishment, the saving indicated above can be effected.

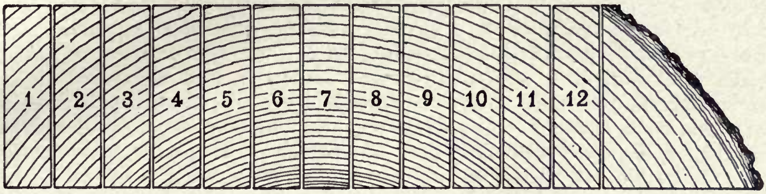
The saving is greatest when the Band Resaw is used in connection with the rotary sawmill, when from the saw dust pile will be saved 1,000 feet in every 11,000 cut, or between 6,000 and 7,000 per day, and the output increased 40 per cent.

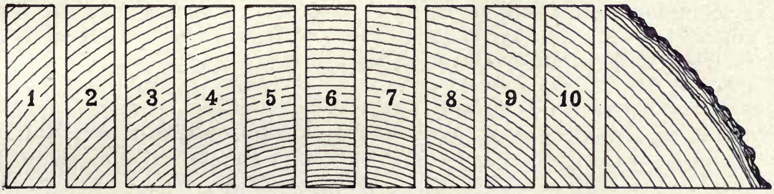
Even in connection with a band mill, a resaw will save 2,000 feet in every 70,000 or a day's run. In a box factory, 1-inch stock often takes the place of 1¼-inch, thus saving 25 per cent.

Band Edgers are well adapted to taking edge grained or rift sawed flooring from plank and the diagram shown above will prove of interest.

They represent the same cant or plank ripped first by an ordinary circular edger, such as is usually used for this purpose, and, second, the same plank ripped into flooring on a special band edger.

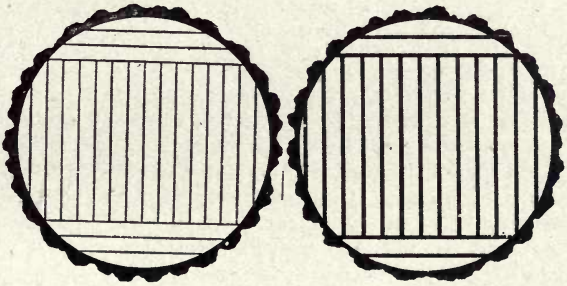
The saving is so apparent that further explanation is unnecessary. It is certain that a saving of 20 per cent in the most valuable part of the log, will pay for a great deal of labor. A special band edger, with two men, will manufacture 8,000 to 10,000 feet of this stock daily.





There are two ways in which to make a saw run well. One is to keep the saws and machinery in the best possible condition, handled by expert operators, so that the sawing will be both accurate and fast, and the other is to use thick saws. There are band mill and band resaw users in this country who, lacking proper tools and expert knowledge as to fine fitting, solve the problem by using saws of heavy gauge, which approximate the circular after being heavily swaged. The advantage of the band saw lies in its saving of material, and if this saving be lost by reason of lack of proper machinery or saws or tools with which to fit the saws, the question naturally arises, why use the band with its increased first and subsequent cost?

Where the timber is most valuable, there the thinnest saws will be found in use.



A log 17 inches by 12 inches cut with a 14-gauge Band Saw produces as above 176 feet.
The same log cut with a 16-gauge Circular Saw produces 146 feet.

As between Europe and America, there is a great difference in the methods of lumber manufacture and conversion. In the English mill or factory, the main question is not one of quantity, but of quality with the smallest degree of waste. In Europe log bands range from 16 to 18-gauge, and until recent years they have most generally set their saws instead of running a full swaging, as they conceive that a spring set is more conducive to smooth cutting and a slight kerf. This is contrary to the best practice in America. But swaging is gaining rapidly in favor abroad, and there can be little doubt that with a general introduction of saw fitting machinery and tools similar to those used in the American mills, the same methods in swaging, sharpening, sidedressing, tensioning, etc., will come into vogue in Europe, Spanish America, Australasia and the Far East.

There is a very general tendency on the part of band resaw operators to use wider and slightly heavier gauge saws as a natural result of the manifest advantages arising from the use of resawing mills but according to the up-to-date fashion, having wheels of larger diameter and face, and much greater strength and rigidity. Thus in many plants the earlier type of mills carrying saws 3, 4 or 5 inches in width are being discarded for mills carrying 6, 7 or 8-inch saws, and the mammoth band resaws capable of running 10 to 12-inch bands are also having quite extensive introduction in the sawmills. A 20-gauge saw taking a kerf of $\frac{1}{16}$-inch scant with saw 7 or 8 inches wide is a possible and an every day proposition, but it is an entirely different proposition from that of a saw 3 inches wide, same gauge, run in an indifferent fashion with spring set. To say that the band resaw in its best type today is better than the old type of log band mill of twenty years ago, is a well known fact, both as regards the frame of mill and the width and cutting qualities of the blade.

The band resaws used in sawmills as an adjunct to the log band or circular are usually from 16 to 18-gauge; those used in woodworking plants from 18 to 24-gauge, although the great majority of band resaw operators employ saws of about 19-gauge. These saws run on a kerf of from a scant $\frac{1}{16}$ to a full $\frac{3}{32}$. The capacity of the band resaw properly speeded and properly fitted is immense and there is no other saw so advantageous for work properly within its capacity. A great many band resaw machines are now being marketed to operators of log sawmills, the machine being placed behind the log mill, or between it and the edger, and as the large mill saws 2 or 4-inch planks, the resaw converts these into 1-inch boards. The resaw adds but little to the load on the engine and requires practically no additional boiler capacity, for it saves one-half of the steam feed. The resaw will save a small fortune from the saw dust pile, and has to commend it, its accuracy, smoothness of sawing and large capacity. For a general resaw, the band easily surpasses the circular, and the modern machines are capable of cutting straighter lines on a bigger feed, and with smaller kerf than circular resaws. The band resaw is also immensely advantageous in a great variety of woodworking plants, such as planing mills, box factories, furniture factories, wagon and carriage works, in fact, for any requirement in the resawing of stock, whether in timbers or short blocks, whether warped and twisted, whether of narrow or extreme width, etc. The requirements in the saws themselves is high temper and tenacity, to which must be added the finest skill in fitting them in the saw shop and filing room, which applies with increasing force as you pass into the thinner gauges of saws. Whatever may be said relative to the care of log band saws applies with similar force to the care of band resaws. The teeth must be perfectly swaged, sidedressed, with proper hook, gullet and spacing for the timber being cut, and the saw must be leveled and tensioned to a nicety. This perfection of fitting can be attained only by the use of a complete outfit of machines and tools for the filing room, operated by a competent filer. By this we do not mean to assert that fair or even good success cannot be attained in band resaw fitting by a man who has previously had little or no familiarity with the work. There are many successful band resaw filers who have taken up the care of the saws without previous experience, other than the general knowledge that comes from circular or narrow band saw practice. Their success has been due to innate intelligence, and the use of efficient filing room machines, assisted by special information on band saw practice and experience gained from day to day.

We give below some practical suggestions from two filers, both of whom are experienced and successful men and the fact that their practice differs somewhat, demonstrates again that there is no universal method in successful saw fitting.

"I think 75 feet a minute a slow feed for 6-inch, 19-gauge saws. If the saw runs 9,000 feet per minute and is the usual 30 feet length, it will go around 300 times per minute, putting the saw through at the rate of 75 lineal feet per minute, in only a 3-inch feed. If the filer would put up his saws according to the following instructions he can just as well make the feed 150 lineal feet per minute. The lateral movement of the saw at that speed will not exceed ¼ inch and will not reach that except in 20-inch cuts or over, neither will the saw dart forward on the wheels when not on the cut, nor will it show a tendency to crack.

"First get a good make of resawing machine with perfectly balanced wheels, the face of wheels flat, and set the mill on a solid foundation. Pay as much attention to oiling the straining device as to oiling the bearings, so tension on sawmill will be entirely sensitive at all times. The rolls must be in line with saw so stock wll pass through straight and at even speed. Put a crown in back edge of saw equal to 1/32-inch in 5 feet 6 inches of length. Do not do this by guess or you will not get it even. Use a concaved back gauge 4 to 6 feet long, concaved as required, and which can also be had with opposite edge straight, if desired. Now roll back edge of saw the length of the back gauge, expanding the saw until it fits the concave gauge all the way round, and keep the saw thus expanded. Tension the saw to a 36-foot circle, from one edge to the other. This must be well done. There must be no loose or stiff places in the saw. All this should be done with a stretcher.

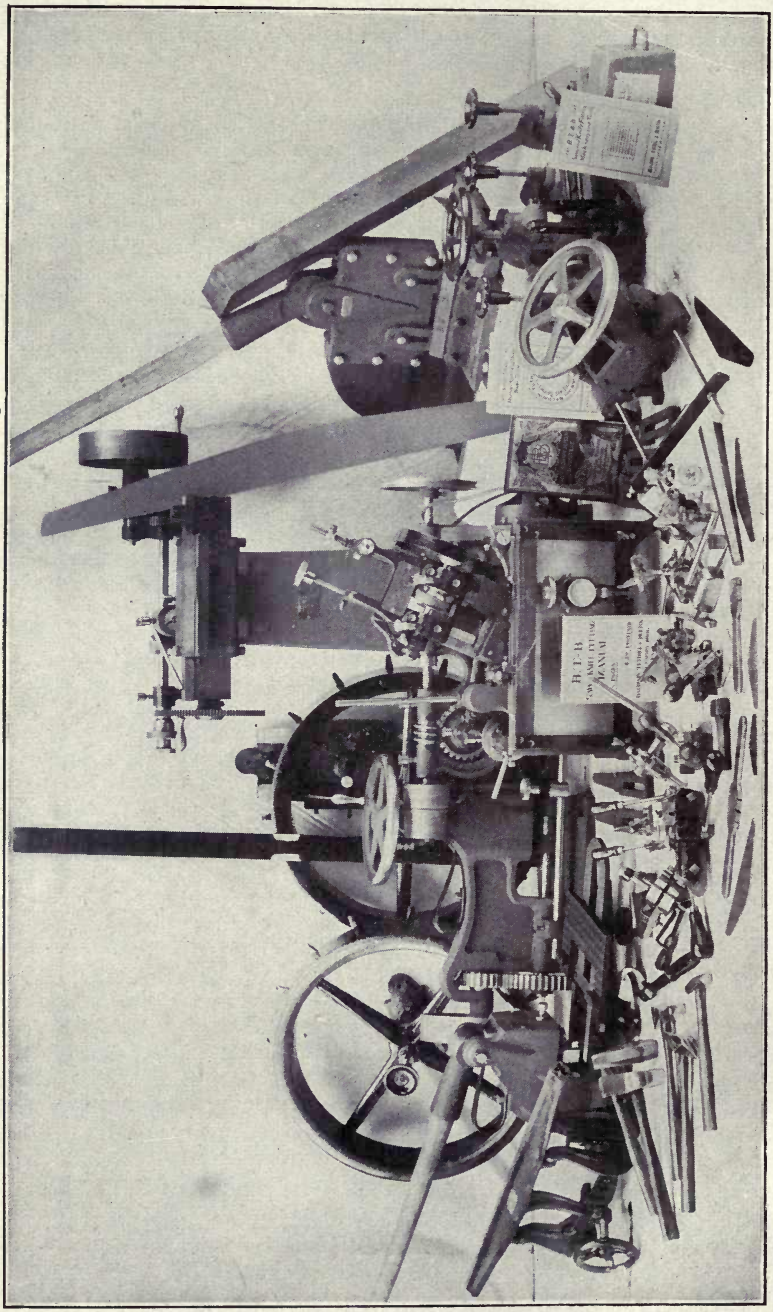
The other tools required for the perfect leveling or tensioning of the saw will comprise a doghead and cross-face hammer, which for thin saws should range from 2 to 2½ pounds each, also a straight edge and a tension gauge, to suit the width of the saw, the latter ground on the segment of a 36-foot circle. Next level the saw by taking out all cross face lumps on the inside, then the long face lumps, go over the outside in the same manner and repeat until the saw is perfectly flat with a true back and perfect tension. Space the teeth 1¼-inch, ½-inch deep, with a good large round gullet made by ½-inch emery wheel. Use about 3½ inches hook in a 6-inch saw, round or raise the back of teeth a little so as to offer plenty of strength to the teeth, but do not raise the back too high. Swage with a face swage; side dress with a shaper or pressure sidedresser. Do not use a side file at all, and do not use a heavy swage. Do all of your sharpening with the automatic band resaw sharpener, having care to use a very easy cutting wheel. If the sharpener is properly adjusted it will do better work than can possibly be done by hand. If you fit your saws by these methods they will not oscillate or flutter in the guides, but will run straight as a string, without a quiver—you can take off the back guide and sell it if you wish, for your saws will not run back on the wheels in the cut. You can feed them till they 'snake' or 'break,' but they will not go back on the wheels. Have wheels in perfect line, and use the tilt but not the cross line." Do not use a top swage or an upset, or a spring set, on a band resaw unless you desire to date yourself back 15 years.

Width of Band Saw or Pulley	Radius of Crown on Pulley Face	Height of Crown Above Edges	Radius of Tension Gauge	Height of Crown of Tension Gauge	Difference or Effective Tension
5 in.	26 ft.	10/1000	16 ft.	15/1000	5/1000
6 in.	26 ft.	15/1000	18 ft.	20/1000	5/1000
7 in.	30 ft.	17/1000	24 ft.	28/1000	11/1000

Above shows amount of Tension for Crowned Rims.

Width of Saw	Radius of Tension Gauge	Height of Crown of Tension Gauge	Amount of Convexity on Back of Saw in 5 Ft.	Width of Saw	Radius of Tension Gauge	Height of Crown of Tension Gauge	Amount of Convexity on Back of Saw in 5 Ft.
5 in.	26 ft.	10/1000	1/32 in.	9 in.	34 ft.	25/1000	1/32 in.
6 in.	26 ft.	15/1000	1/32 in.	10 in.	38 ft.	27/1000	1/32 in.
7 in.	30 ft.	17/1000	1/32 in.	11 in.	40 ft.	32/1000	1/32 in.
8 in.	34 ft.	20/1000	1/32 in.	12 in.	40 ft.	38/1000	1/32 in.

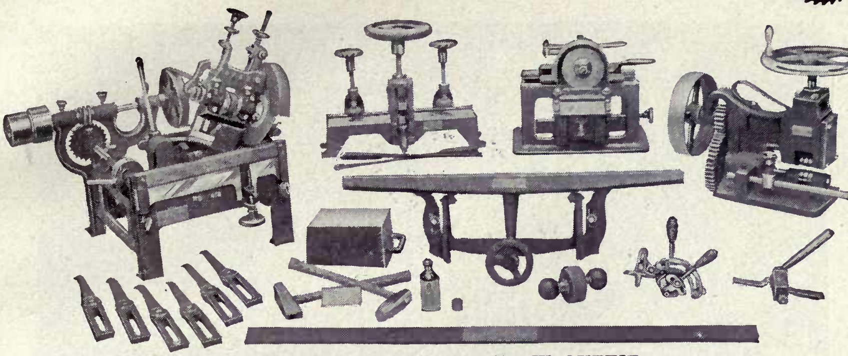
Above shows amount of Tension for Flat Rims.



6-INCH BAND RESAW FILING ROOM OUTFIT

The illustration contains dependable machines and tools for the care of 6-inch or narrower band resaws or ripsaws, comprising Automatic Sharpener, Stretcher, Swage, Swage Shaper, Shearing and Cross-cutting Machine, Retoother, Lap Cutter, Brazing Clamp, Filing Clamp, Adjustable Pulleys, Doghead, Cross-face, Combination and Twist-face Hammers, Anvil, Leveling Block, Back Gauge, Tension Gauge, Straight Edge, Silver Solder, Brazing Compound, Emery Wheel Dresser, Sawsets, Tooth Gauges, Jointer, and B T & B Manual on Saw & Knife Fitting.

We are in position to supply complete outfits for band saws up to 4, 6, 8 or 10 inches wide, as used primarily for band ripping or resawing, furnishing the sharpener in R. H. or L. H. style or combined R. and L. H., as required, and each customer will be best served to equip with a complete outfit at the start rather than to attempt to get along with a partial outfit for a time, if general experience and present day practice in this regard may be considered a fair criterion to go by.



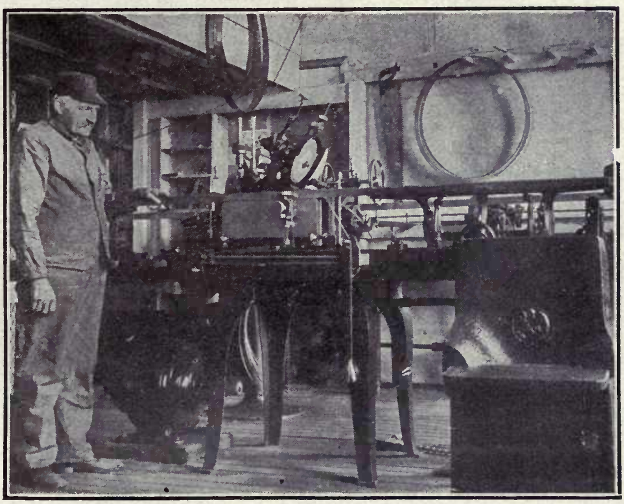
4-INCH BAND, RIP OR RESAW OUTFIT

Specify Hand of Sharpener required. Cut shows L. H.

To operators of band rips or resaws ranging 4 inches or less wide, we especially recommend the complete filing room outfit itemized below, suitable for saws having teeth spaced 1 inch or more from point to point, with usual gullet outlines, an outfit that is high-class in every respect for saws within its capacity, and that is adapted to afford the finest possible service.

The stretcher, brazing clamp, swage, shaper and saw tools correspond to types for saws up to 6 inches wide, differing slightly in design but mainly in weight and lesser cost of manufacture.

A NAVY YARD FILING ROOM

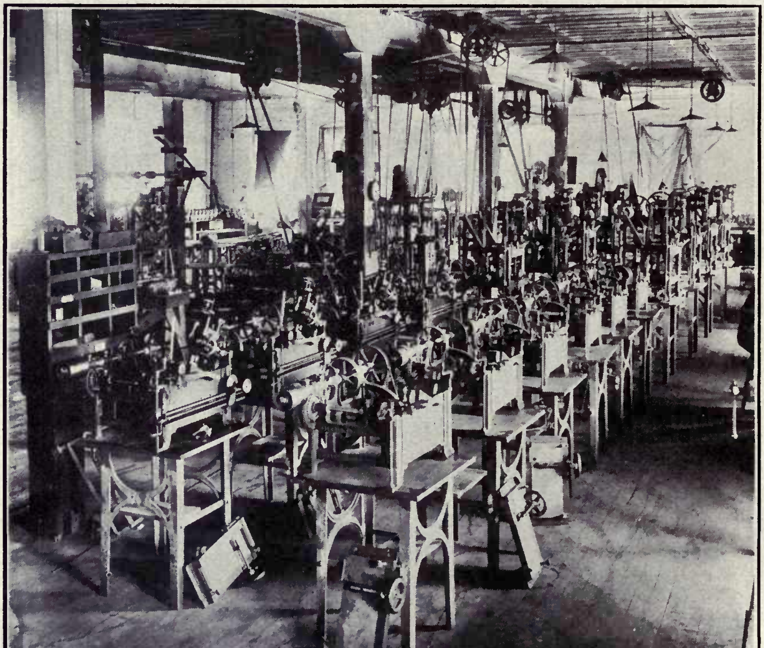


SHARPENER FOR BAND RESAWS AND CIRCULAR METAL SAWS, AUTOMATIC FILER AND SETTER FOR NARROW BAND SAWS, SWAGES, SHAPERS, SAW TOOLS, ETC.

NELSON R. GARDNER (From The Woodworker)—The Band Resaw Sharpener is another of your machines which I am proud of, which sharpens from 5 to 8 bands daily.

The above band resaw sharpener is one of the many we have furnished for use in U. S. Navy Yards and also to numerous private ship yards, dry docks and car shops throughout the United States and foreign countries. Our machines for band resaws, narrow bands, small circulars and machine knives have always enjoyed the greatest of popularity in the filing rooms of the largest Woodworking Plants of every description, where the requirements are the most critical and exacting, and where both quality in construction and high-grade working efficiency are considered of quite as great importance as price.

BAND RESAW SHARPENERS



SHARPENERS IN PROCESS OF MANUFACTURE

FITTING BAND RESAWS

"When fitting a band resaw 6 inches wide, 18-gauge, I drop it to a 30-foot circle, with a ¾-inch tire on front and back edge. Some filers will probably not agree with me in this. I use a perfectly straight back for reasons which will be explained farther on. I carry extreme hook, diminishing as it forms round the throat. I carry a high back, with fair clearance, and a spacing of from 1⅝ to 1¾-inch. My swage is always 4 gauges thicker than the gauge of the saw. On a high speed mill this amounts to about 1 or 2 gauges, and on a slow mill to about 6 gauges, since the speed of feed increases or decreases the saw kerf equivalent to a light or heavy swage. I drop a 6-inch 20-gauge saw to a 40-foot circle; this is somewhat looser than saws of that gauge are fitted at saw factories. I have always had full outfits of the best filing room machinery to aid me. I never use hammers except in extreme cases, being a firm believer in the merits of the saw stretcher. My tension being so loose, it must be kept very even, since saws so fitted are more liable to crack than if you have them too tight; this equalizes the strain throughout the saw and prevents cracks. To crown the back throws all or most of the strain on the tooth edge. Feeding, especially higher feed, makes the strain greater and the back being longer, will not support the toothed edge. In a straight saw both edges share the strain, which is my reason for putting an 'equal' tire on both edges. I drop an 8-inch 18-gauge saw to a 36-foot circle. An 8-inch 20-gauge saw I drop to a 50-foot circle. Otherwise I treat them same as 6-inch saws. My saws have few cracks, most of them having occurred during my early years of saw fitting. Concerning 'riding' the back guide, the greater part of the repair work in saw factories comes with a flange on the back edge of saw, some of these flanges being heavier than the swaging. This is very bad practice. It puts undue strain on the tooth edge and case hardens the back, causing cracks on both edges."

The above remarks represent first-class practice, although the above may require some modifications as regards speed of the mill, or the amount of hook, or the spacing and depth of teeth to suit special conditions.

THE FITTIING OF NARROW BAND SAWS

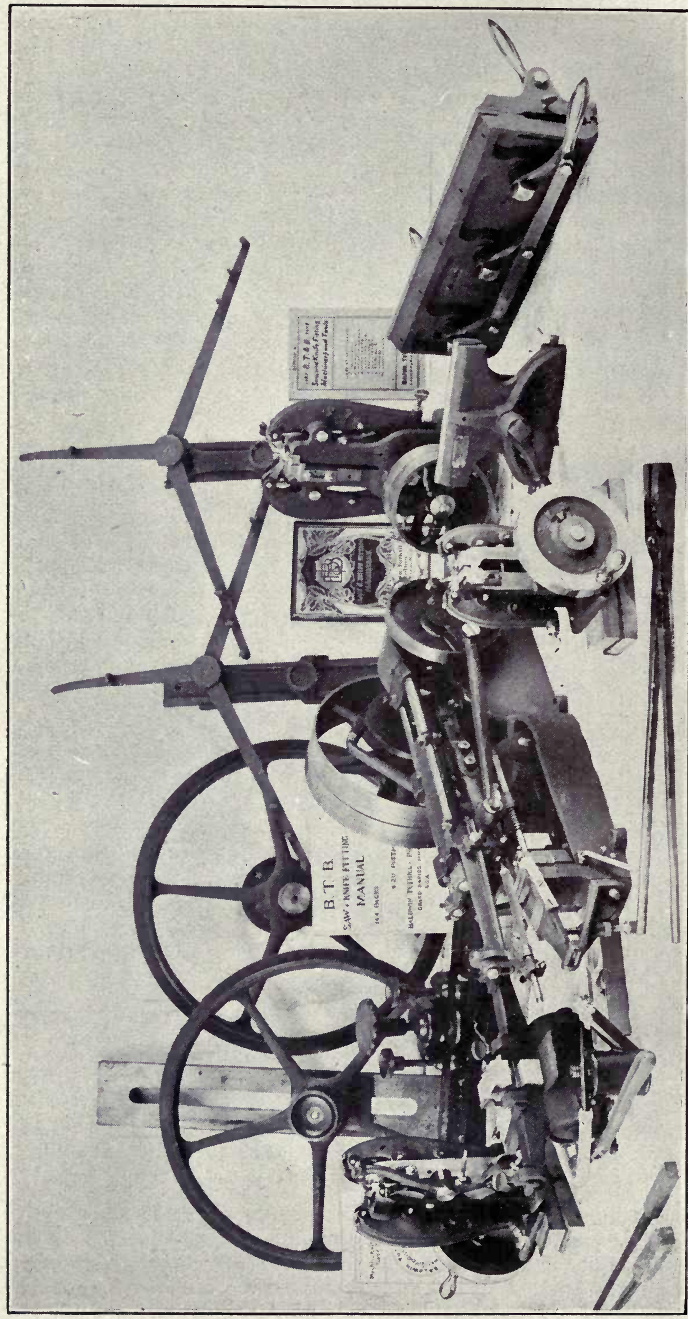
The notion prevails among some scroll band saw filers that hand filing and setting is essential to a perfectly fitted saw, and there is no doubt that as between good hand work and poor machine work, the former is preferable, but it is certainly a waste of valuable time for a man to push a file all around a long band saw and there are numerous factories and shops employing narrow band saws, in which the machine tools are used with entire success, in which filing and setting machines are considered indispensable adjuncts and from their use there results the best band saw work and the most in quantity that can be found anywhere.

The prejudice that exists against such tools is sometimes due to conceit of one's handiwork and sometimes to the fact that some actually defective machine has been given a trial without any satisfactory results. If such failure is due to innate defects in the machine itself, the prejudice is natural and well founded; but if due to a lack of skill on the part of the operator, or to the fact that the condition of the saws which have been fitted by hand, is not sufficiently uniform to permit of at once securing good results on a machine that is automatic and uniform in its motions, then the failure should be charged to the operator and not the tool. There is relatively as much skill required in handling these small machines for fine saws, as the larger machines used on wide bands, and perhaps more skill is required, because the saw and the teeth and the character of every process calls for fine work.

There are thousands of factories employing small band saws, in which the filing and setting machine are each as essential in the care of the saws, as are the sawyers for operating the machines.

But however good the machine or tool, there will always be found the tenth or the hundredth man who cannot or will not use it, merely because he cannot or will not master the mechanical details of the machine and see that the conditions absolutely necessary to its successful use, exist.

Viewed from the standpoint of investment only, the money invested in effective appliances for the filing, setting and brazing of narrow band saws will bring a better return than a similar amount paid out for saws, or lost by poor sawing or by frequent changes of saws dull and poorly fitted. The use of our improved band saw appliances is not recommended on the ground that they are calculated to dispense with the employment of fairly well skilled operators. We do not claim that any of our machines or tools will dispense with intelligent supervision, and we seek no customers on the proposition that with them ANYONE can do good work regardless of lack of skill or familiarity with the work in hand. Saw Fitting appliances are simply means to an end — perfect fitting— in the hands of a capable operator. They enable the practiced man to attain perfection in fitting; they enable the unpracticed man to greatly excel his hand work.



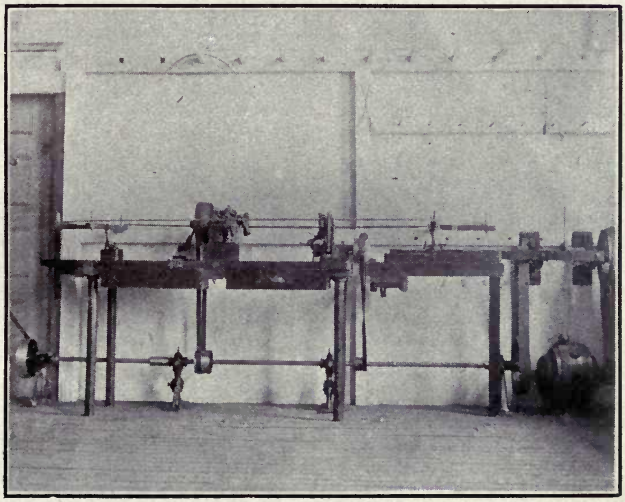
NARROW BAND SAW FILERS, SETTERS, BRAZERS, FITTING-UP WHEELS, VISES, TONGS, SPELTER, SILVER SOLDER AND BRAZING COMPOUND

The illustration on this page shows dependable machines and tools for the care of scroll band saws ranging from ⅛ to 1, 2 or 3 inches wide.

The band filer will accommodate saws having three or more points to the inch. The setters will accommodate the above and also somewhat longer spacings. A standard outfit will comprise automatic filer, setter, brazer or brazing clamp, filing vise, fitting-up wheels, etc.

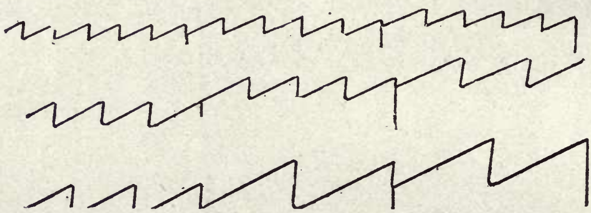
Fine tooth band saws require machines and tools entirely different in make up and capacity from those designed for band rips or resaws having long spacings and relatively larger gullets, that require sharpening with an automatic emery wheel sharpener, also a swage, swage shaper, etc., as enumerated in our band resaw filing room outfit. The economies and benefits resulting from the use of suitable appliances abundantly warrant their installation.

NARROW BAND SAW FILERS AND SETTERS



FITTING NARROW BANDS WITH MACHINES IN A U. S. NAVY YARD

NELSON R. GARDNER.—We do not hear much about narrow band saws of late, I suppose for the reason that everyone knows all about them and there is nothing to be said. However, I have just got into line an outfit for narrow bands, which I am very much pleased with an which gives good satisfaction. It consists of Bolton automatic filing and setting machines. Both machines run by power and are on a bench long enough to take supports for holding saws, the machines being 2 feet apart. The saw supports are made of white ash—simply three arms, and about 2 inches from the end of each arm is an upright bolt with a piece of brass pipe on it, for the saw to work around on. The countershaft is under the bench. The filing machine has a clamping and releasing device that is a good one. While the file is making the cut the saw is firmly clamped in a vise. After the file has done its work, the saw is released and moves easily into position for the file again. This machine files 50 teeth a minute as neat as a pin. The setting machine is set in exact time with the filer. This also runs 50 times per minute. The feature that I like about this machine is that the tooth is not hammered out on an anvil; it is simply pushed over to the required set and the full width of the cutting edge is maintained. I am over willing to give up to these little machines; hand filing is not in it for a minute with them. I am sure a trial will convince any first-class filer.



Our Band Saw Filers, Setters, Brazers, Filing Vises, Fitting-up Wheels, etc., suitable for saw teeth as illustrated or for still finer teeth, on saws ranging up to 1, 2 or 3 inches wide, have been manufactured in a standardized way for over 22 years, during which period thousands of them have been marketed to woodworking plants of every description, such as furniture, planing, sash, door and blind, chair, piano, organ, trunk, carriage, wagon, wheel, picture frame, moulding and show-case factories, navy and ship yards, dry docks, car and pattern shops, etc.

The number of these machines sold to large metal working plants for pattern room use, has been especially gratifying to us, because manufacturers of machinery are even more critical and exacting as to the quality and efficiency of the machines purchased, than is the case in woodworking plants. Many of these appliances are also used in manual training and technical schools, colleges, etc.

All practical men know that cheap, inferior construction or inexact, inconvenient adjustments in filers and setters having to do with fine tooth saws, condemn such machines and the factory scrap heaps are no stranger to machines bought on the single ground of cheapness or because they are urged upon customers on a "trial basis" with the hope that acceptance and payment will be made before lost motion and general dissatisfaction develop, and an unfavorable report reaches the office.

These Narrow Saw Tools are so well built and durable that they give satisfaction for many years, and the orders coming to us for repairs are infrequent in number and trifling in amount.

FEATURES OF MARKED IMPORTANCE

(1) Built with every particle of the idea of cheapness left out.

(2) Tested out and improved, until they meet the approval of thousands of practical, critical and exacting operators in every line of manufacture.

(3) Designed for customers that want fine tools and have no time or money to waste on inferior substitutes.

If you have any need whatever for a Band Saw Filer, Setter, Brazer or Filing Vise, don't hesitate to send us your order, stating the width and spacing of your different saws, that we may understand your requirements and meet them exactly or avoid the shipment.

Our machines are in use by an immense number of people and give them perfect satisfaction. They are more expensive than some, but just expensive enough to insure your getting machines that are worth buying. They are not sold at a delivered price or at a discount. They are designed for people who are critical and exacting, who want the worth of their money and who appreciate from observation or experience that the purchase of narrow band saw tools on the single ground of cheapness nets them a total loss on their investment.

AUTOMATIC SCROLL BAND SAW FILER

The small band saws so extensively used in every variety of woodworking plants have from 500 to 1,600 cutting teeth and it usually takes a competent man from 30 to 90 minutes to file such saws. Hand filing is a tedious process, and even where the greatest skill is exercised the teeth are likely to be left irregular and uneven in pitch and outline, and a saw cannot run smooth and cut straight with the cutting points out of line or bevel. It is also obvious that band saws having some teeth longer than others are much more liable to crack by reason of the excessive strain put on these long teeth. The action of our automatic filer directly avoids this trouble. Successful band sawing requires teeth of a length and saws of a width, uniformly spaced. Using the automatic filer frequent jointing is unnecessary, as the machine serves both as a filer and a jointer. The results are that waste and breakage of the saw and loss in time and quality of work are avoided. The circumstance that filing machines have been marketed which failed to operate successfully must not cause possible customers to conclude that a successful machine cannot be produced.

Our filer is a DISTINCTIVELY SUCCESSFUL machine, with a construction and an efficiency that insure good work. Its construction is that of a machine tool. It is a machine that fills a long felt want, performing its work in an ideal manner in factories where from one to fifteen or more band saws are used and where it has been subjected to the most severe tests on saws of every size and style, and has uniformly proven satisfactory.

It will file the saws without attention when once adjusted and started.

It will save nearly one-half in the cost of files.

It will file the saws sharp, keeping the teeth in perfect alignment, thus equalizing the strain. It will encourage the operator to keep the saws sharp by making the process an easy one. It will save the saws from breakage. It will file the saws in a much more rapid manner than can be accomplished by hand work, filing from 50 to 60 teeth per minute. It uses a 6-inch band saw file which swings into the throat on an angle, adjustable to afford as much or as little hook as can be obtained with a three-cornered file, filing the face of the tooth last and removing the burr at the finish as in hand filing. It files the teeth square with no beveling on face or back. It can be instantly started or stopped at any point. It has only three essential adjustments, feeding, clamping and filing tooth after tooth, all easy to get at, and so simple that anyone can readily see how to effect a necessary change in adjustment of the file or the feedfinger or the clamping mechanism. It will file each tooth separately or each tooth alternately, as adjusted. It may be run by hand or power, and while usually run by power, anyone that can turn a crank, can file a saw in a few minutes more expertly than can be done by hand in an hour. A perfect clamping device is essential in a machine of this class, and the clamp is so timed that it acts instantly when the feedfinger reaches the end of its forward stroke, and it will clamp thin back saws with certainty of holding them firmly in position. The feedfinger is entirely out of the way of the stroke of file and is adjustable to feed the tooth last filed or the next tooth ahead or the second tooth ahead, as desirable, according to the uniformity of the teeth. All parts are adjustable to wear, securing freedom from lost motion and consequent defects in operation. The large diameter of the driving pulley insures abundance of power. All moving parts are operated by one shaft. No gears, everything simple, durable and reliable. Adjustable for teeth spaced from 1/16 to 1/2 inch. The machine should be mounted on the filing bench, the saw being supported on pulleys or racks in a horizontal position. The belt pulley should run about 50 to 60 revolutions per minute, the machine filing the same number of teeth. But the speed of the machine should not be faster than is necessary to suit the work and if there is not a large amount of work, run slower than the recommended speed, say, 40 to 50 revolutions per minute.

A narrow band saw filer should never be run at a speed of over 50 teeth per minute if you wish to get a properly uniform feed and a good even cut of the file, that is to say, get the best filing the file is capable of affording. Such rate of speed will not only do the filing better but make the file last longer, and as in the use of a band filer, a uniform speed of say 50 teeth per minute is amply fast enough to take care of all the work, requiring as it does no constant attention from the operator, no one can properly complain of this speed being too slow.

When first applying the machine to a saw that has been filed by hand it is best to go over it several times until the teeth become regular. Care should be exercised in brazing to maintain a uniform spacing, although it will work successfully, requiring no attention from the operator, unless there are marked inequalities in the spacing. When the saw is once filed into shape a light dressing with the file will be all that is necessary. The machine has a combination of revolving cams that feed the tooth into position, clamp it and, after the stroke of the file, release the clamping jaws and repeat the feed. There are no springs or attachments likely to get out of order or any working parts likely to develop lost motion if the machine is handled with ordinary care. It can be belted direct from any line of shafting either above or below the floor as preferred, or may run by motor direct connected. The varying widths of saws are accommodated by an adjustment of the guides for back of saw, whereby the tooth is readily brought into perfect alignment with the stroke of file, which must not be too heavy.

In addition to their successful use by all manner of concerns operating narrow band saws, our filers and setters are used by manufacturers of band, hack and meat saws, or by concerns in large cities engaged in saw repair work.

AUTOMATIC BAND SAW SETTING MACHINE

The essential requirements in a machine of this class are that it shall hold the saw properly rigid and set the teeth without straining the blade, setting the teeth alternately with one travel through the machine. In a perfect running band saw, each tooth will stand, properly sharpened and presented to the wood, to cut away clean its proportionate part of the kerf. A proper spread of the tooth for clearance will result from the use of our Setting Machine.

A Band Saw once set with this machine will be perfectly true and uniform with respect to the spread of the teeth and each tooth will perform its proportionate part of the cutting, thus securing good work with the least possible strain on any part of the saw, with economy in the wear of the saw, in the amount of the kerf, and with smooth sawn stock resulting. Using our setter and filer, every tooth is bound to be treated exactly alike. The machines are used in a manner so that there is no shifting of the saw from one place to another, the saw, when once placed on the pulleys, not being removed until it is a finished blade ready for work. This economizes time, space and labor.

The machine works with an easy crank movement, requiring no exertion on the part of the operator. One revolution of crank feeds and sets two teeth, one to the right and the other to the left, the feedfinger acting on the tooth being set. All these movements are automatic and can be carried on at a speed of 100 to 200 teeth per minute. The machine gives its blow in such a manner that the tooth stays where set, and as the force of the blow can be instantly regulated by thumb screw at lower end of setting lever it is readily adapted to heavy or light blades and to various grades of temper. The blade travels in a channel formed by the saw vise, guide for back and the tooth guide, all of which are adjustable to various widths and gauges. The feed and setting mechanism are strong and powerful, the pawl and hammers being made of finest steel properly hardened. There are take-ups for wear and when necessary any part can be replaced. The pawl and hammers can be removed for grinding when worn or replaced by duplicates. The machine is constructed throughout like a machine tool with careful attention to all details. It is adjustable for saws from ⅛ to 3 inches wide. It is ordinarily positioned on the fitting-up bench next to the filing machine, the saw being supported on pulleys. It has been subjected to every requirement and found perfectly suited to all work within its capacity, giving entire satisfaction.

NARROW BAND SAW BRAZER, FILING VISE AND WHEELS

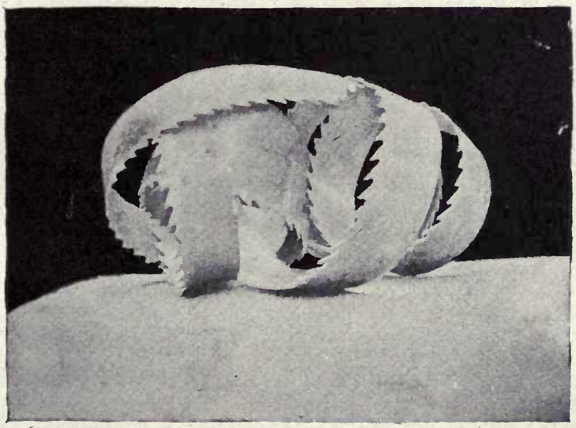
In addition to the filer and setter, there are required a brazing apparatus, steel jawed vise and a pair of adjustable iron pulleys for supporting the saw to machines.

A FEW DON'TS

Don't expect a saw that has previously been fitted indifferently by hand to show perfect results the first time it is placed on the filing machine or you may be disappointed. You must go over the saw several times to bring the teeth regular in length, hook and pitch and must make your brazes with care to maintain a uniform spacing.

Don't attempt to take off an eighth of an inch if there are some long teeth, for the file can only take its regular depth of cut at a stroke. Don't expect in once around saw that short teeth will come up to the prevailing lengths. Uniformity in lengths only results after a series of filings, but when once obtained can be maintained. Don't attempt to set a band saw with the vise loose. It should be set to hold the saw snug, not too tight to prevent a ready feed, nor too lose to feed too freely or to twist with the blow from the setting hammer. The narrower the blade, the closer should be the jaws of the vise, and very narrow thin saws should rest on a steel plate mounted on the saw rest so that the saw cannot bend down under the action of the pawl.

Having the saw once in uniform shape, a light filing or setting is all that is required to keep it perfectly sharp and properly set.



A TWISTED BAND SAW

SCROLL BAND SAW BRAZING

Good brazing of scroll band saws means that the braze must be so perfectly made that it gives no evidence of itself in the running of the saw.

The saw filer should first square off the ends of the saw, being sure after allowance for the lap is made, that the set in the teeth will be alternate; an oversight here will necessitate a raker tooth which is very annoying on the setting machine. The length of the lap is usually determined by the spacing of the teeth. Avoid a tooth point in the middle of the braze, so that if the lap is filed from gullet to point and the length of the lap is the space between two teeth, each tooth point will be retained the full thickness of the saw, and strain on the tooth point due to the character of the braze, will be avoided.

The laps should be filed very carefully with a sharp file. The ends of saw must be perfectly flat, square, and the laps must be filed perfectly flat and true, because if one edge is filed thinner than the other a twist in the saw is likely to result, a rather difficult condition to overcome.

Next fasten one end of the saw in the brazing vise, so that the braze will come in the center of the opening. Clean the surface of the laps and solder or spelter, with a rag dipped in Brazing Compound. Have one end of saw fastened in vise before doing this, to better prevent the liability of foreign matter coming in contact with the laps when placing same in the vise, thus defeating the purpose of the acid bath. Do not allow oil, grease or moisture from the fingers to remain on any part of the saw or brazing ingredients.

Next place the other end of the saw in the vise so that the back edge of the saw will be perfectly straight after brazing, and see to it that the clamping screws or blocks that hold the ends of saw in position, also hold the saw perfectly flat on bed of vise. Set the blade so that about $\frac{1}{32}$-inch of the lap is visible, that is, the point of one lap should lack about $\frac{1}{32}$-inch of reaching the heel of the other, to allow for expansion.

Silver solder, thin sheet brass or spelter are variously used between the laps. Silver solder is preferable for saws 1½ inches or more wide and for saws 1 inch wide if 18 or heavier gauge. For narrow bands spelter is widely used.

Grease or foreign matter or even moisture from the fingers on silver solder may cause spots resembling bubbles, in the braze, preventing a perfect integral weld, and often causing an opening up of the braze or a fresh break of the saw, necessitating a complete repetition of the brazing process. Borax is commonly used as a flux. It should be fresh and if chalky ought not to be used. The borax should be fine pulverized and a very little put between the laps. Then put a little on the solder and opening the laps slightly, slip the solder between them.

Next apply heat, first making sure that the alignment of the saw in the vise has not been affected.

For heat purposes, a kerosene or gasoline flame, may be employed, but care must be exercised when applying the flame, because if a strong blast is applied abruptly to the edge of the saw, the borax may be blown away from the edge before it melts. To overcome this, apply the heat from above until the borax flows and then bring the nozzle of the torch about 2 inches from saw and a little below, so that the blast will strike the saw underneath.

When the solder flows, squeeze the laps together with a pair of pliers, at same time releasing one of the side clamps to permit of contraction. But to avoid a kink at the braze one must be expert with the pliers because a slight twist of the saw while red hot will produce a kink.

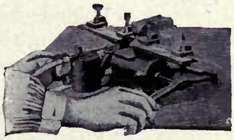
Next remove the saw from the vise and test the braze with a file. If the saw has been hardened as a result of its sudden cooling by the pliers, the temper should be drawn before the braze is cleaned. This can be easily done but the heat must be done carefully and do not make softer than blue.

The most convenient way to clean up the braze is to use a segment of a circle in a bench vise. Lay the saw over the segment and file lengthwise of the saw. If the proper allowance was made for expansion when the saw was placed in the brazing vise, very little filing will be required; but in any case do not file the braze thinner than the rest of the blade.

With proper care and attention to detail up to this stage of the process, all that remains is to remove the surplus solder, file and set the teeth and the saw is ready for use.

The following supplemental directions are specially applicable to our No. 84 Narrow Band Saw Brazer illustrated in connection.

With this device band saw brazing is neither an expensive nor difficult operation, for an inexperienced person can file the laps, braze the saw and dress the point in from 5 to 10 minutes. It is so designed that one casting answers the purpose of a scarfing frame, brazing clamp and air pump, and all that is necessary to complete the outfit is an ordinary flat file. With each brazer we furnish enough wire and spelter to last an ordinary factory two years. While the brazer has a capacity for saws up to 1½ inches wide, we recommend the use of regular brazing clamp and irons as more efficient for saws exceeding 1 inch in width. File laps on the right hand end of clamp, making about a ⅜-inch lap for saws up to ¾-inch wide, ½-inch for saws up to 1½ inches wide. File nearly to a knife-edge. Place the saw in frame, with the laps in center of opening in frame, and in placing the laps together allow a very little in matching the teeth for the expansion of the teeth when hot. Wind the lap firmly, especially the ends, with a piece of steel wire, and under the last turn of the wire place a small amount of the spelter or solder. Put on plenty of powdered borax, place the block of wood back of the saw, leaving a space for the fire to go around the saw.



A small block of wood opposite the flame should be used, as it aids in holding the heat. Use kerosene oil in the lamp. See that the lamp wick is smooth on top and a little lower than the blow pipe; light the lamp and holding it 3 or 4 inches from the saw, pump the blast on the saw until the solder flows freely. Then blow out the fire, remove the block and pump cold air on the joint. File off the surplus solder between the clamps on either side of the flame. ALWAYS USE THE LUMP BORAX, powdering as you use it, and dampen it before using it. The device is efficient and successful for the purpose and secures a perfect weld and a straight saw.

SCROLL BAND SAW BREAKAGE

It is a common sight to see a man, serenely sawing away, ignorant of the damage he is causing to the saw by having the top wheel tilted too much, with the saw riding hard against the friction wheel and probably stretched as tight as a violin string. The only time one is justified in thus tilting the upper wheel enough to cause the saw to crowd against the friction wheel is when he must saw in and back out of stock that pinches the back of blade. Otherwise it should be righted so that the saw all but turns the friction wheel and the teeth project just past the front edges of the guide jaws.

The jaws must be kept true and parallel to the saw. They may need an occasional grinding or facing in order that they may not bind the back of saw while the tooth edge has too much play. Besides causing heat, strain and cracks in the blade, the running of saw against the friction wheel causes a sharp, square cornered edge, which affects the sawing of short turns or small circles. The back of the saw may be kept rounded or beveled off by touching a piece of emery to it while at full speed.

Do not strain the saws unnecessarily tight, as this will tend to impair the saws, and also wear the bearings, causing them to heat, wear out of line and cause trouble in general. A slight flutter of the saw between the saw does not necessarily mean that the saw is too loose.

After finishing a job of sawing that requires the guide raised higher than regular, drop it to its regular working height. The saw may be easily twisted or broken if many short turns are made with the guide a few inched too high.

Another practice that strains, twists and breaks saws is to try to saw turns with a saw too wide for the job. No hard and fast rule can be laid down in such case, because the more set a saw has, the shorter the turn it will make, while a saw with insufficient set, no matter how narrow, will not saw short turns successfully.

Despite the objections of some of the old time filers, whose pride in their handiwork and love of "elbow grease," may be commendable from the standpoint of personal enthusiasm, it is not worth while in these days to attempt to get along without the use of a good filer and setter, even if the filer has nothing to do but watch the operation of the machine as the work proceeds and stop it when the filing is completed.

It is very bad practice to allow a machine to keep on filing longer than necessary, because even though the machine is so well adjusted that nothing can go wrong, it will go on, filing the fronts of the teeth after it has cleared the backs, wasting the steel and perhaps affecting improperly the gullet outline.

Rubber tires on wheels must be kept in good condition. It is improper to keep the saw running in one place on the wheels so long that a groove is worn in the rubber. Simply move the guides back and forward and make the saw run where you want it by proper change in the tilt.

Excessive dust or a stray chip between saw and wheel produces strains and breaks. Keep the dust guard up close and arrange a brush to clean the face of lower wheel where the saw leaves it.

One prime essential is that the teeth shall be kept of uniform length. A long tooth strikes much harder upon the stock than the rest, thereby causing a sharp tremor, which is likely to crack or break the blade. The remedy is in the hands of the filer and if he does his work properly little trouble will be experienced from this cause.

It is also very essential that the saw shall be kept sharp. A sharp saw will cut through the stock regardless of whether thick or thin, almost as easily as a table knife passes through cheese. But if the saw is continued in use and the points allowed to become thick and dull, it will become necessary to force the stock against the saw in order to cut at all, under which conditions, the blade is forced into an unnatural or distorted condition and it breaks with a loud bang.

Special care must be exercised when sawing sharp corners or small curves, that the saw shall not become jammed in a tight place or given an unnatural twist under which it will give way.

Broken saws must either go into the scrap heap or be rebrazed or used as sections for brazing into other saws. A sufficient quantity of scroll saws should always be kept on hand, fitted and in good condition to run, ahead of probable requirements.

Brazing of saws is a somewhat tiresome job, but such work must be done from time to time as breakages occur, or in quantity when a number of broken saws accumulate, unless the saws can be sent out to a nearby repair shop as done by some plant operators in the larger cities.

Hand filing of band saws in any busy shop is an absolutely out-of-date method that is losing money every day for the owner.

LEVELING AND EXPANDING THE BACK OF SCROLL BAND SAWS

Scroll band saws ranging from ¼ to ¾-inch or more wide, are used extensively in all industries, and being subjected to a lot of abuse, are prone to get out of order to an extent that they will not cut straight or may even run off the wheels. Such saws become stretched on the tooth edge and acquire line twists, or short kinks, the same as wider band saws. They will assume a figure 8 or a wide range of similar distortions. But such saws can be readily straightened, using an ordinary leveling block of iron or oak or maple, measuring about 6 x 6 x 12 inches or other convenient size. These narrow saws can also be expanded on the back edge by hammering with round-face hammer, but the hammer should be of light weight and so ground on face that it will not mark the saw.

Scroll bands from ¼ to ⅜-inch wide will stand a crown on back of $\frac{1}{16}$-inch in 2 feet and those ½ to ⅝ wide of $\frac{1}{16}$-inch in 3 feet. Expansion of the back edge is preferable to tipping the top wheel and if the expansion is properly done, the saws will track on the wheels and stand a good heavy cut without running hard back against the roller guides.

Scroll bands should be given plenty of hook, say approximately 1 inch in 5, all that can be given with the ordinary triangular band saw file. Many saws are run with too little hook. The amount of set given to the saw should be merely sufficient to give clearance to the blade and no more.

Scroll bands with 4, 4½ or 5 points to the inch serve better for general sawing than with more teeth, except that for the very dry, hardwood 6 to 8 points to the inch work efficiently. A saw only ⅜ or ½-inch wide, with the right hook, set and expansion of back edge will saw oak or walnut up to 10 inches thick without snaking or dodging and without running hard on the guides.

SCROLL BAND SAWING MACHINES

The saw pulleys on scroll band sawing machines should be perfectly balanced, run true and the covering or rim surfaces should be kept in good condition. The wheels are commonly covered with rubber bands and in some cases with leather, cork composition, etc. If the face of pulley is allowed to become lumpy and uneven, the likelihood of breakage of saws is greatly increased. A piece of sand paper, held against the face of a revolving wheel, will usually serve to true same, if the job has not been too long neglected. Rims slightly crowned assist in preventing side movement of saw. Saw dust forming lumps on face of rim, will have the same effect as a badly worn rim. Flanges on rims are no longer employed, and the modern type of roller guide with hardened steel roller to take the back thrust of the saw, is universally employed. A sensitive straining device is important, in the form of a spiral spring or weighted lever. Pulleys of small diameter are undesirable and for any but the lightest work the pulleys should not be under 30 inches diameter. Speed of operation depends upon diameter of pulleys and width of saw and other things being equal, the faster a saw can run, the faster it will cut.

Usual speeds are as follows: For 30-inch pulleys a rim speed of 3,500 feet per minute. For pulleys 36-inch diameter and saws 1 inch or less wide, 4,000 feet per minute; above 1 inch wide, 4,500 feet per minute. For 42-inch pulleys and saws 1 inch or more wide, 5,000 to 5,500 feet per minute.

The following schedule of pulleys, widths and revolutions per minute, may be of service to practical men.

Diameter Saw Pulley	Maximum Width Saw	Speed of Saw in Feet per Minute 3000	3500	4000	4500	5000	5500
24-inch	¾	Rev. 470	------	------	------	------	------
30-inch	1½	Rev. 382	445	500	570	------	------
36-inch	2	Rev. 318	370	425	477	530	580
42-inch	2½	Rev. 270	315	360	405	450	495
48-inch	3	Rev. 235	280	320	360	400	440

In the case of band rips or resaws run on metal wheels of 48 inches diameter, saws of 4-inch width are employed and run at a rim speed up to 7,000 feet per minute.

The amount of strain to which scroll band saws of different widths and gauges may be subjected, has hardly been worked out in a standardized way, but the following table is published for what it may be worth.

SUGGESTIVE SCHEDULE FOR SCROLL BANDS

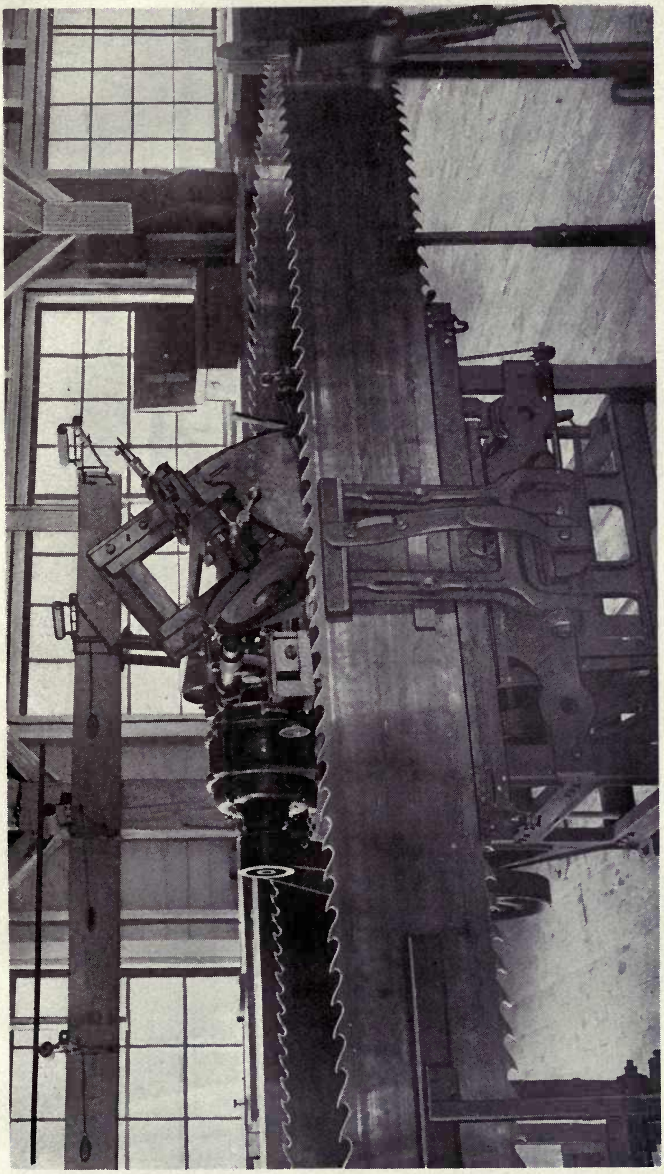
Width	Spacing	Gauge	Max. Strain, Lbs.	Minimum Radius Cut, Inch
1/4	1/8	22	55	3/4
3/8	3/16	21	100	1 1/2
1/2	1/4	21	160	2 1/4
5/8	1/4	21	200	3
3/4	5/16	21	240	4 1/2
7/8	5/16	21	280	6
1	5/16	21	320	8
1 1/4	3/8	20	410	12
1 1/2	7/16	20	525	20
1 3/4	7/16	20	640	24
2	1/2	20	755	30
2 1/4	5/8	20	870	36

Scroll band saws are commonly filed with a three-cornered band saw file, which affords an angle of 60 degrees between face and back of adjacent teeth. Deep gullets should be avoided.

The gauge of scroll band saws should be related to the size of the wheels as well as the character of the sawing. As a general rule 20-gauge may be used on 40-inch wheels and larger, 21-gauge on 36-inch wheels and 22-gauge on 30-inch wheels. Heavier gauges are not pliable enough for small wheels and will break sooner than the thinner gauges and when the character of the sawing does not require a heavy gauge, stiff saw, the thinner gauges are preferable.

In general 21 is very good and may be employed on the majority of band sawing machines. But there are many that employ saws as heavy as 19-gauge for heavy scroll band sawing where the cut is deep and must be very accurate, as in the case of swell drawer fronts and case ends that are to be veneered just as they come from the saw, because the quality and quantity of the sawing is such that they can well afford to take the chance of breaking a few saws rather than to use the lighter gauges. The width of a scroll band saw depends directly upon the design to be sawed and it is good economy to keep on hand a good assortment of widths and gauges so that a proper selection may be made for each particular job. A bevel back saw the same width as a plain saw will turn a much smaller circle and for this reason the bevel back saw is largely used for fine sawing of carvings, wood ornaments, etc.

New scroll band saws ought to be gone over carefully after receipt and it is a good plan to put them on the machine and see that they will run perfectly true before fitting them. The proper fitting of scroll saws is highly important, as the saw must be set evenly and not too heavy for good results. There are very few plants that can economically dispense with a setting machine, and in any such, when hand setting, the saw should be firmly clamped in vise, and the teeth set over against a beveled jaw or plate with punch and hammer, taking care not to set more than one-half of the tooth, for in attempting to set the whole tooth there is danger of twisting the blade.

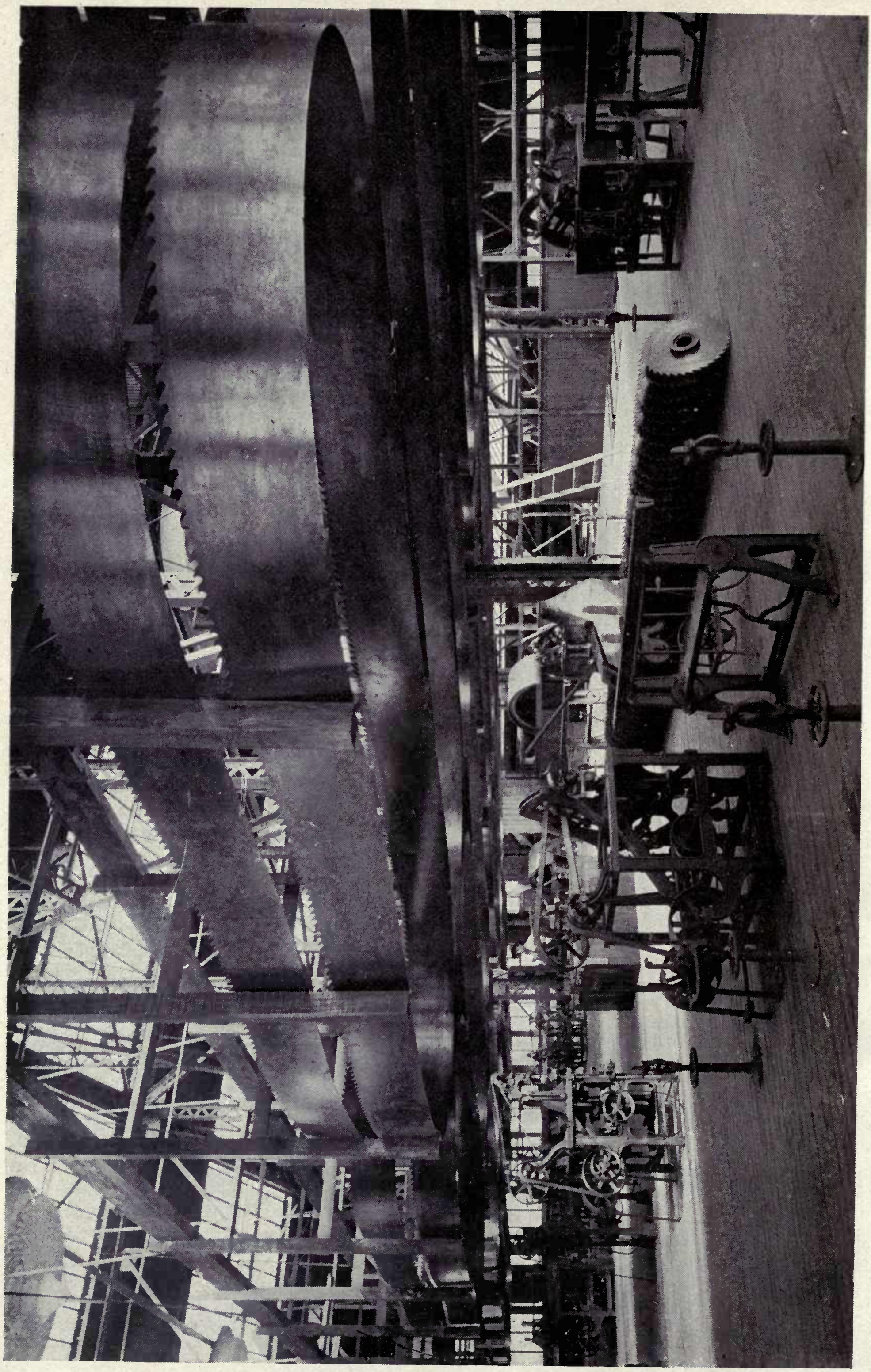


Accurate filing is essential to good life and work. The teeth must be kept uniform in size and shape and filed square across the blade. Never file band saw teeth with a bevel. A quite common mistake is that of filing the teeth too deep, especially so in the case of very narrow saws.

Saws thus filed will not cut well and there are probably more saws broken from this than any other cause. It weakens the blade and the saw loses its strength and stiffness. For saws wider than ⅜-inch, the round-cornered file is preferable. It is, however, very important in hand filing to file every tooth alike and the teeth ought to be jointed occasionally or often if there is any sign of unevenness. Use only sharp saws and do not on any account continue to run a saw that is badly dulled.

For narrow scroll bands, the lamp brazer is far better than the use of tongs or brazing irons, as a better joint results, and the job can be done more quickly. A lap from ¼ to ⅜ inch is standard for saws up to ¾-inch wide. Small saws should be brazed so that they will have an even number of teeth, especially so if to be set with a machine, as you can then begin setting at any part of the saw without stopping to find an odd tooth. Just as setting is indispensable for scroll bands, so swaging should be considered indispensable for resaws.

In a shop employing a resaw that must be hand filed, care must be taken not to file a notch in the blade at base of gullet, as sometimes is done both in filing the face and back of tooth. Use a round file and when the tooth wears too short, gum out the throat with an emery wheel or round file, but leave no case hardened spots or notches. The teeth should be no longer than is essential to afford proper dust room. The tension



in narrow resaws should never be more than enough to make the saw stand up to its work, and should be perfectly uniform throughout the blade. The tension for a 2-inch saw should be just visible under the straight edge and for a 3-inch saw the drop should be about $\frac{1}{64}$ and for a 6-inch saw a scant $\frac{1}{32}$.

Saws over 1½-inch wide require a brazing clamp with irons that are heated in a forge fire. The irons should be ⅜ or ½ inch thick.

Examine the bearings of band sawing machines frequently. The arbors must fit in the boxes closely, especially the lower wheel, because when the saw is strained, if there is any play in the lower box it will lift the arbor out of its bearing and the wheel will not run steady but will jump, thus subjecting the saw to an uneven strain,—a very common cause for band resaw breakage. Stop small cracks by punching a hole at extreme end.

RUBBER TIRES

Rubber tires are commonly employed on machines for scroll band sawing, but such tires are a nuisance on a band saw with power feeding attachment as a means for light resawing, because saw dust and pitch collect on the face and become imbedded in the rubber, tending to pack in lumpy masses that cause the saw to run badly and subject it to improper strains.

It is difficult to clean off this dust and pitch from rubber tires. Brushes while frequently used for the purpose are inadequate, and for this reason an iron or steel-faced wheel, into the face of which dust cannot be imbedded as in rubber tires, and which tends less to collect dust, is much easier to keep clean. The best and most efficient means for keeping hard-face band wheels clean is by the use of a light canvas pad saturated with kerosene and a hinged metal scraper mounted close up to the free surface of each wheel.

The cushioning effect of rubber tires is not essential for saws 1 inch or more if the top wheel has a suitable spring or lever straining device. Rubber tires are mainly important for wheels on which narrow saws are run, that track near the center of the wheel. But when the saw is run directly on iron or steel-faced wheels, the points of the teeth should always project beyond the front rim of wheels.

BAND SAW LAPS

On all saws that exceed from 1 to 2 or 3 inches wide, the making of laps with a file is a very tedious job and unless one is highly skilled in the use of a file on flat beveled filing, and has a good eye and steady hand, the lap will be anything but what it ought to be so that a perfect weld clear across the surface of the joint, will rarely result. It is therefore far preferable to employ a good automatic or hand machine for preparation of the laps, saving a lot of time that may otherwise be better employed and insuring so far as the surface of the lap can do, a perfect braze.

SHIP YARD BAND SAWS

On account of the variety and character of the stock, different angles with the grain, heavy feed, and lack of judgment or experience of the sawyers, there is probably no use to which band sawing machines are put, harder than that in the ship yards, and yet, considering the hard duty they perform, there is perhaps no class of band saws that stand up longer for constant use until worn out, subject to proper interest in his work and care on the part of the filer.

Such saws come from the factory in lengths of 150 to 300 foot rolls similar to belting and the filer cuts and brazes them to length. These saws are commonly 1½ inches wide and from 18 to 20-gauge. New saws are used on the straighter cuts such as framing timbers and after wearing down to 1¼-inch wide, if still in good condition, are transferred to another machine on which bevels or perhaps curves are being sawed. Next after wearing the saw down to say ⅞-inch, if still in usable condition, it will be transferred to a knee sawing machine, where the saw has to work on some very sharp turns and curves and perhaps on a bevel at the same time. Moreover the knees, being hewn out of the roots of large stumps, in order to get as near as possible the natural bend of the root, are of a very hard and pitchy texture and subject the saw to the hardest possible working strain.

The narrower such a saw becomes if otherwise in good condition, the better it will work on such material, and in some cases the saws wear down to ¼-inch only of solid blade from bottom of gullet to back and afford the best results, only to break up sometimes before properly strained and in motion, simply because there is not enough material in the saw or it has become so badly crystallized that it has no proper tensile strength remaining.

Pinching in the cut often causes breaking or injury to several feet of the saw, such that a piece must be cut out and a new section brazed in, but if a good braze is made, a number of such joints can be made without impairing the efficiency of the saw to a serious extent.

The teeth are usually spaced 1 inch with a rather shallow gullet which will be sufficient to carry the dust in ordinary proper feed. Some filers employ a spacing of ½ or ⅝ or 1½ up to 2-inch, but comparatively few filers indulge in such extremes either way. There are ship saw filers who crown the back of their saws all the way from 1/64-inch in 5 feet to ⅛-inch in 4 feet and with a range in tooth spacing as wide as mentioned above and obtain good results. Under such circumstances, no rule can be laid down and the determination of what conditions of fitting may be best for him, is up to the individual filer.

The problem of hook is an important one in ship saws, because of the variety of angles at which the saw teeth may approach the stock. In cutting curves the teeth sometimes get crosswise of the grain in which case, a saw with the right hook to the teeth for ripping, will run ahead on the wheels. In such case, the hook may have to be reduced or a saw with less hook substituted.

Ship saws are run with spring set, but some use a raker tooth, to serve as a cleaner for the V-point of the kerf.

Ship saws for iron bark, an exceedingly hard variety of African wood, used for the back bone of ships, stanchion post caps and various places where the hardest service is required, is of an oily nature with practically no grain. For such sawing, the cuts being straight, full width saws are employed that must be fitted very carefully. Sometimes the sawyer will not proceed over 6 inches into the cut with one saw, the oily saw dust wedging between the wood and the saw and the moment it begins to accumulate on the saw, it will become hot from friction. It is even difficult to stop the saw in time to prevent heating and many saws have the life burned out of them.

Saws thus employed quickly coat over on both sides, which tends to spoil the clearance of the set, increase the working strain, and generate heat. A light, very even setting and perfect leveling are essential to the successful operation of such saws, and the machine must be stopped and the saw changed as soon as heating or dullness becomes manifest.

Ship yard band sawing machines employ wheels of 40 to 42-inch diameter on which 19-gauge saws are run, up to 48-inch wheels carrying 18-gauge saws.

The saws were formerly hand filed with an 8 or 10-inch three-corner band saw file, filing the back of one tooth and the face of the next, but owing to the sharp angle formed by the file at base of gullet and the comparatively thick saw for the small diameter wheels, and to the twisting and great variety of strains given to the saw in the sawing operation, the damage and loss from cracking was very great and to overcome this as much as possible, the spacing of teeth was increased to 1 inch or more and the automatic emery wheel sharpener, using a 3/8-inch thick wheel, calculated to produce a well-rounded throat line at base of tooth in place of the sharp angular gullets resulting from hand filing, has been very generally adopted.

On the parts of the work where very short crooks have to be gotten around, as in ship knee work, a heavy set is necessary, more than double the thickness of the saw, and every fifth tooth as a raker, facilitates the removal of the little tongue left in the center of the cut. For cutting ship ribs and the like, less set is required and the raker tooth may be dispensed with.

These saws, if run with spring set, should be set with a power band saw setting machine. A 15 degree hook on face of teeth is effective.

Ship band saws, if fitted with a swaged tooth, should have the teeth spaced from 1½ to 2 inches from point to point and the swaged tooth properly shaped with a swage shaper gives a short or abrupt back clearance on the side which adapts the tooth to cut diagonally with or across the grain, more readily. It will be obvious that as between a spacing of 1 inch with spring set and a spacing of 2 inches with a swaged tooth, there will be the same number of cutting corners on each side of the saw and the added advantage of only one-half as many teeth. This doubles the saw dust capacity with the added advantage that in sawing through knots and similar hard spots, when the saw is a little dull, the swaged tooth holds its width, which the set tooth will not do.

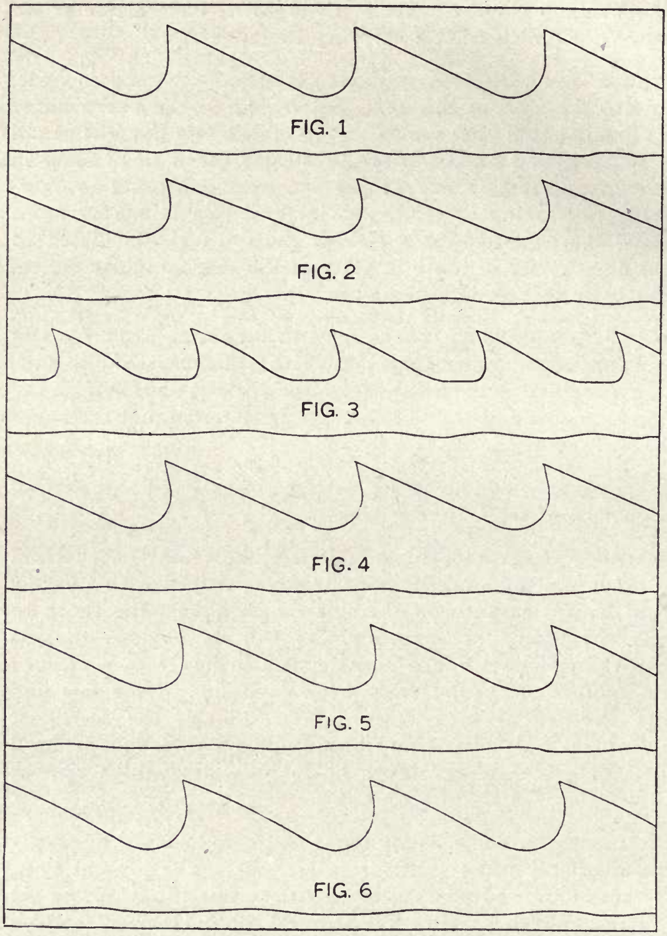
The principle involved is much the same as in the shingle industry. Formerly shingle and similar saws were invariably fitted with spring set, but at the present time, in the largest and most important shingle manufacturing districts, few if any spring set shingle saws are employed. The modified practice has reduced the number of teeth in a 38-inch shingle saw from 80 or 90 down to 60 and the full swage and swage shaping of the teeth, has resulted in a big improvement.

Anyone contemplating a change over of this kind, must cut out every other tooth, and not attempt to run full swage on short spaced teeth as was first attempted on shingle saws, without success.

It has also been found in connection with the operation of ship yard band saws, that the use of a saw stretcher is of great aid in keeping the back of the saw properly expanded to counteract the stretching of the toothed edge, and the rolling of a few lines through the central portion of the saw in the same manner as wider band resaws or wide log bands are rolled, will properly expand the central portion and leave the edges properly tight for straight sawing.

TROUBLE WITH SHIP YARD BAND SAWS

We received the following interesting communication from a saw filer in British Columbia, which we quote in full with illustration of tooth outlines employed and also quote our reply and that of a saw filer to whom the inquiry was referred.



The tooth space of all except No. 3 is 1-inch and the depth of gullet 11/32-inch.

"Gentlemen: The saws which I am now taking care of are 1½ and 2 inches wide, 18-gauge, and 2½ inches wide, 19-gauge. These saws are run on ship band-sawing machines at a rim speed of about 5,500 feet per minute and are used for sawing wooden ship frames from B. C. fir, some of which is very hard. The teeth are spring-set and I crown the backs of the saws about 1/64-inch in 5 feet. I put in tension with a single-geared roll, but find it rather difficult to work tension into the narrow saws which are so heavy in thickness—18-gauge. However, I relieve the centers by rolling them every other day. The amount of tension I put in may be judged when I tell you I use a 4-inch straight edge, and the light must show between straight edge and saw, pretty well up to the back edge and the bottom of throats.

"The styles of teeth appear in the accompanying sketch. You will notice that Nos. 1 and 3 have less hook than the rest. Style No. 1 is used for both ripping and cross-cutting—combination work. No. 3 is used for cross-cutting exclusively and Nos. 2, 4, 5 and 6 for ripping. I have tried more hook on Nos. 2, 4, 5 and 6, but the points of teeth broke off frequently, so I changed back and find that the shapes shown herewith give best results in our work. The tooth space of all except No. 3 is 1 inch and the depth of gullet 11/32-inch. The saws are not supposed to be run more than two hours without changing.

"The top wheels of the ship saws are rubber-tired and the bottom wheels are leather-covered. The top wheels seem to stay fairly clean and do not become lumpy with accumulations of saw dust. The machine on which No. 3 runs has iron-faced wheels, and this saw gives some trouble with cracks. When I started working on these saws I put the same amount of crown in the back of No. 3 as in the others, but there was trouble with the saw running back on wheels, so I increased the amount to a scant

$\frac{1}{64}$-inch in 3 feet to offset this trouble. I have often noticed that when the cross-cutting saw (No. 3) is brought in with cracks showing, the sawyer has been ripping with it or running it too dull, or both.

"I have repeatedly asked the sawyers to put more strain on the saws but they seem afraid to do it. They are not experienced men, and persist in pulling the guide (back thrust) wheel forward into close contact with the back of saw, and that is the way they run it all the time. Frequently the saws come off blue on the backs and as sharp as a knife, from running so hard against the guide wheel. The guide wheels are now cut badly by the backs of saws and of course this aggravates the trouble.

"Once I succeeded in persuading one of the sawyers to keep his guide wheel back, free from saw, and for a while he ran the saw that way and had no trouble until he tried cross-cutting heavy timbers with a rip saw blade, and then he broke the saw. After that he argued that the saw would not have broken if the guide wheel had been close up against the back, to support it.

"The regular rod or lever which is used on the tightening device to put strain on saws is only 8 inches long, and it gives so little leverage that when a man exerts all his strength on it, there is no great amount of strain put on the saw. Would you advise using a longer bar as a lever, so that more strain could be put on the saws? What is your opinion regarding the use of guide wheels on these narrow saws?

"When I first started on this job (I have been here about three months) the saws were badly cracked and some were broken, but I changed the hook and shape of teeth and had no trouble with cracks until recently. Can you advise me what is the trouble and how to remedy it? The machines are in good condition, wheels in line, etc., as a first-class millwright goes over them every week."—Filer.

"Mr. Filer: We acknowledge your letter of recent date, but are not sufficiently practical or well-informed with reference to the operation of such small band saws as you employ for the varied purposes described, to feel warranted in attempting to offer dependable advice. Indeed, the manufacturers of band-sawing machines or of saws for such uses can rarely venture to give expert advice, simply because they do not come in contact sufficiently with the every-day operation of the saws, as does the practical man, to be able to readily determine just what change or changes will best serve.

"We think, however, that your method of tension as described, is not at fault. The tooth outlines show excellent shapes for use in the manner described, and the fact that you have chosen these after considerable experimenting is pretty good evidence that they are O. K. There would seem to be nothing at all about any of the gullet outlines capable of betterment as a means of avoiding cracking from angular gullets, and the fact that saws do come off occasionally with cracks because of dullness and overfeeding, is common experience everywhere.

"The purpose of a guide wheel is to guide the saw, but certainly too much cannot be expected of it in this regard, and sawyers make a mistake if they think that the purpose of the guide wheel is solely or mainly to enable them to force the cut unduly.

"Any increase in the strain will naturally lessen the occasion for using the back guide as a means of supporting the saw in a heavy or difficult cut, but if the strain on saw is unduly great, this in itself will increase its tendency to crack. We have, however, seen a statement made that more saws are broken from insufficient strain than from overstrain, because in the former case the saw tends to dodge and thus come into violent contact with the guides. The same authority also advises that the saw blade shall not be allowed to come in contact with the back-thrust wheel, because the latter, on modern mills, is intended mainly to prevent accidents and not as a means of support for the saw to run against.

"We are not familiar with the straining device you describe, but in general terms may state that the standard amount of strain for a 2½-inch, 19 or 20-gauge saw, is 1,000 pounds, and a less amount for thinner or narrower saws. We infer from your letter that the faces of band wheels are true, free from wear on edge, and that saw dust does not form on the rim so as to cause undue strain under the saws; also that the wheels are in perfect balance.

"The facts that the timber is hard and the sawyers are men of little or no experience and doubtless exercise no judgment in the matter of feed, undoubtedly have a good deal to do with your problem, and we do not know that there is any way in which even the most skillful fitting of saws can compensate for such working conditions, because a poor man can put a well-fitted saw out of commission in no time and yet be entirely ignorant of the fact that he is the sole cause of the trouble.

"These problems of yours doubtless come up to a great many sawyers and filers connected with shipbuilding plants."

REPLY OF THE FILER TO WHOM WE REFERRED THE LETTER

"The trouble you have with saws cracking is undoubtedly due to their rough treatment at the hands of inexperienced sawyers. Ship band-sawing in fir timber is rough work at best and it puts saw steel to a very severe test, but when improper handling of the saws is added to it you may expect cracks and broken saws as a regular thing.

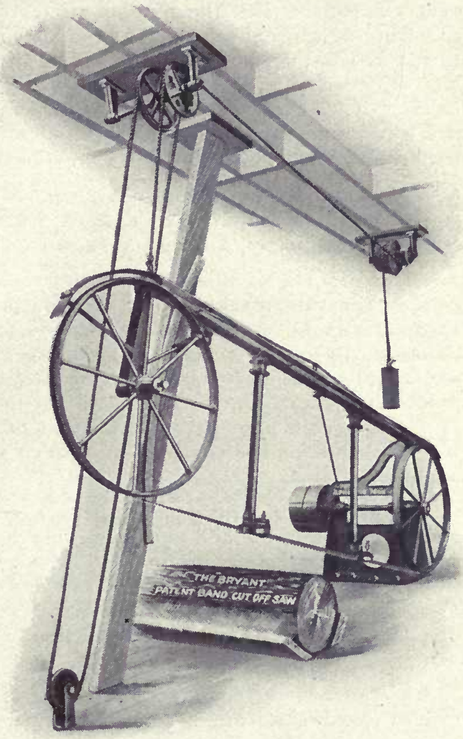
"The backs of band saws should never run hard against the thrust-wheel unless they are crowded back by extra-heavy cutting. The thrust-wheel is there for emergencies only, and it should not be spinning around when the saw is running free or in a comparatively light cut. It should always be in good condition and well-lubricated, however, so that it will not bind in its bearing when the saw is forced back against it. The thrust-wheel should not even touch the back of saw when the saw is running free, but it should be adjusted fairly close so the saw will not be pushed too far back or off the wheels when forced back in a heavy cut.

"If you cannot persuade the sawyers to adjust and use the thrust-wheel properly, I would advise removing the wheels and replacing them with stationary back-thrust blocks of hard fiber or lignum-vitae wood, as this will not case harden the backs of saws when they run against it. The fiber or hardwood back-thrust blocks will require renewal quite often—perhaps once a day or every other day—but they will save your saws.

"In regard to strain, I would use a longer lever and try a little more, as it may give you better results in sawing. The teeth shapes shown look satisfactory for the work which you describe."—W. H. R.

BAND CUTTING OFF SAWS

During recent years the band cut-off saw has met with considerable introduction for use in cutting logs, timbers, etc., into short lengths for shingles, staves, and basket stock, wood pulp, tubs, and pails, cord wood, or in fact any cross-cutting of logs or timber that is otherwise cut with circular or drag saw cutting off machines.



The feature of this type of sawing machine is the employment of a thin band saw ranging from 1⅛-inch up to 2 inches wide, of 19 or 20-gauge with 3 or 4 teeth to the inch. The band saw is run on a quarter twist by means of patent guides or twisting rollers, there being a distance of 4 feet between the point where the saw starts to leave the horizontal and where it reaches the vertical, on a 48-inch machine, and a proportionate distance on other sizes so that the twist is made gradually.

Cross-cutting band saws must be sharpened with an automatic emery wheel sharpener or filed with an automatic filer. These saws are set with an ordinary type band saw setting machine and the general principles that govern the fitting of the wider scroll bands or narrow band rips or resaws, applies substantially to the cross-cutting band saws.

For quiet, smooth and rapid cutting, the band cross-cut saw has much to recommend it. It is always under control, requires very little power and makes less saw dust than the thick, heavy gauge circulars or drag saws. The log requires no dogging or clamping in position, as a small wedge on either side is sufficient to hold it properly rigid. A band cross-cut saw will not stand the abuse that a circular or drag saw will stand, and is liable to breakage the same as band saws used for ripping, resawing or scroll sawing, but the breakage can be largely eliminated by keeping the saws sharp, properly strained and carefully operated.

SAW AND KNIFE FITTING EQUIPMENT AND PROCESS AS RELATED TO THE REQUIREMENTS OF TECHNICAL, MANUAL OR INDUSTRIAL TRAINING SCHOOLS, PATTERN SHOPS AND MISCELLANEOUS WOODWORKING PLANTS

Saws and machine knives are tools of primary importance in connection with all woodworking processes and it will be readily obvious that speed and perfection in sawing, planing, surfacing, etc., must depend directly upon perfection in fitting of the saws and knives.

The band sawing machines in general use divide themselves into two general classes:

First—Scroll band saws ranging from ⅛ up to 1 or 2 inches wide, in the narrow widths not over ½ inch from point to point, and in the wider widths rarely in excess of 1 inch from point to point.

Second—Band resaws or rip saws that range from 2 inches up to 6 or 8 inches wide and that now are generally employed in the larger and better class woodworking plants throughout the country.

It is not possible to keep up fine tooth scroll band saws by hand methods with a satisfactory measure of success, even though it is true that there are some men of long time experience and with a highly developed skill having charge of saw fitting in the better class industrial plants, who can file and set scroll band saws by hand methods, very efficiently. But the number of teeth on such saws, which may range up to one thousand or more, according to the spacing and length of saw, make hand filing practically impossible, because of the time involved and of the fact that the average man, who is called upon to keep such saws in condition for work, lacks the requisite skill or handicraft. Hence, whether one band sawing machine or a larger number are employed, it is a prerequisite that suitable equipment, either belt or motor driven shall be provided for keeping fine tooth band saws in condition for use.

The standard outfit for such purposes comprises an Automatic Band Saw Filer, an Automatic Band Saw Setter, a set of Fitting-Up Wheels for support of the saw about the Filer and Setter, a Filing Vise and a Brazing Outfit.

The process of filing and setting being entirely dissimilar, it is good practice to employ separate machines for such purposes. A standard Band Saw Filing Machine automatic in all movements as regards feeding of the saw, clamping, filing, etc., will as ordinarily operated file fifty or more teeth per minute, producing any desired hook and a gullet outline of approved shape, regardless of whether the saw has only three points or a greater number of teeth per inch. Band saws having teeth spaced in excess of ½-inch from point to point cannot be filed satisfactorily with an automatic Filing Machine and for the sharpening of such saws, an Automatic Emery Wheel Sharpener is alone suitable.

It will be readily apparent that a scroll band saw automatically filed by a well constructed, durable and exact working Filing Machine, will maintain a uniform width, spacing and gullet outline insuring, if perfectly set, that each tooth will do its proportionate part of the sawing smoothly and on a minimum kerf and at a maximum rate of speed. This result is certain regardless of whether the stock is comparatively green or of the hardest texture and kiln-dried.

Of course, in practice, setting of the band saw should precede the filing operation and a standard setting machine will set the teeth oppositely and uniformly at a high rate of speed, say from 50 to 100 teeth per minute.

Both of the above machines are adjustable in all ways to accommodate varying widths and gauges and spaces. The changes in adjustment are readily accomplished and these machines are essentially simple and so free from complication in the matter of adaptation or adjustment that men of no previous experience or skill can readily learn how to operate them to the best advantage.

Indeed, saws that have previously been hand filed and that vary in width or have long and short teeth with hook line on face of tooth and pitch line on back of tooth exceedingly irregular, can in the course of time be brought into practical uniformity by having the feed pawl push in the gullet last filed or in the third gullet ahead. Indeed, it is astonishing how an imperfectly or badly filed band saw can be brought into perfect condition.

Hand filing is such a slow, laborious and tedious process that even where the greatest skill is exercised, the teeth are likely to be left irregular and uneven in pitch and outline and no saw can run smooth and cut straight with the cutting points out of line or proper angle. It is also obvious that band saws having some teeth longer than others are much more liable to crack by reason of the excessive strength imposed upon such long teeth. Moreover, the back thrust of a saw in poor condition, either because of irregular teeth or dull teeth is much greater upon the band saw guide so that as result upsetting or case hardening of the back of saw is likely to occur. Hence such a saw uniformly fitted with automatic machine insures long life to the saw and freedom from breakage, and avoids the time lost in changes, rebrazing and refitting that will otherwise occur.

In earlier years there was a marked prejudice on the part of many practical band sawyers against filing and setting machines, merely because the machines for such purposes were decidedly inferior in construction and means of adjustment, so that a short time operation would cause wear and lost motion to an extent that perfection in filing or setting was impossible.

That such faulty machines were produced and marketed and that there has been gradual evolution in manufacture is natural, and the prejudice against such machines no longer exists, unless on the part of some whose experience has been limited to machines of inferior type and who have not had an opportunity to enjoy the benefits that result from well manufactured and exact working machines for such purposes.

The matter of time saving in filing and setting is highly important. It is unnecessary for the practical operator to constantly attend these machines, unless the saws are being filed or set for the first time, in which case because of irregularity in the teeth, or because of brazes that have not been properly dressed to an even gauge with the rest of the saw, attendance on the machine while filing or setting may be temporarily desirable.

An automatic machine will take the saw just as it is. The machine movements are exact and uniform in all respects and if the saw is not properly straight on the back or if the brazes are improperly finished or if there are high teeth or teeth with improper angles, it is important that special care and attention shall be given until the saw has been brought into proper uniformity.

Moreover, filing and setting machines encourage the operators to keep the saws sharp and in the best condition by making the process easy.

We strongly recommend to every user of scroll band saws the purchase of a Band Saw Filer and Setter of suitable capacity for the variety of saws in use.

It is usual practice to mount the Band Saw Filer and Setter on a bench or table of convenient height in line with each other and with a set of Fitting-Up Wheels, Reels or supporting racks provided to properly carry the saw around the machines. The Filing Vise may also be mounted in connection with the Filer and Setter in readiness, should there be any hand work needful on some of the teeth.

The first time filing or setting of a band saw that is new from the factory or that has been previously hand filed, should be carefully done with a view to filing only the high spots lightly, gradually working the long teeth down to uniform length so that the saw will be of even width at all parts.

The upkeep cost, even after long term of years will prove negligible in the case of filing and setting machines, if same are well manufactured and of approved type with the test of many years' experience behind them as a guarantee of quality and efficiency. Indeed it is practically useless and a waste of money to purchase such appliances, excepting of the most approved type, because otherwise unsatisfactory results and an early abandonment of use of the machine just as happened in so many different plants in past years, will occur.

For the brazing of scroll band saws ranging from ⅛ inch up to 1 inch or 1½ inches wide as a limit, the standard Air Pump and kerosene torch apparatus is most suitable. But for wider saws or for saws heavier than 19-gauge, the use of brazing tongs or a brazing clamp with irons that require heating in a forge fire will alone serve. Brazing tongs are less generally employed than heretofore, because the small brazing clamps rated for saws up to 3 inches or 4 inches wide are more efficient.

In the case of the narrower saws, the brazing is a rather simple operation even for an inexperienced person, because the laps or joint can be filed and saw brazed and dressed usually in 10 minutes or less.

In this connection it may be well to point that unskilled or inexperienced persons, who first put band saw Filers or similar appliances at work on saws previously hand filed and lacking in uniformity may anticipate a perfection in operation and results that cannot possibly be realized at first operation.

It may be necessary in some cases to go over the saw several times before the teeth become regular in length, hook and pitch and approximately uniform as regards spacing from point to point. Do not on any account attempt to speed up the work by undue filing of long teeth, because the file can only take its regular depth of cut at a stroke and this is somewhat variable according as the file is new or worn and dulled by use. Uniformity in spacing and length of teeth must be a result of series of filings, but as soon as these results are accomplished, same can be maintained with facility and a very light touch of the band saw file will usually be sufficient, unless the saw is badly dulled from long use or lack of temper.

As soon as a saw can be brought to perfect condition, light filing and setting will be sufficient and the results in sawing will be about the best that it is possible to obtain.

The practical operators of these little machines for fitting scroll band saws is always of the greatest possible interest either to a boy taking up the study of manual training and having his attention directed to machine operation and adjustment for the first time or to persons of greater age and wider experience. A boy will soon become familiar with adjustment and operation and subject to whatever suggestion may be needful as regards the style or shape of tooth that it is desirable to produce and maintain, will be able to produce practically as good results from these machines as can a man of mature years and long experience, having charge of such work in a large and busy factory, in which numerous band sawing machines are constantly at work.

Subject to ordinary care, the wear and replacement of essential working parts in Filing and Setting machines of approved type will be negligible, even after a long term of years and no one can fail in getting satisfactory results, unless wholly lacking in mechanical ability or judgment.

EMERY WHEELS FOR BAND SAWS

A wheel of medium hardness is preferable for band saw sharpening since it will cut quicker and heat a glaze less than a hard one, although it will wear out sooner. A hard wheel, if run too rapidly, will produce to a greater or less extent, case hardening, which cannot be touched with a file, and from which cracks are likely to result. When the color of the steel goes beyond a blue, under the action of the emery wheel, the steel is red hot and hardens.

There is much in the selection of emery wheels of good grade, and much in keeping the wheel in condition to cut freely without undue feeding to saw. The perfect wheel will cut freely without tendency to glaze or fill up with the minute particles of dust and steel. It holds its shape without frequent dressing. Its finishing cut should leave the tooth unblued and free from burr or roughness. A saw sharpener with motion such that the emery wheel stops long in bottom of throat, is objectionable, as this is exceedingly apt to heat or case harden the saw at base of the teeth. Then, if the gullet is not well rounded, it offers an opportunity for cracking. An 18-gauge saw requires a finer graded wheel than one 14-gauge or heavier, that the wheel may grind to a fine edge without blueing the points of teeth or leaving a coarse wire edge. A coarse wheel will not leave a smooth surface on the edge of the teeth, and consequently the saw will not cut so well. If the wheel is too fine for the gauge of the saw to be ground, it will glaze and blue the gullet and point with the slightest grinding. A soft wheel is very objectionable, for it will wear away a trifle on each tooth, making it impossible to maintain the desired shape, and as a result the hook will be run out and there will be no uniformity between the teeth on a saw or between the different saws. Having a sharpener equipped with a number of different speeds and perhaps driven by a separate engine, it should be possible to properly speed wheels of fair quality to suit their size and the work.

The use of emery wheels with the face concaved is recommended to those that carry considerable hook in their saws, as wheels thus faced will hold their shape with less requirement for dressing than straight faced wheels. When facing an emery wheel with the dresser avoid undue pressure. If the wheel is allowed to trace the entire surface of the tooth, in grinding, its shape and that of the teeth will be better preserved. The teeth will be ground up to a sharp keen edge, every tooth alike, and the uniform width of the saw maintained. The use of a sharpener simply for face grinding or as a gumming machine, will result in having no two saws with teeth shaped alike. But if you have a sharpener that will not grind to a sharp point, and you are obliged to face with the machine and point the back with the file, see that the saw is kept properly jointed. The less that a file is used on the teeth, the better, unless for lightly pointing off a feather edge, and with a good machine and a good wheel this should be unnecessary. In general the use of an upset should be avoided, as it makes the teeth of uneven length and prevents a uniform grinding. A face swage requires face grinding, and renders the preservation of hook more difficult, unless the swage is adjusted to set the point properly ahead for quick facing up. In using a face swage if the logs are gravelly, requiring a frequent swaging, and a consequent large amount of face grinding, you may run the teeth back too fast and make them too slim, with a tendency to dodge or vibrate, and must shape the grinding to avoid this. Always keep a good sized gullet so that the dust will clear easily. The teeth should never be allowed to get short and stubby, or without the proper amount of hook, as they will do less work and take more power. and the saw has a greater tendency to bind and heat, owing to the want of sufficient room in the gullets for the saw dust to escape rapidly. If you have occasion to grind in a deep gullet, a coarse wheel may be employed, to be followed up with a fine grit wheel for finishing and pointing.

In sharpening saws, the pressure of the emery wheel should be light on the work. It is erroneous to suppose that heavy pressure produces rapid cutting; it simply results in the glazing of the wheel and the hardening or burning of the teeth, which will then crumble or fracture in the cut or when swaging. If a saw has been badly fitted and it is necessary to remove much metal, instead of forcing the wheel as hard as possible to the plate and making it red or blue from the heat, the work should be gone over lightly a number of times.

Having a saw with teeth uniform, you should after swaging, place the saw on sharpener and grind around once to remove any feather edge resulting from swaging, then sidedress with a pressure sidedresser, and then finish sharpening. If any teeth have been bent in swaging or from other cause, straighten them. A saw will cut smoother, stand more feed, and run longer when sidedressed with swage shaper, than by any other method. Constant attention to the matter of keeping the teeth exactly alike and perfectly fitted, is essential to a fine cutting saw.

COMPOSITION OF GRINDING WHEELS

Some users of grinding wheels, particularly small quantity users, still have the impression that a wheel is a wheel and that any kind of a wheel will do. There are, however, marked differences not only in the kinds of abrasives employed but also in the sizes of grains, and in the composition of the bond and the heat treatment.

Natural abrasives are emery and corundum. Emery is the oldest known abrasive, used since remote times for the sharpening of edge tools and the best quality comes from the island of Naxos. It is of reddish brown color readily distinguished from Turkish emery from Asia Minor, which is nearly black. There are also important emery mines in various parts of the United States, particularly in Massachusetts.

Emery wheels are no longer regarded as equally efficient to those made of corundum or some of the electrically made abrasives, although still used for various purposes.

Corundum is another natural abrasive found in India, Canada and the United States. It is of crystalline formation, very hard and sharp, and unlike emery, is inclined to fracture when dull, instead of wearing flat. This characteristic causes the numberless grains on the surface of the wheel to automatically keep themselves sharp, thus tending to afford a free cutting wheel.

Corundum wheels give excellent results for the sharpening of wood cutting tools and are generally considered much superior to those made of emery.

The electrically manufactured abrasives, being made at a high temperature, ranging up toward 6,000 degrees Fahrenheit, which causes all impurities to be burned away, are practically pure alumina, and as alumina is the cutting unit of any abrasive, it will be obvious why the manufactured article possesses qualities superior in general to the natural product.

The manufactured abrasives are very fast cutting, enabling the user to grind away a large amount of metal, in a comparatively short space of time without danger of burning the work.

The bond of a grinding wheel is the material that holds the grains in place, and three bonds are employed, viz., vitrified, silicate and shellac, the latter sometimes called elastic.

Vitrified wheels consist of a special mixture of abrasive grains, with certain clays and fluxes, which after partly drying and being formed into wheels, are burned in a high temperature kiln until the clay and fluxes begin to melt and fuse the bond and cutting grains into one homogeneous mass. The wheels are then trued up, bored, bushed, balanced, tested, inspected and graded for the market.

Wheels thus made are very free cutting and owing to their open nature will resist heat, cold, moisture and the action of acids.

In the silicate bond the binding material is silicate of soda or liquid glass. Owing to the short time it takes to make wheels by this process (a day or two at most) this bond is very popular among wheel manufacturers whose facilities for manufacturing on a large scale are somewhat limited. Silicate wheels are more close and compact than vitrified wheels, therefore they are not as free cutting, but owing to the fact that they can be made with a wire web, inserted as a factor of safety, they have long been popular and largely used.

In the shellac or elastic bond wheel the grain is mixed with a good grade of ground orange shellac, celluloid or rubber, after which the mass is pressed in a hot mold. These wheels are very free cutting, and owing to their tough nature it is almost impossible to fracture them even through hard usage. Thus some filers will use no other bond and for the very thin hard wheels used in sharpening fine saw teeth, wheels thus manufactured are considered preferable, not being readily broken when subjected to slight twisting and turning strains.

Very thin wheels used for saw sharpening, slot grinding and similar fine work are much safer and in general more satisfactory if put together with a soft bond.

But most wheels used for woodworking plant use are made with hard bonds, by the vitrified or silicate process.

The nature of the bond has practically everything to do with the so-called degree of hardness of grinding wheels because there is no hard and soft emery or corundum any more than there are hard and soft diamonds. Grains of any genuine abrasive, say corundum for example, are all practically of the same degree of hardness, but if they are so bonded together in the wheel that they may be torn or broken away quite easily when in service, then the wheel is said to be soft, otherwise it may be called hard or a medium hard wheel, depending upon how well the grains are held together by the bonding material.

Manufacturers of grinding wheels commonly employ letters for designating grades of hardness but owing to the different materials and methods of manufacture employed, the system of lettering is not uniform. But practically all manufacturers stamp wheels with the grain and grade, so that the user may re-order according to the tag or data sheet, affording particulars as to suitability or efficiency for various purposes.

The grain number applied to grinding wheels indicates the size of grains used in any specified wheel, and is determined by the number of meshes per lineal inch in the sieve through which the grains are passed in the grading process. Thus a wheel of No. 36 grain is composed of grains the largest of which will just pass through a sieve having 36 meshes to the inch, and the smallest of which are too large to pass through the next smaller size of sieve, No. 40. The grain of wheels commonly employed on woodworking tools falls within the limits of 24 to 60.

The success of saw and knife grinding lies in the selection of the right grinding wheel. Soft bonded wheels cut quicker and glaze less than hard wheels. They do not last as long as hard wheels, but produce more work in a given time and are a better investment than hard wheels as they will not case harden or burn. The proper wheel for the work holds its shape without frequent dressing and cuts freely without tendency to glaze or fill. The pressure of the grinding wheel should be light on the work. Over-pressure does not produce rapid cutting but is liable to cause glazing of the wheel and burning of the teeth. Better and faster results are obtained by light pressure. A wheel that is too fine works with about the same results as a wheel that is too hard. Be sure your machine is free from vibration before you condemn the wheel.

Proper speed has much to do with efficiency, durability and economical operation. Thus wheels that run too slow usually appear too soft and wear away rapidly, while those running too fast are apt to glaze more or less, do not cut freely and show unduly hard.

It is presumed that the maker's recommendation for speed is fairly intelligent and this should be followed as closely as conditions will permit.

Thus for wet grinding a rim speed of 4,000 feet per minute is customary and for dry grinding 5,000 feet or slightly more or less may be effectively employed. As the wheels wear away appreciably, a faster arbor speed becomes necessary to properly maintain the rim speed.

Unfortunately there are many factories and shops that maintain the same speed from the time the wheel is mounted on arbor, brand new, until worn down so near to the collar line, that it must go into the discard.

This is wasteful because with decrease in diameter there is a corresponding decrease in the rim speed and as a result the grains wear away or break out more easily and rapidly than they should.

A better practice is either to speed up the wheel as it wears down, or shift the worn wheel to some other arbor operating at a faster speed.

It is obvious that a grinding wheel must wear slightly that fresh particles of the abrasive may come up, because it is in this way that the wheel tends automatically to keep itself sharp and in proper condition for continuous cutting. Unless the grains of the abrasive do tear out or break off as the grinding proceeds, the face of wheel will become smooth or polished and particles of steel or any metal that is being ground, will fill in between them so that the wheel will not cut. Dressing the face of wheel will remove the glaze and renew the cutting face but no wheel that readily fills up or glazes over, will cut rapidly or cut without heating. Such wheels start cracks and draw the temper of steel on which they may be used and the only remedy is to replace the wheel with a new one, if the conditions cannot be overcome by variation in speed or regular dressing.

A grinding wheel should always be examined before being put to use to make sure that it is sound and free from flaws. Like a circular saw, a grinding wheel should be marked to correspond with a mark on the collar of the arbor so that these marks may always occupy the same relative position whenever the wheel is replaced on the arbor.

A new wheel may be tried in different positions on the arbor to determine in what position the best running balance can be obtained and the wheel should then be marked accordingly and trued up with a dresser.

It is of the greatest importance to keep a wheel properly trued, in smooth running condition, and always in balance. Otherwise it will wear away rapidly, require an extra amount of dressing, and afford a less satisfactory service than it should.

As regards wet and dry grinding, it is probably best when grinding extra long bevels on very thick knives, such as veneer knives, to wet grind them, but for jointer, molder, matcher and planer knives, both thick and thin, dry grinding will do very well, if the condition of the wheel is always good and the speed of the cross-feed of knife to wheel, properly slow.

To grind dry with any measure of success, wheels, moderately coarse, free cutting, in grain 30, 36 or 40, should be employed. A free cutting wheel will wear out in less time than a hard wheel, especially in woodworking plant use, where speed counts for a good deal, but the satisfaction and improved results are an abundant offset to any increased expense for wheels.

Soft emery wheels are especially objectionable because they wear out of shape and thus change the shape of the gullet, besides tending to run the hook out of the teeth.

A wheel too fine tends to glaze and case harden the teeth, while a very coarse wheel will not produce a smooth surface.

SPEED FOR WHEELS

A rim speed of about 4,000 to 5,000 feet per minute is recommended by the makers of wheels. This may be increased to 5,500 if necessary but there is nothing to be gained by running it faster than this. It is possible by running a wheel at a high rate of speed to glaze it over so it will not cut, while the same wheel may cut satisfactorily if run at proper speed. Moreover, the strain on the wheel is greatly increased as the speed is increased; thus the strain on wheel at 4,000 feet, rim speed is 48 pounds per square inch; at 5,000 feet, rim speed, 75 pounds at 6,000 feet, rim speed, 108 pounds, etc.

Table of Straight Emery Wheel Speeds

Diameter of Wheel	Rev. for Rim Speed 4,000 Feet	Rev. for Rim Speed 5,000 Feet	Rev. for Rim Speed 6,000 Feet
6 inch	2546	3183	3820
8 inch	1910	2387	2865
10 inch	1528	1910	2292
12 inch	1273	1592	1910
14 inch	1091	1363	1637

Every saw filer should have a speed indicator and know that his wheels are properly speeded. It is an unquestionable fact that in some mills emery wheels are being run at a speed that is positively dangerous and that in other mills the speed is so slow that the action of the wheel is merely a rub instead of a cut. Great injustice is frequently done emery wheel makers or dealers by half using and then condemning emery wheels that would prove perfectly efficient if properly run. When you order emery wheels, specify the slow and fast speeds of emery wheel arbor. Then if your order is filled intelligently, you will probably be well served and if not, you will have a basis from which to order something better adapted to your work.

Don't burn or case harden your saws by using a poor emery wheel. Band, gang and other thin saws are so liable to case harden and crack that you cannot afford to take chances in sharpening with a poor emery. Many filers are adopting the dished or concaved wheel, which it is claimed gives more hook with less tilt, misses point of tooth when wheel is descending, affords an easy curve to throat of tooth, leaves extreme face and point of tooth straight and sharp and maintains a uniform hook until worn out.

DRESS YOUR EMERY WHEEL

"Were you ever so unfortunate as to have a piece of hardened steel on which you have spent considerable of your valuable time, present a surface containing hundreds, yes, I may say thousands, of small cracks, which would completely ruin the piece for your purpose?" asks a correspondent in Sparks from the Crescent Anvil. "If so, you may think you have been spending your time on a very poor piece of steel, and again you may have come to the conclusion that the smith has ruined it by ill-treatment. Both your ideas may be possible but not probable. I would suggest that you turn your attention to the emery wheel and examine it; to see if it is exactly true, cutting free and easy, or whether it is gummy, the small crevices being filled with iron or steel cuttings and the wheel simply sliding over the surface, polishing it instead of reducing the piece in size. The friction caused by a wheel in the latter state, when brought to play upon a piece of hardened tool steel, produces an intense heat and causes the surface of the steel to expand and crack at the extremely small point of contact, as it can not relieve itself in any other way, the part not as yet subjected to the wheel being rigid and hard.

The writer has seen shear blades that have met with this treatment; half the surface of the blade containing thousands of cracks, and the remainder being perfectly sound and solid, the wheel being dressed in the middle of the operation. The presence of water on a wheel as above mentioned does not obviate the difficulty. Dress your emery wheel occasionally, or frequently as needful.

Those who use emery wheels in fitting saws and woodworking cutters generally, should make a note of this.

MISCELLANEOUS SUGGESTIONS ON EMERY WHEELS

An emery wheel is a circular file, and if on some particular work a wheel does not run well, it may often be made satisfactory by changing the speed.

If a wheel fills or glazes, it suggests that it is speeded too high or is too hard for the work.

Start new wheels on the slow speed cone. Endeavor to maintain the rim speed as the wheel wears down, or, in other words, increase the speed of spindle as the diameter of wheel decreases. Keep the wheels perfectly balanced and true by use of emery wheel dresser.

Keep the boxes well oiled and free from dust. Look out for heating and expansion of arbors.

Don't leave your machine running if the bearings are not well oiled, as your arbor may get hot and expand and burst the wheel.

Don't run a machine if the arbor is loose, as it will jump and not do good work, and may break the wheel.

Don't put a wheel on the floor when you take it off the machine; have a shelf to put it on. Take good care of the wheel if you want it to do good work.

Avoid heavy contact of wheel with work, as this causes a wheel to glaze and fill up much more rapidly than a light contact.

Never hack wheels, as they are liable to be broken or cracked so that they will break in use. Wheels should be run toward the operator.

The working strain is as the square of the velocity. If the revolutions be doubled the working strain will be increased four times.

Never crowd a wheel upon an arbor. Don't mount it unless as easy fit. Use good sized concaved flanges. Never mount wheels without flanges.

If wheel shows softer toward center, it suggests that it has not been speeded up as it wore down, so that the rim speed has become slower, which causes the wheel to wear away faster and thus appear softer.

Have your emery machines equipped with dust pipe and exhauster where possible.

Remember that wheels do not often break from inherent weakness or defects. Most accidents arising in the use of wheels are due to carelessness or ignorance.

Common causes of accidents are: Catching of work between the wheel and the rest; heating and expansion of arbors; using too small or too light flanges, and not having them properly concaved; not using any flanges, but simply screwing on a nut against the wheel; allowing arbors to become loose in the boxes from cutting and wear; running wheels on shaky machines, allowing the emery wheel to descend on the saw tooth, or feed finger to push against the wheel when in the throat.

CAUTIONARY SUGGESTIONS ON GRINDING WHEELS

Grinding wheels in stock waiting for use or sale, should be carefully stored, supported on edge in a suitable rack, except that shellac or rubber bond wheels of ¼-inch or less thickness, should be laid flat on a straight surface to prevent warping.

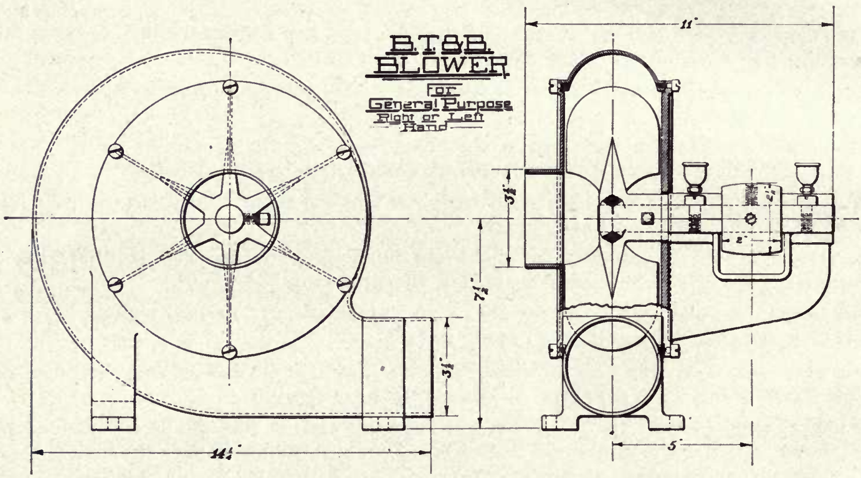
Immediately on receipt, wheels should be closely inspected to make sure that they have not been injured in transit or otherwise. For added precaution, wheels should be tapped lightly with a hammer; and if they do not ring with a clear tone, they should not be used. Damp wheels when tapped with a hammer may not give a clear tone. Wheels ought to be dry and free from saw dust when applying this test.

All grinding machines ought to be sufficiently heavy and rigid to prevent vibration and should be securely mounted on substantial floors, benches or other suitable foundations.

No wheel of larger size than recommended as maximum by the builder of a machine ought to be employed on same.

Every grinding room ought to be well lighted, ventilated, and kept warm and dry. machines employed for dry grinding ought to be connected with a dust exhausting system, as a protection to the operator, and to lessen the wear and tear on bearings and belts.

Filing rooms have not generally received the attention in this regard that is due, although the requirements of factory inspection laws in some states and countries, as well as the obvious benefits that directly result in preventing wear and lost motion, are leading many plant operators to equip their sharpening or grinding rooms with a small exhauster and suitable piping, which for an ordinary filing room will necessitate a comparatively small outlay. An exhauster suitable for such purpose is illustrated in connection.



Grinding wheel arbor holes ought to measure about .005 inch larger than the machine arbor.

Protection guards or hoods, securely fastened to the machine and of suitable material or strength such that in case of breakage, injury to the operator will be unlikely to result, are desirable and indeed essential.

Grinding wheels are commonly tested by the manufacturers at a rim speed of 9,000 feet per minute, which affords a safety factory of almost 2 for 1 in the case of saw sharpening wheels and more in the case of knife grinding wheels as customarily speeded. Hence the liability of breakage from centrifugal force is very small, unless the wheel is cracked or the work catches, in a manner that subjects the wheel to a side or torsional strain. Of course this is what sometimes happens in connection with saw sharpener operation, if the wheel descends on top of tooth, or end of feed pawl or otherwise, due to improper adjustment or careless control by operator.

Hoods for knife grinding machines should be adjustable to the constantly decreasing diameter of a straight wheel.

Grinding wheel ought to fit the spindles loosely but should neither be too loose nor forced on.

Wheel washers of blotting paper, rubber or leather should be used between the wheel and its flanges.

When tightening spindle nuts, care should be taken to tighten same only enough to hold the wheel firmly, otherwise the clamping strain is apt to damage the wheel.

In no case should a speed about 5,500 rim feet per minute be exceeded and in general 5,000 rim feet per minute should be a limit, for straight-faced wheels. For cup wheels of the vitrified and silicate types, a rim speed of 4,500 feet is recommended as standard for a 12-inch cup, but smaller cup wheels are rarely speeded over 3,500 feet per minute.

The maximum size of grinding wheel which may be used, together with maximum operating speeds, ought to be indicated on or over each machine.

Flanges, whether straight or tapered, should be frequently inspected to guard against the use of flanges that have become bent or sprung out of true or out of balance.

A wheel used in wet grinding should not be allowed to stand partly immersed in water. The water soaked portion may throw the wheel dangerously out of balance.

Work ought not to be forced against a cold wheel but grinding pressure should be increased gradually, thus giving the wheel an opportunity to warm and thereby eliminate possible breakage. This applies to grinding rooms which are not heated in the winter and to wheels which have been stored in a cold place.

Goggles should be provided for the use of grinding wheel operators, where the character of the grinding may render possible injury to the eye. For protection against flying chips or particles of emery, plate glass guards in a metal frame may be suspended just above the grinding spaces of the wheels, or a leather flap may be attached to the guard or hood and adjusted to interrupt sparks and emery dust.

DURABILITY AND SERVICE OF GRINDING WHEELS

The durability and service grind of emery wheels is largely due to the condition of the machine and its operation at proper speed.

Wheels out of the same lot, practically identical by all tests, may afford widely differing results, perfect satisfaction in one plant, and be strongly condemned in another plant.

Similarly identical wheels operated on different machines in the same filing room and under apparently similar conditions, may afford widely different results.

The reason is that one machine may be improperly speeded, or intermittently speeded because of changing power conditions, or because bearings on the machine are badly worn and need rebabbitting, or the cams or idlers, studs or pins on the machine are badly worn and need replacement, such that the wheel instead of descending gently, producing a light grind, comes down with a crash, causing not only excessive wear, possibly chipping and breakage, but also grinding the teeth unduly hard, affecting the swaging and possibly causing gullet cracks.

If a good wheel operated on a machine in good condition, were substituted for the condemned wheel on the poor machine, in almost every instance the good wheel would meet with similar condemnation.

Something is due wheel manufacturers the same as saw manufacturers and if a wheel or saw does not afford good service, don't condemn it unless you know that the conditions of use are perfect, so that lack of efficiency must be due solely to the wheel itself and in such case advise the maker or distributor fully as to the conditions surrounding its use, so that a substitution can be made intelligently and not by guess.

A machine in poor condition is always likely to cause trouble even with the best of grinding wheels in use.

A good grinding wheel is one that cuts freely, does not heat the steel, and holds its shape, as a wheel that will not hold its shape and consequently will not maintain the required gullet outline, is impossible.

For high speed steels a wheel of open texture is more successful and much less likely to affect the temper injuriously than a dense wheel, because it runs cooler and cuts faster.

TABLE OF CAUSES OF GRINDING WHEEL ACCIDENTS

Safety Code for the Use, Care and Protection of Abrasive Wheels (2nd. Edition). Reprinted from "Grinding Wheels"—Copyrighted, 1913

Broken wheels (caused by)	Cracked wheel (caused by)	Improper inspection of wheel	Before issued to operator. When being mounted.	
		Dropping or striking against some object while not being operated	During storage While being mounted While standing	Carelessnesss. Horseplay.
		Being forced on improper sized spindle	Too small bushing. Too large spindle.	
		Heated Spindle	Tight bearings	Lack of oil. Improper spindle size.
			Inner flange not fixed on spindle.	
		Only one flange	Careless mounting. Ignorance.	
		Uneven bearing of flanges	Bent or broken flange or flanges Bushings projecting beyond sides of wheels High spots on flanges High spots on wheels	Improper specifications. Ignorance.
		Flanges of different diameters	Careless mounting. Ignorance.	
		Flanges not properly relieved	Entirely without relief Diameter of relief too small	Improper specifications. Ignorance.
		Compressible washers	Missing Too thin Too small diameter	Carelessness. Ignorance.
		Tightening of nut	Carelessness. Ignorance of mounter.	
		Hacking of wheel	Desire for increased cutting. No restriction on use of wheel.	
		Screwing wheel on taper arbor	Ignorance.	
	Too high rim speed (caused by)	Spindle overspeeded	Overspeed when first set up.	
			Speed increased	Desire for increased cutting. Thoughtlessly increasing speed of line shaft.
			Use of cone pulley. — Shifting to small pulley.	Desire for increased cutting. Loose shifter. Carelessness.
		Use of too large wheel for spindle speed	Wheel initially too large	Carelessness. Ignorance.
			Too large wheel substituted	Desire for increased cutting. Ignorance or indifference.
			Wheel of different grain and lower recommended speed substituted Wheel of different shape substituted	Ignorance or indifference.

	... tween rest and wheel (caused by)	Improper adjustment of rest	Lack of attention. Ignorance.	
		Improper handling of work	Side grinding when rest not designed for it. Pushing work under rest	Ignorance
Broken wheels (caused by)	Out of true (caused by)	Loose bearings	Lack of attention. Ignorance.	
		Bent spindle	Lack of attention. Ignorance.	
		Loose frame	Lack of attention. Ignorance.	
		Rough or improper use	Inexperienced men. Responsibility of foreman.	
	Unbalanced wheel (caused by)	Wheel standing in water (see under "cracked wheel"). Side grinding (see below). Wheel untrue.		
	Weakened wheel (caused by)	Wheel standing in water (see above). Side grinding (see below). Hacking wheel (see above).		
	Too small spindle (caused by)	Bushing too small in wheel. Wrong spindle used for size of wheel	Ignorance or indifference.	
	Side grinding on improper wheel (caused by)	Lack of proper equipment. Inexperience of men. Indifference.		
Flying wheel unbroken (caused by)	Mounted so that nut works loose (caused by)	Spindle threaded in wrong direction		Improper specifications.
		Belt twisted so that machine runs opposite to initial direction		Equipment incorrectly erected.
		Motor reversed. Spindle turned end for end		Ignorance.
Work or dresser hurled out of workman's hand (caused by)	Caught between rest and wheel.	See above.		
Flying particles of emery, inhaled or in eye (caused by)	Exhauster defective (caused by)	Entire lack of exhauster	Exhauster not provided. Exhauster disconnected.	
		Exhauster line not proper size	Ignorance. Desire for saving expense.	
		Exhauster line stopped up	Not often cleaned. Poorly designed or constructed.	
	Eye protection insufficient (caused by)	No goggles provided. Improper goggles provided. Goggles not used	Prejudice. Carelessness. Fear of infection.	
	Chip guard defective (caused by)	No chip guard. Chip guard not in use	Broken and not replaced. Prejudice of workmen.	
Flying pieces of broken revolving type of dresser (caused by)	No guard for dresser			

PURCHASE OF GRINDING WHEELS

Each wheel manufacturer recommends his product as standard and high class for usual grinding requirements and there are numerous manufacturers of grinding wheels, whose products are high class and in general reliable and satisfactory subject always to a proper selection for the grinding to be done. The main trouble lies in this, that the customer defers his order till out of stock and then orders one or a lot of wheels, from the nearest and quickest source of supply, in many cases with no information as to use and indeed without proper specifications as to size.

Many dealers carry a comparatively small stock with which to meet a wide range in requirements and with the multiplicity of diameters, thicknesses, arbor holes, shapes on edge, grains and grades, it is impossible to fill all orders with particular regard to quality and fitness, from such a stock. Hence if a customer wishes to place his business with some local dealer in wheels he should anticipate his requirements well ahead and make it possible for his dealer to handle such order on a special order to factory with a view to the best possible service.

Manufacturers of grinding machines, carrying stock wheels of approved size, shape and efficiency, for replacement purposes, as a means to enable users of their machines to obtain their requirements promptly and to the best advantage and such purchase from the machine manufacturer has much to recommend it.

The tags from satisfactory wheels should be preserved or tacked up conspicuously near the machine, as a handy reference guide for future orders, or an emery wheel reference book for further orders, with the tags pasted in and the essential specifications, name of the machine, maker, price for wheel, etc., may be kept in the filing room or by the purchasing agent.

If an order for grinding wheels gives all essential specifications, this obligates a proper handling of the order without substitution and no one can have more experience in the specialized adaptation of grinding wheels for certain purposes or be more concerned to insure satisfactory results in operation, than the original maker of a sharpening or grinding machine, regardless of whether grinding wheels are supplied on original or replacement orders.

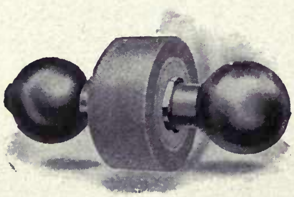
THE METCALF EMERY WHEEL DRESSER

Patent No. 12546 **Reissue October 23, 1906** **Patent Applied For**

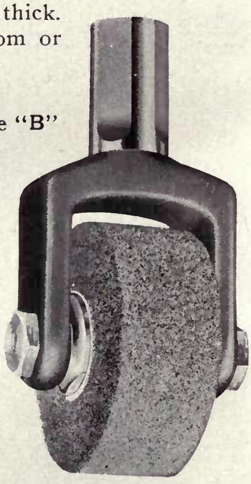
"The best Dresser for Tool Room or Filing Room use you ever saw." "It's a Wonder." Over 75,000 in daily use. Marketed to all industries.

Type "A" Metcalf Hand Dresser

Recommended for turning square, round, bevel or V edges on wheels 1 inch or less thick. "It's a Wonder" for Filing Room or Tool Room use.



Type "A"

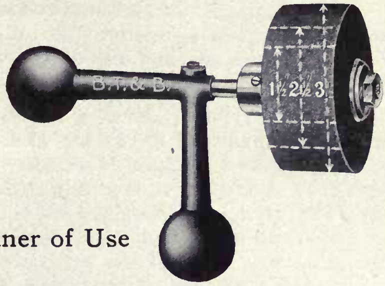


Type "B"

Type "B" Metcalf Tool Post Dresser

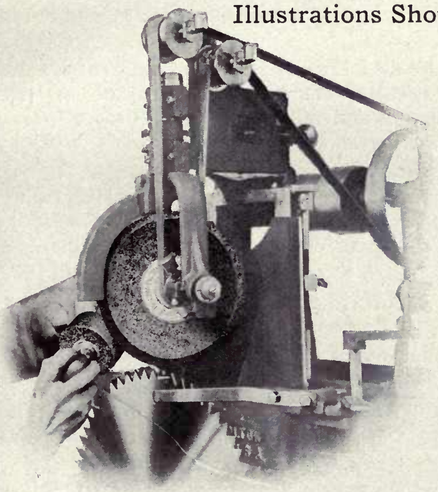
Recommended for use with Landis, Norton, Brown & Sharpe, Modern, or similar types of cylindrical grinding machines. Will afford a fast roughing or a smooth finishing cut. Superior efficiency in grinding and **reduction in expense for diamonds** will result to every user who makes a careful study of his grinding wheels and dressing tools and the problem of intelligent, judicious use. Order must specify diameter of shank required.

Type "C" Metcalf Hand Dresser

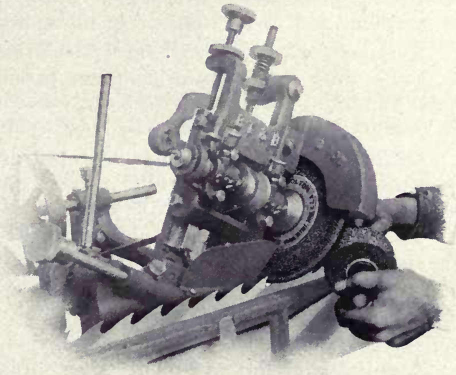


A Tool Room or Filing Room Dresser. Will turn square, round, bevel or V edges on wheels 1 inch or less thick, dress the sides of straight or dished wheels, dress special shapes internally, and with a small dressing wheel employed will work in very small space.

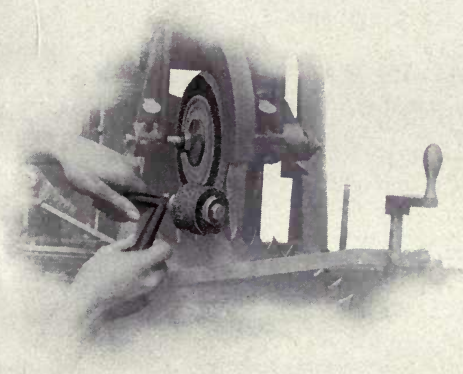
Illustrations Showing Manner of Use



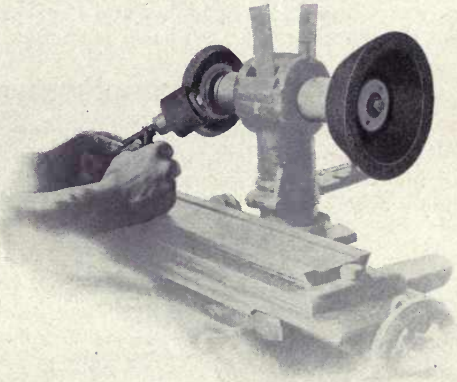
Type "A", Dressing Wheel for Cut-off Saw



Type "A", Dressing Wheel for Band Resaw



Type "C", Dressing Wheel for Cut-off Saw



Type "C", Dressing Wheel for Cutter Grinder

EMERY WHEEL DRESSERS

Different types of emery wheel dressers are in use, made variously of washers, corrugated pressed steel cutters, diamonds, commercial substitutes for diamonds, and most important of all, those of the abrasive wheel type which employ a grinding wheel that acts on the principle of the well known Metcalf Dresser.

The common washer or cutter dresser is mainly useful for rough dressing of coarse grinding wheels of the larger diameters and thicknesses. Such dressers are wasteful of stock and unsuitable for the turning of sharp profiles.

The diamond dresser may be employed on wheels with angular face and on fine, hard wheels, but is open to the objection that sharp, angular edges cannot be turned because of the tearing out of the abrasive particles and to the fact that there is no guarantee on diamonds, which are frequently lost from the holders.

The old type of "washer" dresser, formerly seen in filing rooms, has been generally abandoned and for truing and dressing of saw sharpening wheels of all sizes for band, gang and circular saws, the Metcalf Dresser is superior because it will turn a bevel, V, round or square edge, quickly and effectively, prevents chipping or breaking away of the grinding wheel, will turn a very sharp edge on thin hard wheels used on fine tooth saws, and while doing better work than a diamond on medium and small saw gummers, is much less expensive.

It is used for sharpening or tool grinding wheels 1 inch or less thick and the harder and thinner the wheel, the better will be the results. The Metcalf Dresser is practically indispensable in every saw, shingle or cooperage mill, and woodworking plant, filing room, and in the tool or grinding rooms of metal working plants.

Regular dressing with a Metcalf Dresser, will prolong the life of a wheel, and at the same time increase the grinding production or efficiency, because it quickly eliminates pieces of metal that have ingrained themselves in the face of the wheel, producing a glazed surface. It also avoids undue or excessive dressing and waste.

Grinding wheels should be dressed as lightly as possible, as the only service an operator gets out of a grinding wheel is what occurs in actual grinding and all stock that is wastefully dressed off is a dead loss.

The Metcalf Dresser is not suitable or recommended for use on large, thick, coarse wheels used for rough casting grinding.

A judicious combination of two or more types of dressers is often desirable and may be strongly recommended, in plants where a wide variety of grinding wheels is employed.

A suitable equipment of dressing tools is indispensable for use in keeping the face of grinding wheel true.

Dressing is not "trueing" but "sharpening" the grinding surface. Excessive dressing wears faster than grinding and if excessive dressing is necessary, it is an indication that the wheel may be too hard or runnng at the wrong speed.

KNIFE GRINDERS ESSENTIAL IN MANY INDUSTRIES

Knife grinding machines in numerous types and sizes, suitable for knives from a few inches up to 15 feet long, are employed in many thousands of plants in many different industries and a casual study of our sales records indicates sales to the following widely different and highly important lines of manufacture.

Linoleum, Veneer,
Paper, Pulp, Steel,
Miscellaneous Metals,
Fibre Board,
Box Board,
Wall Paper,
Printing, Publishing,
Lithographing,
Felt, Cloth, Tanneries,
Wood Dishes,
Matches, Edge Tools,
Miscellaneous Job Grinding,
Stoves, Saws,
Machine Knives,
Baskets, Barrels,
Handles,
Columns, Packages,
Paper Boxes, Pianos,
Photographic Supplies,
Vehicle and Automobile Bodies,
Agricultural Implements,
Machine Shops,
Fire-Arms,
Iron Works,
Steel Mills,
Time Recorders,
Egg Cases,
Cash Registers,
Sewing Machines,
Trunks, Woodenware,
Boxes, Ship Yards,
Dry Docks, Crates,
Showcases, Carbide,
Furniture of Every Description Both Wood and Metal,
Saw Mills,
Type Foundries,
Bleacheries,
Textile Mills,
Sheet Steel and Tube Mills,
Tinfoil, Extracts,
Electrotype Foundries,
Gas and Oil Stoves,
Cotton Seed Oil Mills,
Boats, Caskets,
Bending, Hubs,
Electrical Equipment,
Governmental and State Institutions,
Such as Navy Yards,
Public Printing Offices,
State Prisons,
Arsenals,
Turpentine and Creosoting Plants,
Butcher Supply Trades,
Knitting Mills,
Brick Yards,
Raw Hide and Belting Manufactories,
Kindling Wood,
Chemicals,
Bed and Mattress Factories,
Vehicle Wheels,
Excelsior, Bobbins,
Shuttles, Pure Foods,
Musical Instrument Factories,
Scales,
Thermometers,
Carpet Sweepers,
Elevators, Derricks,
Hoisting and Steam Shovels,
Talking Machines,
Ivory,
Packing Establishments,
Locomotive Works,
Street Railway and Car Shops,
Tobacco Factories,
Stone Quarries and Yards,
Manual Training and Industrial Schools,
Pattern Shops,
Flooring Mills,
Sash, Door and Blind Factories,
Planing Mills, etc., etc

CUP WHEEL KNIFE GRINDERS

Cup Wheel Grinders are made variously semi and full automatic in sizes suitable for knives any length up to 180 inches. Each machine will grind knives up to its rated capacity or any shorter length with equal facility, and will afford a flat or concave edge grind, on any desired angle, and is practically universal in its adaptation. These machines have been very extensively sold for grinding planer, hog, barker, chipper, veneer, tobacco, paper, cooperage, huller, and stone knives, metal shear blades, etc., and are not surpassed in efficiency or intrinsic value, and being built in a large way, carefully tested, crated, and fully equipped ready for use on receipt, afford the very best knife grinder bargains obtainable from any source, whether for domestic or export trade.

Cup wheel knife grinders have become very popular in part because with the cup wheel grinder either a flat bevel or a concave grind on knife may be obtained, and in part because they are relatively less expensive not only in original cost of machine, but also in the subsequent cost of wheels, for when the cup part has been worn out the back of cup may be used on an ordinary bench grinder. The rim speed of cup is always constant, while the rim speed of a straight-faced wheel is constantly lessening as the wheel wears smaller.

Bench Cup Wheel Grinders are sold principally to small sawmills or woodworking plants, tanneries, etc., that require a machine at low cost because of a limited amount of grinding. These machines are sold as dry grinders only.

Column Grinders in 26 to 48-inch capacity are sold with or without automatic water attachments, as desired, although at the small advanced cost for water attachments it is well for a customer to have his machine so equipped, even though the attachments are not regularly put to use.

The Heavy Grinders are sold for large veneer, planer or paper cutting knives, metal shear blades, etc., used variously on wood, paper, tobacco, leather or metal.

MAMMOTH TRAVELING CUP WHEEL GRINDERS

These machines differ from the types referred to above in that the knife bar is stationary, adjustable to any desired angle before the wheel and the head or carriage for the grinding wheel travels back and forward past the stationary knife. The construction is especially heavy and massive and the machines lend themselves to great rigidity and freedom from vibration, accuracy of grind and require less floor space lengthwise over all.

The mammoth grinders being full automatic in all movements, readily adjustable in all ways, practically universal in their adaptation to all usual types of knives in all industries, and possessing exceptional advantages in weight and quality of construction, are recommended to operators wanting very durable, straight grinding machines for the most exacting requirements in the paper, veneer trade or metal working industries. These grinders will afford either a flat bevel, stout edge or concave, thin edge grind on machine knives.

STRAIGHT WHEEL GRINDERS

Straight Wheel Grinders are also made both semi and full automatic in sizes up to 42-inch length of knife capacity. These machines are exceptionally heavy, well designed, rigid and carefully manufactured, and equipped with every feature of advantage necessary to produce first-class results.

Straight wheel grinders are necessarily higher priced than cup wheel grinders in corresponding size, because of much greater weight necessary, provision for faster speed as wheel wears, size and increased cost for the wheel itself, special attachment needful for thin knives and the standard of construction.

For exclusive thin high speed steel knife grinding, we recommend the straight wheel grinder with thin knife attachment but without water attachments. For both thick and thin knives we recommend the straight wheel grinder as above with water attachment. For exclusive thick or laid-up knife or shear blade grinding we recommend the cup wheel grinder unless the requirement be for very fast grinding in which case or a case of actual preference for some other reason, the straight wheel grinder will be more desirable.

TWO WHEEL GRINDERS FOR THIN HIGH SPEED STEEL KNIVES

The grinding of thin, high speed steel knives may be accomplished on a cup wheel, straight wheel or two wheel knife grinder. Plants that have had thick, laid up or solid machine knives in long time use, and that have occasion to purchase a new grinder, usually select a straight wheel machine with knife bar suitable for thick or thin knives, but the rapid introduction of high speed planers, matchers, scrapers, jointers, etc., that employ thin knives, run with back bevel, has brought about an increasing demand for the two wheel grinder adapted to grind a single or double bevel, commonly on about 40 and 15 degrees, for which our two wheel grinder is excellently adapted. The grinding is accomplished by the use of two wheels, 8 x ½ inch, mounted oppositely, and capable of maintaining any standard bevels that may be required, regardless of the size or change of wheels. This type of grinder is recommended to those having a large amount of grinding to keep up, as both bevels can be ground at once and very accurately. The finishing grind should, however, be done slowly, the grinding wheels being allowed to barely contact with the knife, so that the knife will not heat and expand, thus affecting the perfection of the grind.

ON-THE-MACHINE KNIFE GRINDERS

The electric motor driven knife grinder for light grinding of knives without removal from the head, is a feature of convenience that has been developed during recent years by several manufacturers and while this method of grinding can never displace or do away with the usual types of cup and straight wheel grinders, the motor grinder has obvious advantages that recommend it.

OWNERSHIP OF A GRINDER

The importance of having woodworking machine knives accurately balanced and ground as a prime requisite to well dressed lumber must be self-evident to all wood workers or finishers, and similarly the perfect grinding of knives or shear blades is of the utmost importance to all operators, whether the blades are used on wood, metal, paper, leather, rags, tobacco, cotton or otherwise. The proper place to grind knives is in the plant where they are used; the proper time when they need grinding and the proper means, a knife grinder operated by a man to whom the care of the knives is delegated. The process is simple, easy and requires only ordinary care and supervision. It is highly expensive to send knives away to be ground, freight or expressage, cost of grinding and delays or loss of time from inability to use the knives, all being elements of cost, amounting in the case of many concerns to a round sum each year, which might far better be put in the form of a permanent investment for every day use.

The range in price lists enables the customer to select a machine at a price fairly relative to the amount of grinding and the consequent utility of the grinder, such that the fixed investment will not be unduly high.

ESSENTIAL INFORMATION

Customers when writing ought to give explicit information regarding the different lengths, widths, thicknesses, bevel and slots or bolt holes of the work to be ground, and in the case of an order not preceded by correspondence, give the above information and whether the machine is required as a wet or dry grinder, and whether for flat or concave beveling, and whether also for back beveling.

The time to avoid mistakes is before they are made, and to get machines specially adapted is before they are shipped.

WEIGHT, STRENGTH AND CONSTRUCTION

The patterns for each size and style of grinder should be made with careful attention to the elements of abundant weight, strength and rigidity. The main frame must be very heavy and of good design, with a broad base on floor to insure freedom from vibration during operation, and the bed, slide and knife bar suitably reinforced, with supports for the ends of bed furnished for cup wheel grinders of 32-inch or greater capacity.

Knife bars must be adapted to hold the knives straight and the machine must grind knives straight. Good machines are not liable to get out of order and the repair costs are low. In fact, if the operator will exercise anything like proper care to keep the machine clean, free from dust and well oiled, it should serve for years without repairs.

All bearings should be hand scraped, all gears cut from the solid, with oil cups at every bearing, the reverse movement of slide free from vibration and the working parts protected from dust.

High efficiency and high cost are usually associated.

RAILWAY FREIGHT RECEIPTS

Buyers of machinery ought always to send a competent man to inspect machinery purchased, before giving the railway company a clean freight receipt, as a means to determine whether any breakage or damage in transit has occurred, or any parts have been lost, and in such case the shipment ought to be receipted for as in "broken or damaged condition or short," with proper particulars so that a claim may be made against the carrier to properly cover the loss. No customer can afford to lose his right to full redress from railway company through lack of careful inspection before taking delivery.

SETTING UP

Knife Grinders should be securely bolted to a firm, rigid foundation, free from vibration. The room should be well lighted and kept clean. Sharpening or Knife Grinding Machines should never be located in a dark, dingy or poorly lighted room. Grinders above 26 inches capacity, in connection with which post or column supports for ends of bed are provided, should have such supports properly mounted so that no matter what the length of Grinder or the weight of a knife in process of grinding, the bed casting will continue straight.

SPEED

Run a grinding wheel with regard for proper speed. A wheel may be run so fast it will not cut well and so slow that it will wear out unduly.

Recommended speeds, while not arbitrary, prove satisfactory in general practice, subject to the well known fact that grinding wheels exceptionally hard may do better if run more slowly and wheels exceptionally soft may do better if run more rapidly. The grinding wheels we furnish with our machines and on repeat orders are the best we can obtain for the service, based on many years' experimentation and the practical experience of operators of these machines in all industries.

OILING

Grinders are oiled when tested, but each customer before putting machine to use should see to it that all slides and wearing surfaces are again lubricated, that oil cups are filled, and that the oil receptacle within the base of column is nearly full of water with a quantity of oil poured in finally to fill the receptacle. This combination of water and oil is preferable to the use of oil only. Ordinary machine oil is suitable. Never allow the wearing surfaces of a Grinding Machine to become dry or impaired by emery dust as cutting and wear will be certain to result. The particles of dust and steel developed in grinding render a machine of this class peculiarly liable to impairment by wear.

Grinders are well protected but each operator must exercise care in this regard and also prevent oil or grease from getting into the water circulation.

TIGHTNESS OF PARTS

If working parts of a machine appear unduly snug or tight, when machine is first put to use, the condition is usually caused by paint, slushing grease or rust preventive, that may have worked into bearings, sliding surfaces or joints and that must be cleaned away, with careful regard to lubrication. Rusting of parts will sometimes occur due to leaky car roofs or to long continued dampness incident to sea shipments and any such condition if found to exist in machine must be carefully overcome. Mere tightness or close fitting incident to new manufacture, can often be assisted by a light tapping with hammer, in connection with careful cleaning and lubrication mentioned above.

MOUNTING OF BED, SLIDE AND KNIFE BAR ON COLUMN

When mounting the bed, slide and knife bar on column, care should be had that the rack on the main slide meshes properly with the pinion at top of column which imparts motion to the slide. The bed plate or main slide which bolts on top of column has bolt holes slightly slotted so that a proper meshing of worm and gear may readily be obtained and wear taken up should any occur.

The slides of a knife grinding machine will, if operated at full length stroke, be much less liable to wear, than if the dogs that reverse the slide, are set for a short stroke when grinding short knives. If there is a large amount of grinding of both long and short knives, grind the short knives by mounting several of them end to end, if this be possible, and in this way the wear of the slides can be kept at a minimum.

Frequent changing of the length of travel on a knife grinder will gradually cause the slides to wear out of straight and when this condition occurs the only remedy is to machine and rescrape the ways. Wear in the ways is minimized by an occasional wash with gasoline to remove dirt and grit followed by a thorough re-oiling.

FLAT BEVEL OR CONCAVE EDGE GRINDING

Cup Wheel Grinders are designed to permit of flat beveling or concave edge grinding on any desirable angle. For flat beveling the bed casting should be set so that the knife will travel at right angle to emery wheel spindle, in which position the knife should contact with the left hand side square end of cup wheel; thus producing a flat bevel grind. For convace edge grinding the bed should be swung around at an angle with emery wheel spindle, so that the slide will travel obliquely thereto, in which position the knife will contact with the left hand corner of cup wheel, thus producing a concave edge grind.

USE OF TURNING TOOL OR EMERY WHEEL DRESSER

Every operator of a Grinding Machine should be provided with a suitable Emery Wheel Dresser, Diamond or similar tool for facing the wheel from time to time as needful. If a wheel tends to fill up or glaze over this condition can in most cases be readily remedied by application of Dresser to the cutting edge of wheel, thus bringing up fresh particles of the abrasive.

THE KNIFE BAR, BOLTS, CLAMPS, ETC.

The knife bars are carefully designed for strength and rigidity as a means to insure straight grinding of knives. The slots permit of the ready bolting on of most knives, whether slotted or provided with bolt holes, as commonly in use. There are, however, types of knives and shear blades, for the proper holding of which special clamps are indispensable, that will be made up by us to order or that may be arranged for by customer after receipt of machine. It is very desirable that an order for a Knife Grinding Machine shall contain specifications of the different knives to be ground, giving lengths, widths, thicknesses, bevels, size and location of slots or bolt holes, etc. With full information thus given in advance, whatever may be needful in the way of special construction or equipment can be better anticipated and suitable provision made so that each customer can install and put his machine in operation without trouble or expense. Our Grinders are provided with suitable grinding wheel, all necessary internal belting and bolts as needful for ordinary requirements and upon setting up and application of power the machine is ready for use.

CROSS FEED MECHANISM

Knife Grinders in style B, E and F are provided with two hand-wheels at ends of slide for cross-feeding the knife toward grinding wheel, and there is also provided a lever and spring cross-feed device, capable of adjustment to afford a suitable pressure of knife against wheel during the grinding process, that requires little or no readjustment unless considerable stock must be removed to properly finish the knife.

Grinders in styles D, G, K and L are provided with automatic screw cross-feed mechanism which consists of a cross-feed shaft operated by hand wheel, with a clutch provided on the shaft so that either one or both ends of the knife bar may be cross-fed at a time, when lining the knife with wheel preparatory to automatic grinding. In connection there is provided an adjustable V shaped dog which throws the pawl lever when the latter is in contact and actuates the pawl engaging with ratchet wheel on feed shaft, and according to the distance that the pawl lever travels against the side of the dog toward the point of the V, a variation in the cross-feed of from one to several notches is possible. This dog may be set so that the feed pawl will pass by the point of V, in which case there would be a cross-feed movement at each forward and backward movement of the slide, but in most instances the pawl lever should not be allowed to pass the point of the V because in such case the cross-feeding is likely to be too rapid and every one knows that in the operation of an automatic Knife Grinding Machine, the slower the cross-feed of knife toward wheel and the slower the grind compatible with the speed needful to suit the amount of grinding to be performed, the better will be the results. Fast grinding of machine knives is always to be deprecated and while between different types of knives as regards thickness, length of the bevel and use to which the knife is put, the speed of the grinding must be variable, general experience advocates the slowest grinding compatible with the number of knives or amount of grinding to be performed.

AUTOMATIC DEVICE FOR PRE-DETERMINING AND FOR UNIFORMITY OF GRIND

On special order we equip our Full Automatic Grinders, 24 to 48-inch, Straight Wheel or Cup Wheel, with an Automatic Stop Device, in connection with the ratchet for cross feeding of knife toward grinding wheel, whereby the operator, having ground one knife of a set, may adjust the machine to grind other knives of the same set precisely the same, as a means to keep the knives in perfect balance. This attachment may also be furnished for any Grinder heretofore sold and not thus equipped.

WATER ATTACHMENTS

Most Knife Grinders are regularly equipped with automatic water attachments, consisting of a water tank with rotary pump, piping and hose, whereby a stream of water may be directed on the knife at the grinding contact, and with a stop cock provided whereby the flow of water may be lessened or entirely shut off at will of operator. The water flowing down from the edge of knife at the grinding contact is caught in the trough shaped top of the upper slide and thence returned to the water tank through the lower slide. The water circulation is well adapted to prevent emery dust or particles of steel from flying about or settling on wearing surfaces, and also tends to keep the knife cool during the grinding process. Straight Wheel Grinders if supplied exclusively for grinding thin high speed steel knives, do not require automatic water attachments, it being common practice to grind such knives dry. If, however, both the ordinary laid up machine knives and also thin high speed steel knives are to be ground, the water attachments are desirable for the laid up knives, while the thin high speed steel knives may be ground dry.

The formation of edge cracks, a short distance inward from and running parallel with the cutting edge, due to heating and expansion from use of a wheel run dry or that is a poor cutter, and hollow grinding due to expansion of knife and springing of knife bar, rarely occur in the case of a machine operated with water attachments.

Machines thus equipped may be run with safety in an engine room, if it is desired that the engineer perform the knife grinding.

The water circulation should be renewed with suitable frequency to prevent foulness and no oil or grease should ever be allowed to contact with grinding wheel.

It is practicable in some plants to convey water from city or overhead tank service to the grinder, thus insuring at all times a supply of perfectly clean, fresh water. In such case order may instruct that the rotary pump, piping and hose be omitted and the water tank alone furnished.

PREVENTION OF RUST

In the operation of knife grinder with automatic water attachments it is a good plan to add some washing soda (salsoda or sodium carbonate) to the water, as a means to prevent the water from rusting the machine. Use enough to make the water feel a little smooth to the fingers, or experiment, using less and less until the proper solution is arrived at. Some think that the use of warm water improves the results.

BELT SHIFTER, BELT GUIDES AND BELTS

Our Cup Wheel Grinders are tested with the knife bar traveling at right angles to emery wheel spindle and the shifting levers that cause reversing of the slide are properly set. Of these levers, the longer should be set at right angles to emery wheel spindle, regardless of whether the grind on knife is to be flat or concave. The short shifting dog or lever should be set at right angles to the slide, no matter whether the slide is traveling at right angles for flat beveling or obliquely to emery wheel spindle for concave edge grinding. The belt guides should be set so the reversing belts will come just flush with the outside edges of the tight pulley. These parts are properly set when machine is tested and unless changed through carelessness or ignorance, no difficulty will be experienced in reversing.

Clean the slushing grease or rust preventive preparations from the pulleys of new machines to prevent the belting from being affected thereby Belts should be kept properly tight and if slack appears this must be immediately taken up. If any trouble is had in reversing, it will almost invariably be due to slack belts or improper setting of belt guides or shifting levers. The machine must be in proper alignment with the shaft from which power is taken. The collars on the end of horizontal shifting rod inside the column of Bench knife grinders must be set with respect to the shifting lever to prevent any lost motion. The outside bracket for support of feed reversing shaft on straight wheel grinders must be properly mounted. The feed pinion and rack and likewise the worm and gear must contact properly to prevent wear. If lost motion develops in any part, this ought to be immediately refitted or renewed.

A knife grinding machine by reason of the quantity of emery dust and steel particles produced, is peculiarly liable to cutting or wear and consequent lost motion, and hence the best care must be exercised in all respects to keep the grinder clean, well lubricated, and all working parts in the best condition for service. There are plants in which proper care in these matters is not exercised and in all such undue wear and deterioration is bound to occur.

ATTENTION TO KNIFE

Have face of knife and knife bar perfectly free from gum, dirt or other matter before bolting down. Tighten to an easy degree, but do not strain on bolts more than necessary to bring knife tight to bar; when knife is about half ground, slacken bolts that hold the knife, except one, then immediately tighten and finish grinding. If this is done you are unlikely to have crooked knives. All ordinary grinding, such as planer, stave or veneer knives, may be ground dry if machine is properly speeded to suit the wheel, but the use of water on the work is a desirable safeguard against heating. Knives may be injured or even ruined by the action of a poor wheel overheating the edge, which results in short cracks running parallel to edge and generally taking a curve out to edge, such cracks showing at from ⅛ to ¼ inch inward. The knife will sometimes be left soft and sometimes case hardened as a result of improper grinding. There are some very hard knives, whose temper can be drawn enough to seriously injure them, if not ruin them, and yet no color will be shown. Use no more bevel than necessary, for a long bevel on a thin knife weakens the cutting edge and is more difficult to grind without injury. Never allow the face of knives to become rusty.

Before grinding thin knives to a finish, loosen all the bolts but one, then retighten and finish. This is especially helpful to good results. Some parts of the knives heat more than others and the heat expands them, changing their normal shape. It may seem strange to the beginner that an emery wheel will grind harder against the knives after running a few minutes. This is because it is set too close and as the knife begins to heat, it swells or expands toward the wheel, with two results possible, one that it will heat the knife unduly and spoil its temper, the other that the knife will come off hollow ground.

KNIFE CRACKS AND SPEED OF THE GRIND

The most prolific cause of cracking is improper grinding by forcing the grind on a wet grinder or by running the wheel too fast, or by employing a wheel that is too hard and of too fine grain for the knife. While a hard, fine-grained wheel may last a lifetime it will delay the work on account of slow grinding and will spoil or injure the knife if the grinding is forced or hurried, because of the heat that will be developed thereby. If the knife is being ground "dry," undue heating will most likely draw the temper of carbon steel and crack thin high speed steel. If the knife is ground "wet," the heating and quick cooling by water, may cause knife cracks in any kind of steel.

A medium-coarse, free-cutting wheel is most suitable for automatic cross-feed knife grinders, but even such a wheel, good in itself, may cause trouble if speeded too fast, or if the face of wheel is not dressed regularly or if the grinding is forced unduly. Every practical man ought to experiment with the cross-feed adjustment on his grinder as a means to determine its range and what rate of cross-feed can be employed with safety and success on knives of varying thickness and composition. It is a safe rule to grind always as slow as possible and get the work out. Complaints from customers usually claim that the wheel glazes over or is too hard or that it heats the knife, causing cracks or that the knife is not ground straight. In general all troubles of this kind are within the control of the operator and the exercise of a little judgment in changing the speed of the wheel or the rate of the cross-feed, or in clamping the knife on the bar, etc., will usually overcome the difficulty. In case of such complaint it rarely serves any purpose to send another wheel, because stock wheels are standardized in make-up and it is not usual for any one to carry in stock a varied assortment of wheels, as regards grain and grade, to accommodate all of the varying conditions incident to operation in different plants. Betterment of results is primarily up to the operator of the machine and incident to manner of operation, excepting in case where the wheel shows itself to be hopelessly bad such that replacement is imperative.

A grinding wheel speeded too rapidly tends to glaze over, cause frictional heat and not cut properly. Such wheel if reduced in speed, will often do good work A 26-inch straight knife wheel if properly speeded when new, will require speeding up when worn down, in order to maintain the approximate average rim speed at which the wheel will do the best grinding, based on grain and grade.

Occasional or frequent dressing of the face of a knife grinding wheel is necessary because the cutting surface is likely to fill up with particles of steel, which are melted during the grinding process and which fill in the pores of the wheel. Grease or oil or a foul water circulation will also lessen the cutting efficiency of the wheel. If under such conditions the wheel merely rubs on the knife without cutting, the knife is bound to heat and expand and while the extreme pressure of knife against wheel, as a result of continued cross-feeding and impaired cutting or grinding, may at some spot cause the knife to dig in to the wheel and act in effect as a dresser, and thus start a fresh surface for grinding, the exceptional heat created and the increased pressure of the cross-feed, will almost certainly cause hollow grinding. Moreover if a stream of water is playing on the knife when thus overheated, small edge cracks are practically certain to occur.

When a knife is ground to a true, sharp edge—not a wire edge—stop grinding and remove the knife from the machine. It can be given maximum sharpness by use of an oil or special rub stone, passed over the edge in easy strokes, the full length of the knife.

PROPER SPEED FOR KNIFE GRINDING WHEEL

The recommended speeds for the wheels employed on our knife grinding machines, as given in our catalogue, are the speeds that in most cases afford satisfactory results for wheels of usual grade and for all wheels in the same lot. In practice, however, variations in speed for the same wheel, for different classes of knives, may be beneficial and while such variation in speed would necessitate some form of variable speed control, rarely employed, there can be no doubt that a variable speed control, would greatly facilitate results.

For example a customer operating one of our 60-inch grinders with wheel at 1,700 r. p. m. or 200 above our recommended speed, reported that on some knives the machine afforded excellent satisfaction, but when grinding long bevel, thin edge paper knives, the temper was impaired and edge cracks started. We recommended a softer wheel or a slower speed. The speed was reduced to about 1,250 r. p. m. and satisfactory grinding of the knives in question immediately resulted.

Thus we have known of 12-inch cup wheels doing good work at 1,800 and also at 1,200 and yet the particular wheel if run materially faster or slower than it was run, might have produced grinding results short of the best. Again, because one wheel out of a lot grinds well at 1,500, this is no insurance that another or all other wheels out of the lot, will do similarly well, similarly speeded. The wheel at work is the only and final test as to its cutting and grinding efficiency but nearly every wheel if it can be properly speeded to suit its makeup, will do good work.

Again, the varying quality and temper of the different steels, the varying thicknesses, and the makeup whether solid or laid or high speed, all affect results; so also does the width or amount of the grinding contact, whether ¾, 1, 1¼ or 1½, and with all of these conditions most favorable, a lack of proper dressing of the face of the wheel, may in itself occasion unsatisfactory results. Hence while we recommend a speed of 1,200 to 1,500 for 12-inch cup wheels, of 1,500 to 1,700 for 8-inch cups, and of 1,700 or more for 6-inch cups, these speeds should never be regarded as arbitrary and the operator of a grinder ought to take into account all of the conditions that surround the operation of his machine and speed the wheel properly therefor.

STRAIGHT GRINDING

Be constantly alert to grind the knives straight. Perhaps the most common cause of hollow edge grinding is due to the fact that more or less heat has been communicated to the steel, and as the process of radiation is slow, this leaves the greatest amount of heat at the cutting edge, causing expansion or elongation. Meanwhile, the back of knife being cool, holds like a bow string, while the middle portion of the knife stands out, is consequently ground off, and so when the steel cools the edge is found to be actually concave or hollowing. A remedy for hollow grinding is to grind the knife almost to an edge removing most of the heel, slacken bolts and allow the knife to cool and then finish the grind with a very light cut, after which test the knife for straightness on edge and uniformity of weight.

THE GRINDING WHEEL

The grinding wheel may be made variously of emery, corundum, alundum, carborundum, carbonite or other natural or electrically manufactured abrasive, any of which may give perfect satisfaction subject always to the employment of a proper grain, bond and heat during the process of making, most suitable for the kind of grinding to be performed. Much of the difficulty that occurs in practical operation of grinding wheels arises from the fact that buyers and distributors of grinding wheels assume that any wheel will afford good service under all varying conditions.

The wheels that we supply for our knife grinders are made in large lots, and in grain and grade and cutting qualities are as good as can be obtained. However, it is not impossible for emery wheels made in the same lot to be variable in quality or for an occasional wheel to prove poor, by reason of being unduly hard or soft or disposed to glaze. An undue softness or hardness of wheel can usually be overcome by increasing or diminishing speed; but a tendency to glaze is more difficult to overcome, and if the use of wheel is continued this must be done with extreme caution, for you are liable to heat and spoil the work, grind out of straight because the knife or holder expands so that the wheel grinds unduly at some point. The efficiency of a grinder depends largely on the cutting qualities of the wheel, which can be demonstrated only when put to actual use by each customer. A hard wheel may usually be recognized by not cutting fast enough, tending to clog, overheat the knife and make it soft on edge. Try a slower speed. A soft wheel wears away rapidly, causes an undue amount of dust if run dry, and while it will probably not injure the knife, it will prove unduly expensive by reason of rapid wear. Try a faster speed.

Be sure to keep the cutting edge of wheel properly faced as needful, with a suitable dresser. The particles of emery or corundum of which the wheel is composed become dulled in grinding and fresh surfaces must be exposed or you will merely heat the knife without grinding. Then, too, many knives are made up of tool steel welded on soft steel, which latter has a greater tendency to fill up the pores of the wheel and thus the wheel may glaze. With any of these conditions free cutting cannot result.

If a wheel used on certain work is not satisfactory, it can often be made so by changing the speed. If wheel glazes this suggests that it is either speeded too high or is too hard for the work.

Keep the rim speed of wheel constant throughout its use in so far as possible. The rim speed of a cup wheel is always constant, regardless of wear.

A straight-faced wheel if not speeded up as its diameter grows smaller, will wear away and appear softer, due primarily to the reduction in the rim speed.

Keep wheels true. Frequent truing will prolong the life of wheels as well as increase production.

But mere dressing is not truing.

Excessive dressing wears wheels faster than grinding.

If much dressing is necessary it is an indication that the wheel is too hard for the work.

Any knife grinder, no matter how carefully or expensively built, may fail to give perfect satisfaction if the wheel is unsuited to the work. Hence it is of the utmost importance to us that we furnish with a machine or on subsequent orders, wheels that in grain and grade will prove satisfactory.

There is no grinding wheel made that is suitable for all purposes and hence grinding wheels should be ordered with special reference to the use to which they will be put.

A wheel that lasts a long time is not necessarily the most economical. Such a wheel may consume more value than its cost in the time required to grind properly with it, or may spoil a saw or knife by drawing the temper or causing cracks that result from case hardening.

It is desirable to buy a saw sharpener, knife grinder, lap grinder or band wheel grinder, already equipped with a wheel suitable for the use to which the machine is to be put. It is advantageous to order extra wheels with each machine, thus saving freight and what is even more important, being supplied with wheels that in quality and efficiency, are the best that long time experience enables us to supply.

Regardless of the above facts there are people that will buy any kind of a wheel, careless of its proper shape or fitness for the work, one at a time, at the lowest obtainable price, and most of the troubles that occur in operating wheels, arise in this way.

A solid foundation, freedom from vibration, and from lost motion in bearings are prime essentials in the machine, and a perfect circle, perfect balance, and a proper shape on edge are prime essentials in a wheel, coupled with a correct speed for the grade and a correct grain for the work, and the use of a dresser that will shape the edge as needful. Every operator must look constantly to these conditions and have them properly met, as a means to the best results. Don't forget to oil the bearings. Don't ever permit any oil to contact with a grinding wheel, or belt.

SPECIAL ORDERS FOR GRINDING WHEELS

Orders should always be placed well in advance of probable requirements. No one can afford to get out of grinding wheels and be compelled to take something without regard to adaptation for the individual use. It is a mark of good business to anticipate requirements both for grinding wheels and all tool repair parts that are likely to require renewal.

GRINDING WITH A SANDSTONE WHEEL

The use of a sandstone wheel for grinding machine knives is regular practice amongst manufacturers of machine knives, because the knife can be crowded very rapidly against the stone for fast grinding of rough newly forged knives to secure finished surfaces with greatest possible rapidity; but the use of a sandstone wheel by knife operators is practically impossible and is nowhere employed unless it be in a mill or shop where the work is limited and the most crude results in knife grinding are permissible. It may be stated as a well demonstrated proposition that for the great majority of machine knives, excepting types employed on planing or surfacing machinery, the Cup Wheel Grinder is the only type worthy of consideration because of its adaptation to grind a short flat bevel, stout edge for hard service or a long, thin, flat or concave edge for light service, according to the local requirement.

In mills where there are both thick knives to be ground on a short bevel and thin knives to be ground on a long bevel, it may pay to have coarse grained grinding wheels capable of faster cutting for use on the heavy knives, and finer grained wheels designed for slow and fine finish grinding for use on the thin, long bevel knives.

Printers, publishers, lithographers, paper box makers and others having one or several Paper Cutting Machines in use can as a rule, much better afford to equip their plant with a Grinder having capacity for the range in length of knives employed as a means to the convenient grinding of same whenever dulled, than they can afford to dispense with this nominal investment in a Grinding Machine and depend upon sending their knives out to some other place, whether it be an edge tool works or a job grinding establishment, because the expense of cartage or freight, cost of grinding and the delays likely to be incident in connection with getting the work done, will as a rule amount each year to a sum much larger than ownership and operation of one's own Grinder at one's own plant would amount to. We have had instances before now of very large concerns which have been in the habit of sending their knives out to be ground and hesitated to purchase a Knife Grinder because of the belief that its cost in operation would be out of proportion to the advantage of having the knives properly ground whenever occasion demanded it. With perhaps no exception these people have after purchase and installation of one of our Grinders been greatly surprised and pleased at the advantage and economy arising from its ownership and use, and the ownership of a Grinding Machine in any establishment employing machine knives will abundantly pay for itself times over in five to ten years of operation.

PROPER BEVELS ON MACHINE KNIVES

For smooth surfacing, just enough bevel so that the heel of the knife will not hit the face of the stock, is in line with usual practice, and most knives and cutters are ground to a bevel that is twice the thickness of the knife, that is a ⅜-inch planer knife will be ground to a ¾-inch bevel from cutting edge of knife to heel on the face of the bevel. However, the degree of the bevel is often varied to suit local conditions and it is desirable to avoid getting too long a bevel with its consequent thin edge because while the machine may run more easily, it is unlikely to improve the quality of the work.

It is undesirable to do much concaving, because in effect this is the same as grinding too long a bevel. However, a concave edge permits of whetting or light sharpening of knife on the head, whereas in the case of a flat ground bevel, whetting would be quite laborious unless the work was all on the cutting edge, in which case a blunting of the knife would result, causing it to run hard and pound when in the cut.

Some grind their knives to a double bevel, grinding first a bevel at edge of knife on required angle and then behind this a second bevel, some 4 or 5 degrees less than the first and the front of which stops about ⅛-inch back from the cutting edge.

IMPAIRMENT OF TEMPER

It is a very easy matter to impair the temper of a good knife by too fast grinding and when the edge turns blue or blue spots appear on its face, you are taking out temper. Herein lies one marked advantage of an automatic cross-feed over hand cross-feed, in that the speed of the cross-feed is well timed, and the rate uniform, so long as the grinding continues. It will pay better to devote an hour or so to grinding a knife than to rush the grinding and spoil the knife. Keep the knives of same width throughout their full length. This is essential to the preservation of a running balance because if a knife is wider and consequently heavier at one end, such unequal distribution of weight subjects the cutter head to an undue working strain. Run the knives in pairs and besides having the knives balanced endwise as well as for total weight, have the bolts and washers of uniform size and weight. The bolts and washers when brand new are practically uniform but as a result of breakage it is not uncommon to put in another bolt that does not correspond. Attention to all of these details whether big or little is needful to the best results.

EXTENSION OF KNIVES ON HEAD

The principle involved is essentially the same as in the hand plane. For rough work and light running, the knife may be allowed to extend from ⅛ to 5/16-inch, but for smoothing planers and fine results, the extension should rarely exceed 1/16-inch beyond the cutter head.

The amount of knife projection for all-round furniture work on the buzz planer should be about ⅛-inch. In mounting knives on the head, see that the lip edge is not bruised or burred. If so, the burr should be removed with a file, being careful not to round edge of the lip, as this will cause the knife to "pack," that is the wood will wedge in between the knife and cylinder, causing the bolts to break. Many serious accidents have resulted from such cause.

ADJUSTMENT OF KNIVES ON HEAD

Numerous devices for the adjustment of knives are in use, some home made and some rigid gauges supplied by the makers of planing machinery. Of the latter some are gotten up quite elaborately for very accurate measurements, and undoubtedly afford material assistance in accurate and rapid setting. It is a well recognized fact that accurate knife setting is one of the more difficult details in connection with the adjustment or operation of a planer and there are technical experts who assert that it is impossible to set four planer knives perfectly enough, even if the best of setting gauges are used, to insure that each knife will cut exactly the same as the others. Some operators, after setting the knives with the greatest possible accuracy, start the machine and joint the knives, as a means to get all the edges absolutely even.

When bolting a set of knives on a head, the locknuts should be set up only lightly until all of the knives are in place. Then go entirely round the head turning down each screw or nut medium tight. The third time round they may be set up hard, with the assurance that the strain will be equally divided all round the head.

A FEW DON'TS

Don't set up your knife grinder in a dark corner or some hole that cannot be put to any other use, but rather set up the machine in front of a window so that a good light will strike on the work.

Don't think that an inexperienced mechanic can know all about knife grinding until he learns it, although a man of no experience with machine knives may develop into a very competent knife room man, if properly cautioned and instructed. All "skilled" men had to learn "how," but some of them in learning spoiled knives worth a good many dollars, without knowing it. The employer paid dearly for this experience.

Don't be hasty in grinding knives or think it takes too long if the grinding seems to go slowly. Well informed operators know that a knife if ground slowly, cannot be spoiled by having the temper drawn or edge cracks started. A light cut in grinding is best and a knife slowly ground will need grinding less frequently for the reason that the temper has not been impaired and its cutting edge will remain keen for a longer period.

Don't think that any kind of a wheel will cut well because there is water running on it. Water is useful for keeping the knife cool and preventing wear of machine by dust getting into slides or bearings, but water will not make a poor wheel cut freely and may actually cause a good wheel to fill up if oil gets into the water circulation. If oil reaches the face of the wheel it is next to impossible to keep the wheel from glazing. Frequent use of an emery wheel dresser is the only remedy. Be sure that your grinding wheels are right in grain and grade for the work. Wheels are exceedingly various and may easily be furnished in grain, grade and hardness unsuitable for the work.

HIGH SPEED STEEL KNIVES

High speed steel costs much more than ordinary steel, will do far more work with once sharpening and will last much longer. But on an even break in these respects, its use has another very marked advantage,—that the operation of the machine on which it is used instead of stopping three times to have the knives sharpened, will stop only once. The continuous operation of any machine is necessary in any plant where continuous product and large output are highly important and this fact will explain the rapid and general introduction of high speed steel for machine knives, cutters, tools, etc., in both the wood and metal working industries. Keep the edge properly thin. Beware of overheating the knife while grinding as it is beyond the skill and facilities of the average machinist to harden and temper high speed steel. Should the knife not produce good work, as smooth as it should be, with fine lines showing, the fault is too thin an edge. Minute particles of the steel may have broken out from the cutting edge and it is this ragged edge, even though not noticeable, that produces rough work. Reducing the angle on the cutting edge will usually rectify this condition.

Thin high speed steel knives ranging from 1/8 to 1/4 inch thick and 1 to 2 inches wide, are now commonly used in both square and round cutterheads on such machines as planers, jointers, molders, matchers and shapers. Owing to their composition and the heat treatment given during manufacture, knives of this type are generally more or less brittle and always extremely hard, so hard in fact that they cannot be filed, hence the only method of sharpening is by grinding.

The selection and care of grinding wheels for sharpening these knives is very important. Different wheel manufacturers have different markings to designate the kind and grade of their wheels, therefore it is difficult, if not impossible, to specify the kind and grade of wheel that is best adapted for thin high speed steel knives. However, this much is certain,—the wheel should be of a grade and grain which cuts freely and rapidly and requires but very little dressing. The nature of a grinding wheel is such that it must wear away somewhat as the grinding progresses, in order that new cutting points or grains of abrasive are presented to the work. In this way a good wheel automatically keeps itself sharp and in condition for continuous cutting.

When a wheel is very hard or fine-grained, or when it is run too fast, so that the grains do not break off or tear out as a knife is being ground, the surface wears smooth and particles of steel fill in around the grains. A wheel in this condition is glazed and will not cut as it should, but if forced to cut it heats the knife edge very rapidly and causes knife cracks. Every grinding wheel should be dressed with an emery wheel dresser, but dressing is only temporary relief for a wheel that glazes badly. The frequency of dressing always depends upon the action of the wheel while in use. The right kind of wheel for the work will only need an occasional dressing to keep it in good condition.

In most of the present-day shops, high-speed steel knives are ground dry, probably because this is the easier and cleaner method, but it is by no means an established fact that dry grinding is superior to wet grinding. With a copious supply of water to serve the dual purpose of lubricant and cooling agent, the knives can be sharpened fully as satisfactorily as when ground dry. In cases where wet grinding has apparently proved unsatisfactory the real cause of the trouble has usually been due to the small amount of water supplied at the point of contact between knife and wheel during operation.

An insufficient supply of water is far worse than none at all. It is not enough to keep the knife edge cool while the grinding is being carried on, and what really happens is that as successive parts of the knife come under the action of the wheel they are quickly cooled again by what little water pours or splashes over the exposed knife edge. The sudden expansion and contraction invariably cause fine cracks on the edge.

The efficiency of thin knives depends largely upon the grinding. Complaints are often made to knife manufacturers about their knives cracking and breaking, when in reality the fault is not in the knife itself, but rather in improper grinding or other abuse. Improper grinding will injure the best high-speed steel knife ever made. Under the impression that time is money, some operators hurry the grinding by taking excessively heavy cuts. This is absolutely wrong and should not be allowed under any conditions. It causes the edge of the knife to be burned and checked, and naturally, when placed in operation, it cracks, breaks out in pieces or perhaps breaks down altogether, depending upon the extent to which it has been injured.

The practice of taking too heavy a cut is being automatically discouraged through the use of very light belts on modern grinding machines; this causes the wheel to stop in a heavy cut. Light cuts should always be taken, especially when using wide-face wheels or making long bevels, so that the heat generated will be reduced to a minimum. A fairly slow carriage travel, about 15 feet per minute, is good, because it enables the wheel to remove the necessary steel without being forced. This is especially true when grinding double-beveled knives with a twin-wheel grinder, as both wheels cut at almost the same place on the knife edge, thus causing just that much more heat to be generated.

There are of course other causes of knife cracks, among them being too much knife projection in head, too fast a feed for the speed of the head, and too much vibration when in service, due to improper balance, loose bearings, light foundation and excessive cylinder speed.

Owing partly to the different kinds of woods being worked and partly to the different angles at which knives are held in different styles of heads, every shop usually has one or more standard knife bevels, which are always kept the same by the use of gauges. When old style grinding machines were used there was more or less trouble in maintaining a uniform cutting angle or bevel, on account of the wheel gradually wearing smaller in diameter; also, the concave often became so severe from small diameter wheels that the cutting edge was weakened. These conditions, however, are largely remedied on modern grinding machines by the use of either larger wheels or an adjustment which permits of changing the angle of carriage travel past the wheel.

The thin steel knives on cutterheads are frequently jointed at full speed in order to bring them all into a true cutting circle. A medium coarse, narrow stone is generally preferred for jointing straight knives, since it does not wear away too fast nor easily fill up with particles of steel. Knives should always be jointed lightly, just enough to bring them all into action and then they can often be jointed several times to renew the cutting edge before being reground.

The width of heel, caused by jointing, which can be reached before regrinding is necessary, should not greatly exceed 1/32-inch. However, this depends somewhat on the angle of the knife and the kind of material being cut. When the heel produced by jointing becomes too wide, the rear edge strikes the wood, and the efficiency of the knife from that time until it is reground decreases rapidly. This particular feature is closely watched in most woodworking plants, because the quality of work is seriously impaired and the strain on the knives, cutterheads and machine is greatly increased when the knives carry an excessive heel.

Thin machine knives are being ground variously with cup wheel grinders, employing wheels ranging from 8 to 12 inches diameter, with straight wheel grinders employing disk wheels of 26-inch or less diameter and with two-wheel grinders employing 8 x ½-inch wheels or smaller. It will be readily apparent that the results obtained from these different types of grinding machines must be somewhat dissimilar more especially in the character and rapidity of the grind.

Thus, using a cup wheel, one may obtain either a flat or concave bevel; using a 26-inch straight wheel, one may obtain a concave grind on the segment of a 26-inch circle, this concave or thinness of edge increasing as the wheel wears smaller on its diameter; and using an 8-inch or smaller wheel, a maximum amount of concave or thinness of edge results, which obviously increases as the wheel wears smaller.

This leads up to the question whether it is best to grind thin knives with a cup wheel grinder adapted to afford a flat bevel, stout edge, or a concave bevel, always constant throughout the life of the wheel; or with a large wheel straight wheel grinder having a 1½-inch face and consequently adapted to accomplish the maximum amount of grinding in a given time, or with two small wheels affording an exceptionally thin edge, that grows always thinner as the wheel wears smaller.

Again, it cuts figure whether the thin knife is ground with one or with two bevels, and according as thus ground, it will be apparent that the cutting edge becomes increasingly variable according to the type of grinder employed.

In the matter of general utility, the cup wheel or large straight wheel grinder, either of which is adapted for any width, length or thickness of knife within its rated capacity, has the small two-wheel grinder outclassed and the same is true as regards investment and maintenance costs. Hence a customer must consider the matter from the standpoints of original investment cost, upkeep wheel cost, rapidity or productivity in grinding, and finally the results on the knives themselves, or in other words, the grinding efficiency.

It seems to be quite well demonstrated in practice that knives ground concave with a cup wheel or large diameter straight wheel, will prove more practical and dependable for use than if otherwise ground, absolutely so where the practice is to joint or true up the knives on the cutter heads. The effect of jointing knives ground concave on very small circles is that each successive jointing changes the angle of the cutting edge, departing more and more from the correct angle and tending by so much to impair the quality of the dressing. It is a well known fact that in dressing some stock the slightest deviation from an approved angle on knife is apt to raise the grain or tear the surface of the stock.

The cutting bevel on a knife is put there for a purpose and the effective angle is the angle on knife at cutting edge rather than the angle of the entire surface and the heel of jointing will gain much more rapidly on a knife ground on a small circle than if ground on a large circle. The greater the heel on a knife the greater is the liability of accident in operation.

If the matter be considered from the standpoint of investment or upkeep cost, it will be readily apparent that the advantage is in favor of the cup wheel or large disk wheel grinder. Either of these types is practically universal in its application, suitable for either thick or thin knives, subject to small repair expense unless grossly cared for, and the grinding wheels if intelligently selected, will cut freely and afford long service. The distinctive "two-wheel grinder," which employs the small diameter, thin wheels, is a high priced machine, and in its application is limited to thin knives, being quite unsuitable for grinding the ordinary laid up knives universally employed until recently, and even now used side by side with thin knives in many plants.

KEEP THIN KNIVES KEEN

There is no economy in running thin knives too long without grinding. Repeated jointing forms a heavy heel that not only prevents smooth surfacing, but also requires so much grinding to sharpen that altogether too much steel is wasted in the operation.

A tearing out and general poor work is caused by too much heel. No dull knife can do good work even with tremendous power back of it, and so frequent light grindings are essential to the best results.

No rule can be laid down as to the frequency of the grinding. In some plants or on certain stock, under favorable conditions, thin knives may continue to do good work for a couple or more days without resharpening, while on heavy work or hard, knotty or gritty hardwoods, a daily grinding may be needful.

A combination of watchfulness and good judgment, with a careful study of comparative results will prove a safe guide for every good practical man.

PROPER BEVEL FOR HIGH-SPEED THIN KNIVES

With reference to the back bevel on the cutting side of a thin steel knife, it is impossible to work various kinds of wood to best advantage with any one bevel. In fact, soft woods, such as white pine, basswood, poplar and wood of this class, is worked to best advantage without any back bevel at all, using the angle at which the knife sets in the cylinder, which is usually 30 degrees in the round head and 40 degrees in the square head, from a radial line. A radial line is a line drawn from the cutting edge of the knife through the center of the arbor. On kiln-dried hardwood, as oak, birch and maple, it is necessary to back bevel 10 or 15 degrees from a radial line, while on very hard kiln-dried maple, such as rock maple, it is often necessary to back bevel the knives to a radial line.

The dryness of the wood also affects the back beveling of the knife to a great extent. Even on the very hardest of wood, which is run green or partially dried, it is impossible to carry any great amount of back bevel, because the scraping cut will cause the grain to raise and make a fuzzy surface.

One can readily see that it would be impossible to strike a medium bevel that would properly work both hard and softwood to best advantage in all factories. However, in the larger factories it is seldom that one machine is called on to work all classes of wood, the work being confined to softwood or to hardwood. But in nearly every small factory the opposite condition exists, and a machine is required to run dry softwood as well as dry hardwood. In these smaller factories it is therefore necessary for the operator to determine the angle which will work best on the majority of the kinds of wood that he is working. Under such circumstances it is found that an angle of 20 degrees from a radial line works to very good advantage. If the larger percentage of the work is hardwood, 15 degrees would perhaps work to better advantage, while if the larger percentage runs to softwood, 25 degrees would be best.

Ordinarily, under such conditions, it would be impossible to get the very best results from the machine. For instance, on hardwood it is necessary to carry a slower feed than if the knives were beveled to 10 degrees, while on the softer woods the knives will not run as long before they become dull and raise the grain of the wood. However, this is offset on the majority of up-to-date machines, as they are equipped with on-the-machine grinding and jointing devices. With these it takes perhaps fifteen minutes a day (allowing five minutes to a grinding with the heads running full speed) to keep knives sharp, and turning out a grade of work all the time that also allows the possibility of using stock that otherwise would have to be thrown out or used for low grades. On machines less modernly equipped it is necessary to break the setting and grind the knives by hand (which takes the best part of an hour), while four-fifths of the day the knives run dull and give poor work.

It is advisable in any case to use just sufficient back bevel to prevent the stock from tearing around knots or in cross-grained places, as the scraping cut will dull the knives sooner and also requires more power to drive the heads.

In round heads back beveling has been eliminated very largely by setting knives in the head at various angles to accomplish the same purpose as the back bevel. Regularly the heads are furnished milled 30 degrees for softwood and 15 degrees for hardwood. However, they are also made with a 20 and a 25-degree bevel, so that when a customer has determined the proper bevel for his class of work these special heads may be furnished, milled at the proper angle to eliminate the necessity of back beveling. While it is still possible to back bevel knives in the round head, as back beveling requires an extra operation in grinding the two bevels, it is very desirable to use round heads milled to suit the special class of work.

The following table shows the correct angles for best working of the various woods named:

	Kiln-dried	Air-dried	Wet or Green
Oak	15 degrees	20 degrees	25 degrees
Maple	5 "	10 "	15 "
Birch	10 "	20 "	25 "
Yellow Pine	20 "	30 "	30 "
White Pine	30 "	30 "	30 "
Hemlock	20 "	25 "	30 "
Spruce	30 "	30 "	30 "
Poplar	20 "	20 "	30 "
Gum	15 "	20 "	30 "
Cottonwood	30 "	30 "	30 "
Basswood	30 "	30 "	30 "
Cypress	30 "	30 "	30 "
Fir	20 "	25 "	30 "
Beech	10 "	20 "	25 "
Ash	15 "	20 "	25 "
Redwood	30 "	30 "	30 "
Elm	15 "	20 "	25 "
Cedar	30 "	30 "	30 "
Larch	20 "	25 "	30 "
Mahogany	15 "	20 "	25 "
Average	20½ "	24½ "	27¼ "

FAST FEEDS IN PLANER AND MATCHER WORK

The modern fast feeds of 200 to 300 feet per minute, possible with machines fitted with round heads carrying 6 or 8 thin steel knives cannot result in a good quality of output unless each knife is in action, cutting and cutting alike, all of which involves perfect balancing, grinding, setting and light jointing of the knives, with a last final touching up with the head grinder.

Fitting up matcher heads is a very particular work and should be done by none other than skillful, experienced mechanics. A setup man must have a good eye, a good judgment and a fine sense of touch and must be afforded proper time and equipment, if highly satisfactory results are to be attained.

Jointing must not be allowed to cover up careless or insufficient or excessive knife grinding.

Inaccurate setting will necessitate prolonged and heavy jointing to bring the knives to a proper cutting circle. The knives will be left with uneven heels, light here, and heavy there, and it is well known that smooth work is impossible when the cutting knives show anything but a light even heel. A knife with a heavy heel, the same as a dull knife, has a tendency to pound while parts of the knife with little or no heel will cut freely.

A heavy heel appearing here and there may be ground off with a head grinder but this involves more time than would be saved by careless setting of the knives in the first instance.

Moreover if this jointing or leveling off process is decidedly pronounced, it is likely to throw the knives somewhat out of balance, which will cause a wave finish and jar or pounding in the bearings.

Knife changing, properly done, takes considerable time, and so instead of changing the knives as soon as they show a heavy heel, it is common practice to resharpen same on the head, with an electric head grinder, employing a small, coarse, free cutting wheel which travels back and forth on parallel ways and is belted or directly connected to a small motor.

This sort of resharpening merely grinds off the excessive heel. The knives should not be ground to a wire edge but a faint trace of the last jointing should be left all along the extreme edge of the knife. Such resharpening can usually be done during the noon hour while the machine is standing idle.

The number of times the knives can be resharpened on the head before changing depends upon how far they were set out beyond necessary clearance at the start. Usually they are set out about 1/16-inch plus ordinary clearance. Under such setting, 1/16-inch can be jointed or ground off on the cutting edge; that is from one month to six weeks or so can elapse before it becomes necessary to change the knives.

Resharpening the knives on the head saves time and labor and indeed saves the knife steel because the knives will not require jointing so often or so heavily. Jointing is rarely necessary after resharpening but is always necessary after setting the knives.

TEMPERING MACHINE KNIVES

The following method of tempering machine knives, in actual or slightly modified forms, has been found productive of excellent results.

Get ready a forge fire equal to a coke fire, being careful to burn away all sulphurous gasses before inserting the knife. The heat from new or uncoked coal is apt to burn or eat the knives. Heat to a cherry red the part to be tempered, blending gradually to black at back of knife. Have the fire hot so that it will require little blowing to bring the knife to an even cherry red.

Have a can of water ready, also one of some good oil, such as engine, lard or linseed if some better high-grade tempering oil is not available. Grasp the back part of knife with a good pair of tongs and plunge it squarely about 1 inch into the water, withdrawing quickly. Do this as often as necessary to cool the cherry red to a dull dark red. After the dull red effect is secured, hold steadily in a good light and watch closely and at the point when the dullness is about to change, plunge the whole knife quickly in the center of the can of oil, being careful not to allow the knife to touch the can at any point.

Some use a can of water with about ½ inch of oil on top, with good results. In such case plunge it slowly into the can giving the oil a chance to act before the water. Keep it in the oil and water about a second, then withdraw, polish the edge and face quickly and watch for the colors. When the light straw color appears, plunge the knife in the can again and cool it completely.

Water starts the process of tempering, but should not be used alone, as the oil tempering blends back to the softer parts more gradually and will answer for all kinds of work. Warm water is better than cold.

If the knife comes out too hard, the temper can be drawn by heating a suitable piece of iron in fire. While this is heating, brighten face of knife, then lay on heated iron until brightened part near cutting edge shows straw color and plunge it into cold water. This should afford a hard, tough temper hard enough for grinding and whetting for softwood and also tough enough to work hardwood without breaking.

SELF HARDENING STEELS

In practically every woodworking plant in which self-hardening steel has been used for any length of time, the mechanics who have used it like it well. This is due to the fact that the steel holds its edge for a long time, does not easily nick, and requires no hardening or tempering. Its use produces quantity and quality results.

THE HARDENING AND TEMPERING OF STEEL

At the outset the two principal kinds (not brands) of steel must be specified, as their treatment is as different as day and night. They are the older and more familiar carbon steel and the new self-hardening steel.

Carbon steel is still largely used in woodworking factories for machine knives, saws, bits and hand tools. Carbon is used to give hardness and strength to the steel so it may be used for cutting purposes. The percentage of carbon in carbon steel is always low, seldom exceeding 1½ per cent, usually .8 to 1.2 per cent. A slight difference in the per cent of carbon makes a vast difference in the steel, and the amount of carbon in steel is designated by the manufacturers as high, medium or low-temper steel. The word temper, as used here, should not be confused with the act of tempering which will be explained later.

If a piece of red-hot steel (iron and carbon combined) be suddenly quenched in cold water, a compound of extreme hardness results, the carbon and iron combining in some strange way not thoroughly understood. In practical work, steel is usually quenched in oil, because oil does not chill the piece as does water, particularly cold water, but has a milder effect, making the hardened tool tougher and less brittle. Having hardened the tool to a degree considerably beyond that required, it is then necessary to temper it, which involves a reduction of the hardness to a point necessary for the work required.

Entering upon the details of procedure, the fire naturally deserves first consideration. It is often pointed out that a clean charcoal fire is best for heating steel, and no doubt this is true because charcoal contains no impurities that will affect the quality of the steel. Good forge coal, however, has always given very satisfactory results and is commonly used by factory mechanics and blacksmiths. It is said that green coal will ruin cast steel; if sulphur or phosphorous are present in the coal they will be absorbed by the hot steel, causing brittleness. A common practice among forge workers when heating steel is to use some of the old burnt coals of previous fires as a precaution against impurities. It is reasoned that if impurities exist in the fresh coal the intense heat will gradually burn them out, causing them to leave in the form of gases.

The heating of the tool is very important. Start with a bed of good live coals; place the tool so the thin cutting edges will not be heated first and thereby burned before the remainder of the tool reaches the proper temperature. When heating an ordinary beveled machine knife my practice is to place it on the hot coals face up, letting the thin cutting edges and any narrow points project somewhat past the hot blast. Start a slow, even draft, and try to concentrate the fiercest heat along the heel of the knife, say about ⅝-inch back of the edge, where it is of full thickness. Watch the edge closely and shift a bit if necessary, in order to heat evenly. Do not let the extreme edge heat first, but aim to have the first signs of red—the low, dull red—appear simultaneously all along the edge ⅝-inch or more back. Force the draft somewhat and when a cherry red is reached or a lower red, if found sufficient, quickly withdraw the knife and plunge, point downward, into the cooling bath, usually a bucketful of oil.

Remember to quench the tool at a rising heat. Do not let it remain in the fire "soaking" after it has reached the proper heat, as this causes decarbonization—the loss of some of that necessary element, carbon, in the form of gas. Never allow any point of tool to get white-hot, as it will be hopelessly ruined. It is very important to get the steel just so hot before quenching, and this knowledge must be gained through experiment and experience. The only rule to follow is to quench the steel at the lowest possible heat at which it will harden.

For quenching, sometimes water is used, sometimes a mixture of rain water and one or more chemicals, but more commonly oil is used. There are several different kinds of oil advocated, although some mechanics claim that it makes no difference what kind is used. Raw linseed oil is excellent for this purpose and is used quite extensively. The writer has even used common red mill oil and could really notice no great difference in the knife after the treatment. Mineral oil, however, is not recommended for quenching steel. Some mechanics are cranks on certain oils and will use no others; whale oil, fish oil, sperm oil and tallow each have their advocates. It is said that two-thirds tallow, one-third beeswax and a little saltpeter added, will improve the steel and give a hard, tough edge, if the tool is afterward drawn to a light straw color. Salt in water will tensify the hardening effect, while ammonia is used to give toughness.

After the tool has been hardened it will be necessary to temper it. This is accomplished by gradually raising the temperature until the hardness is drawn or let down to the required point, then quickly cooling in water or oil, which fixes the hardness at the point desired. Correct tempering of hardened steel depends on the workman's ability to raise the temperature to the proper degree before cooling. Unless a mechanic has an improved tempering outfit at his disposal, the old-time color test must be employed to show this temperature. First brighten up the surface of the steel along the cutting edge, then draw temper by holding the edge on a red-hot iron or over a flame. The slower the temper is drawn the tougher the tool will be. When it has reached a temperature of about 430 deg. F., the film of oxide on the bright surface will become a faint yellow.

Some mechanics have difficulty in seeing the colors, but they are very plain in good daylight. A thin piece is liable to heat too rapidly, and run into dark-blue or black before one can check it. The accompanying table shows the degree of temper resulting from the run of colors. Remember, however, that there will probably be a slight variation of temper in bits drawn to a certain color, if the bits are different brands of steel or have been hardened differently.

Very pale yellow Pale yellow	very high temper.
Light straw Full yellow or straw	moderately high temper.
Dark straw	medium temper.
Brown	mild temper.
Brown with purple spots	mild temper.
Purple	low temper.

A method of hardening and tempering steel at one heat is often used by some mechanics. That is, heat the tool not only at the cutting edge, but a considerable distance back from the part to be tempered; the heat in this portion is used for drawing the temper of the cutting portion. In quenching, only the point is immersed, ½-inch back, and held until the red is nearly faded out of the heated portion. The tool is then removed and brightened up quickly, to watch for the colors, the heat in the balance of the piece sufficient to draw the cutting edge. A straw color will start moving toward the point, and, when the correct color reaches it, the tool is plunged in water or oil to cool. If too much heat remains in the piece, the colors will run too fast, and the point must be immersed a second time, but not the whole tool. If too little heat remains to draw the point, a red-hot iron or flame is used. For small tools with fairly regular edges this method is excellent, but for large knives of irregular outline it is not recommended, for obvious reasons.

Another method of hardening and tempering at one heat is as follows: When the tool is hot enough to quench, plunge it, point downward, in oil, but leave it only a few seconds until the edge is black, quickly withdraw and finish in water. With some brands of steel this will give just the right degree of hardness, but if too hard it may be drawn in the usual way.

When a solution of certain chemicals and water is used for quenching, the ingredients are usually so proportioned that drawing the temper is unnecessary after quenching. Some of the commonest ingredients used in solutions of water to produce toughness are saltpeter, sal ammoniac and corrosive sublimate (poison). Certain recipes call for ½-oz. each of these to a gallon of soft water; a handful of salt is then thrown in to increase the hardness. It is rare indeed that a suitable water is found which, without the addition of some chemical, will do for quenching wood-working cutters.

Self-hardening or alloy steel of late years has come into quite extensive use in wood-working establishments. The chief advantages it has over carbon steel are: Most brands require no hardening or tempering treatment; it has a hard, tough edge, that will stand up to faster feeds; it will hold an edge longer; retains its hardness at a high temperature; the knife or cutter lasts longer. These characteristics are due to the fact that alloys other than, or in combination with, carbon are employed in the manufacture of this steel. Chief among these are tungsten, manganese, chromium, molybdenum and vanadium. These are used either singly or in combination of two or more, so it is readily seen that there are far more varieties in self-hardening than carbon steel. Fortunately, however, most of the self-hardening steels used by woodworkers require no hardening or tempering treatment.

When it is necessary to bend or forge the cutter to suitable shape it is heated to between a red and white heat—a lemon color—and worked only at that color. It cools rapidly, so it must be worked quickly and a little at a time. After forging, allow it to cool, then heat to a white heat—until the scale on the surface appears molten—then if it is an air-hardening brand, it may be allowed to cool in the air. If desired extremely hard, quench it in a cold blast of air from the empty forge or a compressed-air hose. It is wise to follow any directions the manufacturer may give for treatment of such steel. Tungsten steel may be air-quenched, but maganese steel is improved in toughness by water or oil-quenching. It might be mentioned here that a charcoal fire cannot be made hot enough for treating these steels, so good forge coal must be used.

Great care must be exercised in grinding self-hardening steel, especially thin knives, as the surface of the emery wheel frequently becomes glazed and heats the edge unevenly, causing it to crack or check. It is therefore important to dress the wheel at the first signs of glazing. For such grinding a soft, coarse, free-cutting wheel is recommended. The kind of steel at hand is readily recognized by the emery wheel spark test. Carbon steel gives off bright, dazzling sparks; the harder the steel the brighter the sparks. Self-hardening steel gives off dull-red sparks.

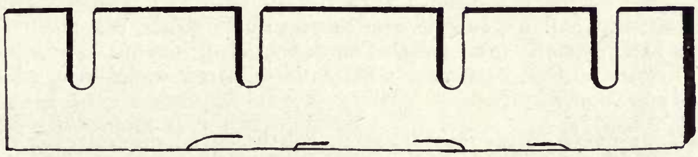
In conclusion it is well to remember that each brand of steel has its own peculiarities and must be treated accordingly. The best of steel has been condemned by a molding room foreman simply because it did not respond to his system of hardening and tempering.

CARE OF MACHINE KNIVES

Get the best knives. A good knife will do more and better work and require much less care than a poor one. The men who have charge and care of knives generally have tenacious ideas about the temper suitable for their work, and as a rule their ideas should be conformed to unless decidedly wrong. Knives that cut across the grain, such as stroke jointer, tenoning and dado, should be so hard that a file can make no impression upon them. Many prefer to have sticker knives and moulding knives the same unless there are some corners that an emery wheel will not conveniently reach. The hard knife will do most and best work, but is more difficult to sharpen. The same is true of lathe knives. All planer knives should be of such temper that they can be sharpened with a file, hardwood requiring a knife that a file will just touch while pine requires a knife that will file easily. The temper suitable for elm and ash is a trifle harder than for pine, that for basswood another degree harder, that for oak still harder, while kiln-dried maple and beech requires hardest temper of all. It will plainly be seen that for one set of knives to work on all kinds of wood a medium temper is the best that can be procured. The grade of files used has much to do with what a workman calls a filing temper. A knife that one workman will call too hard to file another will call too soft for use. Some prefer to use the file more and grind less, while others prefer to grind more and use the file less.

GRINDING MACHINE KNIVES

The common method is to use an emery grinder, using water to prevent heating the edge and drawing the temper. Great care should be used in grinding with an emery wheel. Many knives are injured and often destroyed by its use. The danger comes from the friction of the wheel heating the edge, and this may result in cracking the knife and generally leaving it soft, but occasionally leaving it in the condition called "case hardened." An examination of the knife will reveal the effect as a BLUE COLOR IS LEFT UPON A POLISHED SURFACE. When the knife is cracked, the crack usually runs parallel to the edge and generally takes a curve up to the edge (see cut.) Its distance from the edge is determined by the point of contact on the opposite side of the emery wheel. The crack is usually from ⅛ inch to ¼ inch from the edge.



KNIFE CRACKS CAUSED BY HEATING OF EMERY WHEEL

There are some knives whose temper can be drawn enough to seriously injure them, if not ruin them, and yet no color will be shown. Very hard knives, like plane bits, stroke jointer knives, shaves, etc., are examples of this. Knives can be ground upon an emery wheel and not be injured, but they will not submit to careless treatment, Use a soft, coarse wheel and be SURE it does not GLAZE. Have the knife move steadily and reasonably rapidly over the wheel and do not attempt to grind it too FAST, keeping a stream of water upon the point of contact between the knife and wheel. If a glaze forms upon the wheel it is next to impossible to grind a knife without injuring it. If the knife has a wire edge have it removed and edge nicely smoothed with a fine whetstone.

The length of the bevel on the knife is important. Under no circumstances should the bevel be allowed to rub on the work as it will draw the temper in a few seconds. But if the bevel is too long it weakens the cutting edge, and care and judgment must be used to get this just right. If workmen will use a shorter bevel and sharpen more often, their knives will do work that knives with a long bevel cannot do. Many good knives have been pronounced worthless simply because they have attempted to use them with too long bevels. Never allow the face of the knives to become rusty, as the rust eats out a hole in the metal and when the edge reaches this it will leave its mark in the work.

Grinding for different kinds of wood and for different purposes demands good judgment. Perhaps the majority of men grind the same bevel for all kinds of wood. A thinly ground knife will tear up the grain and tear out knots and splinters. Clear white pine will stand a pretty good bevel, but when you get down to box stock the bevel should be considerably shorter if you would save knots and shakes from making a bad showing. One can often take advantage of conditions in running the coarser kinds of stock by waiting until knives get a short bevel from sharpening with a file; sometimes using a bevel from the front will help out. In hot, kiln-dried Southern pine, sharpening from the front of the knife often gives splendid results. A little good judgment will many times save work and make a very nice finish, but one has to be more careful and sharpen oftener. The short bevel knife takes more power and must be sharpened oftener, but pays by saving stock in many instances.

There is not a safer or better chipbreaker made than a knife ground from the front side. One sometimes sees planers with the knives fairly set back into the head. There is an element of danger in this such as cannot possibly exist with a knife ground with a bevel front. With the front bevel there is no possibility of shavings being forced under the knife and breaking it off. Most planer operators have seen a set of knives stripped by getting shavings under a knife. When one goes there is no hope for the others. Where pony and buzz planers are concerned, it is well to grind a front bevel and set the knife out a little to save the wear on the lip under the knife.

Coming to the hardwoods, there is some difference of opinion. One man makes almost a square edge in order to finish hardwood stock to suit him. Another turns his knives over to work a lot of maple stock for finish and flooring, using in all cases solid side-cutter bits for tongueing and grooving. Slow feed and constant care to keep his tools sharp and clean give him splendid results; or, to use his own expression, he "polishes it." Every man, in order to do good work, must grind his knives for the work he is doing.

BALANCING KNIVES

The proportional balance enables the operator to balance the knives endways, at the same time balancing the total weight, and as a result, having each knife in the set balanced against the others, both as a whole and in parts, smoothness of running and freedom from vibration results.

All rapidly revolving knives must be accurately balanced, duplicates in every respect, for smooth dressing. The uniformity must extend to width, thickness, bevels, and slots, otherwise vibration will ensue, which is detrimental to good results according to its degree. Each knife should weigh exactly the same and should not vary much in their shape. A wide, thin knife and a narrow, thick one may weigh the same, but will not run smoothly, in other words, a standing balance is not a running balance. Have the knives in perfect balance. It is not only essential that the knives should be of the same weight, but just as necessary that the corresponding ends of knives should be of the same weight. Suppose two knives of the same weight are placed upon a 4-inch cylinder, revolving 4,000 revolutions per minute. Knife No. 1 is perfectly balanced, each end weighing the same. The left end of Knife No. 2 is one ounce heavier than the left end of Knife No. 1. By centrifugal force, under conditions mentioned, this is practically equivalent to 58 pounds, and this is forced through its course 4 inches up and down and 4 inches back and forward 4,000 times each minute. A cylinder revolving with knives in this condition will soon wear its bearings out of round and then must be repaired. But this is not all. The right end of Knife No. 2 is necessarily an ounce lighter than the right end of Knife No. 1. Then, while revolving, one end of the cylinder is thrown up and its opposite end is thrown down, producing a vibratory motion, and practically doubles the defect. After perfectly balancing, to run smoothly the knives must be placed in line upon the cylinder—that is, the ends must be the same distance from the bearings. The knives should have a true face running from end to end and from the back of the knife to the cutting edge, slightly concave, so that the face at the cutting edge will fit exactly upon the edge of the cylinder. This point should be guarded with the greatest care. If there is a minute space between the knife and cylinder, shavings will drive under and will break the strongest bolt that can be made, and the knife is forced loose to the great danger of life and limb and the damage to the machine. Set the knives out evenly so that every one will cut.

Judgment must be used in tightening bolts which hold the knives. They should not be drawn so tight that the bolt is strained and weakened. Swedish iron makes the safest and best bolts. They should be of the same size, balanced, and care used that they don't touch the bottom. Many accidents have resulted from this cause. The workman thinks he has the knife held firmly to its place, but the pressure is at the end of the bolt and not at the head. Never allow a careless workman to use or care for machine knives.

BALANCED KNIVES

Planer, surfacer, jointer, shaper, hog and similar knives must be maintained in perfect weight and running balance.

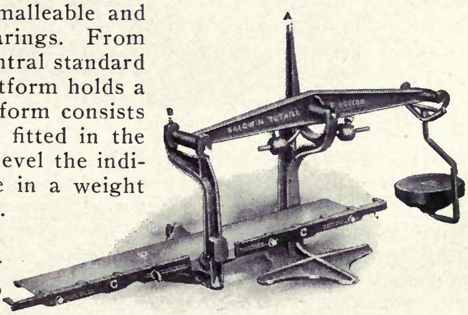
Each knife in a set must weigh the same.

Each knife must be in balance itself, that is—each end weigh the same.

A properly manufactured knife balancing machine will balance knives one against another for a weight balance and one end of the individual knife bar against the other end for a running balance. Thus each knife in a set will weigh the same and also be in perfect balance endwise, the cylinder head will run without vibration and smooth, accurate planing or surfacing result.

The constant pounding of a cylinder caused by poorly balanced knives is injurious to the journals and racks all parts of the machine. Perfect knife balancing stops the pounding, and this insures longer life both to knives and the machine and improved service.

The knife balance illustrated is made of malleable and gray iron, steel and brass, with hardened bearings. From each end of the beam which swings on the central standard is suspended a platform. The right hand platform holds a knife for weight balance. The left hand platform consists of a long brass bed, which tilts on bearings fitted in the left supporting arm. When this platform is level the indicator points to B and if the two knives are in a weight balance, the two indicators at A will coincide.



Attached to the long platform are two slides, inversely connected to adjust to or from each other uniformly, and notched to receive and center any size of knife within rated capacity, without being moved to exceed three inches.

Place the lightest knife of the set on the left platform and another on the right one. Center the knife on the left platform by means of the slides. The heavy end of the knife will be indicated by the pointer. After you have corrected this **the knife will need no further attention.** There is only one exception to this. If one of the heaviest knives of a set is so far out of balance endways that, to correct it, it will become the lightest knife, then the first knife, which was originally the lightest will have to be reduced to the same weight.

This knife should now be put on the right platform. It is perfectly balanced endways and, being the lightest of the set the other or if there are more than two in a set, the others must be reduced to the same weight. With this knife on the right platform, place another on the left. Pointer A will show how much heavier it is than the knife which has been balanced, and pointer B will indicate where this excess of weight is located. Reduce this knife until it balances endways, and if it is still heavier than the other knife reduce evenly without changing the endways balance until it is of the same weight as the other knife. If there are more knives in the set proceed with them in the same manner, using the first knife for a balance for all the others.

BALANCING OF HOG KNIVES

Hog knives ought to be balanced in pairs and then when placed on the rotor, locate each pair or each knife of a pair directly opposite in line of travel. The result will be a much better running machine with reduced vibration, no jar or hot boxes and more perfect lubrication. The writer has seen hog knives in operation where one knife was ¼-inch wider than its mate and when running, excessive vibration was set up simply because the knives were out of balance. It is not a waste of time or steel to keep the knives in balance. Out of a 12-knife set, it will usually be found that at least four pair will be in balance and with a good grinder and hog knife balance, it is an easy matter to balance the rest.

Short knives run in sets can be ground with good advantage as regards maintaining the balance, by grinding the knives opposite each other on the head, two at a time end to end. Thus suppose four knives are run on a 16-inch head. These may be marked, 1, 2, 3, 4, and by grinding 2 and 4 and 1 and 3 end to end in pairs, two grindings are sufficient, with a saving in time and better uniformity as to width and bevel.

Do not grind notches in the back of knives to bring about balance. Grind the knives in balance, keeping them of the same width, and be sure that they are accurately set on the cylinder.

QUALITY IN KNIVES

There is something in the steel, in the forging, the temper, the grinding, the punching or milling of the slots, and the final balancing. The steel and temper are the most important points of all for the manufacturer to contribute, for any well equipped mill can attend to the further grinding and balancing. Knife makers can make better knives today than they ever could, if they use the right steel and skilled labor. Competition in quality of manufacture is always good business; competition in price is always poor business save as it is the legitimate result of improved methods or cheapening of the raw materials. The knife maker that puts good stuff in his goods is the next friend of knife operators.

Having ground knives to balance on the scales, you must set them to run in balance on the machine. If your knives are ground to a pattern just alike so that they balance nicely, they must still be set to cutting line, so that all cut, and then you have a running balance. Some operators seem to figure like the man that set one knife out just so far and then the other just a trifle farther, so as to take a light cut to finish, somewhat as the barber goes over his work a second time for a smooth shave.

A feature in smooth molding is to keep the stock so it will feed easily, for if there is any let up in the feed rolls or if the pressure is too tight, it will show on the stock. Another defect sometimes noticed is a hollow bed just under the knives. When this happens it should be trued up, then with well balanced knives, reasonably tight boxes, easy pressure and straight guides you may expect good smooth work. Avoid a trembling floor or uneven joints in belts. Belts should preferably be run endless where possible, otherwise with lace or hooks.

One cannot be too careful about setting knives and one should go over the bolts the last thing to make sure that they are not too tight or too loose before putting on the hood or starting the machine. Many an accident is caused by a strained bolt. Many an accident is also caused by absurd carelessness. Don't take chances with a buzz saw or with a revolving cylinder head or with a revolving blower or with any other type of high speed machinery. For if you do it may mean the loss of a finger or hand or an arm. Moving belts and machines do their work in fractions of a second.

TEMPERING PLANING KNIVES AND MOLDING CUTTERS

In forging or hardening molding irons it is important that they should be heated as evenly as possible, for if one part of the cutter is thinner than the other, care must be taken that the thin part does not heat more rapidly than the rest, or it may be burnt and break off at the cutting edge while at work. In heating cutters for tempering they should be repeatedly turned over in the fire and withdrawn from it occasionally. In the case of molding cutters, if the cutting edge is heating too rapidly, it should be pushed through the fire into cooler coals. If there are a number of cutters, great care should be taken to temper them as nearly alike as possible or they will vary in wear and the outline of the work will vary accordingly. It is important in tempering any kind of tools that there shall be a gradual shading of color. If there is a distinct line between the colors toward the edge of the cutter, it will probably chip at this line. The point to aim at is to have the edge of the cutter fairly hard, and this hardness to be reduced as you go farther from the cutting edge, and the softer metal at the back will be found to strengthen and support it. Great skill is requisite in tempering owing to the varying amount of carbon contained in different steels, to suit which the amount of temper must vary accordingly, and the proper temper can only be ascertained after one or more trials. As a rule different brands of steel cannot be treated alike, and this very fact explains why one smith will prefer one manufacture of steel, because of his familiarity and success in working it, while another may think ill of it. It may be taken as a rule that if it is necessary to heat the steel so hot that when it is annealed it appears closer in the grain than the piece from which it was cut, that it is of too low a temper for the required work, and a steel of higher temper should be selected. A steel cutter, when properly tempered and suited to the work in hand, should always be of a finer grain than the piece from which it was cut. The process of tempering should be gradual as the steel becomes toughened and less liable to fracture by slow heating and gradual softening than if the process be performed abruptly. When the proper heat is reached the tool should be removed from the fire. In forging, welding or tempering steel tools, any excess of heat over what is necessary is detrimental, as it opens and makes the grain of the steel coarser. If a tough temper is required the cooling should be as slow as possible. The right color in tempering will vary with the steel and the hardness required.

CARE AND SPEED OF MACHINES

The use of good machines, coupled with experience on the part of the operator, are prime factors in successful planing mill work. The operators should be mechanics who keep abreast of the times, who are constantly seeking to improve their product and at the same time put all the stock possible through the machine. A planing machine is a delicate mechanism, subjected to severe work, yet expected to hold to an adjustment of infinitesimal parts of an inch. In the hands of incompetent, careless mechanics they soon become unreliable, full of lost motion, and destructive of good results. There are some machine hands that can do more harm to the machinery in six months than they could make good in a lifetime. Practical, successful proprietors of plants realize the importance of having not only a skilled foreman and tool or machine man, but skilled men to run the machines, and the extra amount of their pay roll is amply compensated by good, perfectly manufactured stock that commands the highest market price with no regrading or rejecting.

Many of the commonest points pertaining to alignment or adjustment of machines are ignored or overlooked by incompetent men, and these same incompetent men are the most common cause of unjust complaints or criticisms of machines and their makers.

If you want good work and plenty of it, put your machines up for doing it. Use four knives on the cylinder and see that all follow and cut. Don't take them right from the emery wheel and put them on, thinking they are true. Try them with a square across the face of the cutting edge and make sure they are true. Then put them on your cylinder, set up the bolts tight enough to allow the tap of a hammer to drive them in and out, place a short piece of wood for a gauge in position where it can be held firmly and not slip, turn your cylinder slowly, driving the knives in and out until they touch the gauge. Do this at both ends; and if properly adjusted all four knives will perform their allotted part. Care must be taken in filing not to remove more metal from one knife than from the others, and if you file, file straight and even across the entire knife.

When millmen awake to the fact that practical experience, both on their own part and on that of their employes, is a most necessary element to their success, they will find progress and profits easier.

VENEER KNIFE GRINDING

Veneer knives and saws are items of considerable expense to the manufacturer of high-grade veneers. This expense, of course, varies with the degree of care either may receive in the hands of employes, whose duties require them to grind and prepare them for the machine operator.

Veneer knives are made in various sizes from 1 to 16 feet in length, and are usually of laid steel, or of tool steel, which has been forged to low grade steel, the object of which is to produce a finished knife that will remain straight, without warp or wind, as would be the case if made wholly of tool steel.

Tool steel has a well-known tendency to contract and buckle in the process of tempering, hence the desirability of producing knives in this manner, so that they may be readily straightened in making and afterwards. Much of the unfortunate troubles experienced in grinding are overcome by the use of this softer steel in the backing, but enough trouble remains to continue to annoy the veneer maker. The methods pursued and materials used in a modern knife factory are of such a nature that perfect knives can be guaranteed of much superior quality and far better finish than ever before.

In ordering knives the veneer maker should always state the character of the work they will be used for.

A recent writer has truly said: "The man at the knife grinder can not change a poor knife into a good one, no matter how much skill or care is exercised, but when the skill and care are lacking it is very easy to change a good knife into a bad one."

Many knives have been injured and ruined in the operation of grinding through carelessness, ignorance or worse.

Grinding the thin edge of an expensive veneer knife is indeed a delicate operation and requires an order of skill that many veneer makers do not seem to appreciate.

It is possible to overheat, burn or crack any veneer knife, in this operation, in such a short period of time that it seems increditable. Few realize that but the fraction of a second is required to do the harm that renders many otherwise perfect knives useless through the drawing of the temper or by cracking. Several kinds of artificial grinding wheels are being made for this work, some of which are of excellent quality, but others are quite unsuited to the work and cause trouble.

The manufacturers of artificial grinding wheels have made great progress in perfecting them, and wheels of the present day are far superior to those of former times. It should not be construed, however, that this advance in the science has reached the point where the grinding of expensive veneer knives and saws may be accomplished by unskilled labor without fear of injury.

Wheels which prove most satisfactory and serviceable are those in which the abrasive grains are known as size No. 30 to 36.

The most satisfactory bond is that which retains the service of each individual grain for just so long as it continues to cut, but releases it at that moment it has grown so dull that it refuses to perform its function and becomes an increasing danger through friction. This is precisely what a hard wheel does; owing to the hardness of the bond, it retains its hold on the grain after it has served its usefulness, with a tenacity that frequently nothing but an emery wheel dresser will dislodge.

Ordinary grindstones have been used with safety, but can not be relied on to run true and are not recommended for this work.

CARE OF KNIVES FOR VENEERS

Face grinding should not be attempted by unskilled persons, nor should it be done to such an extent that the value of the temper is lost by cutting through it into the softer structure of the interior of the steel.

Fine veneers can not be cut with a poorly tempered or poorly ground knife, but fortunately it is not necessary to use them, as excellent veneer knives may be had from well-known makers, who are willing to guarantee satisfaction.

To cut veneer of uniform quality and thickness it is necessary to use a uniform tempered, accurately ground knife, which must be ground with care on an automatic knife grinder that is rigid and where the knife is firmly bolted to a knife bar that is incapable of any spring, the grinding wheel taking but a very light cut, which is covered with a liberal stream of running water, ever remembering the maxim that "haste makes waste."

Occasionally a knife that seems a little hard at first will, after being ground the first time, prove satisfactory and hold a good edge thereafter.

Knives that have been used and ground two or three times and seem to be working all right, will continue to do so until they are worn out and subsequent troubles are in nearly all cases traceable to inexperienced or unskilled labor and handling, for which no fault can be attached to the tool or its maker.

Among the defects that may be noted in veneer knives are poor welding, uneven grinding, unsuitable or uneven temper, errors in location of slots and poor joints in the case of sectional knives.

PAPER AND PULP MILL KNIFE GRINDING

Our Cup Wheel Knife Grinders have met with a large sale to pulp and paper mills and have given eminent satisfaction for the variety of knives commonly employed, such as barker, chipper, bed, under-cut, over-cut, rotary and other types.

Barker knives now in use on the large 5 and 6 foot machines range from 12 to 20 inches in length. The chipper knives range from about 24 inches in length by 10 inches in width by 1 inch thick to about 12 inches in length by 8 inches wide by ½ inch thick. The paper trimming knives range from the short lengths up to 180 inches long by 2½ inches wide by $\frac{7}{16}$ inch thick, these larger sizes being called stop cutter knives used on the end of a paper machine.

Now in considering the purchase of a suitable Knife Grinding Machine a paper or pulp mill operator should first take into account the range in variety and sizes of knives, submitting to us if convenient, a complete list of these knives with specifications as means for special recommendation. However, each grinder in rated capacity is adapted to grind knives any length up to that rated capacity or any shorter length with equal facility, and it is possible to grind from two to four or more of the shorter knives placed end to end at one time, the only objection to this being that the different knives in a set may not require uniform grinding, and if several knives in a set are ground simultaneously some one of the lot may require a little supplemental grinding to properly finish it.

For heavy barker and chipper knives, some of which weigh up to 50 pounds or more each, it is essential that the grinding machine be amply rigid and properly reinforced in all parts as a means to straight and uniform grinding. Heavy knives are unlikely to be ground with perfect accuracy on a light machine because of vibration or because of spring in the slide or bed casting. Our grinders seem to meet these several requirements as regards rigidity, and freedom from vibration as a means to accurate grinding, exceptionally well, and it is doubtful if the bed and carriage arrangement could be constructed in a better manner even with no limit on the expense. The ways and the general workmanship of these machines are perfect and customers who run these grinders on barker or chipper knives almost constantly and who have done this for years, assure us in unqualified fashion of their great efficiency. Every pulp mill needs a first-class grinding machine for its variety of work and cannot afford to operate a "clap trap" grinder. Such knives should always be ground with a very free circulation of water and the knife should by no means be crowded to the grinding wheel with undue rapidity. A reasonably slow cross-feeding of knife toward wheel is imperative if one would avoid undue heating of the knife and impairment of its temper. Hence, a full automatic grinding machine for this service has marked advantage over a hand feed grinding machine, because after the grinding starts the constant attention of operator may be dispensed with, or he can busy himself about other work even though being watchful of the grinding process. The constant attention of a man is expensive and in hand cross-feeding it often happens that a man desirous of finishing the work quickly will crowd the knife to the wheel, grinding too rapidly and thus causing edge cracks to form which will result in nicking or chipping out the edge of the knife and thus involve an extra amount of grinding with waste of time and metal, to again bring the knife to a proper edge.

PAPER TRIMMING KNIVES

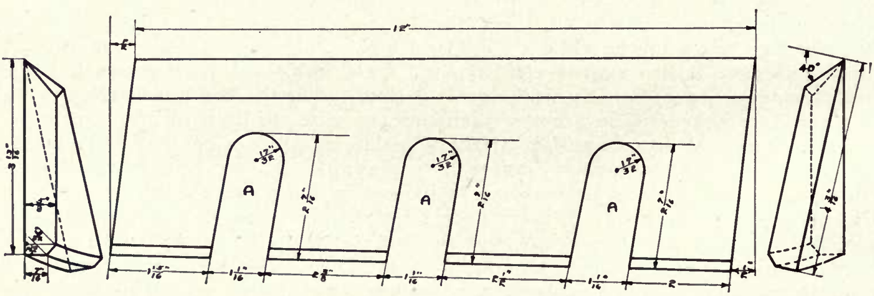
Paper trimming knives, especially those employed in printing, publishing or lithographing plants, box factories, paper warehouses and similar establishments for cutting quantities of paper to required size, may be ground in a perfectly satisfactory manner. These knives differ from the heavy barker and chipper knives both in thickness and bevel, that is to say the paper trimming knives do not average to be over one-half as thick as the heavy knives and require a long bevel and a consequent thin edge. It is practically as easy to grind a long bevel, thin edge on a thin paper trimming knife as it is to grind a short bevel on a thick barker or chipper knife or a heavy metal shear blade, some of which latter for the grinding of which our machines are employed, range up to 1½ inch in thickness, but in grinding thin, long bevel paper knives special care must be exercised to grind slowly and also to have the grinding wheel well adapted in grain and grade to secure perfection in the work.

Wheels employed in grinding the different types of machine knives range variously from 24 up to 60 grain and troubles in grinding are often traceable to the purchase of wheels that are distinctly unsuitable for the particular work in hand.

BARKER KNIVES WITH CURVED EDGE

The knives employed on some types of Barkers have a curved outline on the cutting edge, with edge oblique to the slots instead of at right angles thereto. Our Grinders in regular construction will not serve for such irregular shaped edges but we have adapted some number of machines to grind irregular shaped edges and we invite prospective customers to send blue print or drawing of special knives as a means for quotation.

RAG OR SIMILAR SPIRAL KNIFE GRINDING

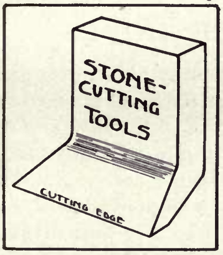


Our Knife Grinders can be supplied on special order suitably equipped for the grinding of spiral shaped knives, such as are employed on rag cutting or similar machines. Sample knives must be submitted as a basis for quotation. The requirements in this respect are somewhat various and each Grinder must be built specially for the local requirement.

METAL SHEAR BLADE GRINDING

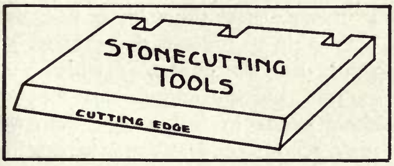
There has been a good demand for our Grinders for use in grinding the large and heavy metal shear blades used in metal working plants, rolling mills, boiler shops or the metal furniture trades and similar establishments where sheet steel or other metals must be sheared to size. Shear blades for which our Grinders have been supplied range up to 1½ inch in thickness by 8 inches wide and from 3 to 13 feet long. Metal shear blades are commonly ground on a very short bevel, but little removed from the square edge. Any requirement in this regard can be readily met.

BARK MILL AND TANNERY KNIVES



There has been a good distribution of our Knife Grinders amongst concerns in the tanning and extract trades, used variously for grinding bark mill or leather splitting knives. The requirements in such knife grinding differs in no essential respect from any of the other types of ordinary machine knives in common use. The standard grinders prove perfectly adapted for this service.

STONE TOOLS



Many Grinders are supplied to operators of stone quarries or stone yards for grinding the special shapes of tools employed in this industry, and to some of these concerns several Grinders have been marketed, one after another for different plants. Workers in stone who wish information about Grinding Machines for this use are requested to write us, giving sketch and description of the tools they desire to grind and a formal quotation will be made on a machine suitable for the local requirements.

MANUAL TRAINING AND TECHNICAL SCHOOLS, PRISONS, REFORMATORIES

The introduction of industrial training in wood or metal working in many of the high or industrial schools of the country and likewise industrial departments in many of the prisons and reformatories has opened up a substantial demand for knife and tool grinders and miscellaneous saw sharpening equipment.

TURPENTINE PLANTS, EXTRACT AND CHEMICAL WORKS

Manufacturers of wood alcohol, turpentine, tannic acids and similar products of distillation in connection with the reduction of pine stumps, limbs of trees, edgings and cuttings, bark, etc., can in many cases make excellent use of knife grinders and are requested to make known their requirements.

JOB GRINDING ESTABLISHMENTS

In a number of the large cities we have customers for grinding machines, who specialize in the grinding of machine knives from plants that have a limited number of knives to be ground and that prefer to have their knives called for, ground and returned to them. Thus cutlery or edge tool works, machine or saw repair shops, etc., may do a good commercial job grinding business by equipping with a grinding machine ample to meet the requirements of the various local trades. Machines in 48 to 76-inch capacity are most commonly ordered for job work service.

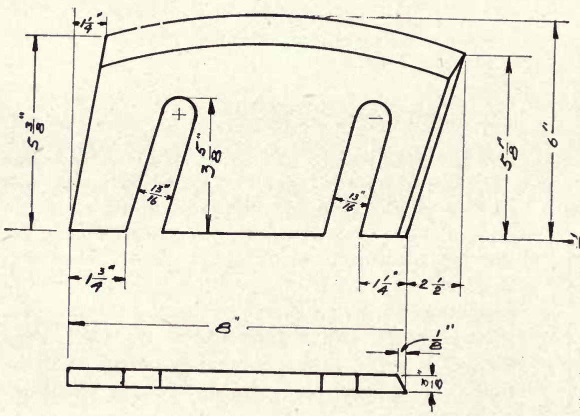
LEATHER SPLITTING KNIVES

Our Knife Grinders are well suited to the requirements of plants working leather or manufacturing leather goods. Leather or rawhide, belt and harness factories, etc., can be very effectively supplied by us, and we have quite a number of customers in these industries.

COTTON AND WOOLEN MILLS, TEXTILE WORKS, LINOLEUM MILLS, ETC.

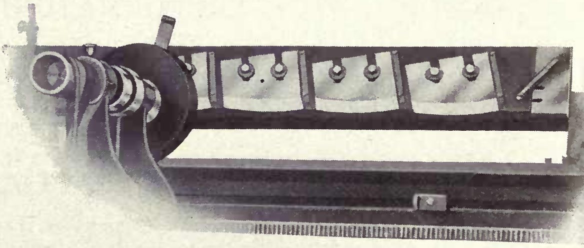
All knife grinding requirements in these industries can be met satisfactorily, and to some of these concerns we have sold grinding machines up to 13 feet capacity.

ADZING AND MISCELLANEOUS CURVED EDGE KNIVES

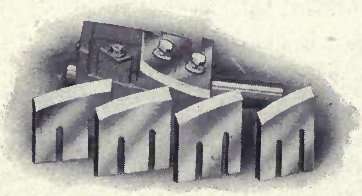


There are so many different types of regular or special machine knives employed in the different industries, for which our grinding machines are suitable or may be adapted that it is impossible for us to describe all, but it is hoped that the preceding comment and the several illustrations will influence many who have problems in knife grinding that they have not yet been able to meet satisfactorily, to send us sketches, drawings or sample knives and make known their needs in full detail, that we may recommend and quote intelligently for the service.

The Adzing Knife illustrated at the right is run in sets of 4, R. H. and L. H., for the grinding of which we furnish one of our 48-inch Cup Wheel Grinders, equipped with R. H. and L. H. knife holder to grind four knives simultaneously, and with suitable mechanism to produce the desired curvature of edge on all four knives in the set, uniformly.



KNIFE MANUFACTURERS



While it is true that knife or edge tool makers regularly employ a sandstone wheel for the fast, rough grinding of knives in the process of manufacture, there are a number of the largest knife manufacturers in the country that employ grinding machines for shop use, to insure a perfect straight edge finishing grind. Grinders are thus employed on planer, veneer, paper, leather and stave knives, metal shear blades, etc., in final manufacture.

STAVE AND JOINTING KNIVES, COOPERAGE MILL REQUIREMENTS

There are a lot of these concerns that are getting along with crude equipment for saw and knife fitting. Their present equipment dates them back 10, 15 or 25 years behind the times. It don't pay to be a back number. You can't get anywhere by saving at the spigot and wasting at the bunghole. Wake up to the fact that you can grind your saws with automatic sharpeners, swage them with efficient lever swages, sidedress or shape the teeth with devices well adapted to produce smooth sawing, grind stave knives accurately on a true circle, grind planing and jointing knives that will cut to perfection, and that a full equipment of the necessary machines or tools, will not put you in bankruptcy. A few hundreds of dollars wisely expended in first-class filing room equipment is not an expense—it is merely an investment, and one that will most likely pay for itself over and over again, possibly in a single year.

An Automatic Sharpener, swage, shaper and stave knife grinder will save the time of your saw filer, enabling him to keep ahead of his work instead of behind it, enabling you to cut stock faster and better, thus insuring you a better demand and a better price.

Profits in stave manufacture depend on making first-class staves and selling them for the highest market price. There is a demand for good staves, for better staves than many manufacturers are making and the practical question for any maker to ask himself is, "Am I making good staves and getting the top notch price or am I making poor staves and having hard work to sell them at all, and if the latter condition prevails, what is the reason for it?"

It is a business proposition to buy an unquestionably good grinder instead of trying to get along with a grinder that is not adapted for circle grinding.

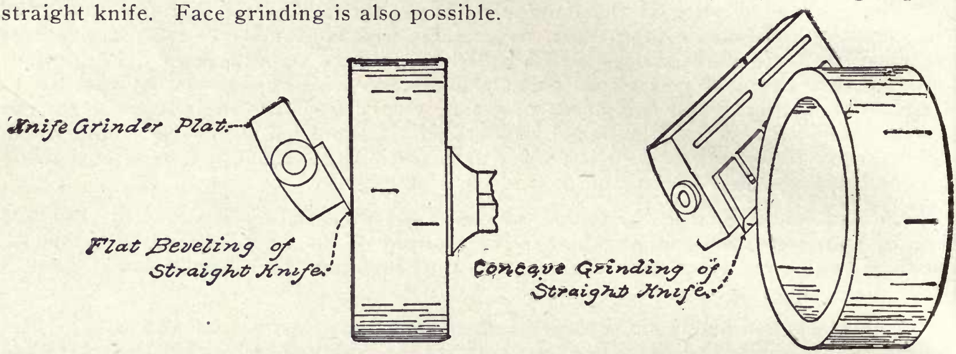
It is beyond question that many stave manufacturers can much better afford one of these machines than they can afford to do without it, because their losses from poorly manufactured staves will ordinarily amount in a year's time to a sum much greater than the total cost of one of these machines. The make-shift devices employed in some of the cooperage plants for stave knife grinding are not at all to the credit of the operators in this industry, and while economy in cooperage plant equipment may seem to many needful, the far-sighted manufacturer who desires a high-class product and a maximum market price will find it well worth while to possess a good stave knife grinder.

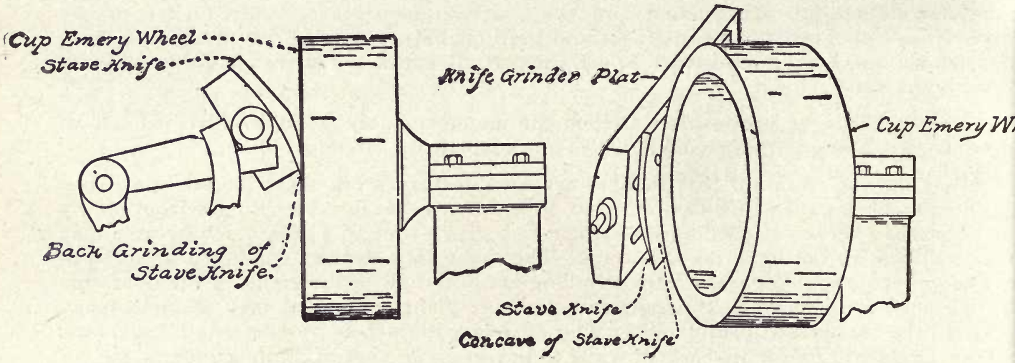
THE DESIRABLE FEATURES IN KNIFE GRINDING MACHINES

A distribution of iron that insures rigidity and strength.
Accurate fit and finish of all slides and bearings.
Suitable means for lubrication.
A hood for wheel to prevent flying dust particles or water splash, and lessen the hazard from breakage.
Adaptation for dry or wet grinding.
Adaptation to afford either a flat or concave grind.
Automatic variable screw cross-feed mechanism.
Automatic adjustments.
Means for quick alignment of knife with wheel.
Means for quick adjustment and locking of knife bar.
A heavy and well-reinforced knife bar.
Means for regulating the water circulation.
Means for adjusting travel of slide to suit length of knife
Adaptation for service on all usual types of knives.
Reasonable cost for wheel replacement.
Dependable reversing mechanism.
Means for predetermining and equalizing the grind.

CUP WHEEL KNIFE GRINDING, ACCOMPLISHED BY DIFFERENT TYPES OF GRINDERS

Detail showing the possible grinding of a straight or circle knife; concaving the face of a circle knife on true circle of 20 inches or longer diameter; convexing back of knife on true circle; concaving edge of straight knife as desired, flat, beveling edge of straight knife. Face grinding is also possible.



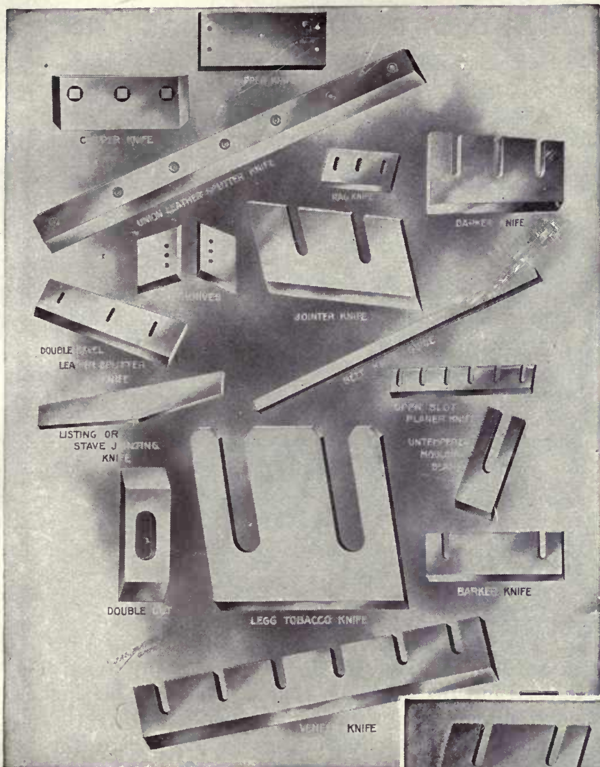


Describe your grinding problems to us.

Any information or suggestion within our experience will be gladly furnished.

THE PRIME ESSENTIALS TO SUCCESSFUL INSTALLATION AND OPERATION

(1) Careful inspection for breakage or damage in transit.
(2) Solid foundation, free from vibration.
(3) Setting up and mounting of essential working parts.
(4) Oiling of bearings, slides, gears, etc.
(5) No undue tightness of working parts.
(6) Proper speeding of wheel.
(7) Adjustment for grinding as desired, flat, bevel or concave.
(8) Equipment of knife bar with suitable bolts or clamps.
(9) Proper adjustment of cross-feed mechanism.
(10) Adjustment of knife bar.
(11) Water circulation.
(12) Prevention of rust.
(13) Adjustment of belt shifters, guides, and tightness of belts.
(14) Free cutting of wheel. No glazing. No heating of knife.
(15) Use of diamond tool or dresser.
(16) Maintenance of balance in sets of knives.
(17) Predetermining of the grind. No waste of steel.
(18) Disuse of poor wheel.



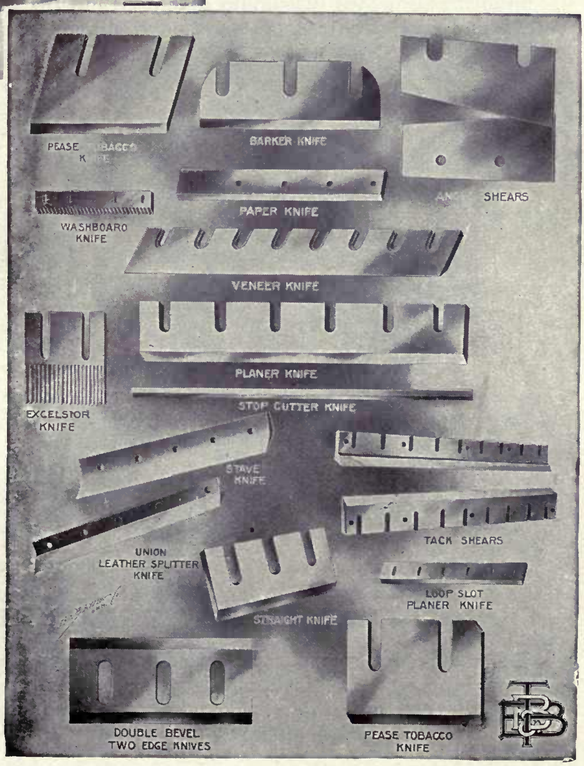
DIRECTIONS FOR ORDERING LAID-UP KNIVES

SEND TEMPLETS

In ordering knives place the knife face down on the paper, mark around to show the length of knife and size and position of slots, and state length, width and thickness, as shown in diagram; also state the number of knives in a set, if back bevel is needed, and the temper required, whether high, to grind only, medium, to file slowly, low, to file easily, and for what purpose the knives are to be used.

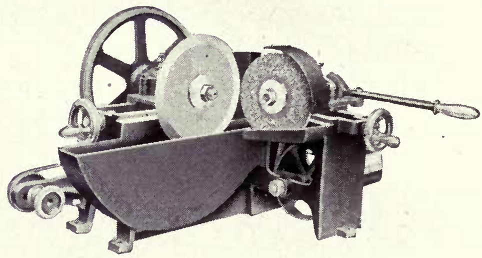
In sending specifications for knives the length is the distance between ends of the cutting edges; the width, distance from cutting edge to back. Price of irregular knives is determined by the greatest length and greatest width.

Knife Grinders Suitable for all Types of Machine Knives Employed in All Industries

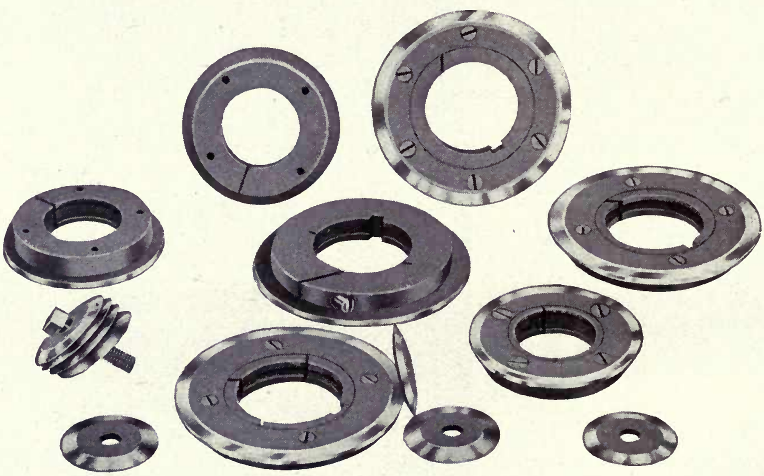


CIRCULAR KNIFE AND CUTTER GRINDING

There is a considerable variety of circular disks, knives or cutters, ranging from a few inches up to 14 inches or larger diameter, that are employed for cutting meat, paper, cork, cloth, rubber, etc. These cutters are variously straight-faced or dished, as shown by illustrations. Some are ground on a bevel and some double bevel or V shape.



For such requirements we offer a 20-inch Disk Grinder with capacity from 1½ minimum to 20 inches maximum diameter and for grinding a zone from 0 to 2¾ inches wide. The cutter unless of very small diameter, runs in water while being ground. All details of adjustment and operation are readily obvious.



Illustrative Small Cutter Grinding

OIL-STONE GRINDERS

During recent years there has been a very extensive introduction of oil-stone grinders in pattern shops, technical and manual training schools and general wood-working plants, where the rapid and accurate grinding of chisels, gouges, miscellaneous tools, even machine knives used on jointers, surfaces, planers, etc., is of the greatest importance.

Equipped with fine and coarse oil stones, grinding cone, tool grinding wheel and certain types, with knife grinding attachment, it is possible to put a smooth, keen edge on a chisel in about one-fourth the time required with a bench oil-stone, while the leather stropping wheel finishes the edge to perfection in a moment. The grinding cone accommodates many different odd jobs of internal grinding, such as gouges, and similar tools.

Suitable tool rests for the grinding of miscellaneous tools are provided. The oil-stones are saturated with kerosene oil supplied from tanks with gravity flow to the cup part of the wheel, from which the oil is directed by centrifugal force to the rim.

PROPER SPEED OF CUTTING MACHINES

Most cutting knife edges should have a speed of not less than 4,500 feet per minute and up to 5,000 would do better. This applies to moulders, planers, jointers and shapers generally, although the modern shaper should run up to 7,500 or 8,000 feet per minute to do the finest work. The knife speed of the glue jointer should be 6,000 to 6,500 feet per minute; the single end tenoner, 3,800 to 4,000 feet per minute. A scroll jig saw should run 650 to 800 strokes per minute and more if the floor and anchorage above are thoroughly firm. The tooth travel or speed of cut-off saws should be 8,000 to 9,000 feet per minute for smooth sawing; rip saws the same. A 36-inch band saw should have 500 to 550 r. p. m. or 4,500 to 5,000 feet tooth speed. All of the above speeds contemplate sharp edges for knives and sharp teeth for saws. Very careful attention to proper belt adjustment, oiling and general upkeep of machines must be had, otherwise a dry box or tight belt will soon compel a job of rebabbitting with consequent shut down and loss of time. Where machine catalogs recommend speeds that differ appreciably from the above, it will be well to take the matter up with the manufacturer of the machine for final determination. It is true that as between different makes of machines having similar capacity and designed for similar service, there may be a wide range in weight, quality of manufacture and assembling, etc., so that what would be a proper speed for one machine may be too fast or too slow for some other. In actual practice there is great variation in operating speeds of identical machines in different plants and likewise of different makes, similar in type.

PATTERN AND CARPENTER SHOP TOOL GRINDING

Wood trimmer knives, chisels, gouges, plane bit and similar cutting tools to work efficiently, must always be kept very sharp, and for sharpening purposes the old time sandstone grinding wheel, bench oil-stone and bench emery wheel grinder are fast giving way to the modern Oilstone Grinder, motor driven, about which from one to four men at a time may perform grinding operations, accomplishing a maximum amount and perfection of grind, in a few moments of time.

"Keep your tools sharp," is an old adage and an Oilstone Grinder is amazingly efficient for this purpose.

Several strong reasons may be urged to show why every self-respecting mechanic, especially the woodworker, should give diligent heed to this simple advice. First of all, a sharp tool, whether a bench or machine tool, does its work far better than a dull one. Every man who has had experience in handling tools at all, knows perfectly well that much more and better work may be turned out by the use of a sharp chisel, a keen-edged plane iron or a well-filed saw, than is otherwise possible. A chisel with a razor-like edge will cut its way through a piece of wood almost as easily as through a lump of cheese. In dressing a piece of lumber, a sharp plane does not scrape the surface, leaving it streaky and uneven to the touch (as is usually the case with a dull iron), but leaves the wood clean, smooth and silk-like in appearance. If you take a saw in good trim, it is simply amazing to see with what ease it eats its way through the lumber. In a word, it is a real pleasure to handle tools that do their work efficiently and well.

When kept in tiptop trim, the teeth of a band saw will eat their way through the wood, even if several inches thick, as easily as if passing through a piece of pasteboard. On the other hand, if the teeth be dull they will just scrape their way through, leaving behind a rough, ragged surface. A dull saw never can produce anything like a clean, smooth cut. To obtain the best results, therefore, in the least amount of time, it always pays to take the best care of one's tools.

The vast majority of mechanics are perfectly familiar with the truth here emphasized, yet every once in a while the expression is heard: "Oh, well, I can't afford the time to sharpen my tools. I must get this job off my hands as quickly as possible." And thus some continue to plod along in a bungling, slipshod fashion, making a botch of their work. Is it any wonder such mechanics are often dubbed "wood-butchers?" The name is a most befitting one, because a decent job hardly ever leaves their hands. In the long run it would repay these reckless "butchers" to sacredly devote a share of their time to putting their tools in good cutting order.

I have found it true in long years of experience that the difference between a good and poor mechanic is not altogether a matter of superior skill, but is due in part to the better care bestowed by the former on the tools with which he does his work.

The best mechanic I ever knew—a man who could turn out some of the finest work I ever laid eyes upon—was scrupulously careful to keep his cutting tools in first-class condition. He was fairly a crank on this matter; he would neither tolerate a dull tool on his bench, nor allow a fellow workman to handle either his chisels or gouges. Consequently, when a piece of work was finished and left his bench, it invariable bore the stamp of a masterly hand.

SAFEGUARDS IN WOODWORKING PLANTS

As the proper safeguarding of the limbs, life and health of the employes in woodworking plants is a matter deserving the careful consideration of every employer, superintendent, foreman and millwright, their attention may be directed to the following possible places for improvements:

(1) The guarding of saws of every kind.

(2) The guarding of belting, gearing, set screws, shafting, drums, etc.

(3) The guarding of stairways, landing, elevators and elevator entrances, hoistways, hatchways, elevator wells, wheel holes, etc., by hand rails or gates.

(4) The construction and distribution of fire escapes.

(5) The removal of dust and odors by a blower system.

(6) The guarding of emery wheels and tool grinders.

(7) The introduction of water systems or similar checks on fire.

(8) The use of automatic shifters or other mechanical contrivances for throwing belts on or off pulleys.

(9) The use of exhaust fans for carrying off dust from emery wheels, grindstones and all dust creating machinery.

GUARDS FOR SAWS

The numerous small saws of different kinds used in the average woodworking plant are probably a greater menace than are the larger saws in the mills. Any saw, regardless of size or speed, is dangerous, but there is a recklessness or carelessness on the part of many workmen, especially boys, that demands from the operators the taking of every reasonable precaution to prevent accidents and injuries.

In England the Home Office now requires all circular saws to be guarded and the factory inspectors all over the country are very zealous in prosecuting those firms who try to evade the law. As employers, since the coming into force of the Workmen's Compensation Act, have been rendered liable in fixed sums for accidents which may occur to workmen in their employ, they are adopting really good devices of this kind. The factory inspection laws in many of the states are likewise becoming more strict and imperative.

SAW FITTING IN WOODWORKING ESTABLISHMENTS

Comparing saw practice in large sawmills with that in small sawmills and woodworking plants, it is noticeable that there is a radical difference in the character of the fitting and the equipment for the work. For while the up-to-date sawmill operator recognizes that a good filer and a good filing room equipment are alike desirable, the small mill man and factory operator is less disposed to be critical or exacting in these respects. But saw fitting as a fine mechanical employment, is relatively just as desirable and advantageous to the operator of small saws as to the lumber manufacturer, and indeed more so because the small saws have to do with the preparation of the finished product. It is a well demonstrated fact that every mill or factory, whether devoted to the manufacture of lumber, shingles, heading, veneers, etc., or to the production of boxes, furniture, sash, doors and blinds, or to general planing, turning and wood finishing connected with any line of manufacture, will find the use of finely-fitted saws a prime essential to successful work.

Factory saw fitting deals with a different class of saws from sawmill work, in that there are in use small bands, band resaws, circulars for ripping, resawing and cross-cutting, which are expected to cut clean and smooth on a small kerf, true to a line, and stand good feed; jig or scroll saws, and the great variety of knives, cutters and bits that are found in the equipment of every extensive plant.

In the fitting of factory saws there are several essentials to first-class work, as follows: The right hook and pitch of teeth, the right throat room, the right tension, the right fittings of the cutting points, the absolute roundness of the saw, the proper feed of the timber to just meet but not exceed the capacity of the saw, the construction of the sawing machine itself, the right number of teeth for the work, etc.

The location of the filing room should be as readily accessible to the different woodworking departments of the mill as possible. The features of ample size, abundant light, heating and ventilation cannot profitably be ignored, but it is in these very respects that the majority of woodworking plants are extremely lacking. These defects work positive loss in time, and the practical fitting of the saws and every hundred dollars here spent intelligently in construction of filing room and its equipment will yield a larger per cent of profit on the investment than double such expenditure in any other department of the plant. The anvil bench where the band or circular saws are hammered and tensioned should have a north light with no side lights that will interfere with the filer's tests of the saw with straight edge or tension gauge. In some rooms the use of a skylight for admission of light on sharpening and grinding machinery proves both satisfactory and desirable. The arrangement of the tools must be accommodated to the individual conditions of each plant as regards its size and arrangement. A room in the form of a letter "L" is often found to be the most efficient. Refer also to a plan for a factory filing room on another page.

Spring set and hand filing have no more place in a factory than in a sawmill, except on such saws as are used for cross-cutting, or which, from the fine character of the teeth, cannot be swaged successfully. A full swaged tooth is the only tooth to run on any kind of a rip saw. A saw well rounded, with teeth swaged and properly sidedressed, and with proper pitch and clearance for the dust, is a combination unsurpassed.

Edgers, bolters, lath and shingle saws, barrel, stave and veneer saws, solid and segment rip and resaws, run with a swaged tooth, will do more and better work than if fitted by hand with spring set. It may be claimed that the hand filing and setting are simpler and require less skill on the part of the filer than the use of an emery sharpening machine and a saw swage, and this is measurably true; but no one will argue that there is a profit in crude, inferior saw fitting or that the factory saw filers are not disposed to progress and improve the character of their work. If a higher grade of work is demanded there will be found men to meet the advanced requirements and a man of fair ability can do so, if given proper tools to work with. A few factory operators have considered that any kind of a roustabout could fit their saws well enough, and have considered a cheap man and a file to be a complete filing room outfit. Some have furnished an upset and swaging hammer, a bench grinder and a piece of T rail for an anvil. And some, still more progressive and quick to see the advantage arising from the use of finely fitted saws, have furnished rooms of proper size, well lighted and equipped with sharpener, swage, hammering outfit, knife grinder, and other tools adapted to the various requirements.

A good saw fitting equipment, well suited to general woodworking plants, may be obtained for a small outlay, and it will save its cost several times a year over inferior tools, or an absence of tools.

Dull saws and rounded corners cost the operator a good deal more money than a well paid competent filer. To put cheap men into the filing room is one way to lose money.

Again as a rule cheap tools are not good and good tools are not cheap. It not infrequently happens that as between two machines for filing room service the price for one may be from 50 per cent to 100 per cent higher than for the other. Be assured that in most instances you get just what you pay for. In a machine which with ordinary care and good usage ought to last from five to ten years as used for saw fitting purposes, the primary cost is of far less importance than the question of its lasting and satisfactory working qualities and when the difference between the best filing room tools and best workmen and the poorest tools unskillfully handled means much, is it not strange that some millmen and factory operators are so blind to their own interests as to purchase equipment and hire cheap men, whose sole recommendation is low price?

It is doubtful whether the policy practiced in some mills and factories of making the filer a general utility man, liable to interruptions and calls upon his time for duties entirely outside of his regular work is a good one. Thus in some factories the filer is expected to keep up a lot of machines, make and temper a great variety of molding cutters, keep up an engine or two, take care of a lot of high speeded belting economically, do filing on saws that require the very finest and most skillful treatment, and do all this perhaps with an outfit of odds and ends. Certainly it is a fact that a factory filer who is thoroughly competent and who answers on call to all these multitudinous requirements is a pretty capable man and deserving of better pay than he generally receives.

Keep your saws jointed so that every tooth touches the jointer, and you will have a round saw with each tooth performing its portions of the cutting. If you use a spring set, having no machine swage and sidedresser, have your saw-set fit the teeth and spring the tooth with a slight twist which will leave the face of the tooth out a trifle more than the body of the tooth and make the saw less liable to timber-bind. Use just enough set to clear the saw. File the teeth square on face or straight with arbor, but the use of an emery wheel is much better for it keeps a round throat and leaves a harder and a longer lasting edge. Dress the backs or tops of teeth a trifle fleming so as to give the outside corner a little lead. Fit the teeth so that they will be uniform in size and shape. Keep the hook line between one-half and two-thirds distance from center of saw. The saw thus fitted will run well in any ordinary ripping, but if you are cutting cross-grained stock a small amount of flem in face of tooth will be a benefit. Should the corners become a trifle rounded, joint lightly with a file jointer, as often as may be necessary and understand that fine work from the saw depends mainly on fine fitting. Maintain short teeth, round saws and round throats.

The stock should be fed to the saw so that the teeth will take a deep, full cut, rather than a light scraping one, as they will stand up to the work with less tendency to dull. It is sometimes observed in sawing kiln-dried hardwoods that the saw is dulled in a short time, and this fact can usually be traced to improper feeding, assuming that the saw was in the first place properly fitted.

There are conditions of excellence that must exist in the machines on which saws are to run, always requisite to the successful operation of the saw, however well fitted; and it is presupposed that every saw arbor is level, and in line with the table or carriage, and runs without end play or lost motion in the boxes, that the mandrel hole in the saw fits the arbor, boxes run cool, etc., otherwise the best fitted saws will not be able to do good work.

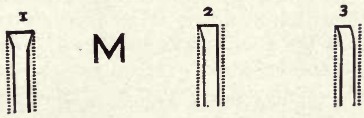
THE SET

The set in a saw is intended only to give clearance to the blade, and requires skill and practice where close and smooth work is required. Hollow ground circular saws are well adapted to smooth sawing on light work and, having no set, do nice work where the saw is of small diameter, but when saws over 10 inches diameter are used they will seldom give satisfaction unless a little set is used, and this would put them in the same class with ordinary circular saws. What constitutes just the right amount of set may seem a trivial matter to those who are accustomed to the waste in kerf of the circular mills or of factories in districts where the value of lumber has not yet been appreciated. Where dry stock is being worked and smooth work requires considerable study and experimenting to determine and care to maintain the right amount necessary. Close setting tends to smooth cutting, and while there is a slight saving in power over a full set, this saving may come to be in a measure eliminated by the increased side friction in a close cut, besides having a tendency to heat the saw, which brings on other troubles of a serious character. Soft woods require more set or swage than hard woods, and woolly or fibrous woods the greatest of all.

SWAGING, SPRING SET AND SHARPENING

The teeth of all saws wear narrowest at the extreme points, subsequently they must be kept spread, so they will be the widest at the very points of the teeth, otherwise the saws will not work successfully.

The points of saw teeth are variously fitted with full swage, spring set, or half swage and half set, and there are doubtless conditions where any one of the three forms may prove preferable to either of the others. But in general practice the full swaged tooth is considered the only thing to run. M illustrates these three forms for clearance.



1—Full Swage. 2—Half Set and Swage. 3—Spring Set.

Figure 1 shows the full swaging which is in all mills of any capacity accomplished by the use of an eccentric or direct pressure machine swage. Very few use an upset or bar and hammer for the purpose.

A saw swaged full on both corners, as illustrated in M 1 above, will do the fastest cutting and make the smoothest lumber, but requires the most power. It is not possible to always spread the points of the teeth exactly alike when swaging, but they may be readily reduced to uniform width and bevels by use of a file sidedresser or swage shaper. This insures smooth cutting and strong full corners that are not liable to break off in hard cuts. M 2 shows a tooth fitted with half swage and half set, but neither this nor 3, which is fitted with spring set, are in general use except in mills or factories poorly equipped with saw fitting appliances, or on small factory saws having teeth too fine and small to be fitted otherwise than by hand filing and setting.

There is one invariable rule to be observed in setting saw teeth, whether it be by "spring" or "spread" (swage), and that is, the extreme or cutting edge only of the teeth must bear on the material to be cut out. Any other part of the teeth or plate that touches the material must do so at the expense of power, and cause friction and heat. If any part of the tooth is "parallel with the body of the saw" and as wide or nearly so as the point, the fine corner soon dulls and the whole parallel side of the tooth is wedging its way through the cut. For fine teeth band saws (eight points or more) the teeth are set at an angle from the base to point; for coarser tooth saws a "quick" point is set out, a part of the tooth from the base up being parallel with the blade. In any kind of point the corner must be backed up sufficiently strong to prevent its crumbling off in striking the material being sawn, but no more, for the reason above stated.

In case of a tooth fitted with spring set, the corner should be sprung close to the point, and some file slightly beveling on the under side and square on top, though most saw fitters prefer to file the face of tooth perfectly square, and bevel the back if any bevel at all is used. They consider that all splitting saw teeth should be perfectly square on the front and that it is absurd to bevel the front of a ripping tooth on any kind of saw, even a hand saw.

The object sought in beveling the tooth on the face is to have it present a full sharp edge on the outside. But this bevel must be very slight if used, for if filed with more bevel on one side than the other it will cause the saw to lead out or into the log. There is little to recommend the use of spring set unless it be to save power, or to save time, files and emery wheels, but this will be done at the expense of the quantity and quality of the output, except in case of saws where the use of a swaged tooth is clearly impossible.

The use of swaged teeth, in nearly every instance, has been far more satisfactory than a spring set tooth, not only in the smoothness and quality of the lumber turned out, but also in the life of the saw. Where spring set is used, there is a certain amount of bevel given the tooth, which, when working, tends to spring the teeth sideways, causing the saws to crack in the gullet. The swaged teeth will very often stand in hard sun-dried stock, where it is impossible to make a spring set saw hold points.

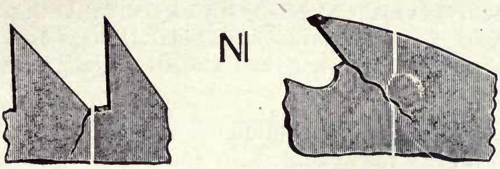
The use of an upset swage or bar and hammer on small circular saws can never be so satisfactory or efficient as the use of a machine swage, for the reason that the hand tools do not maintain the uniform length or shape of the teeth, and on saws hard or brittle are more liable to cause a fracture of the tooth or a crumbling of the corners. The use of the upset shortens the tooth, gets the saw out of round, and requires a great amount of gumming. The machine swage draws out or prolongs the tooth, preserves the hook, affords a sharp, keen point that requires little dressing with file or emery wheel, and improves rather than impairs the quality of the steel at the point. It is rapid and uniform in operation, swaging from 10 to 20 teeth per minute, as usually operated and only requires that the teeth shall be approximately alike, having the same hook on the face and pitch on the back.

Swaged circular rip saws should have fewer teeth and larger throat room than sprung saws, as each tooth has two cutting points.

For the swaging of circular saws we offer two different types of swages, one style swaging by a direct pressure of swaging die on top of tooth, such as the Rhodes or Kinney swages; the other style swaging by an eccentric roll of die on face of tooth, such as the Hanchett. The eccentric type of swage being less expensive although very efficient, is most popular with sawmills and woodworking plants, and as these several types of swages are manufactured in a number of sizes, variously adapted to saws from 12 to 72-inch diameter and from 4 to 22-gauge and to all usual sizes and outlines of gullets, it follows that there is no reason why any filer should not be able to perfectly swage his saws, whether large or small, unless it arise from the lack of a suitable swage for the work.

There are many thousands of these machines in use, and there is absolutely no question regarding their efficiency or durability, and peculiar adaptation to swaging tempered saw steel. To secure uniform work from any kind of swage, it is necessary to keep the teeth of proper shape and thickness at the point and to swage sufficiently often. If the tooth is too slim it will be impossible to secure the requisite amount of spread or strength of tooth; if too blunt the swaging may be too heavy and may also strain the steel so much as to cause a fracture. It is therefore best for those that use a machine swage to swage every second, third or fourth time, as may seem desirable, and so keep the corners always out full, but without exerting an undue strain on the fibre of the steel. Do not attempt to run or swage or set a saw, if frosted, without first taking out the frost.

Teeth on all saws should be kept as near a uniform shape and spacing as possible, in order to keep the saw in proper balance and condition. Keep the saws round so that each tooth will do its proportionate share of the work, or if a reciprocating saw, keep the cutting points jointed on a straight line. If a saw has long and short teeth, the long teeth will be subjected to the most strain, which may cause the saw to leave its line, heat, and give bad results generally. One cause of cracking lies in the saw getting out of round. The ends of some teeth crumble off and those next succeeding take all



Cracks from Angular Filing

the strain. There are convenient and simple methods for keeping a saw properly jointed and there is no excuse for running saws out of round.

Never file any saw with too sharp or acute angles under the teeth, but file on circular lines so far as possible as all saws are apt to crack from sharp corners. Figure N illustrates some forms of sharp angular filing from which cracks may result.

Hand filing should be avoided so far as possible, as it tends to change the shape of the teeth, affecting their uniformity, shortens the teeth and reduces the size of the throat or chamber for dust.

SHARPENING

The use of some kind of a saw sharpening machine is necessary. Heretofore it has been the custom in many establishments, not only in the small, but also in many of the large ones as well, to use some kind of a cheap bench grinder, in no way adapted to insure roundness or uniformity in the shape of the teeth. A bench grinder for such work, without stops or adjustments for insuring uniformity, instead of being an economy, is a foolish prodigality. A combined hand rip and cut-off circular saw gummer, with capacity for all sizes of saws to be fitted, is suitable for all-around factory requirements where the sizes and styles of saws are exceedingly various. But in every establishment where there are many saws of a size or kind to be sharpened, the use of an automatic rip and cut-off circular sharpener will certainly be considered indispensable if once introduced.

FILING

The proper filing of saws and knives is something of an art and can be acquired only by long practice. The saw or knife should be positioned so that the filer can naturally file his work square. Sharpness is to be secured, but not at the expense of proper shape; a sharp, badly formed tooth is more likely to go wrong than a dull tooth perfectly formed, and this is true of all wood cutting tools. The front of the tooth is made square or more or less beveling by the position of the filer, and if the front is wrong, the top of the tooth will necessarily be wrong, for even if the top shows square, one edge will be the longest. This likewise applies to the top of tooth. As regards manner of filing, the proper way is to push a file straight from the shoulder the whole length of the file. If anyone thinks he can do this on the first trial, he should take an inch block of steel and a straight edge, and see how long it takes to produce a perfectly flat surface.

A perfectly filed saw with imperfect tension will do better work than a poorly filed saw with perfect tension.

In the use of a file on knives, it must make perfect surfaces and edges, the edges of the knives being straight or properly curved, so that each knife or cutter shall do its proper share of the work. If the knives are filed on the machines, it can easily be seen where and how the knives are cutting, and if not cutting true the spots must be corrected so that all parts shall cut alike. On the solid bit knives, the fronts should be filed straight and square, and if any beveling is to be done, as in flooring, to make the proper clearance it should be done from the back side of the knife. Cutters for two-sided work must be filed square, both front and back, as well as the backs.

Some in filing the fronts make a rolling stroke, so that both edges are low, and they have to correct this by filing from the back side. Every filer, whether on saws or knives, should make it a constant study and effort to attain perfection both in method and results.

The greatest wear of a saw is on the under edge of the teeth and the wear under the point is in proportion to the amount or the extent of the feed. Thus if a tooth at each revolution takes out one-eighth of an inch, it will tend to become dull for one-eighth of an inch below the point, or more or less as you diminish the feed. File to a point but not to a thin wire edge. Do nearly all the filing on the under side of the teeth, and see that they are well spread at the point. File square and have the corners project alike on both sides of the saw. Do not try to run dull saws, for a few minutes spent with file or emery wheel will save ten-fold the amount of time and labor consumed in forcing a dull saw, besides making a saving in the power consumed and a heavy percentage of difference in the quantity and the quality of the lumber cut or resawed. It is just as essential to keep a saw sharp, as a razor or a plane, and a sharp saw requires less set, takes less power, cuts cleaner and smoother, and is in every way superior to one not in good order.

Don't file a rip saw beveling on the face, or with one side of the back higher than the other. File the teeth alike. Remember that sharp saws will do more and better work and take less power than dull ones. Don't try to run your saw as long as it will turn round. Saws will generally go right if fitted right, and in the case of small circulars do not talk about "poor tension" until you have looked to the fitting of the teeth.

If you must swage by hand, file the teeth properly at the point to permit the upset to act properly. In swaging use a light hammer weighing from ¾ to 1 pound, and when placing swage on tooth, hold the hand well down, so as to bring the back of the swage at the same angle as the back of the teeth, then strike lightly. See that the teeth are spread widest at the points and that the corners are evenly balanced to project alike when filed up.

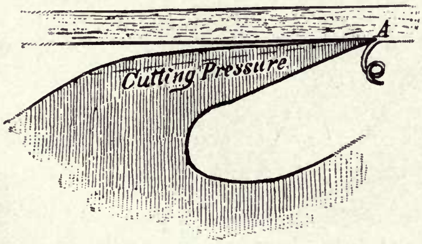
If you use an emery wheel in sharpening, which should be the case on all saws having a gullet of sufficient size to permit the use of emery wheel, avoid the erroneous notion that an emery wheel gums rapidly by being forced upon the work. Such action only tends to heat the saw red hot, causing it to glaze or case harden, so that the file will not touch the steel in pointing, besides rendering the plate liable to crack or the points to crumble. Then, too, undue gumming or heating of the plate on the rim, causes expansion to such an extent that the plate may buckle or run unevenly, and render hammering immediately necessary. The avoidance of ill effects is better than their cure.

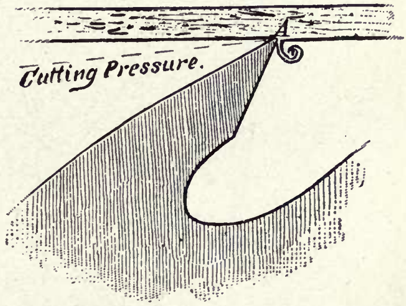
Some filers consider it desirable to point their saws with the file, after sharpening with the emery wheel, to remove any burr or feather edge, and any glazed or hard spots that may have been formed, as by so doing the points of teeth stand better and it will prevent the starting of cracks at glazed spots. The quality of emery wheels being somewhat variable, it follows that the teeth are not always left in the best condition for going on the arbor, direct from the sharpening machine. The vibration of the emery wheel or of the machine when loosely or lightly constructed, often removes from the tooth its fine cutting edge and leaves it a bit dull. Then, too, the emery wheel may be fed to the saw so as to blue or burn some of the teeth in spots. If there is any pressure of the emery wheel as it passes over the top of tooth in leaving the tooth, it will drop and leave the point dulled. For the above reasons, the filer may point the teeth with a file, if his examination of the saw as it comes from the emery wheel shows that this is necessary. On the other hand, many filers are so expert in the use of emery wheels and so particular in their selection of wheels of the right fineness and hardness for their work, that they commonly finish the saw with emery wheel, and very rarely touch the point with a file. This method is followed in the most successful practice.

Small band saws and jig saws require to be filed but one way, square on both top and bottom, the set making the necessary bevel. Special care must be taken to remove all bends, twists and lumps; also see that the braze is dressed to a uniform thickness with the rest of the saw. Keep the band saws well pointed and be careful in filing brazed teeth to avoid forming a hollow place in the saw at that point.

HOOK

Suppose you have saws with the teeth lacking in proper hook or nearly straight on face. These teeth scrape instead of cut. This causes a tremendous strain on the plate which calls for more tension. The scraping soon wears away the sharpness of the point and the saw will not cut at all. Taking into consideration the elasticity of the steel, it is reasonable to concede that anything that strains or pulls the plate will stretch it. A dull saw under heavy power is obliged to go, but it runs snaky. The more hooking the teeth, with the back clear and metal enough to stand, the better. Also, the more hooking the tooth, the less metal it takes to stand the strain, for the saw cuts easily like a chisel instead of scraping out the dust.

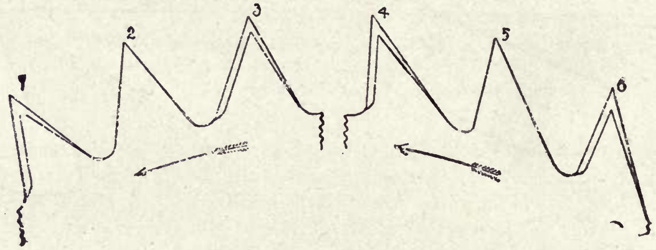




An Object Lesson in Hook

For pitch pine, basswood, or any woolly or cross-grained wood, it is best to put more bevel or flem on the backs. An increase in the amount of hook in a saw up to a limit, tends to make it cut easier, but if the teeth have too much hook, their strength will be diminished, and they may break or dodge and lead out of line. If you diminish the hook beyond a limit, the saw will take more power, stand less feed, dull more quickly and its operation becomes one of tearing or scraping, rather than of cutting. Avoid the filing of square gullets in your saw as cracks are particularly liable to start if the saw is dull or weather frosty. Keep the teeth sharp by frequent dressing. A few minutes spent on a saw each day will pay in saving power and labor, to say nothing of the increased quantity and quality of the output. A saw is just like a razor or a plane, it must be kept sharp all the time to do good work. If you run an extreme hook, the back of the tooth must be strengthened to a well rounded form, but avoid getting the backs higher than the points, or the gullet too small to chamber the dust. If the teeth lose any of the proper amount of hook or gullet, the saw will be harder to keep in order, will require more power, and will produce inferior lumber. The length of the tooth, the spacing and the size of the gullet depend directly upon the amount of feed. For light feed a short tooth is preferable as it will cut the smoothest lumber, but as the feed is increased the length of the tooth and the size of the gullet must be correspondingly increased to properly care for the dust.

Assuming the hook in circular rip saws to be normal when tangent to a circle whose diameter is one-half that of the saw, it is a matter of common observation that this standard is often departed from. The wear on the teeth will sometimes give an intimation of the degree of hook required, but as this is influenced by the clearance of the back of tooth, this feature must be taken into account. If the wear is greater on the under or throat edge of the tooth it may be given more hook, but if the wear is greater on top, either reduce the back or lessen the hook, as required. In soft woods more hook can be carried than in hardwoods, and of the soft woods those that are stringy or fibrous require the most hook. The hook or pitch of the teeth in circular crosscut saws may be assumed to be normal when the front and back of the tooth make the same angle with a line from the point of tooth to center of saw. This is often designated a peg tooth. For smooth cutting this style of tooth is popular among furniture makers. For the general run of cutting of saws the pitch of the teeth is not given the consideration usually bestowed on rip saw teeth. Cut-off saws may not require so much care in this respect as rip saws, yet it is evident that it would be profitable if more care were bestowed upon them, for the reason that there is a far greater number of crosscut saws cracked or broken before being worn out than of the rip saws. Other causes besides the shape of the tooth on a cut-off saw cut figure, as for example the angle at which the tooth enters the lumber varies materially according to the part of the saw that is doing the cutting. Cut-off saws are run both above and below the saw-table, cutting on the top or bottom of the saw. Or, the cutting may be done on a line just above or just below the arbor. When fine teeth are employed, dust chambers can be employed to advantage. They relieve the saw and assist in keeping it cool. A combination of cutting and cleaning teeth is a help in some cases.



A cut-off saw that feeds the work to the saw below the center of the saw ought to have the teeth shaped like 1, 2, 3 in sketch, while 4, 5 and 6 indicate the style of teeth desirable for a saw that feeds the work to the saw above the center; because when the saw is fed below the center the saw attracts the wood and the teeth must be so shaped that they will repel correspondingly, while in the other case, the saw will repel the wood and the teeth must have a shape that will attract it. In general, the cut-off tooth should be beveled on the front edge and the back should be filed square, and so fitted the saw will be capable of its best work, assuming it has proper speed and power.

The depth of throat for any cut-off saw ought to be three-fourths of the measured length from point to point of the teeth; that is, if they measure one inch spacing, the gullet should be ¾-inch deep, making the teeth ¾ of an inch long. In fact this rule will apply well to cut-offs of any size.

JOINTING

If the saw is not in round, the long teeth do the work, and if one tooth is shorter than the others the next tooth behind it has to do double duty, which subjects it to an undue strain and tends to dull it so much faster.

Neglect in such a matter as jointing may cause a large amount of trouble. A man may give close attention to keeping his large band or circular teeth in proper length and yet neglect the small saws, either because they are small saws or because of pure negligence or possibly lack of time. The teeth must be kept true to the cutting line.

If they are not some of the teeth have no labor and others have an undue amount. This causes a jumping or tremble of the saw, which in the case of a circular, will ultimately bring about wear and lost motion, to say nothing about the ill effects upon the saws themselves.

Where modern automatic sharpeners and machine swages are used, there is little or no trouble in maintaining the true shape, but such appliances, found in mills and factories of good proportions, are less common in very small mills, and, in fact in some large factories, so that where small saws are in use, their fitting is confined to hand filing and hand swaging or spring set. The upset swages as commonly used drive down and blunt the tooth in the process of swaging, necessitating a large amount of hand filing on the top or back of tooth. From this it is evident how the tooth or the saw sooner gets out of round than when fitted on an automatic sharpener or swaged with a machine swage.

The use of a circular filing vise and jointer is found of the greatest advantage in the jointing and filing of small saws, and it is so handy and efficient that no factory can afford to do without it for saws that are filed by hand.

In the case of circular rip saws, whether small or large, we strongly advise the purchase of a bench casting and jointer such as we supply in a number of sizes for use with the Hanchett swages. This bench casting takes up little room, has a cone for centering the saw as on an arbor, a jointing rig that can be set to accommodate a saw of any diameter, and is so constructed that when the swage is used in connection, the saw being in perfect round, cannot be swaged out of round. This method of using an eccentric swage is far better than to attempt the swaging of saw when on the arbor of mill.

SIDEDRESSING AND SWAGE SHAPING

The use of the side file is not the best practice; instead of giving a slightly relieved tooth, as shown in sketch of band saw teeth swaged and sidedressed, the sides of the teeth are parallel and soon become somewhat rounded off.

This lack of proper clearance to the tooth may be overcome by hand filing, using a side filing gauge, whereby the tooth may be given a certain amount of clearance, or, in other words, made slightly wider on the face than on the back, tapering downward and backward.

A better method, and the only method that will insure a strictly uniform sidedress to the teeth, is to use a circular swage shaper, whereby the teeth are all compressed to exactly the same shape and clearance, like band saw teeth.

The swage shaper is now very generally used for the sidedressing of log band and band resaws, is used quite generally on gang saws, and while less extensively used on circulars, is coming more and more into favor. The principle is exactly the same, whatever the size of the tooth or the gauge of the saw, and if the dies in a circular swage shaper are properly beveled to suit the clearance required, and if the tooth when swaged is spread properly to suit the shaper; that is, not swaged too wide and with too heavy a corner to suit the pressure dies, so that no undue compression of the swaging must result such as would cause crumbling or fracture of the corners, the work of the shaper on heavy gauge saws will be as good as in the case of thin circulars or 13 to 22-gauge band saws. It is merely a matter of the circular shaper being used by the filer with conditions favorable, and as they must be if the tool is to be used successfully on any saw, whatever the gauge. The efficiency of any swage shaper depends directly upon its construction and adjustment for the teeth upon which it is used and upon its proper use by the operator.

HOW BEST TO SHARPEN SMALL CIRCULAR RIP AND CROSSCUT SAWS

Sharpening Circular Cross Cut Saw

Automatic Rip and Crosscut Sharpeners are in the class of indispensable machines.

In a letter that we lately received from a lumber company, they tell us that in their factory they run a large number of cut-off saws, the most of which have a diameter of from 10 to 14 inches and the ordinary peg tooth with a space of from 3/8 to 7/16 inch between the points, and which have always been sharpened in the ordinary manner with a three-cornered file. They also state that they contemplate purchasing an Automatic Saw Sharpener to do this work with an emery wheel if they can be certain of getting a machine likely to give satisfaction on this class of work, and request us to send them promptly full information concerning our Sharpeners, with a quotation on one having capacity for rip and crosscut circulars from about 6 to 22 inches in diameter.

The above letter is typical of letters coming in almost daily, both with reference to small circular rip and cross-cut saws and likewise with reference to band rip or resaws and scroll bands, and demonstrates the great and growing demand for automatic "emery wheel" machines, which are preferable for all teeth capable of thus being sharpened, and for automatic "file" machines for the very fine band-saw teeth, for sharpening which an emery wheel cannot properly be used.

It is probable that within the past five years the number of these small Automatic Sharpeners in use throughout the country has increased ten-fold, and saw filers are now becoming so familiar with the operation of these machines, either by practice or observation, that it is exceptional for any one to have any difficulty in putting a machine satisfactorily to work. There has been a great gain in the quality of the sharpening because of a more judicious selection of grinding wheels, and a more careful and delicate adjustment of the machines, and indeed there has been a marked improvement in the construction of the Sharpeners, both as regards rigidity and strength of the frame work, a bettering of the adjustments and a more careful regard to the fit and finish of the working parts, and to protection of same from wear and lost motion. Skilled saw filers understand that a light grinding is best, which produces a sharp, keen tooth without any tendency to blue or case harden the point. With the corner the sharpest that it can be made, and by changes in adjustment or in the outline of the form which gives shape to the tooth, it is easily possible to produce teeth of any desired hook or shape of back, and make a well rounded gullet, all with proper reference to the kind of wood being sawed. Since the Sharpener is full automatic the operator can allow the machine to feed the saw around several times, dressing each tooth slightly and thus insuring absolute uniformity in the shape of the teeth and perfect roundness of the saw. Given proper adjustment and intelligent operation an Automatic Sharpener will discount the work of hand filing every time. If any saw filer falls short of the best results from the use of his machine, it is either due to the fact that he has an old time, poorly constructed Sharpener, incapable of accurate work, or else he is making use of an inferior emery wheel, or does not appreciate the need for delicate grinding.

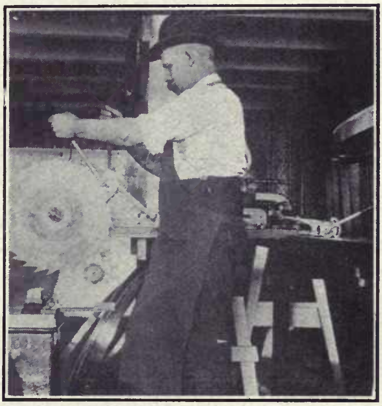
Managers and superintendents of woodworking plants ought to know more about the filing room end of the business than they sometimes do, and whether the practical man on the job is intelligent and painstaking as well as experienced, whether he is a time server or ambitious to keep up his saws or knives in a way to insure quantity and quality of output, whether he keeps his filing room clean and neat, his machines and tools in good order, and whether he keeps ahead of his work rather than always behind it. He ought to be paid for his skill in handling machines and tools useful in his work, rather than for his hours of mere physical labor. Brains in the filing room are more profitable than brawn. Perfection in the fitting of saws and knives is something that ought to be not only aimed at but attained. There is no question about the fact that mill and factory operators employing small circular saws, whether for the manufacture of lumber, shingles, headings, veneers or for ripping, resawing or cross-cutting in miscellaneous woodworking plants, are coming to find that the perfect sharpening of their circular saws is a prime essential to successful work, and there are many thousands of these concerns that can much better afford to purchase one of our Automatic Rip and Cross-cut Sharpeners in whatever size may be suitable for the variety of saws they have in use, than they can to dispense with the machine.

SWAGES FOR VENEER, SIDING, BOLTING, SHINGLE, HEADING, LATH AND BARREL SAWS, EDGERS AND MISCELLANEOUS RIP AND RESAW

SAWS SETS FOR RIP OR CROSSCUT CIRCULARS

We furnish swages suitable for swaging saws while on the arbor or removed from arbor, supported on bench casting, the most satisfactory method.

We furnish swages suitable for all diameters, gullet outlines and gauges of saws in common use, but the purpose of this paragraph is to interest in particular, factory or woodworking plant operators having in use the medium and small diameter saws, ranging from 11 to 20-gauge or thereabouts. A swage, in order to work successfully, requires that the teeth shall be uniform in outline. For this reason the swage is recommended only to those using a good hand or automatic circular sharpener on their small saws, as saws filed by hand or gummed on a bench gummer, rarely have the teeth sufficiently uniform to permit of the best results in swaging. The work of the swage is vastly superior to the upset swage, as it makes a better corner, keeps the saw in round and affords a sharp, keen cutting tooth that requires but little dressing with emery wheel or file to bring it to a perfect point. A swaged resaw of any kind will do more and better work and take less power, than one fitted with a spring set, an upset, or with a combined swage and spring set. Its work is in no respect experimental, further than that it requires intelligent handling and saw teeth that are fairly uniform in hook and pitch of the back.



Swaging a small circular saw. Any saw having teeth that can be swaged will do far better than if run spring set.

"We have just tried the saw that you fitted up with the swage and swage shaper and must acknowledge that it does the best sawing we have ever done yet. Our Mr. Sheip told the writer today that it does the best sawing he has ever seen. We did nothing to this saw to change it in any way from what it was when it came from your place. Please accept our thanks for the information that you have given us in regard to a swaged saw. While the writer was positive it could be done, we acknowledge that the laurels are all yours as we probably would never have been able to get this saw to such a condition had you not proposed sending the saw to your place."

The saw above referred to was used for sawing cigar box lumber, and measured 30 inches in diameter, 22-gauge at rim and 1-gauge at eye. Heretofore spring set has always been employed by this company, who require a minimum saw kerf and very smooth sawing and who were satisfied that if they could use a swaged tooth, the saw would stand up much better and cut much easier than with a spring set. We received the saw direct from the Disston factory, with teeth as they came from the punch press, and our work consisted in sharpening it on one of our automatic sharpeners to bring the teeth perfectly uniform and then, in swaging it and sidedressing the teeth.

Moreover by the use of grinding wheels of different thickness and shapes, and of forms specially shaped to suit, almost any practicable gullet outline can be produced and maintained as needful for individual requirements.

THE GRINDING WHEELS

The thickness of wheels employed for factory saws may range from ⅛ to ¾ inch, with edge variously round, bevel or V-shaped. For fine tooth saws, elastic wheels are essential, these being better adapted to hold their shape and to withstand breaking strains. An emery wheel dresser or better still, a Metcalf dresser, is needful.

THE FIRST-TIME SHARPENING OF HAND FILED SAWS

The first-time use of an automatic sharpener by a man unfamiliar with its operation or special adjustment demands no more care than the most highly skilled man must bestow on the process. The grinding wheel employed must be of suitable thickness and shape on edge. The saw must be adjusted on crosshead to suit its diameter and the hook of the teeth. The belt should be pulled by hand to see that the wheel movement corresponds properly to the gullet outline and if the saw has previously been filed or ground by hand, producing teeth of uneven length or otherwise lacking in uniformity, the wheel should be allowed to contact at first only with the high spots on the saw, and if the teeth are fine and are unevenly spaced, the feed pawl should be adjusted to feed the tooth next ahead of the one being sharpened, as a means to equalize the spacings, and ultimately produce a perfect uniformity of the teeth. A special direction sheet for operation of machine should be carefully studied and followed until it becomes an easy matter to sharpen everything that comes along.

It is remarkable what fine and satisfactory results may be obtained if the operator will but exercise care and intelligence, remembering that the sharpener takes the saw as it finds it, and that until the teeth become uniform, careless adjustment may lead to breakage of the grinding wheels or burning of saw teeth.

Lack of familiarity with the operation of one of these sharpeners is not a serious handicap. While many factory saw filers are unfamiliar with automatic circular sharpeners, reports of trouble are infrequent, and easily overcome. In operating any new machine, the adage, "The more haste, the less speed," applies with force. A study of the directions for operation, of the mechanism of the machine, and its various movements when running idle, and of the means for adjustment, all before putting on a saw, is time well spent.

EXPERIMENTAL SHARPENING FOR PROSPECTIVE CUSTOMERS

As compared with handsharpening, the superiority of an automatic sharpener whether on band, gang or circular saws is now so well understood and admitted that the proposition requires little or no argument.

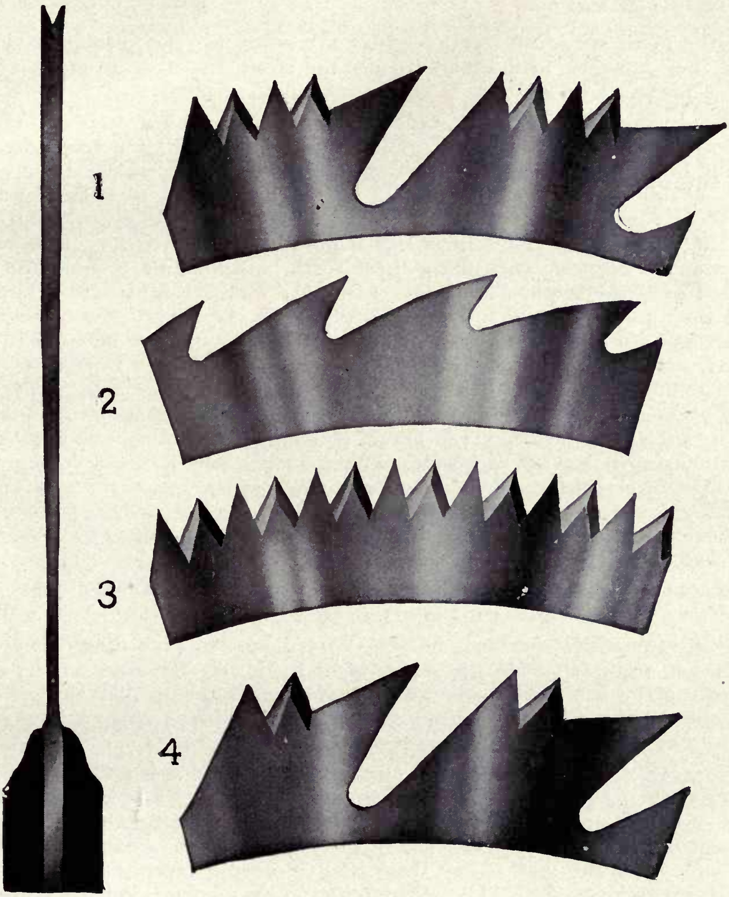
But there are some factory and mill operators that question whether in their particular instance, the purchase of such a machine is warranted. For any such we can demonstrate the work of a stock machine, if customer will send prepaid one or more sample saws, either crosscut or rip or both, such as are in every day use. These saws when sharpened will be returned as instructed, and we will rely entirely on the evident superiority of the machine work as compared to the methods previously employed, for securing an order.

In this experimental sharpening of sample saws, sent in to us by different operators, we have often been surprised at the facility with which the sharpener could be adapted to seemingly impossible conditions. Saws have come from plants in which the filing had been done entirely by hand, as a result of which the saws were out of round, the spacings uneven, the teeth very irregularly shaped, some teeth cutting unduly and others not at all, and in several cases a number of teeth in succession have been stripped entirely off.

HOLLOW OR CONCAVE GROUND SAWS

Hollow or concave ground circular saws may be sharpened very successfully if the teeth are uniform as in cuts Nos. 2 and 3 below. Cuts Nos. 1 and 4 must be hand filed.

A bevel edge wheel is suitable for No. 2; a V shape wheel for No. 3. Our sharpeners are just the thing for hollow ground saws with teeth capable of being sharpened automatically.



Although hollow ground saws with raker or cleaner teeth are recommended for smooth ripping, excellent results can be obtained with an ordinary spring set rip saw, if properly fitted. The advantage of using the ordinary style of rip saw is that it permits a faster feed. The teeth must be well shaped, with rounded gullets, medium pitch, plenty of throat room and yet with proper metal to afford strength. In setting the teeth do not attempt to bend over the points with a light hand tool, because points thus bent, spring back more easily and will not afford the best clearance. Use preferably one of the machine type circular saw sets, in which each tooth is set over a solid anvil with a solid hammer blow. Some type of trip hammer sawset is the best because the force of the blow is variable, but always uniform according to the adjustment and maximum power is available for the heaviest gauge and hardest saws, within capacity.

Setting for clearance must be done accurately because teeth that set to one side or the other of the line of cutting points invariably leave their marks in the form of deep scratches and teeth that do not set out far enough leave ridges. It is also important to have them in line with the cutting circle when the saw is in motion on the arbor. This necessitates jointing the teeth with an emery wheel or file while the saw is tightened on the arbor and revolving. Jointing is of no value unless the collars and saw are marked so that the saw can be replaced on the arbor in exactly the same relative position every time.

The saw must also fit the arbor. Do not attempt to run a saw with arbor hole too large for the arbor.

After the teeth are jointed and set they are ready for the automatic sharpener. If hand filed they must be filed square across the front and may be given a slight bevel on back. They must be kept sharp to produce good results.

For rapid, smooth miter work, hollow ground saws with groups of four or six fine beveled teeth alternating with dust gullets and raker teeth, are recommended. Such saws should be 13-gauge on rim and ground tapering on both sides of the collar line to 16-gauge. Inside the collars they should be 13 or 12-gauge, to stiffen and strengthen them. The fine teeth have some pitch forward and should be given about a 45 degree bevel on the front edges and a little less if possible on the backs. It is best to use a file with rounded corners when filing these teeth, and in filing to hold the file level as it is pushed over the teeth. The raker teeth are filed straight across both front and back, and their points should fall just a little below the line of the other teeth, unless the saw is used for ripping exclusively. Saws of this type can be used for ripping or crosscutting across the grain, but they will not stand a fast feed in ripping. When used for fine trimming and crosscutting, the raker teeth and large dust gullets are of no value and by so much reduce the number of available cutting points. A 14 to 16-inch saw, having all small beveled teeth about ¼ inch apart, will contain 200 teeth, which means 100 cutting points to each side. When such a saw is fitted so that every tooth does its share of cutting, remarkably smooth work can be produced. In cutting across the grain there will be no torn fibers on the back edge or bottom of the piece and if cutting short stock lengthwise of the grain, the sawed edge will be as smooth as though it were dressed with a sharp hand plane.

Teeth on fine crosscut and trimming saws should be peg shaped, with similar pitch on each edge or may be given a slight lead forward.

In filing such teeth one must be very careful not to give more bevel to one side than the other and not to file the teeth on one side heavier than on the other, which would result in the teeth being small on one side and large on the other, or slim on one side and wide on the other. In either case, the saw will lead more or less when cutting or mitering anything but the narrowest pieces.

To preserve the shape, pitch and size of the saw teeth file the fronts around one side first and then file the fronts of the remaining teeth. The file may rub or scrape the backs of the teeth in this operation, which will not matter, but do not attempt to file the front of one tooth and the back of the next tooth at one operation, as this practice will soon draw the teeth away from their uniformly even, true shape. Finish the fronts first, then the backs. This will put the finishing points on the teeth.

If a fine tooth saw shows quite dull, better joint after filing and then again touch up the points to bring them again in perfect alignment. In heavy filing it is very easy to overfile some teeth. Jointing after filing should be lightly done—just a bare touch of the points with a file or hard oilstone. Then again put the saw in the vise and lightly point the teeth that were touched. Only by such careful painstaking workmanship, can all of the teeth be brought into perfect line, to cut smoothly with minimum power and continue sharp for a long time. Considerable practice is necessary to develop proficiency in factory saws for smooth sawing, but care and attention in this regard is time well spent both for filer and employer.

It will be understood that circular saws having the so-called "cleaner teeth" of special shape as made by various saw manufacturers or having special teeth, cannot be sharpened with an automatic sharpener, which is suitable only for saws with all teeth uniformly shaped. But, the tendency in all woodworking shops of any appreciable importance is very strongly in the direction of introducing the automatic sharpener, which, being adjustable to produce practically any approved shape of tooth and gullet, affords smooth cutting saws requiring minimum power, set or swaging, that are least liable to crack, because the gullet outline is free from angle and clears the dust with the greatest facility.

Practically all of the prejudice existing in former years on the part of the old time filers in woodworking plants against automatic band saw filers or circular saw sharpeners has disappeared, because the successful development and every day use of these machines on all sizes and types of saws in a vast number of plants in all of the industries, with results of marked importance in the saving of manual labor, in prolonging the life of the saws by avoiding cracks and breakage, in reducing the saw kerf, in increasing the speed or rate of feed, and in smooth sawing, are so amply demonstrated that prejudice or personal pride in hand work can no longer serve as an obstacle to the introduction of such appliances in any establishment desirous of improved results.

Moreover the investment cost will be spread over a long term of years, with a trifling upkeep cost in the way of repairs during the period such that the annual investment cost becomes negligible, not in the least burdensome and with the advantage in reducing labor cost also, without considering the better and faster sawing largely to the credit of the machine.

The practical saw man performs less hard, intensive and tiresome manual labor, accomplishes each process in less time and consequently can perform daily a larger amount and variety of work, not to mention his development in skill, likewise in determining the best manner of adjustment and operation of his filing room machines so as to produce saws most perfectly fitted for the kinds of sawing locally required.

It is useless and impossible to attempt to lay down any hard or fixed rules as regards the precise form of tooth or gullet to be employed on a saw, simply because the working conditions or requirements vary so exceedingly in the different shops and factories. But, there is so much opportunity for an intelligent man to study his local conditions and indulge in intelligent experimentation, that his work becomes more interesting as a matter of course, while the plant operator profits by having a greater amount of work kept up with facility at no higher cost, and in some cases at an actual saving in the larger plants, besides having marked improvement in the speed and quality of the sawing.

Hand filing should be dispensed with wherever possible. Moreover the saving in cost of files alone in many instances will gradually in itself pay out the cost for the special devices or machines that may be introduced.

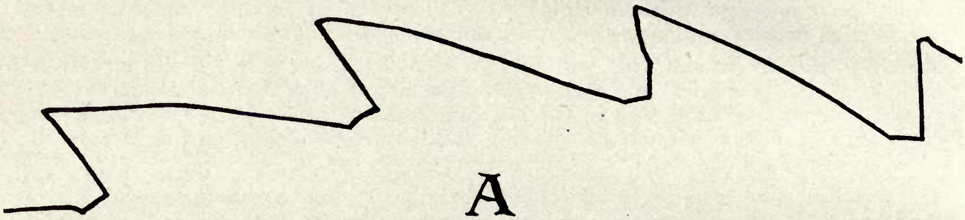
Sharpening machines long in use that have been poorly kept up and that consequently show wear and lost motion, and produce results short of the best, may be sometimes pointed to as a proof that sharpening machines are not an important advantage and that the claims made for them by representative manufacturers are for sales purposes only. The answer to this is that no machine, just as no practical man, can by reason of undue wear, lack of upkeep or lack of skill and intelligence, stand the test by which efficiency is measured.

A practical man, who is careless and slovenly in keeping his filing room and his machine tools clean, free from dirt and dust, is rarely a desirable man to have about the place, and of all machines the sharpener or filer is the one that should have most care and attention as a means to the prevention of wear, because the emery dust, filings and steel particles are obviously productive of wear, but it would be preposterous for any intelligent man to urge this fact as an argument against their use.

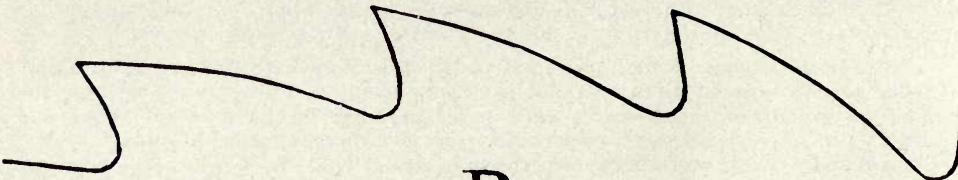
We recommend the introduction of a suitable outfit of saw fitting appliances to manual training schools, pattern shops and to all less active or important woodworking plants, having a long time operation ahead, that are at all interested either in instruction as regards methods, practice and equipment for those taking up the various woodworking processes as beginners or that may approach the matter purely from a commercial standpoint, measuring the results with the dollar yardstick.

Indeed, there may be a question whether the small shop can so well dispense with a proper equipment of filing room tools as can the larger one, merely because no skilled workman can be kept constantly at hand available for keeping up the saws or machine knives, cutter, etc., as a specialist. The work must be done by the foreman or by some woodworking machine operators, pattern maker or otherwise, whose time is valuable and often times can ill be spared for slow, laborious hand work, which he is often compelled to slight because of press of other duties.

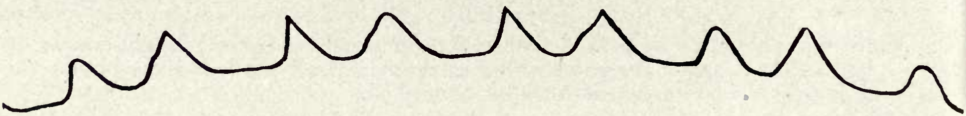
Hence in all such instances the use of automatic machines that are at once accurate and exact working, and that are less susceptible to wear, because of the limited or somewhat infrequent services to which they are put, are obviously time savers and enable such establishments to obtain as good results as can be obtained in large factories where one or more skilled men are employed as specialists in such work.



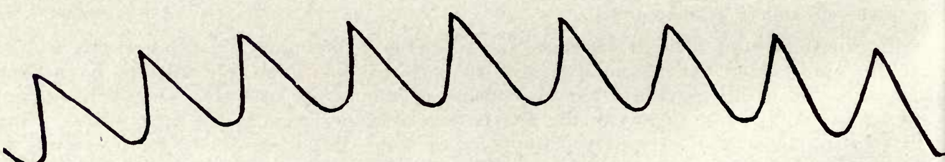
A



B



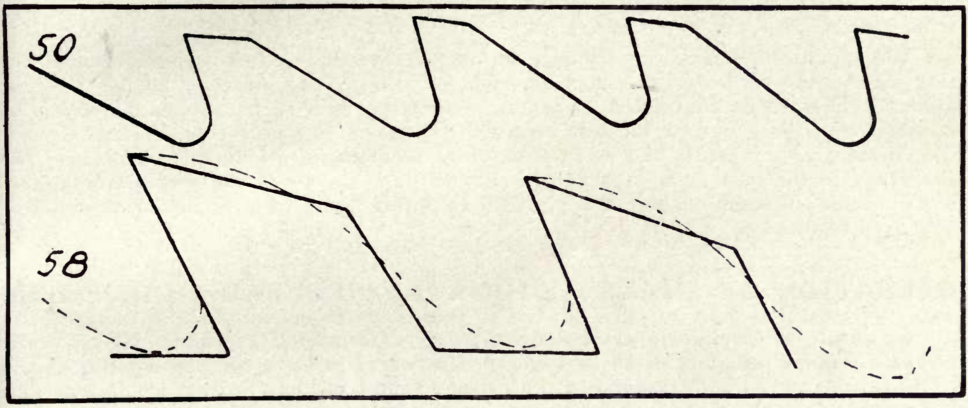
C



D

Tooth outlines A and C are from hand filed saws with irregular teeth, sent in for experimental sharpening on the No. 71B Automatic Rip and Crosscut Sharpener, which can be made to produce any desirable gullet outline, equalize the spacing, shape all teeth exactly alike, bring the saw into perfect round and balance and keep it so, saving time and labor, with maximum sawing efficiency afforded. Tooth outlines B and D are from the above mentioned saws after sharpening on the No. 71B Sharpener, as instructed by customer.

SUGGESTIVE INFORMATION FOR FOREIGN OPERATORS CONCERNING SAW TOOTH OUTLINES Nos. 50 AND 58



The solid lines represent shapes of circular saw teeth as originally submitted to us by an English customer in connection with an order for an automatic Circular Rip and Crosscut Sharpener.

The broken line represents change in the direction of improvement because a rounded outline at base of gullet prevents tendency to cracking and a rounded gullet and back can be much more easily produced and maintained with an automatic sharpening machine, whether designed for log bands, gang or frame saws, band resaws or circulars.

Hence, customers for sharpeners in all countries, who are now operating their saws with angular gullet outlines, are advised to adopt the American style of tooth. But it should be clearly understood that the broken outlines that we illustrate are in no sense arbitrary.

What is the most desirable shape must depend upon the hook, spacing, depth of gullet and the character of the stock being sawed.

In the United States, Canada and Australasia, and indeed, in most countries in which sawmilling and woodworking is carried on in a large way, the American style of tooth, which may vary exceedingly in spacing from point to point, depth of gullet, hook on the face of tooth, and pitch on the back has been generally adopted, and indeed, its adoption is practically necessary in order to use a Saw Swage for swaging the points, a Swage Shaper for sidedressing after swaging, and to obtain the best results from an automatic sharpener.

Automatic saw sharpeners have cams or tooth forms with round or elliptic faces designed to produce rounded shapes for the saw teeth, subject to the modifying influences due to the use of grinding wheels of different thicknesses and with the edge variously round, bevel or V shape as may be needful for producing the styles of teeth in common use.

The tooth outlines on saws in the same plant or in different plants vary exceedingly, in general too much so, and if practicable it is well to bring all rip saw teeth as nearly as possible to similar outline and likewise all crosscut teeth, the variations in spacing or depth of gullet being easily cared for by changes in the stroke of the feed pawl or in the thickness or shape on edge of the grinding wheel.

Every operator should understand that it is neither desirable nor possible to instantly change a tooth outline previously employed, to a different shape. Such a change must come as a result of the regular sharpening process and will require days or weeks according to the amount and frequency of the sharpening; but a practical man, watchful of the action of the machine and of the changes in results arising from changes in adjustment or shape of the tooth form or in its position on the shaft or of the grinding wheel, will soon be able to obtain and maintain almost any sort of tooth outline with spacing from point to point or depth of gullet fairly within the capacity of the sharpener selected.

We cannot emphasize too strongly the importance of customer sending in connection with inquiry or order, rubbings on paper off the saws to illustrate all the different gullet outlines to be sharpened, giving in connection with each outline, the width or diameter and the gauge of the saw represented, so that we may correctly understand the different requirements and be in position to recommend intelligently and equip the sharpener to the best advantage before shipment for the tooth outlines or to suggest what changes in tooth outline, if any, ought to be gradually effected in the direction of improved results.

OPERATION OF SMALL AUTOMATIC CIRCULAR SHARPENERS

Be sure that the tight and loose drive pulleys are properly speeded. See that the machine is kept well lubricated and whether or not you have ordered a blower, it is well to connect a pipe to the end of the exhaust pipe furnished on the machine so that the emery dust and steel grindings will be carried entirely away from the machine.

It is well to start the machine on an ordinary Rip Saw, and the Crosscuts may be taken after a day or so use of the machine on Rip Saws. Before starting on Crosscuts read carefully the instructions, and especially those regarding the steel shoe for Feed Finger so as to be able to even up the tooth spacing.

In grinding Rip Saws a bevel edge wheel is ordinarily used, although on the larger rip teeth with round gullets a round edge wheel matching the bottom of the gullet can well be employed. On Crosscut Saws spaced say, ½-inch or less point to point it is best to use a V-edged wheel of thickness as great or greater than the spacing, point to point of the teeth, so that the wheel will completely fill the gullet outline and as the head oscillates, will grind opposite bevels on the adjacent sides of the two teeth at one operation. On Crosscut Saws with teeth spaced more than ½-inch from point to point it is usual practice to use a bevel edge wheel and have the wheel trace the outline of the tooth exactly the same as in grinding rip saws. In ordering wheels it is best to send templets to show several adjacent teeth on each saw and be sure to mark on each templet the diameter of the saw from which it was taken. We carry in stock at all times a suitable assortment of wheels in all thicknesses and shapes of edge and in quality best adapted for automatic grinding of saws.

It is of extreme importance, especially on the fine toothed saws, and where a thin wheel is necessary to have the proper kind of a wheel as regards grit, grade and bond. Grinding machines that in themselves were capable of producing perfect results, have been condemned on account of unsuitable wheels being used. A fine crosscut saw, for example, with five or more points to the inch requires a thin grinding wheel, and unless same is sufficiently hard in grade, it will crumble away, changing the shape of its grinding edge, with the result that the teeth will not be uniform around the saw. Again, this wheel may be hard enough but not of the proper grit, and more often not made with the proper bond, so that it will case harden the points of the saw teeth. Through our years of experience in building automatic grinders we have had the opportunity to study these matters, and to learn the proper make-up of a wheel for a particular type of saw. We therefore, carry in stock wheels made up specially for such work as this, and we do this, not so much for the purpose of selling wheels, as that the users of our machines may have some known source of supply where wheels may be obtained that are correct for their work and thus avoid the delay, expense and annoyance of going through the experience of trying out unsuitable wheels.

After the machine is adjusted and belt applied it is well to see to it that there is no excessive grind on the teeth because in this way no undue heating or case hardening of the teeth will occur and the liability of breakage of the wheel during the grinding process will be practically eliminated and no feather edge or burr on the side of the tooth will result. If there should be any evidence of case hardening on the face of the teeth this can be relieved by adjustment of the emery wheel arbor or feed finger.

It is almost imperative to turn the machine over by hand after making adjustments and before the belt power is applied. Otherwise, a breakage of grinding wheel might easily result through too radical an adjustment. If it is observed that crosscut saws are ground with the teeth longer on one side than on the opposite side of the saw, that is, with long and short teeth, this is due to failure to properly line up the center of grinding wheel spindle with the center of saw, this being a most vital adjustment. It is also very important that the emery wheel oscillate the same distance to the right that it does to the left in grinding crosscut saws. Otherwise, unequal bevels will result.

RIP SAW SHARPENING

First, disconnect upper horizontal shifting lever. See that the grinding wheel is set at right angles to the saw. Be sure that the center of the grinding wheel spindle is exactly lined up over the center plane of the saw. Also, be sure the saw rest is lined up with the face of the saw-holding cup. Then put saw on machine, being sure that cone cannot revolve with the saw. Oil the face of the cup and the leather on saw clamp to facilitate easy feeding of the saw, tightening the clamp just enough to prevent the feed finger pulling the saw back as the finger recedes.

The crosshead on which the saw is held may be inverted so as to hang downward, this by running the crosshead off the end of the screw, inverting and running on again. This makes it possible to sharpen a saw of greater diameter. The horizontal screw through crossbar on which crosshead is mounted is to adjust the position of the saw laterally with respect to the wheel and this position governs the amount of hook in the tooth. Moving the saw to the left increases the amount of hook and moving the saw to the right lessens the amount of hook. The two vertical screws at each side of the machine work in unison and are for raising or lowering the saw to or away from the wheel. The crossbar should be so positioned that the bottom of the tooth gullets are about ½-inch or more higher than the front frame of the Sharpener. Next, adjust the swivel at right hand end of connecting rod to a point up or down on the arc so that the feed finger draws back over one tooth and half way back on the next. Then turn by hand the large drive pulley at the left side of machine until the feed finger contacting with the face of the tooth, comes to the end of its stroke. Next, adjust the hand wheel until the feed finger which is against the face of the tooth, is in line with the right hand side of the grinding wheel. Next, release the lift arm, letting the wheel into the gullet. Again turn lower cone pulley on left hand side of saw by hand to be sure that the stroke is right as adjusted. Adjust head lift screw so that the wheel just clears the top of the tooth. Now turn pulley again by hand. The feed finger should begin to push the saw forward at the same moment that the wheel begins to raise out of the gullet. If the feed finger begins to push the saw ahead, before the wheel begins to lift out of the gullet, then rotate the cam holder forward or to the right as you face the machine. If the wheel begins to raise out of the gullet before the feed finger begins to push the saw ahead, then rotate the cam holder backward on its shaft or to the left as you face the machine. Whenever changing the cam holder in its position on its shaft, be sure that the screws holding same are absolutely tight, so the cam holder will not work loose in operation, and thus change the position and timing of the cam.

The outline of a cam may be readily changed by grinding or filing to suit local requirements, but in changing such outline the operator must study carefully the movement of the grinding wheel with reference to the existing gullet outline so that the change in cam will be made in the right spot and manner. Another method is for the operator to experiment with a hardwood cam, working up to the desired outline, after which the iron cam can be shaped correspondingly.

The lock nut on the stop for the head should not be set until the grinding wheel, subject to the action of the cam, properly traces the gullet outline. When the grinding wheel is at its lowest point screw down the stop by means of its adjusting hand wheel until the stop touches the casting underneath. Then give the stop another quarter turn and fasten the lock nut.

The position of the grinding wheel may be adjusted by means of the Knurled Nut located between the swinging lever and the head. The adjustment of feed finger is relatively the same for either crosscut or rip saws.

CROSSCUT SAW SHARPENING

The machine as received will have the horizontal shifting lever for oscillating emery wheel head in position. Before applying power to the machine always turn the lower left hand cone pulley by hand and watch the movements of the machine. If the head does not oscillate evenly to the right and to the left, this should be equalized by means of the knurled adjusting nut on upper horizontal shifting lever. The pointer will indicate the distance the head oscillates each way from zero. The hand wheel is to regulate the amount of bevel on crosscut teeth. Turning this hand wheel to the left increases the amount of bevel, and turning to the right decreases the amount of bevel.

In sharpening crosscut teeth it is very important that the grinding wheel shall be of proper hardness, the best calculated to hold its shape on the edge. Grinding wheels employed on crosscut saws with from 3 to 10 points to the inch should be ½-inch or less in thickness, with the edge turned "V" shape so that the face of the wheel fills the gullet outline. In grinding crosscut saws the wheel must be dressed to afford the proper bevels, and the most efficient type of emery wheel dresser for this service is the Metcalf Dresser, illustrated, which will turn a sharp "V" or bevel edge on a thin hard grinding wheel without liability of the edge of wheel crumbling unless the wheel is too soft for the service. Very remarkable results are obtained with these Sharpeners on fine tooth saws up to 10 or 11 points to the inch, subject to the use of suitable grinding wheels, properly dressed, and with the essential working parts of the machine carefully adjusted.

A rip saw cam, subject to proper position on the Cam Shaft, and with the feed and the head lift movements properly timed, will grind almost any rip saw tooth to be found in the ordinary plant to which a machine may be sold. Likewise, a crosscut cam will produce almost any cut-off tooth outline desired. The spacing, point to point, is determined by the feed finger stroke, and the depth of the gullet by the vertical travel of the grinding wheel head.

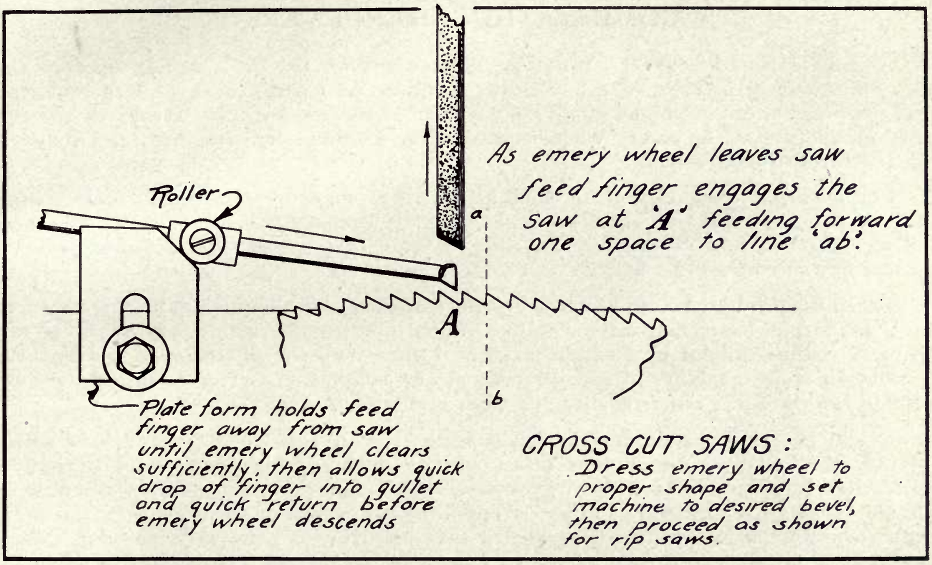
We strongly recommend that in each plant the teeth in different saws as employed on various machines, be brought to the same general shape or outline. This is a good step along the line of standardization, and the sooner the "freaks" or odd shaped teeth are eliminated, the sooner the upkeep of the saws becomes a straight line proposition, and the more uniform the sawing results become. In this way there will be no radical change in adjustments of the machine, the same cam will serve on consecutive saws being ground, and one big advantage of an automatic sharpener, perfectly uniform and well balanced teeth and saws, will certainly result.

By making up special cams, however, a machine will grind almost any workable tooth outline. Indeed we frequently make up special cams, designed, for example, to give more lift to the head, this where the tooth is unusually long from point of tooth to base of gullet, or where a rip saw, for example, has an exceptionally high back, or where the back is very full and may perhaps have a somewhat angular shape.

In order to design these special cams we must have a drawing, or better still, a rubbing taken directly off the saw, this to show the exact size and shape of say half a dozen consecutive teeth. The templet or rubbing must also indicate the diameter of the saw and the diameter of the arbor hole.

IRREGULAR SPACINGS

Circular saws which have teeth unevenly spaced as result of hand filing or careless hand grinding, can be equalized in spacing by adjusting the feed pawl to engage in the gullet from which the grinding wheel has just lifted, or in case this is not possible without interference between the end of pawl and the grinding wheel as it descends, then adjust the pawl to engage in the gullet of the second tooth ahead of the one being sharpened. This manner of feeding may be rather hard on the teeth at first, as some will be ground very heavily on the back and others heavily on the front, but eventually this method of grinding will bring all of the teeth to a size.



FEED PAWL SUPPORT FOR FINE TEETH

For the grinding of the very small gullets of fine teeth on either rip or crosscut saws, where the thickness and edge of the grinding wheel fill the gullet outline, thus grinding opposite bevels on adjacent teeth, there is provided a plate form on the front of the machine, over which the feed pawl rides, as illustrated in cut. By means of a case-hardened roller which rides on the plate form, the feed pawl may be dropped quickly into the gullet last ground by the grinding wheel, the tooth fed forward, and then the feed pawl will quickly recede before the grinding wheel can descend. The timing of the feed cam should be a bit slower than is the case when grinding coarser teeth with the feed pawl engaging in the gullet next to be ground, as is usual practice, instead of engaging in the gullet from which the wheel has just lifted. It will be obvious that enough time must be afforded for the grinding wheel to lift out of the way of the feed pawl as it advances and for the feed pawl to recede out of the way of the grinding wheel as it descends, because otherwise there would be liability of the wheel breaking if it should contact with the feed pawl. Be careful not to set the plate form for support of pawl, higher than necessary.

This adjustment whereby the pawl engages in the gullet from which the wheel has lifted is effective in equalizing uneven spacings which have resulted from hand filing or grinding or which may result in time if the feed pawl engages in the gullet next to be ground. This method affords teeth uniformly spaced and in effect joints the saw, and very irregularly spaced teeth that also vary in length can be equalized and brought into perfect round and balance.

To insure perfection in this adjustment the machine should be operated by hand movement of the driving belt and the various adjustments made with the greatest possible accuracy to see that the movements of the grinding wheel and feed pawl are properly timed before power is applied.

Just before the final application of belt power for operation of Sharpener, raise the head by adjustment of the long screw about one-half turn; at the same time screw down about one-half turn on the positive stop as a means to accommodate slight inequalities in the length of the teeth that may exist when first starting the grind. Then gradually feed the grinding wheel to the saw as may be needful to afford the amount of grinding required.

COMBINATION SHARPENERS

A combination sharpener is one that is designed for use on a variety of saws that may differ widely in type, size and gullet outlines, such that more or less important changes must be made in the shape or position of the tooth forms, stroke of the feed pawl, inclination of the emery wheel head, and in the diameter, thickness and shape on edge of the grinding wheel.

For example, one machine of combination type may be suitable for metal bands, hack or meat saw blades; another for band and circular rip saws; another for bands and circular rips and crosscuts; another for large circular and gang or frame saws; another for circular, drag and wood crosscut saws, etc.

The purchase of a combination sharpener can rarely be justified except for the reason that the purchaser may have a rather limited number of each type to sharpen, such that a lower investment in a single machine rather than the purchase of possibly two or more different machines of specialized type and adaptation, better designed and more suitable for the local requirements, may not recommend itself.

It will be readily apparent that in passing from a 1-inch scroll band saw with 5 points to the inch, to a 6-inch band resaw with 1½-inch spacing and a properly rounded gullet, there must be a change of wheel, increased inclination of the emery wheel head, a longer stroke for the feed pawl and a possible change in the shape or position of the tooth form. This same remark applies in passing from a band to a circular saw or from a large circular to a large frame or gang saw, and while a combination sharpener will meet the requirements of some plant operators satisfactorily, particularly so if the tooth outlines on the different saws can be ground similar in shape; and we will use our best endeavors to adapt any of our combination machines to requirements as described, and invite correspondence with specifications from any one interested; nevertheless, we strongly recommend the purchase and independent use of separate machines for scroll or metal bands, resaws, circulars, frame saws, etc., as in the direction of time and labor saving, as well as more efficient results. The saving in investment cost will in no case amount to a large sum. The investment cost will be spread over a rather long term of years in most instances, and hence the direct saving in labor cost, with increased efficiency, for such term of years, must be measured or balanced against lower investment, in considering the problem.

Any information or recommendation that we may be called upon to give, will be based on local conditions as described, with the customer's advantage our primary consideration.

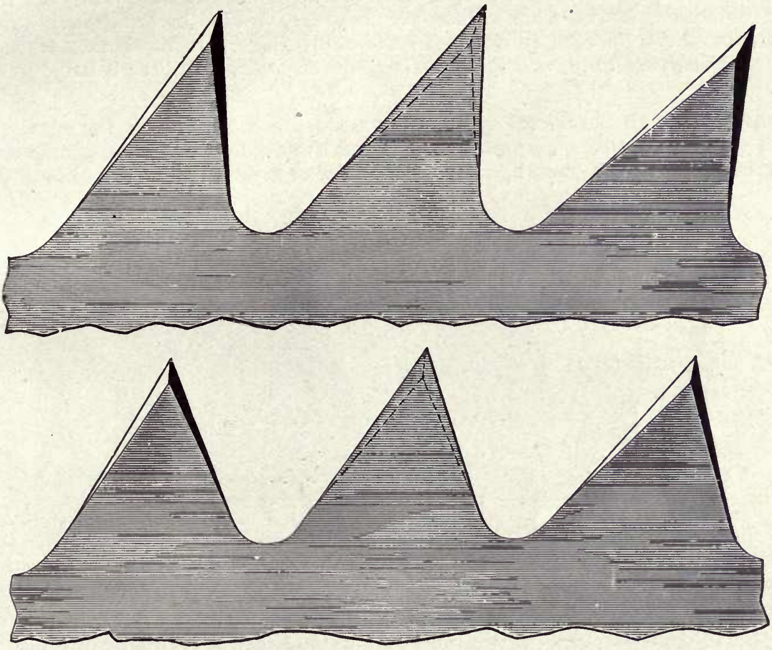
The several changes in adjustment, necessary to adapt a combination sharpener from one saw to another, when understood and practiced for a few times, become essentially simple.

CUT-OFF CIRCULAR SAWS

The fitting of cut-off saws differs from the fitting of rip only in the shape and manner of filing the teeth.

Coarse cut-offs should have the pitch line about one inch from the center for hardwoods and not over two inches from center for soft woods. File the tooth a trifle more fleming on the bottom than on the top and use more flem on soft than on hardwoods. It is unnecessary to twist the point of cut-off saws in setting, but set the teeth square over. Fine cut-offs for smooth work do not need any hook or any pitch to the teeth, unless you wish to do more rapid work, in which case it is well to give some little pitch. For fine cut-offs use one of the saw sets especially manufactured for such purpose.

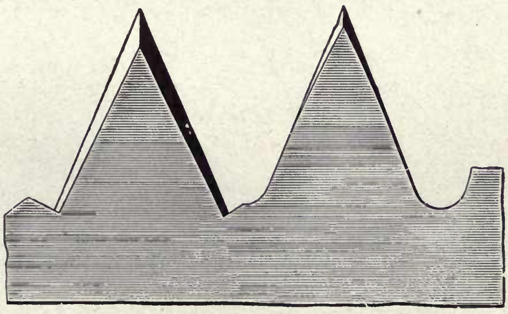
The action of a cross-cut saw, in theory, is the same as that of the point of two knife blades which are held perpendicularly, being drawn across the grain, making on either side of the kerf a small cut, then the following raker teeth shave out the wood



of these two cuts, and when the saw is properly sharpened, the saw dust should be in small lengths the same width as the saw kerf, and not in fine dust, from scraping away of the wood. To make a saw work this way, some advise that every fifth or seventh tooth be sharpened in the form of a raker; that is, swaged out to the full width of the set in the other teeth, and sharpened to an edge about $\frac{1}{64}$ inch below the circle of the side cutting teeth.

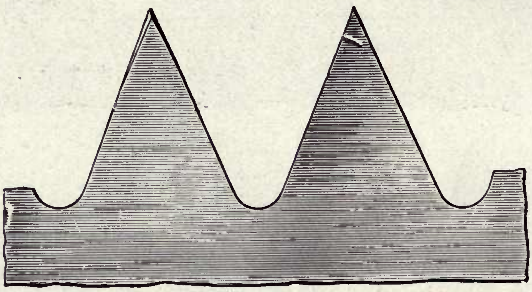
Of the above cuts, the first shows proper shape of teeth for soft, the second for hardwoods.

Hollow ground saws are commonly used for smooth cutting on light work, being run without set, and when of small dimensions, as from 4 to 8 inches diameter, do nice work, but when saws over 10 inches in diameter are used they seldom give perfect satisfaction unless run with some set to give clearance.



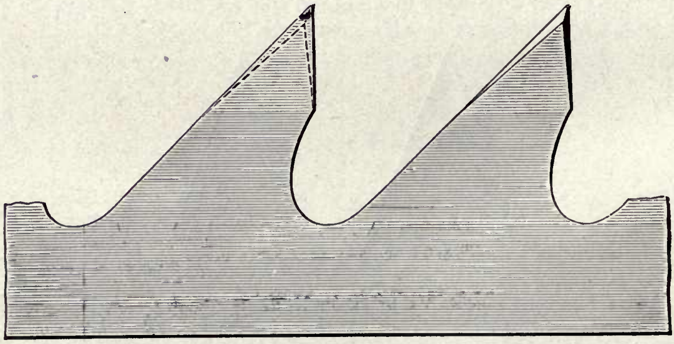
There is a kind of universal toothed saw, made for miscellaneous shop work, having a mixture of crosscut and rip teeth, reminding one of a hand crosscut provided with a drag, which is offered by a number of different saw manufacturers as a very effective saw for smooth cutting. The taper on these saws from rim to eye amounts to several gauges and they are run without set on fine work in furniture factories, cigar box shops or for smooth cutting in sash, door and blind factories and the like. They are not recommended for coarse, heavy work or for use in green stock. In filing such saws the rip tooth should never be filed longer than the following crosscut teeth. If the work is smooth cross-cutting only, no rip tooth is required and all the teeth may be filed lance shaped.

In most cases the breakage of circular crosscuts is caused by the careless manner in which they are filed or gummed; and if the time, labor and files consumed in filing the long bevel down the back and face of teeth was used in filing the gullets down with



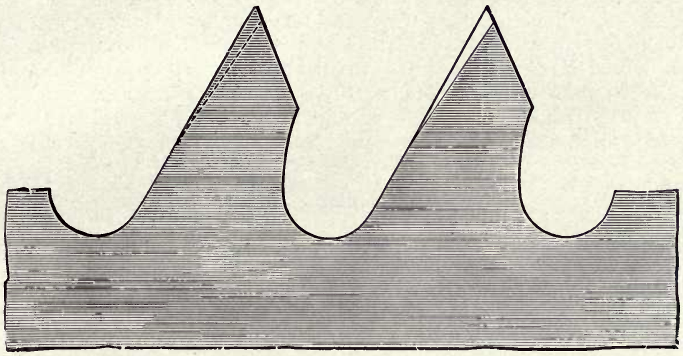
a round file, or in rounding them out carefully with an emery wheel, many saws would be saved and much less power consumed; as filing long bevels on the teeth forms square notches in the gullets, which will cause cracks to start, besides preventing free circulation of the sawdust.

The bevel on crosscut saws should never extend into the gullets; in fact, the points of the teeth only need beveling. The remainder of the tooth and gullets should be dressed straight across, as shown in cut above. The left hand tooth representing an improper filing and the right hand tooth proper filing. In heavy cutting the front of tooth should be filed without any or with very little bevel, as shown in left hand tooth in cut below. This shape will prevent much of the lateral strain and chattering caused by the teeth being forced out of line into the sides of the cut. Saws are frequently broken from this cause, especially when dulled. Some saw filers have adopted the method of filing a number of the teeth square front and back, as shown in right hand cut below. This removes the core or V from the kerf and prevents much of the lateral strain; but the teeth thus filed must be just a trifle shorter than those that are beveled.



All manner of circular rip and resaws as well as all different types of cut-off saws having a throat sufficiently large to permit of its being gummed or sharpened with an emery wheel, are coming to be sharpened with an emery wheel rather than a file. Our automatic cut-off sharpeners are meeting with an extensive sale in mills and factories that have never before used such machines, and there is everything to recommend their use if properly handled, with wheels of proper shape and grade for the work.

Small factory saws will require emery wheels from ⅛ to ⅝ inch thick according to the size of the gullet and spacing from point to point, the automatic sharpeners being used successfully on teeth spaced as fine as $\frac{5}{16}$ or ¼ inch from point to point. For the fine tooth saws a special grain, hard emery wheel is essential.



Cut-off saws with the front of the teeth under cut into a round gullet, as in cuts above are the best, and if the teeth are kept in this shape, less time would be required in filing, and the bad results from running a dull saw would be prevented. Use as little set as possible, file as soon as the saw becomes dull, and save time, power and saw, for the less power required, the less strain and breakage of the saw.

Operators wanting an improvement in results, and a saving in time and expense, will do well to write us for full information about our automatic sharpeners, swages and saw sets for factory saws.

HOOP SAWS

On the subject of keeping hoop saws in order it is but proper to refer to the general principles of filing as laid down for all purposes, and that is that any saw designed for ripping should be swaged and filed perfectly square. There may be some filers yet who adhere to the spring tooth and bevel idea, and they may get fair results out of such practice, but the fact remains, nevertheless, that a rip saw should be filed perfectly square and swaged for corners, and this idea should be followed out at all times when circumstances will permit.

We can meet any ordinary requirement in the line of a swage or gummer suitable for use on cylinder, heading or bolting saws.

STAVE SAWS

In fitting stave saws a good method is to swage just enough to keep good cutting corners on the teeth and then add spring set for necessary clearance. The tooth may vary somewhat for the season, but should be short and strong enough to avoid all vibration of the steel, do smooth work, hold its position well, and stand crowding in all kinds of timber. In sawing frozen timber a ½-inch tooth fitted with an 8-inch blunt pit-saw file proves very satisfactory, but for basswood, after the frost is out, can use a ⅝ tooth and a 9-inch file, keeping the teeth of uniform length and filing perfectly square. This will make the saw run entirely free in its cut with little set required.

The greatest trouble with barrel saw filers is that they run with too slender teeth, not enough hook and saw not in round. To be successful with a barrel saw one must have every tooth filed alike and able to cut its part. Keep the saw arbor boxes in good shape, so the saw has no up-and-down motion. Give the proper lead, which varies considerably, as no two saws run exactly alike; some saws will run well with $\frac{1}{32}$-inch lead and others will not run well with less than $\frac{1}{16}$-inch.

The Drag Saw

On the capacity of this saw depends the output of the entire plant. It is of the greatest importance that it should be given the best attention to insure its usefulness. It should be 8 feet long, 14 inches wide, 9-gauge thick, and have 80 teeth. The teeth should be 1¾ inches long and have a slight hook or slant toward the rear end of the saw. The teeth should be ⅜-inch wide and have a lance point. The tooth edge of saw should be perfectly straight. If allowed to become low or hollow in center, the saw will jump, which interferes with its cutting rapidly. It should be hammered as stiff as it is possible to make it, to avoid buckling on forward stroke and flapping like a fish's tail on return stroke. The teeth should be jointed level to insure a straight cut and have about ¼-inch set for 9-gauge saw. Speed should be 150 strokes per minute.

The Bolting Saw

It should be as large as the frame of the machine will carry, as no top saw is used. The large size saw enables the operator to split large-size blocks through the center and avoid the necessity of chopping, which saves a great deal of time and timber. If a 60-inch circular saw is used, an 8-gauge straight, with 48 teeth, gives the best results, and 500 revolutions, the best speed, with power sufficient to maintain this speed in the cut. The teeth should have full ¼-inch set or swage, and pitch line to intersect a line at half the distance between center and circumference of the saw. This gives a good hook to the teeth. The back of the teeth should be kept down to avoid friction and should be ¼ inch down, ½ inch from point of teeth, measuring from a straight line from point of one tooth to the next. The teeth should have ample throat to chamber the dust, but in no case be over 1½ inches long. A safe rule is to make the length of the teeth half the distance between them, unless the teeth are more than 3 inches apart, when 1½ inches should be the length. If the teeth are too long, they will not permit the dust to pack in the throat, so it will be carried through the cut, but will allow it to pour out at side of the saw and heat the rim. A straight-gauge saw is preferable for this reason. It allows the saw to split the log more easily and without carrying unnecessary swage, which is a waste of timber and requires more power.

Do not put as high tension in saw as would be necessary if sent to a saw mill expecting it to be used six months without hammering. As all practical mill men understand the theory of hammering or straining saws, it is unnecessary to go into details, but put the tension in the saw for speed of 500 revolutions and inspect and keep it there at all times, examining it every time it comes off the mandrel. Keep the eye stiff, the rim true and smooth, the saw as near perfectly round as it is possible to get it, as the capacity of the saw depends very much on each tooth doing exactly the same amount of work. There should be duplicate saws, and they should be changed every five hours. It is an old saying that a poor workman blames his tools. It is also a fact that poor tools will demoralize any workman, but, with the saw carriage and the feed rig in proper condition, 40 cords of stave timber can be flitched from the round block in five hours. It is economy to fit up the filing room with the best and latest improved tools. It should have a set of saw hammering tools, an automatic saw sharpener, and a filing bench fitted to joint and swage all-sized saws.

The Heading Saws

We will consider the upright pendulous swing saw first, as it is more in use. The saw should be as large in diameter as the machine will work, to secure the extra rim travel which admits of increased capacity. Kind of timber regulates the gauge of saw and number of teeth it should have. It would be impracticable to attempt to run a 60-inch saw, 20-gauge on rim, in gum, ash, sycamore and cottonwood, but perfectly so in soft white pine or cypress; but for general use a 48-inch saw, 10-gauge at eye and 15-gauge on rim, with 60 teeth, gives the best results. A good sawyer, with this saw properly fitted, can saw 16,000 pieces of gum heading, averaging 10 inches wide, in 10 hours. Have about 60 teeth, to be able to get the throat of the teeth to carry the dust, which could not be secured if there were 120 teeth, but if cutting 5-inch dimension shingles, 16 or 18 inches long, where the cut is narrow, a saw with 120 teeth could be used to greater advantage, but if 20-inch heading is to be sawed, and the blocks run as wide as 14 inches, the 60-tooth saw will always prove the most satisfactory.

In fitting heading saws it must be kept in mind that they are subject to the same treatment that other saws receive, and must be kept in order by same process. They will need to be taken off the collar and hammered. The idea that a heading saw, when it becomes crooked, must be thrown away, is absurd. No one who is not a careful man, or one who does not have a clear knowledge of saw smithing, should attempt to put one of these saws in order, as they are straight on one side and beveled outside the collar on the other, which makes them very difficult to get straight. Besides, the extra weight in the center makes it almost impossible to determine the amount of tension you have. It is best to only attempt to straighten them. This can be done easily by removing the collar and placing the saw on the end of a wooden block, which is slightly oval, and, by light blows, smooth up the rim and true the plate, using the straight edge on straight side of saw only, leaving it slightly hollow on face side. This will not expand the saw, and will invariably put it in good condition, and enable the saw to be used until worn out.

On account of the position of the grain of the timber to be sawed, the pitch of the teeth should be much greater than on the bolting saw. In fitting the teeth—filing and swaging—use a sprung tooth for cottonwood and gum, and a half swage for hardwood. Cottonwood is the most difficult wood to saw and the points of the teeth should be almost needle points, and full set. The bottom of the swing of the saw should be adjustable, so as to raise or lower it, to bring the center of block on line with center of saw. A short block will be jerked into the saw, and an extra long block will be very hard to feed if not placed in center, but very few machines are so designed.

In setting the gauge for thickness, place the long straight edge across the face of the saw and set the gauge to it and let the dish in the saw provide the lead. This leaves the gauge set to thickness. Continuously moving the gauge will not insure even-thickness heading. No one can make good lumber by using the guide to regulate the saw, nor can you saw good heading by manipulating the gauge. If the saw runs, something is wrong with it and the filer should remedy the trouble. With the saw straight and true, the teeth round, with just enough set to clear easily, every tooth filed square on face, beveled on back and with plenty of hook, it will run and equal any self-feed machine.

The horizontal hand feed machine requires the same treatment as the upright machines, except on this one point, the saw, by its position, is affected by gravity, as it expands by centrifugal force. It is also acted upon by the attraction of gravitation, and the rim of the saw is drawn down. This puts it in the shape of an inverted saucer, as the block is fed to saw, it strikes the saw generally at a point opposite the collar. This causes the carriage to raise against the upper guide, making it hard to feed, also causing the saw to run down and make thin-edged heading.

To avoid this, remove the saw from the collar, and hammer the saw on the straight side until it is fully $\frac{1}{16}$ inch low in center. It will not then fall at the rim below the level and will do good work. This is especially necessary for high-speed power-feed machines. It is preferable to carry a shade more set on the upper side of these saws, as it has a tendency to hold the rim up, and does not wear off the swage of the teeth as the block is drawn back. Special care should be given the mandrel. All end play should be taken out, and it should be plumb and level. The fly wheel and pulley should be in good running balance. Use as large a belt as machine will take, and set the machine a good distance from the driving shaft. This will allow the use of a slack belt, which is always desirable.

The Cut-off Saw

This saw generally receives the least attention of any tool in the mill. Its use being of great importance, it should be kept in first class order. The saw should be at least 36 inches in diameter, 9-gauge thick, with 80 teeth, 1¾ inches long. The pitch line should run through eye of saw, face of the teeth be square and beveled on the back, ½ inch down from the point, and saw kept perfectly round, with set to cut $\frac{3}{16}$-inch kerf.

The Stave Cutting Machine

Here is seen the great advantage of flitched timber, which, if sawed in proper shape, makes the work of the cutter light and shows increased output over split timber. The cutter simply places the timber in the machine and it almost feeds itself. The trimming of the bolt to get it in shape to cut, and the tipping and turning necessary in cutting split timber is almost entirely avoided, and turning into staves a large per cent of material that goes into the fuel pile when cutting split timber makes it possible to easily cut 50,000 staves in 10 hours. To get the best results from a cutter, the following points must be observed:

The ribs, which are the gauges that determine the thickness of the stave, should be kept in perfect circle with the tumbler. The tumbler should be true on its face. The knife should be ground as thin as possible without injuring its strength. It should be set with a lead or draft of $\frac{1}{32}$ inch. The speed of machine should be as fast as the cutter can feed the machine and do good work; 150 strokes is the average speed.

Stave Equalizing Machine

This machine is located on a line with the cutter and about three feet from it, so the cutter can shove the staves direct to the man operating the equalizer. The important work of this machine is to equalize the ends of the staves to the desired length and leave the stave smooth and square on the ends. Cut-off saws of about 22-inch diameter, 14-gauge, and 60 teeth, are best suited for this work. The pitch line of the teeth should be the same as the cut-off above described. The saws should be hammered with more tension out near the rim, because they cut hot timber, which has a tendency to heat the body of the saw and make them expand more than if cutting cold timber.

If the saws are of uneven gauge they should be made straight on the inside, to allow the bunch of staves to go forward toward the center of the saw without bearing against them, which would cause the saws to flare out at rim, making the staves on back side of the bunch longer. This is the cause of uneven-length staves, a serious matter, but one that is neglected in almost every factory.

These saws should be jointed, with the outside teeth a little shorter than the teeth on side next to the bunch. This will enable the teeth to cut clean and smooth, because the inside teeth cut first and have solid wood to work on, whereas, if the outside teeth were even or longer, the wood would be cut away ahead and the inside teeth would simply tear down the wood and leave a woolly end, giving the staves a ragged appearance. These saws should never be allowed to run when dull, and should be changed every day.

STAVE JOINTING

In caring for the jointing machine, the knife should be kept ground thin, with long bevel. A thick point on the knife is the prime cause of failure to get a good joint at first stroke. Particularly is this so with gum. The point of most makes of knives is 2 inches long, and if the knife is ground thick, it goes through the stave 2 inches before the end of knife completes the cut. This acts as a wedge to split out the stave ahead of the cut, and is the cause of the main trouble in jointing gum staves. If the bearing plate is allowed to become worn round on the edge, or is set away from the knife, it will not make a smooth joint on dry staves.

Very few factories have suitable grinding arrangements, except the old grindstone, 6 inches out of round, where the jointer, after grinding his knife, emerges looking as if he had taken a mud bath. It is no wonder they whet their knives for weeks rather than go through such an experience to grind.

To keep a stave jointer in proper condition to do good work requires that the sash works free in the slides, with no play; that the chains pull evenly in each end of the sash; the bearing plate be placed close up to knife, with a square true edge; the rests in exact alignment, to produce equal bevel; the knife set so as to make the bilge exactly in the center of the stave, and the quarter bilges exactly same distance from each end.

HANDLING SHINGLE SAWS

There are so many opinions concerning the tension in a shingle saw that some filers do not know which is right. Allow me to state that I never saw one do good work until it was properly hammered. Do not go wild about some person's ideas, but try them, and if you find one that gives satisfaction, adopt it.

Saws change; the gauge, size and speed change, as well as the output of the mill, so there must be changes from time to time in the art of hammering. Take, for instance, a saw of 14-gauge rim by 8-gauge center, 42-inch, then take a 10 x 18-gauge 42-inch, and see the difference. The 14-gauge used to do about half the work that people now expect the ordinary filer to accomplish with the 18-gauge. Surely there is not more backbone to the 18-gauge than to the 14, but to overcome it they speed the thin saw much higher, which means more care, more hammering and more tension, and this requires steadier motion and exactness of machine work.

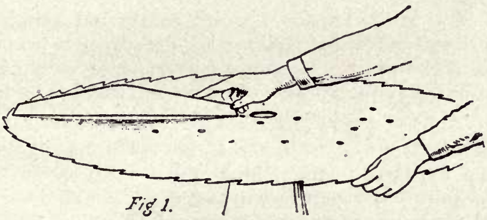


Fig 1.

I was called upon to hammer two 44-inch 17-gauge saws which had 24-inch collars. These saws were of excellent temper and steel, also well ground. They had been sent back to the factory, but would not work. I tested them, also the collars. One collar was high at the center, so I made a ring of paper and placed it around the outer edge of the collar, which levelled it all right. Then I tested the saws. The tension was very good at a point about two-thirds the distance from center to rim, but the center was very fast or tight, which would not permit the saw to cut straight; it would not make even cuts, no matter what the speed might be. I hammered this saw until it showed even tension from rim to center, or, in other words, from rim to rim. I then hammered the other one, leaving them both alike as near as possible. You could not tell one from the other by the way they run, and both went to our entire satisfaction, not even trembling at extreme run, and would do good work in maple or pine grape basket tops and bottoms from ½-inch thick, 16 inches long, down to ⅕-inch thick, through knots and curls, cutting bastard stock, which tries a thin saw, as the block may have a right-hand grain for the saw to start into and come out of a left hand grain, which will change the course of the saw if anything will. This may satisfy you that the center of a shingle saw must be opened to the balance of the saw in order to work well, no matter what the size of the collar may be. Don't dispute this without trying it.

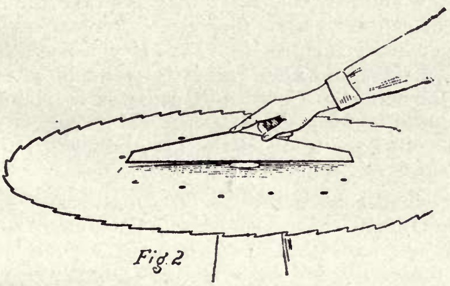


Fig 2

The arbor should be turned true and well balanced. I like to have a shingle saw collar turned true from rim to center. Some order them low at the center, but experience teaches me to have them true and alike. I have used paper between the saw and collar, to level it, which is a help where the machine shop is not handy. Some claim that by having the collar low at the center it helps to keep the saw from running out of the block, but a saw properly hammered will go to a straight line if properly dressed.

I give herewith a sketch showing the tension in a saw that will do fine work; it is a photograph of one of these 44-inch saws that run so nicely. It has even tension all through, both sides alike, and runs about 1,450 per minute. This we will call No. 1. No. 2 is a cut of a saw with a tight center and plenty of tension out toward the rim, but will not do good work.

In straining a shingle saw do not use the cross-face hammer to stretch the steel with, but use a round-face hammer and not very sharp. Be sure you have a tight rim on your saw before you try to run it. Some strain a saw a little more on the block side for horizontal machine. This is a help, but do not go too close to the rim with this treatment or your saw will run into the block, cutting a thick shingle, and will not last as long as if dished more near the center.

Do not hammer the rim of a thin saw any more than is strictly necessary, as the more you work the steel the faster it loses its strength. Use a short straight edge when evening up the tension, and be sure that it shows even tension from rim to center all around.

Now comes the use of the full-swaged tooth. This is a good tooth, but requires lots of work to keep it in proper shape; but without a doubt it is the proper shaped tooth for a rip saw. But do not overlook "economy," as some timber cuts well with the spring-set tooth, while some other kinds cut equally as well with full-swage; either will do the work if properly handled.

When testing your shingle saw for lumps, let the center rest upon the anvil, then use straight edge crosswise of a line from center to rim, which will readily show all bad lumps. Mark each one, and as fast as you level them erase the marks. Go around and around your saw until you are satisfied you can find no more. Use your tension gauge the same way, only letting the saw rest on each rim when you are evening up the tension on leveled side of saw, but do not try to use straight edge crosswise of the bevel on collar side. Always examine the tension in your saw after you have removed the lump, if any, as you may change the tension by taking out the little lumps.

I have hammered 18-gauge shingle saws for men to run that had not two months' experience, and they made a success of it just because the saws were properly hammered for the motion.

I have known of a shingle saw being hammered without removing it from the flange. Never do this as no man can tell much about it this way. Always take the saw from the flange. Use the straight edge from center to rim, then use it crosswise of a line running from center to rim. Do this over every inch of the saw. If you use a long straight edge on a saw that has lost all its tension, you may find it to stand in a twist. Do not try to bend this twist out as, the rim being so loose, will cause it to stand in this twist; simply stretch the saw from center to very close to the rim. When you have done this on both sides of the plate and filed the body of the saw, you will not be able to find that twist; but do not fill the center too full.

When using the straight edge on the bevelled side of the saw you may run it from center to the outer edge of flange seat, then from there crosswise of a line running from center to rim. Use a 12-inch straight edge for this, then to finish use as short as 6-inch. Be sure that your shingle saw shows tension clear out to the rim, leaving the extreme cutting edge the tightest; with a gradual or even tension toward the center. For saws 40 inches in diameter, 16-gauge rims, to run 1,600 per minute, the center should sag from a straight edge that reaches clear across the plate, about 7 gauges; that is, the thickness of a 7-gauge piece of steel. If the saw is of good temper and steel it will be about the proper thing, but if the extreme cutting edge is not the tightest it will not do its work if the center should sag one inch, but would flutter on the rim when under motion.

You cannot tell much about your saw when screwed down to the flange; that is, about the tension. Always take it off the flange to test the tension or strain. Some people hammer more on the block side of the saw so as to hold it into the block a trifle, but for vertical machines I prefer it tensioned perfectly even, both sides alike; for horizontal machines they work well strained a little more on one side—just enough to counteract the weight of the rim, as it has a tendency to lop down a trifle when under motion. Do not use a cross-face hammer to take tension out of a shingle saw; use the round-face or dog head, with not very round or sharp face, so it will not cut the plate. Use a steel-faced anvil and have it a little oval or a little high in the center. Do not use a flat anvil for shingle saws, it will not give the desired results. I like a 6 x 9-inch, or a round-faced anvil say 7 inches in diameter, of about 80 pounds weight. I use the 4¼-pound hammer to strain or tension with and 2½-pound hammer to even and finish with, but this is to everyone's option. Use what you can handle best is my advice. But remember that you can spoil a thin saw with a 2½-pound hammer if you do not use judgment when using it.

EDGER SAWS

"Our edger saws are 20-inch diameter, 9-gauge, 30 teeth, run with half swage and ¾ hook, cutting all hardwood. These saws are kept level and straight, sharpened on an automatic machine, but are not tensioned until the eye will push through or the saw dish on the arbor.

"We run a 24-inch bolter and lath saws 12-gauge and 14 and 16-inch diameter at speed of 2,800. The mill works well but I think that larger collars or smaller saws would work better. In hammering edger or lath saws I usually find that by keeping them level and straight, the tension is kept all right, but in hammering 24 or 30-inch bolter saws that run 3,000 per minute they should be tensioned so as to spring either way alike, or center spring through either way with the same pressure, so that when tightened up on the collars, the edge can be sprung one way as easily as the other."

LATH SAWS

"A saw with spring set is more apt to dodge on one side or the other when it strikes into a cross grained spot or a knot, and a gang of two or more will work badly if one saw dodges a little. I worked successfully for years a gang of four saws, 14-gauge, on an arbor for ripping up sash and blind stock, from siding timber surfaced two sides. I always swaged the saws, used a sidefile, and had no trouble until they were dull, one swaging doing as a general thing for three or four filings. I also worked very successfully three 18-gauge saws in a gang, for sawing blind slats. I could not make them work with spring set, but had no trouble when I swaged them."

SEGMENT VENEER SAWS

Segment veneer saws are used in sizes varying from 64 to 84 inches in diameter, each segment being firmly screwed to a steel flange, with spacing of about 1/16 of an inch between each. These segments are ground with a bevel for about 4 inches in depth, back from the rim or teeth, slightly concaved, with this side of the saw set to the outside, or away from the stock being cut.

Points usually are spaced at ¾ of an inch, with a peculiar pattern tooth, to give the best results, in what is probably the most delicate operation attempted with a circular saw.

Segments at the rim should be pretty stiff and ground with care to insure a straight and true surface on the flat side, beveled down to about 24-gauge at the points for economical cutting. Sawyers use but a slight set, and that only for a fraction of an inch back from the saw points.

It is absolutely essential that segments be ground of uniform thickness and lined up so that each fits exactly in line on the flange, with a set that is adjusted to a nicety, with all teeth cutting equally, avoiding high points, which result in torn or scratched veneer.

It is customary to remove segments about once a month, returning them to the saw maker for rebeveling and adjustment. This class of saws usually are filed by hand without removal of the segments from the flange or saw from its arbor, which method removes the possibility of overheating, which grinders of knives experience.

SHINGLE SAWS

Shingle saws require a nice evenly balanced tension, extending from within 2 inches of the rim, to center. Put most of the tension outside of collar rim and less toward center of saw. Using a 6-inch straight edge, the saw should show straight in center; but using a 16-inch straight edge, it will show a good light. Thus tensioned the saw ought to stand up in any kind of feed. A shingle saw should be hammered to have a tight rim and to support a tight rim, there should be no dish in saw or collar. A dished saw will be a poor running one.

"My saws are ground a light 17-gauge on rim, and taper to 16-gauge 4 inches from rim, with 7½ inches of hook. I use full swage, light 13-gauge, sometimes 14-gauge, from which latter I get only two runs out of one swaging. All saws have 90 teeth. The above contemplates a 38-inch saw with 22-inch collar.

"In putting saws on collar, see that the collar is straight with no wobble. If it shows wobble this can be removed by peaning the collar. Always look over new saws and hammer if necessary, before putting them on collar. After saw is mounted on collar, go over it with a 6-inch straight edge on the rim and take out any lumps. After saw is on collar I go over it using about 2 inches of a 6-inch straight edge on the rim and take out all the little lumps on a hand anvil of cast iron weighing about 4½ pounds, made to fit the palm of the hand.

"I also employ a hand anvil with wood face, which I use on rim of saw only, so as not to let out any tension in saw. I use no screws on rim of collar when putting on the saws, but use ½ x $\frac{3}{16}$ rivets, the saws being countersunk for rivets. This method makes a good, tight job and holds the saw on collar better than screws. All saw collars are 22 inches in diameter, $\frac{3}{16}$ inch thick at rivet holes, on a 20-inch circle."

GROUND-OFF SAWS

The ground-off saw, while common abroad, is little used in the United States. As its name suggests, a ground-off saw is a thick saw ground down to a thin edge, not in a direct line, but in a manner such that a good part of the saw near the teeth, is very thin. It is designed to saw very thin boards and usually ranges from ¼ to ⅜ thick at center to 20-gauge at tooth. This affords a very stiff saw, well adapted to cut very thin boards such as picture backing, etc., which in America, is commonly sawn with a light gauge resaw.

HOLLOW GROUND SAWS

Hollow ground saws are ground tapering from rim to center, with a difference in thickness of from 2 to 5 gauges, according to size.

These saws are used for cutting exact sizes and should produce edges that are as smooth as if planed. No set is required. High speed is essential and the teeth ought to be automatically sharpened, to insure exact uniformity in all respects, so that each tooth will do the same amount of work.

Suitable sizes for such saws are as follows:

18-inch, 10-gauge at tooth and 13-gauge at spindle; 20-inch, 9 and 12 respectively; 24-inch, the same as 20-inch; spacing ¾ inch or less from point to point.

INSERTED TOOTH SAWS

An inserted tooth saw is always the same diameter; always round; always ready—if it has been made right—as most saws are. Others are made with good intentions, but an inserted saw requires study, care, and attention, as well as any other saw.

When refitting new bits or points, rub sockets with rag or piece of waste saturated with good machine or lard oil. This will prevent sockets from wearing and enlarging. After refilling saw with new teeth, see that they are in line, using a saw set gauge for this purpose. If the teeth are not in line, do not dress them down with a file as you would a solid tooth, swaged; but take a saw set and spring the shoulder back into line or until the gauge shows that the points project same distance on either side. When setting or springing the shoulder, take hold of blade immediately back of the heel of the tooth. To gauge teeth frequently will insure uniformity, will make smoother lumber, and be easier on power. I have seen saws lying in the scrap pile that had been sent to the saw shops several times, but could not be made to work at all, and the only thing wrong with them was that the shoulders had sprung slightly, throwing the teeth out of line and causing the saw to run in or out of cut. In many cases you can make them work as well as when new, chiefly by lining up the teeth. This is a small defect apparently, yet it has caused the loss of both time and money.

Another small defect is found in the loosening of the shanks or holders. This has caused much trouble, yet it is very easily remedied. Take out the shank, place it on an anvil or iron block and strike a number of blows with ball pein end of machinist hammer on both sides, taking care that an even number of blows is hit on either side. Strike on the inner circle of the shank's edge, about midway, and hammer until the shank and bit go in fairly tight.

Shanks worn two or three gauges cause trouble, and the only remedy for this is to keep the inner edge of the shank rough with a few rubs of the file occasionally, or put in new shanks.

A man who understands the art of filing bits correctly should consider himself fortunate. A great many men are under the impression that an inserted tooth saw has more hook than a solid tooth saw, but the truth is that an inserted tooth has no more hook than is given it with a file by the operator or filer. It can stand more hook than ordinary solid teeth, owing to its high and heavy shoulder, and for this reason it requires more hook. Experience teaches that an inserted point should be given as much hook as it can stand for frozen woods, especially for hardwoods. As long as you have a proud corner on your points and plenty of hook, you will have no trouble in cutting hardwood or frozen timber; that is to say, your mill and saw are right in every respect. To produce the proud or pointed corner on your bits, so essential for cutting hard and frozen timber successfully, take an upset swage and light hammer. Strike lightly. To overcome round corners it is not necessary to swage the point out as you would a solid tooth, but merely bring the corners to a point so that the tooth will be wide enough at the cutting point of the tooth to cut fresh and easily. Maintain your hook throughout the life of your bits. Most men decrease their hook unconsciously as the bit shortens. This is a costly mistake, as it causes the saw to work hard and cut bad lumber. The hook should increase with the shortening of the bit, if anything, owing to the blunt state the shoulder and bit present as the bit wears shorter. If you wish to economize and use as much of your bits as you possibly can, take a ¼-inch round file or emery wheel and cut a little gullet into the bit as it wears smaller, doing this from time to time until it becomes too weak to stand. In this way you can maintain your hook and get the most out of your bits.

THE THEORY OF CIRCULAR SAW TENSION

Tension is hammered into a circular saw to overcome the stretch of the rim due to centrifugal force, which is greatest at high rim speed.

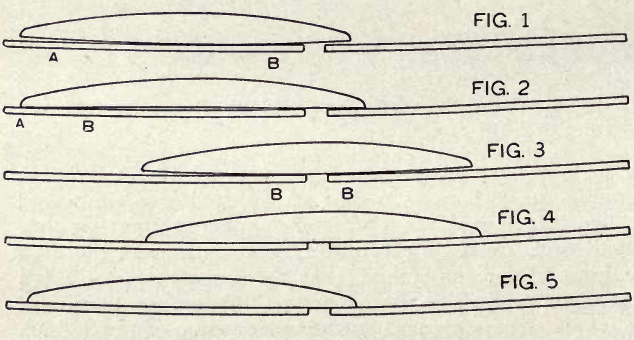
A 48-inch saw at 900 r. p. m. has an approximate rim speed of 11,300 feet per minute, while a 36-inch saw running at 1,000 r. p. m. has an approximate rim speed of only 9,000 feet per minute. The larger saw has a greater number of feet circumference to expand from centrifugal force, caused by weight of saw at rim and the high rotary motion at which it is running. Supposing, then, that the expansion is 1/100th inch to the foot at the rim, and it is believed to be that much at high speeds, there will be over ⅛ inch expansion in the whole circumference, but 6 inches inside of the 48-inch diameter circle, the speed is one-fourth less and there is one-fourth less number of feet circumference for expansion. Thus it follows, that in order to have the saw run stiff and true, and to get the full strength of the steel when at full speed, the saw must be properly expanded where the diameter is smaller and the motion relatively slower than at rim. The hammer expanded portion of the saw, being unable to contract when the motion ceases, as the rim does, there results the limber saw when motionless and the straight saw when at full speed.

Again if we conceive that a 6-inch section of the outside body of the saw could be removed, converting the saw into one of 36 inches diameter, for operation at the same r. p. m., then the tooth speed would be reduced one-fourth and there would be one-fourth less number of feet to expand from motion. So the smaller saw would have to be hammered much stiffer to show the full strength and stiffness of the steel.

Mill men sometimes give their circular saws too high a speed. 9,000 feet speed per minute for points of teeth is fairly standard. At that speed, saws should be hammered open in the body, so that they will shape easily through the stiff rim at full speed, and when tipped a few inches out of plumb, while standing on the floor, the center will drop from one side to the other of its own weight. If the speed is increased to 10,000 or 11,000 feet per minute, it will take a hard push to send it through and unless there is unlimited power, the saw when it enters a heavy cut, will have its motion checked and will dish and spoil lumber.

A saw at exceptional speed is more likely to dodge when dulled. A standard motion saw is so nearly straight while standing that it does not dodge and dish when checked in the cut, provided the tension is right.

The above comment is from a filer operating a pair of 74-inch cross-cut saws at 10,000 feet per minute; a set of 60-inch saws at same speed; a set of 48-inch saws at 11,000 feet per minute and three sets of 36-inch saws at 9,000 feet besides the usual variety of small circulars. He tensions with a 24 to 30-inch tension gauge, with regular curve from end to end. The gauge for a 9,000 feet rim speed drops from a straight line about 5/128-inch; for 10,000 feet speed about $\frac{1}{16}$-inch; for 11,000 feet speed about $\frac{7}{64}$-inch, as nearly as can be determined. The tension gauges are always used with the saw standing on floor or hanging on the anvil hook. For 9,000 feet speed the saw is tipped slightly out of plumb; and if in the test, with gauge applied on the upper side from rim to eye, the saw just fits the gauge all the way round, tested on both sides, the tension is bound to be even and true, with no lumps or twists in the plate. If light shows under the gauge on one side, as in Fig. 1 and on the other side as in Fig. 2, the saw is dished and needs hammering on the full or convex side, to straighten it. But the location and force of the hammer blows must be just right or the job may be overdone. If the tension gauge shows light under the ends and touches the saw at the center of gauge on both sides, the saw lacks tension, as shown by Fig. 1. Turn the saw around on the anvil hook and test whether it shows the same



The saw should fit the gauge on both sides, clear around all the way around on both sides, but don't mistake a dished spot for a tight spot. Few saws will show the same tension all the way around, unless very carefully and indeed expertly hammered. If you find spots that lack tension as in Fig. 6 (No. 1) mark them out with chalk and hammer on both sides till the proper tension is reached all around, as shown in Fig. 5. After hammering let the saw stand for an hour and then go over it again with the tension gauge. It will be found in practice that after a saw has stood for a time or made a run, that the tension will not show precisely the same as just after hammering.

If light shows under center of gauge on both sides of saw as in Fig. 4, there is too much tension and the saw needs opening on the rim with one or two rows of blows, one just back of the base of the teeth and the other 3 or 4 inches inside of that. I have had the best success with a saw tensioned to an even curve across its whole diameter, unless it runs very warm at center from the arbor heating. In that case, the tension gauge, placed with its center across the eye of saw, should show light under both ends; the warmer the arbor runs the more light should show at ends of gauge. A saw is very susceptible to heat and a little at the eye expands the saw so as to dish it and make it heat farther out, unless this is allowed for in the tension.

Uneven tension is the most common cause for a saw rattling in the guides and flopping at the back side. Lumps on the rim or under the collar may cause it, but if the tension is even all the way around, lumps are not liable to form except in case of accident.

Referring to Fig. 6 herewith, No. 1 shows tension gauge from rim to eye across a saw that lacks tension. To remedy it, hammer clear around the saw from A to B, if it shows lack of tension clear around. On the other hand, Fig. 2 shows too much tension. Hammer two or three lines of blows around saw from A to B. Fig. 3 shows a saw hammered for an arbor that runs very warm; if run cool, it should be opened from B to B with the hammer, on both sides of saw, till it fits like Fig. 4. Fig. 5 is same as Fig. 4 with tension gauge in another position. In Fig. 6, No. 1 shows a tight spot in body of saw. It should be marked out and hammered on both sides till tension gauge fits all around the saw on both sides. No. 2, Fig. 6, shows a loose spot in a saw. It should be laid out the same as No. 1, then the space between lines A A and B B (marked C C) hammered on both sides. But don't hammer on No. 2 except to take out any dish there may be in it.

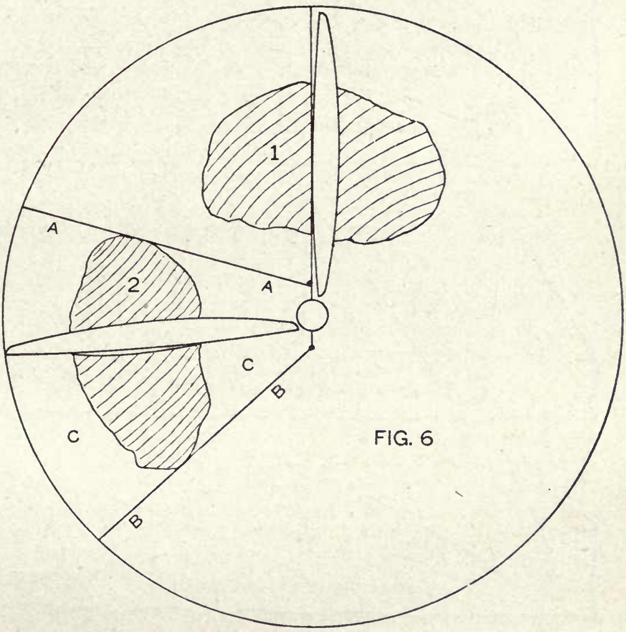
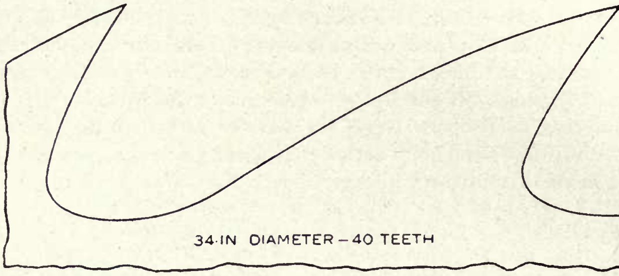
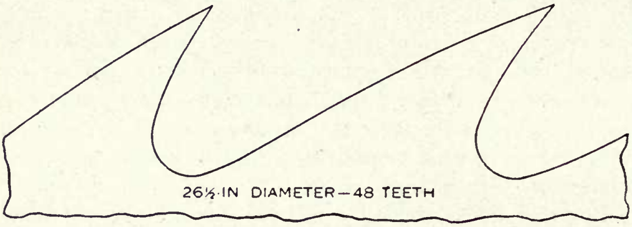


FIG. 6

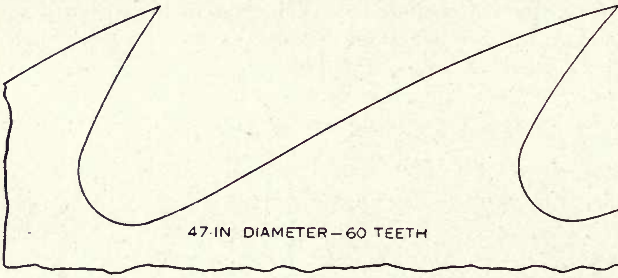
No. 1 shows a Tight, and No. 2 a Loose Spot



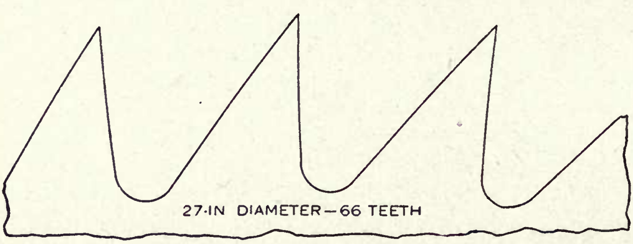
34-IN DIAMETER – 40 TEETH



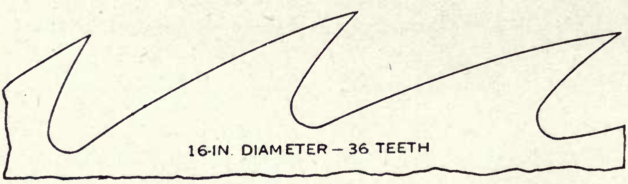
26½-IN DIAMETER – 48 TEETH



47-IN DIAMETER – 60 TEETH



27-IN DIAMETER – 66 TEETH



16-IN. DIAMETER – 36 TEETH

POSITION OF TOOTH FORM ON AUTOMATIC SHARPENER

The movement of a grinding wheel in gullet, with especial reference to the resultant shape for back of tooth, may be modified variously by changing the outline of the form by filing or grinding, or by changing the position of the form on the form shaft.

The illustration of five different shapes of teeth will show how by merely changing the position of the same form on the form shaft, and by use of grinding wheels of suitable thickness and shape on edge, radically different tooth outlines may be obtained. This is accomplished by turning the form forward or backward so that a different section of the surface of the form or cam will contact with the idler which serves to lift the emery wheel head. In case the variation in tooth outlines is merely that incident to a difference in spacing of teeth from point to point, the position of the tooth form will not be changed and the operator will merely change the adjustment of the feed pawl and put on a grinding wheel of suitable thickness and shape on edge.

CRUMBLING OF TEETH

Crumbling of circular saw teeth is often caused by the use of an upset swage. A repeated hammering and driving back of the points of the teeth with an upset, and the changing strains, slight though they may be, due to the varying angles of the blows, will crystallize the steel. If I owned a sawmill or woodworking factory in which full swage round saws could be used, I would use an eccentric circular swage if I had to mortgage the plant to buy it.

An upset in the hands of an unskilled user is an abomination. Indeed it is bad enough in the hands of a skilled filer, because it wastes time and steel for it shortens and blunts the teeth instead of pulling them out as will a correctly adujsted eccentric swage.

Small circular rip saws of the "brier-set" variety—with one point set to the right and the other to the left, often make rough and unsightly edges when barely one point is gone. The only remedy is to joint the rest of the teeth down to the line of the broken tooth, which is a waste of good steel, time and withal a tiresome job.

The cause of the tooth going bad is usually due to the matter of the setting. A blow too hard may fracture the steel over the edge of the sawset anvil and a knot will do the rest. Brier set points will be less likely to break if sprung or bent out to afford the set required, but they must be sprung or bent at proper angle or the teeth will not cut well. The angle of the line on which the tooth is bent or set over, should be neither horizontal nor perpendicular but should be at about 45 degrees, so that the tooth will have clearance everywhere and thus set it will come as nearly as possible to the shape of a tooth properly swaged and sideshaped.

Circular saw accidents are often due to improperly shaped, set and filed teeth. Improperly shaped saw teeth soon wear dull which greatly increases the chance of the hands slipping off the sides onto the saw and also of a "kick-back," due to the increased pressure necessary to force the stock to the saw. Such conditions are prevalent in small factories and shops where there is no skilled filer in charge, and where the saws must be kept up by a foreman, or general utility man or even the machine operator, with little or no equipment for the purpose and without knowledge as to good practice.

If you ever find half of the teeth in a circular saw dulled more than the other half, it is a good sign that the mandrel hole in saw is too large for the arbor.

A blued spot on a round saw with a bright spot on the opposite side indicates surplus metal that is buckling out simply because it cannot go any other way. The remedy is to stretch the other parts of the saw until the blister disappears.

In spring setting round saws the bend on tooth should not come square across but on an angle so as to afford clearance behind the cutting edge. Thus set, the saw is less likely to dull, bind and heat on rim and run wabbly. But if round saws are thus set over the corner of the anvil, extra care must be taken or the set is likely to vary.

DISADVANTAGE OF FLEAM FILING

The cracking or breaking of saw teeth or of the saw at base of gullet is often charged to poor quality of the steel when the real cause of the trouble is more commonly due to insufficient set or to fleam filing. As explained below, there is good reason to believe that improper filing has much to do with the formation of cracks.

The needle point of a fleam filed saw tends to follow the fibrous grain of the wood and as the extreme point of the tooth is the only sharp part, the tooth is inclined to be drawn outward into the wood, caused by the beveled heel of the tooth, which is not sharp and which acts as a wedge. The following tooth being beveled in the opposite direction, causes a small amount of spring between the point and the root of tooth. This causes a certain amount of crystallization at the point of greatest deflection and the needle point that results from fleam filing has a tendency to split or separate the fibers of the wood while the heel or beveled edge of the tooth, soon dulled, is compelled to nip off the ends of the fiber.

In the case of a 14-inch saw running 2,600 r. p. m., subject to a board feed of 150 feet per minute, each tooth had a sawing duty of a trifle over .02-inch. This saw was a self-feed rip built to accommodate from 1 to 4 saws. With fleam filing and poor set it was a heavy load to operate one saw but after truing the saws and square filing, three saws worked successfully cutting 2-inch hard oak.

The improved results were obtained as a result of square sharpening of the saws on an automatic sharpener and giving them ample set. Care must be had to avoid wedging of particles of wood between the saw and the throat piece, which would cause heat and expansion between eye and rim.

CRACKS IN SMALL CIRCULAR SAWS

Cracks in round saws are unsightly, an indication of someone's negligence, and possess an element of danger.

They may be caused by insufficient tension or by a tight line or ridge extending from somewhere near the eye, outward toward rim, that may be either long or short. This condition sometimes is found in brand new saws and may be readily hammered out, using the long face of the leveling hammer, striking blows running with the ridge.

To find the ridge, place the farther edge of the saw on the anvil and the near edge in your left hand. Apply a straight edge 8 or 10 inches long, midway across the eye of the saw. Slide the straight edge to and from you, from eye to rim. Try the saw all around on both sides. If you find any ridges, hammer on both sides with the hammer in the same direction, until they disappear; but before you start this process see that the saw has nearly enough tension to run with. No matter how slow the speed, the eye should never be tight enough to hold up a straight edge which is long enough to reach clear across the saw over eye. Always test and hammer both sides similarly.

SMOOTH SAWING

The modern mill or woodworking plant demands smoothly sawed stock. Indeed timber is too valuable to waste with rough sawing which necessitates heavy dressing. Hence every saw filer should take maximum care to fit saws for smooth work, regardless whether circular, band or scroll.

PROPER HOOK FOR CIRCULAR SAWS

A cut-off saw for any kind of wood will ordinarily do a good job of sawing if the front edge slopes back one-third of the base width of the tooth. The back of the tooth should slant forward two-thirds of the base width of tooth and the bevel on front of tooth should approximate 30 degrees from square. If given too much bevel there will be a tendency for the teeth to spread and heat the points in hard, seasoned wood. If filed as above, 15 degrees less than a miter, the saw dust will be swept out clean, the points will remain cool and the side vibration will be at a minimum.

In the case of circular saws, the hook will depend upon the speed, the character of stock being commonly sawed, and the position of the saw with reference to the material being sawed. In general the hook should be more on a small than on a large diameter saw.

The cracking of circular saws in gullet, while operating in frozen timber is not unusual. A 60-inch saw at 850 r. p. m. may be well tensioned as follows: Lay saw on anvil bench with log side up. Go over it carefully with a 12-inch straight edge, applying it first across the center directly over the eye. Applied in this manner, with the dished side of the saw up, there should appear quite a little light, say 1/64-inch, under the straight edge. Then slide the straight edge along the rim testing at each point same as at center, with a trifle more light showing under the straight edge than at center, until a point about 6 or 7 inches from the rim is reached, where almost no light will be seen. In applying a straight edge to the rim of saw see that its end will just reach the bottom of gullet and using same test as at other points, little light should show under the straight edge. In other words the saw should show a good wide tire without tension. Such a tire is calculated to do away with undue tensile strain on extreme rim which is chiefly responsible for cracks in gullets, where tension is carried too close to rim. Moreover, when the tension is carried too close to rim, the general tension must be greater, for a narrow rim stretches more easily than a wider one, and such stretching lets down the general tension, to counteract which a greater degree of tension will be necessary to hold the saw up to the feed.

There should be a proper relation between diameter, gauge, number of teeth and diameter of collar, for frozen timber, somewhat as follows:

60-inch saw—9-inch collar—6-gauge—80 teeth.

60-inch saw—10-inch collar—7-gauge—90 teeth.

60-inch saw—12-inch collar—8-gauge—100 teeth.

The above contemplates fast speed and feed. The hook in saws running under such conditions should be such that if a straight edge is applied in line with face of tooth, it should touch the edge of a circle whose diameter is one-half that of the saw. The above will do very well for pine or similar soft woods, but for hardwoods or frozen timber more hook may be employed.

For soft timber under above conditions a tooth with face 1⅜-inch deep gullet ⅝-inch wide, with rounded back and with enough stock for strength so that it will run without spring or chatter, but not too blunt at point to swage nicely, is recommended. The swaging must be well balanced and properly relieved on sides, and if sawing frozen timber some increase in the hook, with good large, round gullets and increased clearance on sides of swaging, back from cutting point, will be desirable.

If the saw will not stand up in frozen timber, but lays over in slabbing and makes the last end of the first board thick, it suggests that it has a little too much tension for frozen timber. Therefore the rim should be drawn out so that when in the cut it will have the same strain as in summer sawing. In other words the saw should be more stiff or have less tension for frozen than for unfrozen timber.

Two-thirds of the work in fitting shingle saws, consists in keeping the teeth perfectly sharpened, swaged and sidedressed—not in hammering.

INFORMATION TRIPS

A saw filer can pick up useful information by cultivating the acquaintance of other filers and by going about, whenever time and opportunity permit, visiting other filing rooms, noting the types and condition of the equipment, the methods employed in saw fitting, and discussing problems of mutual interest. All work and no communication with others is poor practice.

Indeed it will pay the plant operator to take the initiative in this matter and at a time when the filer can be spared, slip him some expense money and tell him to go about and see how the other filers do their work.

EXTRA SAWS

A sawmill or factory should at all times be equipped with saws of the very best quality, and with band saws especially, extra saws, so that in case of accident to a saw another may be immediately substituted, instead of being obliged to shut down while a temporarily disabled saw is being repaired. There are reasons why the practice of keeping extra saws on hand may be commended. For instance, if saws are not called into constant use, it enables the filer to give them close attention, even to the extent of occasionally using a file on the saw teeth so as to give them a cleaner, sharper point than it is possible to give with an emery wheel. Such a course would greatly improve their cutting qualities and would be along a line of improvement calculated to give the hammer and anvil an occasional rest, because a saw that does its work easily will run longer without distortion than it will if allowed to get so badly out of order as to require an undue amount of power to force it through the material being cut. Especially is this the case with the band saw, those toothed on but one edge, for in addition to the strain on the blade, caused by its being drawn taut and passing over the carrying wheels, the front or toothed edge of the saw must perform the cutting. This labor causes the saw to stretch more on this edge than on the back edge, and the more unequal this strain becomes, the sooner the blade becomes distorted and in need of corrective treatment.

A few extra saws in the racks ready for use in emergency will save the necessity for using a saw not in fit condition to run, which is too frequently used for advantage to the saw itself, or with good results in the lumber manufactured by it. When a saw is not properly swaged, sidedressed, sharpened and tensioned it ought never to be run, and it is the poorest economy to try to run it.

HAMMERING OF SMALL CIRCULAR SAWS

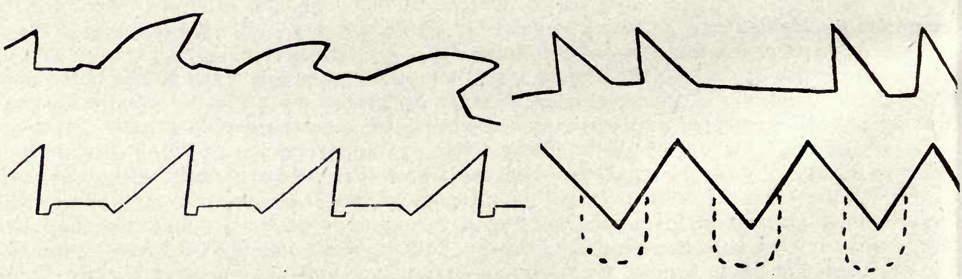
Small saws require less frequent and fine hammering than the large rip saws used in sawmills, and any man equipped with a small and inexpensive outfit of hammering tools, can perform the hammering satisfactorily after a little practice and study of methods. Otherwise if the saws do not run true without heating, they should be sent to a saw shop or hammered by a competent man.

But any circular saw, no matter how small, requires for fine work that it be leveled, free from twist and lumps, with the tension uniform. By uniform tension is meant that the tension or expansion of the steel shall show uniform at any distance from the center, all around the saw, when the straight edge is applied, although the degree of this tension will vary at different distances from the center, being little or nothing at center and rim and more through the body of saw, according to the diameter, speed, gauge and feed. Thus the saw, when properly tensioned, will run true and steady, free from vibration, the centrifugal strain being properly compensated by the process of hammering. Every filing room should be equipped with the proper tools for hammering, and if the filer in charge is not familiar with the principles of hammering, he should master the process by study and practice.

SMALL CIRCULAR AND BAND SAW CRACKS

Cracking is one of the worst evils that a filer has to contend with and he must be on constant guard for the causes, some of which may be readily detected and others of which are exceedingly obscure. One should always look to the fitting and to the operation for primary causes, although there are saws in which the primary causes of cracking exist in the saws themselves, either by reason of poor steel or uneven or too hard temper. In such cases the saws will crack in spite of all possible care.

The cracking and breaking of small circular and band saws is most frequently due to improper filing or emery grinding, the former giving irregular, angular, gullets, and the latter resulting in a case hardening of the tooth at point or in gullet. The angular filing may be overcome by the use of a round file in the throat or by the use of the emery wheel; the case hardening, which results from heating the tooth red hot or nearly so by too fast feed of the emery wheel, after which the tooth rapidly cools by conduction of the heat to the body of the saw, causing the teeth to be hardened the



same as if they had been dipped in water, may be avoided by the careful selection of wheels of proper grain and grade for the gauge of the saw and by an exercise of care in the processes of gumming and sharpening. We illustrate forms of improper filing.

If the filer avoids teeth with sharp, angular gullets or with no or too little hook or teeth of uneven length, and has the points properly swaged, sidedressed and sharpened, and the saws still show a tendency to crack, he may find the causes of cracking arise from the saw not being properly leveled or tensioned, or in flaws in the steel itself, or in the machine on which the saw is run. Operators of small band saws in furniture factories and kindred woodworking plants are often subjected to a large expense in the form of cracked and broken saws and miscuts. These losses in some cases become a serious problem for adjustment. Not only are the saws themselves expensive in the first place, but the loss of time incident to the changes and adjustment, to say nothing about the poorly manufactured stock, are large items. The most expensive saws in such establishments are the band resaws, which vary in price, according to size. In the case of the larger resaws, there are at times conditions in the machine itself that contribute to cracking. The wheels may not be true or their face not perfectly flat or slightly crowned, as best practice suggests. The cleaning devices may not be in order. Band wheels must be kept practically clean or some portion of the blade will be subjected to undue strain. Every machine should be equipped with proper scrapers, brushes and oiling devices to clean the wheels and cut the gum that is likely to accumulate, and the sawyer must keep these devices constantly in order.

The character of the guides, both for side and back of saw, is important. The back guide should be set so that it barely touches the saw when in the cut, and the saw should be forced against the guides as little as possible, otherwise case hardening and cracking is liable to result, notwithstanding the ingenious and highly efficient character of many of the guides in use. The band saw machine should stand perfectly rigid, not only by being bolted to a solid floor or special base of masonry, but by being braced or guyed.

Sometimes the straining mechanism of the band or band resaw mill is at fault, either by reason of subjecting the saw constantly to a too great strain or by not responding readily to an increase or a decrease in the strain, according to the lead of the saw in or out of the cut.

Generally speaking, it is probable that cracks are most frequently caused by short places in the saw, causing undue strain at the point. There are instances where cracking is undoubtedly traceable to a case hardening of the back of saw while the edges are being ground parallel in the shop. As a result, after running for a short time, especially if too short on the back, a lot of minute edge cracks appear that nothing can overcome except by shearing a strip off the back edge. When one has such work to do a rotary shear on a stretcher is found a great convenience.

THE STANDARD NUMBER OF TEETH IN SMALL CIRCULAR SAWS

Diam. Inches	Splitting	Cut-Off	Diam. Inches	Splitting	Cut-Off
4	38 to 40	100 to 120	20	34 to 36	80 to 90
5	38 to 40	100 to 120	22	34 to 36	72 to 80
6	38 to 40	100 to 120	24	34 to 36	72 to 80
7	38 to 40	100 to 120	26	32 to 34	72 to 80
8	38 to 40	100 to 120	28	32 to 34	72 to 80
9	36 to 38	90 to 110	30	32 to 34	80 to 90
10	36 to 38	90 to 100	32	32 to 34	80 to 90
12	36 to 38	90 to 100	34	32 to 34	80 to 90
14	36 to 38	90 to 110	36	34 to 38	80 to 90
16	36 to 38	80 to 90	38	34 to 38	80 to 100
18	36 to 38	80 to 90	40	36 to 40	80 to 100

The size and number of the teeth in circular saws are governed largely by the gauge of the saw.

Whenever saws are very thin for any reason whatever, the number of teeth should be proportionately increased, and the length decreased, as a very slim tooth is liable to spring sideways and make rough timber.

As regards the work of the saw for different woods, there is much that depends upon having saw fitted with the proper amount of set or swaging, having the teeth kept sharp and properly slim and throated, and the feed not too fast. The set on the teeth may properly vary for different woods. Under proper care, 19-gauge resaws are cutting hard maple, and 16-gauge segment resaws easily cut wide kiln-dried oak, being run steadily on such lumber.

The stock should be fed to the saw so that the teeth will take a deep, full cut, rather than a light scraping one, as they will stand up to the work with less tendency to dull. It is sometimes observed in sawing kiln-dried hardwoods that the saw is dulled in a short time, and this fact can usually be traced to improper feeding, assuming that the saw was in the first place properly fitted. Or it may come from a tooth so slim that the use of an upset is necessary to secure a proper corner or from the corner being too much of a needle point to stand up to its work. A tendency to crumble may be overcome by a more frequent and consequent lighter swaging, sharpening and sidedressing. The condition certainly demands that the various fitting strains put upon the teeth shall be as light as possible. In general, careful attention to the proper use of swage and shaper and light grinding will avoid the trouble.

A close watch must be kept on the saw when blue spots begin to show themselves; the cause thereof must be found and removed. A blue spot on a circular saw means that the blue portion has been heated too hot. When pine is sawed a lot of pitch sometimes collects on the saw and burns on. It bakes so tight that it becomes as hard almost as the saw itself, and as this thick place goes around, it makes a good deal of friction in the kerf, and begins to heat.

The more it heats, the harder the coating becomes, and the tighter it sticks. If the saw were looked over often, and all spots of baked-on pitch, grease and dirt were scraped off with a knife or chisel, there would be fewer saws with burned spots on them. As soon as a saw begins to heat, the spot getting hot expands and buckles out, so as to bear still harder on the wood it is going through. If the cause is not removed, the spot will increase in size, and the center, instead of being blue, will be heated so hot that the blue color is driven away, leaving the center of the spot softened from the great heat.

Put a straight edge on a saw of this description and you will find a well defined bunch in it, the bunch sometimes standing out over a sixteenth of an inch. Until the bunch is removed the saw will be useless for good work.

Hammer the bunch on an end grain block, and if the saw is not too open the bunch will disappear, but if the saw is too open, it will dish through and show on the opposite side, in which case the surrounding steel must be expanded to let out the undue expansion of the bunch.

WHY SAW TEETH CRUMBLE

The crumbling of saw teeth may arise from an actually defective temper or innate defect in the saw steel itself such that the latter cannot be overcome. If it is due to a too high temper, and if there are only a few teeth on a saw that show the defect, it may be remedied by the use of a gasoline torch. Place the saw in the filing clamp so that the tooth just shows, then holding a piece of asbestos board or charcoal on one side of tooth, throw the torch flame against the point of tooth. You can draw the temper to any desired degree. Hold the asbestos or charcoal in place a few seconds after removing the flame. This will save heavy grinding to remove the hard point.

Or crumbling may be due to an improper shape of tooth or a faulty adjustment of swage, such that in either case, the swage exerts too great a strain on the fibre of the steel, starting a fracture which though not visible will be manifested when the tooth strikes a knot.

FITTING SAWS FOR PORTABLE MILLS

Portable mills, as a rule, have little or no equipment worthy of the name for keeping the saws in condition, and even though the average sawyer may get good results from his saws while in good condition, many are in doubt what to do if the saw gets sprung or dished.

Portable mill saws rarely run over 350 to 450 r. p. m. and require less tension than saws at a higher speed, but the saw must be perfectly flat, that is, must be perfectly leveled and run true in the guides.

Sometimes a brand new saw, properly hammered for the speed, will meet with an accident which heats the center and causes the saw to lead out of the log and dish. It may remain dished after becoming cool and sometimes blue spots will appear. These blue spots are really lumps which in nearly every case are the cause of the dishing and if knocked down by proper hammering, the dish will disappear, and the saw work effectively.

A suitable outfit of hammering tools is comparatively inexpensive, and will often save money, inconvenience and delay, and if every portable mill would equip with a modest outfit, occasion for sending a saw to the factory or repair shop, could in many cases be avoided.

CROSSCUTTING SAWS FOR LOGS

Heavy cross-cutting of logs or dimension stuff in plants where logs are manufactured into shingles, heading, staves, veneer, ship timber, etc., involves the use of power driven swing saws, drag saws or cross-cutting band saws.

Circular saws, while they fill many needs efficiently are not well suited for heavy, rough cross-cutting, because for large sized logs or timber, the saw must be nearly three times the diameter of the log, and if the saw is of the swing saw type it must be mounted in a large, unwieldy frame, which in turn must be loaded on one side with a big box of counterweights.

Not infrequently a circular gets beyond the control of the operator and cuts its way into the timber altogether too fast, or the saw may choke down in the cut, cause a serious accident, etc.

The drag saw as now manufactured in numerous types, is a familiar and safe machine with much to recommend it. It does not, however, cut rapidly because the saw teeth, instead of traveling continuously in one direction, operate in a reciprocating fashion like a hand saw and the very nature of this movement sets up considerable vibration of an objectionable variety. In fact a drag saw not securely bolted down will shake everything in the vicinity.

LOG CIRCULAR SAWS

Operators of log circulars require an automatic rip saw sharpener, swage, hammering bench, hammers, anvil, straight edges and adjustable tension gauge, set gauge, side file, etc. Some mills also are equipped with a hand sharpener. Where the circular rip and cross-cut saws of each kind are similar in the style of the teeth, a combination automatic rip and cross-cut sharpener is most desirable. In many mills the quantity of work or the range in size of saws requires such sharpener in two sizes. It is certain that a saw automatically sharpened will keep in perfect round and balance and in general do much better work than one sharpened or filed by hand.

The swaging of circular saws is also an important process and practically every lumber manufacturer uses some kind of machine swage. It would be better if every factory or small saw operator should adopt the machine swage for every kind of rip saw that can be successfully swaged, for the swaged tooth is in every way superior to the use of spring set.

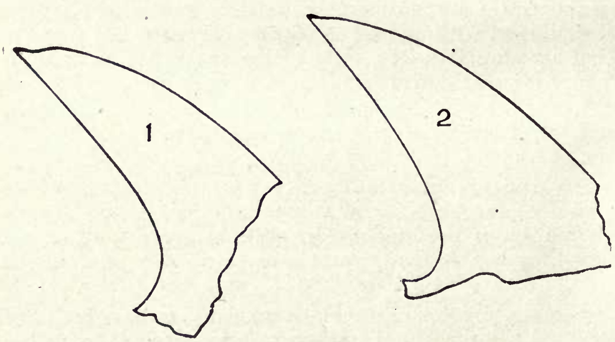
It would be superfluous to allude to a good outfit of hammering tools which are required for use almost daily and which will pay for themselves times over in the course of a year, were it not a fact that there are mills and factories that are either poorly equipped or not at all equipped in this direction. First-class tools for leveling and tensioning circular saws can be had at a trifling expense and will last a life time.

The sidedressing of log circulars can be accomplished by the ordinary types of circular side files, some of which give a downward bevel to the side of tooth, and others a downward and backward bevel, or can be accomplished by the use of a side gauge, and filing by hand. We manufacture a variety of tools for these purposes, but call the attention of filers to our No. 192 sidefile gauge, with which an ordinary mill file can be used, and which is simple and satisfactory in the results it makes possible in the way of a downward and backward bevel on side of tooth. The introduction of swage shapers for all band saws ranging 14 to 20-gauge has become very general, and the shaper as a sidedressing device is now considered by the great majority of users to be superior to the sidefile. The swage shaper for log circulars ought to prove similarly advantageous, although there has not yet been so extensive an introduction of circular swage shapers. Whether this is due to the fact that the side-file is actually better for heavy gauge and heavily swaged circulars, still remains an open question. In the case of saw steel that is tempered very hard, or that shows a tendency to crumble in the process of swaging, the compression of tooth by a shaper would have a greater tendency to impair the tooth or start fractures in the corners, which would ultimately drop off, than would sidefiling. Filers or mill men who desire a swage shaper for circular saws are requested to write us.

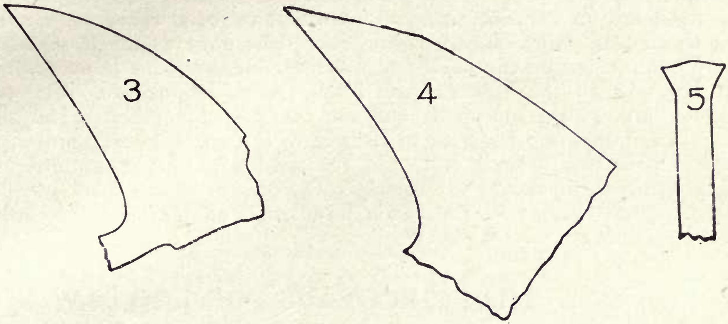
THE SWAGING OF CIRCULAR SAWS

A poorly hammered saw with proper swaging will run better than a well hammered saw with poor swaging. It is frequently the case that a saw that does not swage well is condemned and some filers make a practice of calling for saws of mild temper, losing sight of the fact that such saws will not remain sharp long and consequently require more frequent fitting. It is a certainty that if filers will pay more attention to the matter of keeping their swage in good order, the dies properly dressed and renewed as may be necessary, and have the sharpener and swage "working together," very much better results will follow.

Among the fast mills capable of turning out a large daily output, the direct pressure swage, with die acting on top of tooth, like the Rhodes Upper or Kinney Swage or on face of tooth, like the Hanchett Swage, is most commonly used. The accompanying cut illustrates the top swaging. But face swaging such as produced by the Hanchett Swage has been gaining in popularity for many years until now there are upwards of 30,000 of these swages that have been sold in the United States, Canada and many other countries throughout the world.



Tooth No. 1 shows swage before grinding. No. 2 shows tooth after being ground. Little if any grinding is necessary on face of tooth, it being done mostly from the back as shown. It is unnecessary to remove all of the depression made by the swage on first grinding, but the second and third grinding does this and puts tooth like No. 3 ready for the next swaging. No. 4 shows a tooth that will not swage well, even if the



dies are properly adjusted to it, because there is too little stock for the die to press on. The swage will in such case draw out a long thin point, without spreading the steel sufficiently, giving a needle corner, that must be "upset" in order to make sufficient clearance and strength. The upset tends to split, spring and nip off the corners of the teeth, or start fractures that cause the corners to drop on the first knot encountered. The filer then blames the saw, sawmaker and swage without recognizing his own lack of skill in the use of tools or keeping them in proper order. When it is a well known fact that a standard make of swage is made as well as it can be made and is adjustable to all manner of teeth within reason and is capable of doing perfect work if intelligently handled and kept in order, it is absurd for a filer to place the blame for lack of good results anywhere but on himself. Face swaging properly done, produces the ideal tooth, spread widest at point, properly tapered for clearance, most readily shaped or sidedressed and with hook and cutting qualities most effective.

It is a very bad plan to swage too heavily, even if the tooth and swage are in perfect condition. For if the tooth is too rounding near the point or the die too rounding, the point of tooth will split. If the die reaches too far onto tooth and the tooth does not split, it puts an undue strain on the clamps, and very likely causes the tooth to spread unevenly, thus necessitating the upset or swage bar to equalize the corners, and very likely making one corner unduly heavy, all of which necessitates excessive grinding or sidedressing, a waste of saw, emery wheel and file.

Small mills lacking power, and running 60 or less teeth in general make use of a face swage, one of the type having an eccentric die. Saws having from 70 to 100 teeth may be swaged with a top or face swage. The question whether a saw swaged on the top of tooth and consequently ground on the diameter of the saw, wears out the saw materially faster than if swaged on the face, and ground rather more on the perimeter of saw, is of too little importance for practical men to argue long over, because the number of teeth in the saw and their perfect fitting for the cutting capacity of the mill, are of most importance. If a filer will swage often, he will keep out a perfect corner with little or no liability to fracture the teeth of the hardest saw, little grinding will be necessary to bring the tooth to a point, a harder saw can be run, the teeth will stand and remain sharp longer, and the saw with proper tension can be run on a less amount of clearance, thus making more lumber and less saw dust, than if fitted in any other manner. There are filers who change saws four times daily, who make one emery wheel on an automatic sharpener last for months and never put a file on the teeth unless for sidedressing purposes. Not all men are thus successful but with a sharpener and swage of recognized efficiency, if they fall short of such results, the trouble lies not so much in the machines themselves as in the man and his lack of skill in operatnig or keeping the machines in good order.

Considering further the small circular mills that use the eccentric face swage, and that depend upon a hand gummer, and more or less hand pointing of the teeth when dull, with a file, it will be apparent that it is easily possible for the saw to get out of round, so that unless properly jointed, the strain on the teeth is not equally divided. Furthermore the upset is often resorted to thus exaggerating the bluntness of the tooth or when swaging, proper care is not taken to set the swage to prevent bending the point up or back, thus necessitating an undue amount of grinding on the cutting side to bring the tooth to a point. The swaging should be done as much ahead as possible, so that little or no filing on the back and but little on the front is necessary. Only by careful attention to all these details can good results be insured. The eccentric swage and hand gummer cost but little, and are easily within reach of all small mill operators. They are immensely superior to the use of the upset, burr gummer, and hand filing and any one running a small mill, not equipped with swage, gummer and an inexpensive hammering outfit cannot use money to better advantage than to equip with the tools in question, but every mill, no matter how small, should adopt the automatic sharpener if at all possible to possess one.

THIN CIRCULARS FOR LOG SAWING

J. H. MINER

Much attention is now being paid to thinner saws by practical millmen. Economy more fully asserts itself each year and millmen are beginning to draw the line more closely. Before the band saw was fully introduced it was condemned by ninety-nine out of a hundred. But thin bands or thin circulars are no longer an experiment and some fast circular mills have used nothing heavier than 10-gauge for years. True, they have been tried by many without success, but the fault was not in the saw. The day is coming that 12-gauge saws will cut 50,000 feet per day. I received a letter recently from a prominent filer in Arkansas stating that he had cut 78 lines, 16 feet long, 12 inches deep, of good lumber with a 10-gauge saw in five minutes. But under the same treatment that 90 per cent of the thick saws get, no one could expect a thin saw to be a success even on a smaller output. The fact is that there are but few men who get all out of the circular that there is in it. If one man can run 72-inch by 12-gauge saws successfully, that demonstrates that it can be done. If others can't do it, there must be something lacking. There are several essentials. To be a success, thin saws must be run at a high speed, must have an absolutely solid, steady running mandrel, plenty of power, and a good filer and sawyer. A thin saw is more sensitive than a thick one, and under like circumstances the thin saw cannot be expected to do as much work. Suppose that the millman who is satisfied with 50,000 feet from his 6 or 7-gauge saws, run at the standard speed would put in a 10-gauge 60-inch saw with 100 teeth and speed this saw to 1,000 revolutions, and could get a practical sawyer and filer that could and would run it. He would, to his surprise, increase his cut with a considerable saving in saw kerf. If the man that contemplates a new mill, and wants 50,000 to 75,000 feet per day, would put in 72-inch by 12-gauge saws, with not less than 110 teeth, with speed 1,100, and a 12-inch cylinder feed, to my mind he would have the most economical mill that could be built. There are many who are ready to assert that this is too high a speed and that the steel will not stand this strain. This is a mistake, for saws have been run successfully at this speed. The greatest drawback in introducing thin saws is to get filers who can fit them properly. The filer and sawyer must work in unison. All prejudice and personal feeling must be laid aside, both working solely to the employer's interest, instead of one or the other seeking to work to the other's disadvantage, which is sometimes done in a manner so intricate that the most practical foreman cannot detect where the trouble is.

In running thin circulars the tension must be absolutely uniform and in exactly the proper place. There is a vast diversity of opinion about where the exact location of the tension should be, but practical filers do not disagree on this point. A variation of 1/1000 of an inch in the drop of any high speed saw will take 2 inches feed from it; that is, adjust that 1/1000 of inch and the saw will stand 2 inches more feed.

A high speed saw can be accurately hammered only by the use of a gauge properly curved, and the saw must be hammered until it shows no light under the gauge. It will then be practically all uniform, and so far as tension goes, in perfect condition to run.

The utmost care must be exercised in the temper of high speed thin saws. If it is not uniform then the saw will be thrown out of tension at its speed, no matter how uniform it may be hammered. The grinding must also be perfect so as to insure a perfect balance. It will astonish any practical man that uses the straight edge how much he can improve either bands, circulars or band resaws with a tension gauge of the proper curve. I could not get a saw at high speed anywhere near uniform without one. There is no estimating what a high speed, perfectly hammered saw will do on a quick rig with a good sawyer. At the same speed the thick saw would certainly do more work than the thin. I refer to mills maintaining their present output with thin saws. No one wants to decrease his cut, for what would be gained in one way would be lost in another. I am just in receipt of a letter from a saw company wanting to send a 9 or 10-gauge 60-inch saw here on trial. We are now using 8-gauge, 56-inch, 96-teeth, and don't think we can hold the cut at 100,000 feet per day with thinner saws. If I could increase our speed from 925 to 1,100, I would try the thinner saws.

We strongly recommend the Widemire adjustable tension gauge to all circular saw filers but most of all to those whose sawing conditions demand the most perfectly equalized tension that may be obtained.

THE PROPER CARE OF SAWMILL CUT-OFF SAWS

This is an item in every up-to-date mill where trimmers and gang slashers are used. The public have had much to read in the trade papers about broken cut-off saws, but I find that the secret is in but one thing principally, and that is in giving them more set. They should be filed or ground square in front, with pitch line to center, with the back beveled. This makes beyond a doubt the best tooth for a cut-off saw, swing or stationary. Each tooth is a cutter and a raker. If the reader doubts this, just fit up one saw and that will convince him. Large cut-off saws should be left a little slack on the rim, sufficient not to wave in motion. Cut-off saws should be at least one gauge heavier than the standard. This will add no more in price or in power to run, but will add 50 per cent to the life of the saw. I have never seen a cut-off saw that was not abused; getting pinched or twisted. Keep them sharp, filed square in front and with plenty of set, and that will reduce the broken saw expense to a minimum. It is supposed that the reader is aware that square corners will cause cracks. The same applies to all machinery where subject to strain. Short cracks can be deeply center punched on each side which will arrest them. Cracks over three inches long should be drilled. Solid blows must be applied or the crack might extend farther while punching.

RUNNING THIN CIRCULARS

"In my charge at present are two circulars 76 inches diameter, 12-gauge at rim, 9-gauge at eye; two 11-gauge at rim, 9-gauge at eye, and several 10-gauge saws. These saws were purchased to meet a demand for a reform in the waste of saw kerf. An experience of a number of years trying to meet this demand has taught me the coming circular for all classes of work is an 11-gauge, dressed to cut scant $\frac{3}{16}$-inch. If millmen will give such a saw the proper attention, it will surprise them and save them a great amount of money. The several things essential to make a thin saw run nicely are to give the saw plenty of teeth, not less than 90, in fact for 72-inch saws I use 100 teeth. The saw should be run not less than 600 revolutions per minute, and should have plenty of power behind it. It should be well opened close up to the teeth, leaving a rim of not less than 4 inches. The saw should be opened more at about 10 to 12 inches from the teeth than at any other place, and good results will be obtained. Hammer the saw to the highest speed and do not be afraid to push it. I run an 11-gauge saw as fast and crowd it as much as I can possibly do with an 8-gauge. I follow the following rules: 100 teeth with plenty of saw dust room, and line the front of teeth on a line just 10 inches from the collar or close to it. I use a collar 14 inches diameter, with four lug pins to the edge, and run the saw to its highest speed—600 revolutions per minute. In hardwood or bad cuts I slow the saw down so as to hold it straight, being provided with a sawyer's governor.

RESULTS OF IMPROVED METHODS

Thinner gauge saws may be used. Greater output per hour may be secured. Smoother sawing may be done. Such results demand machines of the best construction solidly set on heavy independent foundations, saws speeded at a faster rate, increased feed and perfect feed works, teeth of saws better fitted, and with plenty of steady power.

It is a well-known fact that as between different mills, there is a vast difference in both the quantity resawed per hour and the quality of finish of the resawed stock. The results arise mainly from the difference in the expert fitting of the saws and the expert handling of the machine itself. If the stock shows rough and snaky, with every revolution of the saw manifest, it is evident that there is chance for improvement in the fitting of the saws and it suggests the need of better saw tools or a better saw filer, or both.

The importance of finely resawed product is not to be underestimated. For whatever purpose the lumber may be subsequently used, its fitness for this use is largely determined by its condition as it comes from the saw. A perfectly resawed stock greatly facilitates the subsequent processes through which it may pass in being turned into a finished product and the time and labor bestowed upon it by other operatives depends to a degree upon the skill and ability of the resawyer and the work of his machine and saw. If the lumber comes out smooth and uniform in thickness the product may be finished up to standard excellence, but if it is irregular, corrugated and wavy, no operator, no matter how expert, can turn out perfect product, except by an undue expenditure of labor.

Clever saw filers will always be on the lookout for modifications in their fitting that may be better calculated to suit their individual requirements. The conditions in no two mills are precisely the same, and while there is commonly a considerable uniformity of work in the mills as regards the care of saws, yet an apt filer will often discover special methods of fitting that improve his own results, which would perhaps not work with equal success in other places. The difficulty of laying down rules that would suit every case is manifest and our discussion of these phases of work is calculated mainly to review principles generally known, and perhaps to arouse or stimulate a desire for improvements in the minds of saw fitters.

As an illustration of changed conditions, the case may be cited of several sawyers who tried in vain to make headway in resawing cottonwood with a 44-inch resaw. One filer concluded there were too many teeth in the saw. Upon removing alternate teeth, it was found that very good work could be accomplished and coarse toothed saws became the rule. The seat of the trouble was lack of power, which was not suspected, and the coarse toothed saws being recommended to a neighboring mill, were tried there unsuccessfully, owing to the saw being too light for the work it had to do.

When you place a new saw on the arbor see that it is just a fit, not too tight or too loose, and that the mandrel collars are clean. See that the nut on the arbor is an easy fit, so that it will be squarely seated against the collar when tightened. You can put a mark on the collars and this together with the mark or brand on the saw will enable you to always replace them in the same relative position. Such points may be considered trifles but trifles make perfection. Hang and carefully test and true up the saw by lining the collars with thin paper where necessary, until saw runs true within one hundredth part of an inch.

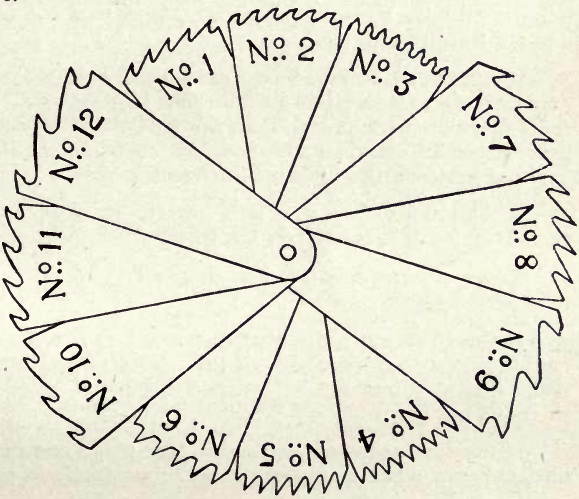
The saws being in perfect running order the machine itself next commands attention. The feed rolls as usually made, wear more rapidly in the lower than in the upper journals and do not have a uniform bearing on the lumber; this point should be sharply looked after, as the correct lining of the feed rolls and their perfect action is essential. The action of the reverse and stop motion of the feed rolls is also important. It must be positive and free from lost motion, an instant's delay in reversing at a critical moment often working damage.

A variable feed controlled by a conveniently placed lever, is a positive advantage which is appreciated by all using thin saws. When entering a hard knot or a shaky place in the board, a variable feed is a necessity. When not on the machine a makeshift is employed by using the stop motion, and by alternately throwing the feed rolls into and out of gear, jerking the board along a little at a time. This loses time and is imperfect at best. In other instances where the feed might be properly increased it cannot be done, thus causing a loss in output. A disc friction meets the requirements in this direction. The guide pins should be set just to clear the saw near the base of the teeth. There is danger of breaking the saw in resawing short stuff, if the material leaves the rolls before the forward end passes the rear of the saw so that the taker-away can grasp the end of the board. As the board leaves the rolls it is liable to swing, throwing it across the front of the saw. A trough formed by setting up a board on each side of the saw may be employed, to hold the lumber in line. For handling short blocks, six rolls, 20 inches or more in length, two boards with a cleat along the bottom and at the back edge of each, will serve nicely. The short pieces are set between and all passed through the rolls at once, thus in some instances saving stock which would otherwise go to the scrap pile.

While there are other considerations which affect the saw's work, the one which is closest to hand, is in most instances perfection or lack of perfection in the dressing of the teeth. This requires time, labor, skill, and a proper filing room equipment for the several classes of saws to be fitted.

It is a very short sighted policy on the part of any mill or factory manager to refuse the small expense that would enable his saw filer to have machines and tools that would enable him to accomplish his work practically correct, save his time by perhaps one-half, and afford saws that could be kept at all times sharp and well fitted, affording a greater sawed product and a vastly better sawed product. It is coming to be noticed that millmen are taking greater pride in the quality of the work turned out and they are aware that the quality of the sawing can be raised and maintained at a higher standard by allowing a reasonable amount of time for dressing the saws, and by affording a proper equipment of tools for the filer's use.

The etching illustrates a number of styles of teeth in common use on circular, rip and cut-off saws. Orders for saw fitting machines should be accompanied when possible with templet of the style of teeth desired, and the utmost care should be taken by every operator to select and maintain shapes of teeth that are well adapted to the speed and feed of the saw and the kind of timber being cut. In general practice too little attention is paid to the matter of hook and pitch of teeth, style of the gullet, and spacing or number of teeth on saws.



CIRCULAR SAWS FOR LUMBER MANUFACTURE

The conditions governing the operation of large circular saws used in the manufacture of lumber from the logs, are exceedingly various, and there is a wide difference between an experimental and an expert knowledge of their care.

It is highly important that you have a good mill, for one with weak or defective parts will be very likely to waste much of the power, and contribute toward inferior lumber manufacture. You also require good saws.

The mill and the saws demand constant care to keep them in the best condition for sawing. The filer or sawyer who is a competent millwright and is thus enabled to watch and judge of the mill and know that it is right and see that it is kept right, is unlikely to be baffled by knotty problems in saw fitting or tensioning, because with the preliminary conditions properly met, the care of the saws becomes more simple.

The conditions of a mill that should directly interest a saw filer, and to which he should give constant attention, are the track, the carriage, the husk, the arbor, the collars, the guides, the power, the speed, the feed, the number of teeth, the hook, the gullets, the kind and quality of the lumber cut, and finally the proper tensioning and fitting in the mill filing room.

Know that the machinery as well as the saws are in good order.

See that the track is level and straight, the carriage substantial, free from end play and the set works positive; the saw mandrel absolutely level, fitting as tightly in the boxes as it will without heating, and with but little end play, the mill lined true with the track; the collars perfectly true, and the power steady and abundant.

The fast collar on the mandrel should be turned flat from the outer edge about ¾ of an inch towards the center; then concaved slightly to the shaft. The loose collar should be flat or but very slightly concaved. This will insure the collars pressing the saw firmly at their rims, thus maintaining the saw flat and straight on the log side. To ascertain if the collars are defective, place the saw on the mandrel and tighten up the collars by hand. Then test saw with straight edge, and if found correct, tighten up the collars with a wrench and test again with straight edge to see if the face of the saw has been altered. If changed, it suggests that the trouble lies in the collars, and this must be remedied.

The mandrel should fit center of hole snugly but enter freely, and each pin should have a bearing. The saw should slip close up to the fast collar. Sometimes the arbor being a trifle large near the collar, the saw when forced up to its place by the nut, is made full on the log side.

It is difficult to make two saws hang just alike on the same mandrel, or the same saw to hang exactly alike on different mandrels. The slightest difference in turning up the collars of the mandrel or in the finish of the saw near the mandrel hole will cause a perceptible difference in the hanging, so that it is often necessary to adjust the saw by packing between the collars with writing paper.

In hanging a new saw it is best to fit it on, screw it up between the collars, and then examine it carefully on the front or log side, and see if the face is flat.

Never attempt to run a saw that is dishing on the log side, as it will be sure to draw toward the log.

If the collars are not true and cause the saw to stand full or dish either way, this condition may be remedied by the use of rings about same size as the collars. These rings should be cut out of firm writing paper, oiled and applied to one or both collars as required.

If the saw is dished on the log side place one or more rings against the loose collar until the saw when clamped up by collar stands in proper position.

If the saw is too crowning on the log side, reverse the position or application of the rings, placing more paper against the fast collar.

If necessary to do any filing at the center of lug pin holes, see that no burr is left on the edges.

Set the spread wheel flush with the saw and a half inch clear of the teeth.

Adjust the mandrel so as to give the saw a slight lead into the log.

Adjust the guide pins clear of the teeth, and close enough to touch the plate at some point in its revolution. This should be done while the saw is in motion.

It is especially important that the mandrel bearing next to saw shall run cool, as heating will heat the center of saw and cause it to lead or dodge. Never have anything to cause friction at either center or rim of saw that can be avoided. If saw warms at or near the center it should have more lead into the log; if it warms near the teeth it should be led out of the log. If the mandrel and guide pins are properly adjusted and the saw does not run straight, you should examine thoroughly to ascertain the trouble. The fault may lie in insufficient power to maintain uniform speed, in which case the remedy is to reduce speed to the velocity that can be maintained, and hammer the saw stiff. A high speed saw requires special hammering.

A saw should never be taken from the arbor very hot at the eye, and then placed in a leaning position, as it is liable to dish. In such case it is better to run the saw slowly out of the cut until cooled down.

SETTING THE HUSK

A prime requisite in mill construction is a solid, firm foundation. Heavy seasoned timbers should be used for husk stringers, leveled and so placed that they cannot possibly change from their position. Then fasten down the husk frame firmly by heavy through bolts, for a slight change will make a great difference in the running of the saw and may necessitate frequent relining and leveling.

LINING THE SAW WITH CARRIAGE

A principal cause of trouble in the running of circular saws is the lining of the saws, which if not properly done, will cause the saw to heat and snake. A saw should be lined almost straight with the track, leading into the log no more than is necessary to keep it in the cut, prevent it heating at the center, or scratching the lumber when the carriage is reversing. In practice, the amount of lead varies from $\frac{1}{64}$ to $\frac{1}{8}$ of an inch in 20 feet, according to the diameter of the saw. Change the line of direction of the saw to give the lead desired by sluing the mandrel in the proper direction. Before attempting to line a saw you must see that all end play is taken out of the mandrel, that the track is straight, level and solid, the carriage free from lateral motion, and the saw plumb and flat on the log side. Then move up the carriage until the head block is on a line with the front edge of saw. Fasten a pointed stick firmly upon the head block with the point lightly against the saw. Move the carriage until the point is opposite the back edge and if necessary slue the mandrel until the point clears the saw from $\frac{1}{64}$ to $\frac{1}{32}$ of an inch.

Or fasten a square edged stick or board firmly upon the head block so that the end of the stick will be $\frac{1}{8}$ of an inch from the saw when opposite its center. Then run the carriage back until the stick is 15 to 18 feet from the saw. Then stretch a line from the back of the saw to the stick and you can give accurately any lead desired.

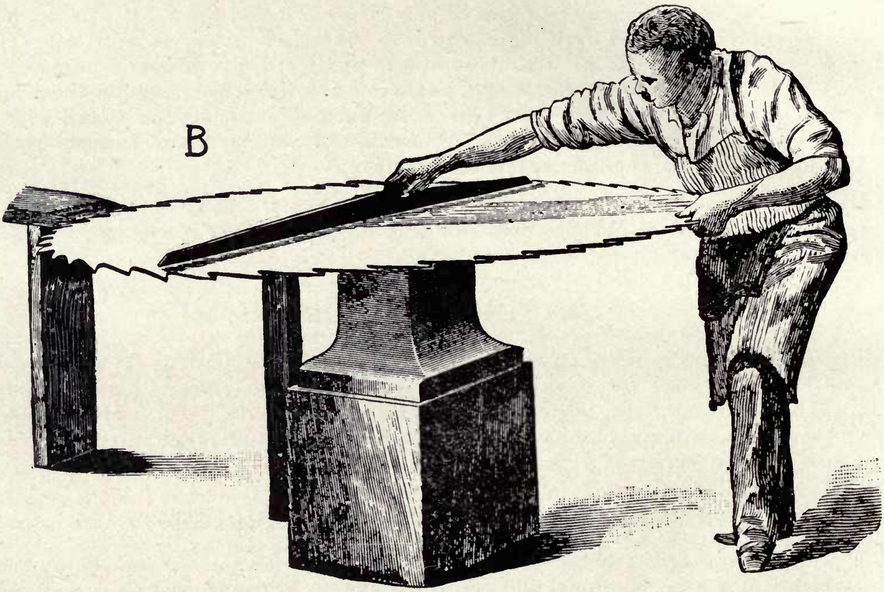
Or a tapering board with a hole at the large end, and a nail or screw at the small end, may be fitted on the stem of the mandrel and screwed up tight between the collars. Measure from the head block to the nail head in the end of board, then turn the mandrel half over by pulling on the belt, run the head block to the new position and measure again, setting the mandrel to give the required lead.

After testing the saw as above, by turning the saw slightly to a new position, and measuring again, any imperfection in the saw itself will be shown. The saw arbor should not be run absolutely rigid, but may be allowed $\frac{1}{64}$ of an inch end play or thereabouts.

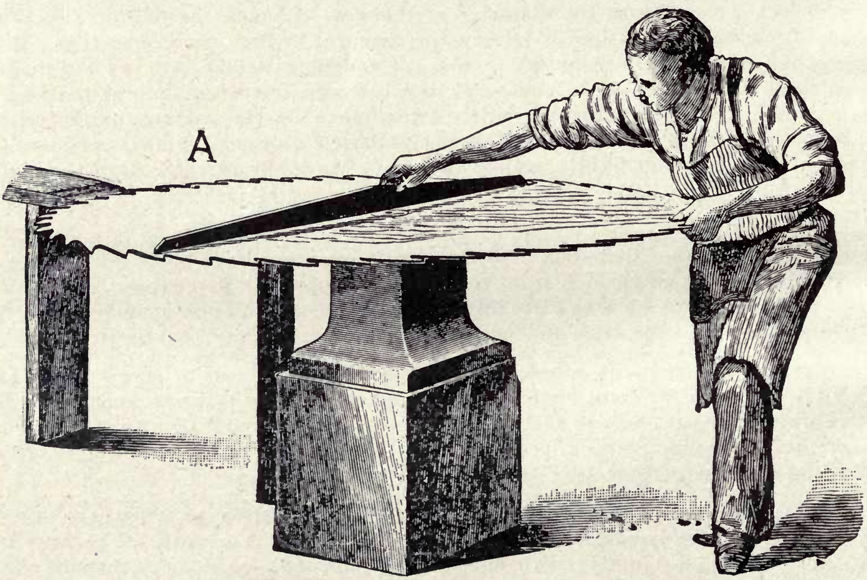
CIRCULAR SAW HAMMERING

Definitions of Circular Saw Terms. (Refer to Cuts)

A "stiff" or "tight" place is one that conforms to straight edge, showing no drop due to expansion or tension. (Fig. B.)



A Saw Stiff With No Tension



A Saw Loose or Opened For Tension

A "fast" place is one that stands up to the straight edge or shows convex.

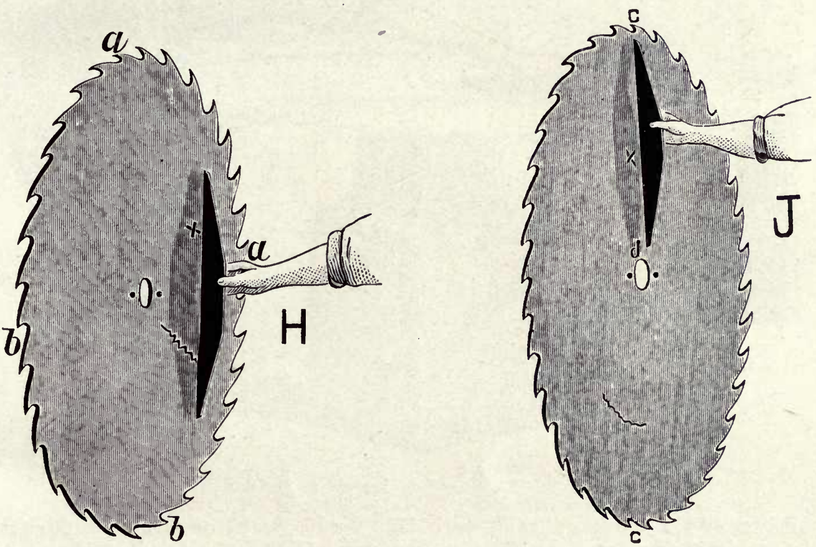
A "loose" place is one that drops from the straight edge or shows concave. (Fig. A.)

A "dished" saw is one that will not lie flat when saw rests on anvil, but shows a bulge or distortion of the saw plate.

A "lump" is a spot or place that stands up on one side of saw only. (Figs. H. and J.)

A "ridge" or "twist" is an extended lump.

"Leveling" a saw consists in reducing all lumps, ridges, twists and similar distortion. "Tensioning" consists in expanding certain parts of the saw plate to a greater extent than others, to withstand the centrifugal strain of the speed, and the resistance of the timber being sawed. The amount or degree of the tension is indicated by the drop of the saw from the straight edge, when applied across the diameter of the saw or from eye to rim.



Testing for Lumps, Ridges and Twists

To remove a tight place hammer directly on the parts that do not drop from the straight edge, but you should hammer on both sides of saw alike so as not to spring the saw.

To remove a loose place, that is a place too open or having too much tension, apply round face blows between the loose spot and the rim, so as to allow the extra amount of tension at that point to run out at the rim.

Bright spots upon a saw are generally tight spots or lumps, and are apt to run in ridges extending toward the center. Such places should be knocked down by hammering an anvil on the pad or end grain block as later described.

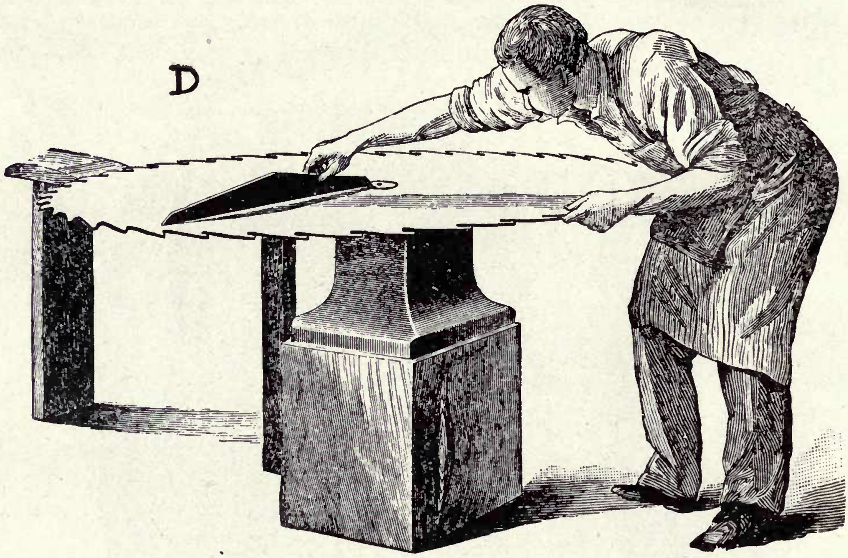
Mark loose places with loop marks, on both sides of the saw. Mark tight spots by loop marks and cross marks.

A lump will show a bulge on one side and a drop on the other side. It should be marked with an (X.) A ridge or twist will stand up to the straight edge when the latter is applied lengthwise, and will show a lump or ridge if applied crosswise. Mark thus ———

HAMMERING TOOLS, CIRCULAR SAW FILING ROOM REQUIREMENTS

The equipment of machines and tools necessary to the proper tensioning and fitting of circular saws is variable according to the size, number and variety of saws to be fitted. A large sawmill requires a larger and more expensive outfit than a small mill or a woodworking establishment, but the requirements are essentially similar in kind and vary only in degree.

In a mill where large circular saws are to be cared for, the filing room equipment should include an automatic sharpener for the large rip saws, a hand or automatic sharpener for the small rip and cut-off saws, a machine swage, an upset swage or a swage bar and hammer, a file sidedresser, or a swage shaper, a hammering bench, a



Testing the "Drop" or Degree of Tension

fitting up bench, a steel faced anvil with face 6 x 10, 8 x 12 or larger, a doghead and cross-face hammer weighing from 3½ to 5 pounds each, a long straight edge equal in length to the diameter of the largest saws, for testing the openness of the entire saw, a straight edge of half this length, reaching from center to rim, for testing the drop of the tension (Fig. D), and for locating lumps, ridges and twists, and a short 12 to 15-inch straight edge for finding small lumps that may be overlooked in the preliminary processes of leveling.

The testing of the saw with straight edges, is the most reliable, and every beginner in hammering should make it a study to read and understand his saw by his straight edge tests. But the straight edge test of the saw when on the mandrel will not be reliable unless the mandrel and collars are perfectly true.

The heavy hammers mentioned above may be supplemented with a pair of light hammers weighing three pounds or less for fine work on high speed saws or for use on light-gauge saws. Some make use of a twist-face hammer and consider it a desirable part of a hammerer's outfit.

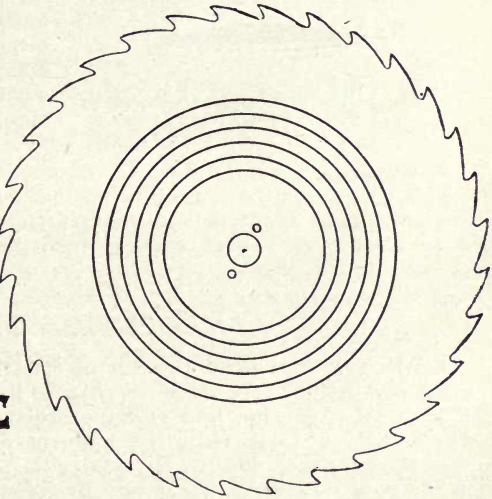
It is extremely important that the face of the hammers and the force of the blow shall be such as to avoid cutting or unduly marking the surface of the saw. None but expert hammerers should use heavy blows, for it is easier to add to them than to reduce the effect of your blows. First know where the blows are required and then place them to count. Let the blows be light but solid, striking the saw fair, with saw firm on anvil.

The hammering process consists in leveling or straightening the saw, removing lumps, bunches, ridges, twists and every form of distortion, preliminary to a proper distribution of the tension or expansion. But a saw without some tension cannot be leveled, and in such a case, the first thing to do is to hammer the saw on concentric circles a few inches apart over a section of the saw lying between the center and rim (Fig. C.) Use the cross-face or twist-face hammer in leveling; the doghead in tensioning.

TENSION

If you revolve an object attached to a cord, about the hand, it will be observed that on slow revolution the cord is slack and the pulling force on the hand scarcely noticeable; but if you increase the speed of the revolution, the cord becomes tense and the pull at the end greater, due to the centrifugal force or tendency to fly from the center, until at some limit, the cord breaks. Each molecule of steel at a distance from the center of the saw may be compared to the object attached to the cord, only in this case these molecules are revolving about the center of the saw as a fixed point, with radial lines in the saw plate representing the cord in the illustration. The centrifugal force or tendency to fly from the center, increases with the square of the velocity, that is as you increase the speed of the saw two times, you increase the centrifugal strain four times. If the plate of a saw were perfectly flat and devoid of tension, it would when speeded up and subjected to the cutting strain, finally reach a condition where the strain of the centrifugal force would exceed the cohesion of the molecules of the saw, and the plate would crack or burst. Hence it becomes necessary for the sawmaker and saw fitter to expand or stretch the body of the saw plate to overcome the effect of speed, so that the saw though loose and vibratory when motionless, will when at its maximum speed run perfectly stiff and rigid. It is therefore evident that there is a direct relation between the degree and location of tension and the speed, and that a saw put up to run 450 revolutions per minute will require less tension than one to run from 600 to 900. The expansion by hammering should be directly in line with the centrifugal force, through the middle portions, until the circumference is approached where the expansion gradually diminishes, leaving a rim or "tire" to hold the saw stiff and rigid when at work. If the tension, speed, feed, and fitting of the teeth are properly harmonized, the saw will run firm and steady whether in or out of the cut, other conditions peculiar to the mill itself being correct.

C

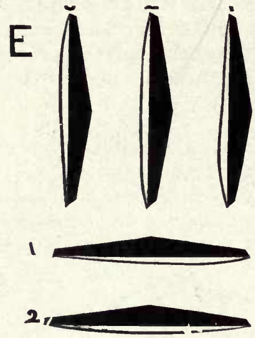


Lines of Greatest Expansion

UNIFORMITY OF TENSION

Uniformity of tension means that the tension or expansion of the plate is uniform on the circumference of any circle described from the center of the saw all around this circle. The expansion at varying distances from the center will be variable to suit the speed, gauge, and the cutting strain on the teeth due to the character of the timber being sawed. There is in each saw what may be called a line or section of maximum tension located not far either way from a circle about midway between center and rim, and diminishing alike either way from this line. This main line or section of greatest tension is the neutral point where the strain of the centrifugal force and speed is balanced by the opening for tension.

If you hammer on circles without the line of greatest tension it will let out the tension, but if you hammer nearer the center of saw it will tend to open or expand the saw still more. If you hammer directly on this line it will have a tendency to run the tension nearer the rim. It will be manifest from this and Figs. E, 1, 2, 3, that the relative location of the greatest amount of hammering for tension must be varied to adopt the saw to high, medium or low speeds.



Relative Forms of Tension Indicated by Straight Edge Test

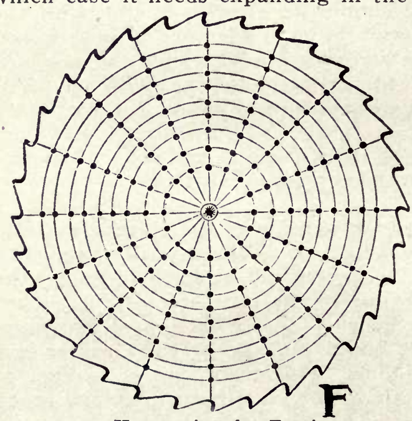
The only absolute test of this degree of tension and the location of a uniform maximum tension line, is by the application of straight edge from center to rim of saw. The vibration of a saw when shaken or the spring of a saw when pulled through by hand, tells much to the expert, but to the amateur it is not a reliable test. Figs. E, 1, 2, 3, is intended to indicate in somewhat exaggerated form the comparative location of greatest tension in a high, medium and low-speed saw, as measured by a straight edge test from center to rim.

A saw in proper condition will do good work, but there are numerous causes for the letting down of the tension or various forms of distortion, which require frequent examination and treatment to counteract. Overfeeding, undue variations in speed, heating in the cut, sudden cooling, teeth improperly fitted, all contribute in various degrees to impair results.

LOCATION OF TENSION

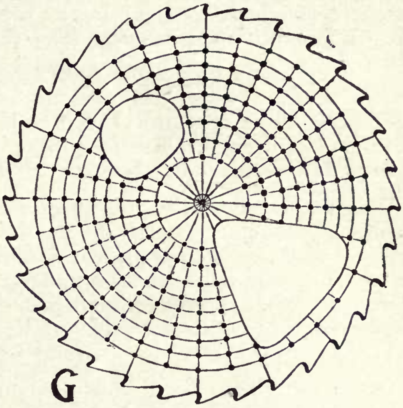
At the eye of the saw there is no centrifugal force and there is consequently no tension required. There is no occasion to hammer a saw for tension under the collar. The greatest expansion in a saw for ordinary work and speed should show midway between the center and rim. If a high-speed saw, this drop may show greatest a little nearer the rim, according to circumstances. Having once gotten a saw in proper tension for your mill, keep it that way by frequent light work with the hammer, for it is easier to keep a saw up in order by frequent slight treatment, than to allow it to run down and then be compelled to give it a thorough systematic revising. Moreover the life of a saw is preserved by keeping it always in good order. Nothing destroys the life of a saw faster than the strains arising from undue and neglected distortion.

A saw may be weak and limber on the rim, due to the center being too stiff, in which case it needs expanding in the center, to prevent it from heating and snaking. The remedy is to hammer the saw on concentric circles, about three inches apart, striking blows about two inches apart all around. Fig. F. Hammer both sides of saw approximately alike. To test the degree of the expansion, stand the saw up on edge, and give it a shake to see which portion of the saw vibrates. If the center still shows stiff and the rim vibrates, or if by giving the center of the saw a pull, it does not readily spring, but stands firm, a greater amount of expansion is required, and you must repeat the hammering on added lines, until the right amount of looseness at center and the right amount of stiffness at rim results.


F

Hammering for Tension

Avoid doing too much work on one side, or the saw will become dished, and you cannot then test the tension with certainty. If you get one side fuller or in such condition that it stands up higher to the straight edge than the other, it indicates a dished form in which case you must mark the highest places and reduce them until the saw shows uniformly alike on both sides.



G

Tension Fairly Correct Except in Spots

EQUALIZED TENSION

It is of the greatest importance that the tension shall be carefully equalized; that there shall not be alternate tight and loose spots, for if such is the case, the saw will not run well. The meaning of this will appear manifest when it is remarked that one part of the saw might be tensioned for 800, another for 700, another for 600, etc., or in other words adapted to such varying speeds, but not uniformly adapted to any one speed. Fig. G.

TENSION TOO NEAR THE CENTER

A saw may be too loose or open in the center, in which case it is likely to heat in the center and run out in slabbing or run in after the center of log is passed. Such a saw requires a suitable expansion of the rim or a letting out of the tension, by hammering on circles from two to three inches from teeth if put up for very high speed or at four to five inches from rim if put up for moderate speed, and if a slow-speed saw the blows may be applied still nearer to center. But these blows should be lightly struck to avoid letting out too much of the tension.

TENSION TOO NEAR THE EDGE

If a saw has its maximum tension too near the edge, the tension will be likely to be impaired or let out, by reason of the saw heating on the rim, thus causing the saw to snake. To remedy this reduce the tension by hammering at about one inch from the roots of the teeth, and then revise the tension through the middle portions of the saw.

DEGREE OF THE TENSION

The degree of the tension or expansion of a saw must depend upon the size of the saw, the gauge of the plate, the speed at which it is to run, and the amount of the feed.

Temper has much to do with the proper expansion of saws.

A soft saw will expand more than a hard one from centrifugal force and such being the case it will stand more expansion in the process of hammering.

Small circular saws used for ripping and crosscutting are rarely given much tension, and are commonly run very nearly stiff or flat throughout. In similar manner, among the small circular log mills, the question of hammering a saw is given little consideration, and it is common practice to run the saw as long as it will cut at all, regardless of the quality of the lumber or the quantity cut, until a traveling saw hammerer puts the saw again in shape for work. But the modern sawmill operator who runs a mill and cuts lumber for profits, and whose profits depend directly upon the quantity and quality of the output, requires a saw to run at a high speed, stand big feed, and cut true lines, and is ready to pay a capable man to make it do so. These high-speed, fast-feed saws vary from 6 to 8-gauge, run from 700 to 900, and stand from 8 to 20 inches of feed, cutting from 60 to 100M feet per day of good merchantable lumber. There is always ample power to make the saw leave the cut at practically the same velocity as it enters it.

Saws thus operated must be fitted right, and demand more careful manipulation than those subjected to lesser requirements. An expert filer will take the saw and condition it to whatever speed, or feed or timber confronts him.

But there is nothing peculiar or exclusive in the fitting of saws for fast mills. The same principles that apply in one saw or in one mill apply in the other, and the results depend simply upon the degree of the skill and adaptation displayed.

There are no inflexible rules to go by in hammering a circular saw. The filer must first ascertain where the saw needs hammering, giving proper consideration to the condition of its operation and then hammer to meet the conditions or improve the conditions if not right. Hammer right up to the roots of the teeth or right up to the eye if the saw requires it. No part of the saw should be sacred ground.

Neither the theory nor the practice of saw hammering is in any sense exclusive, although there are a few who are vastly more expert than the many, as in any employment. But saw hammering is simply the application of common sense to the needs of a saw, and one only needs to understand the condition of the saw and its use, the usual methods followed to accomplish desired results, and apply these ideas in practice, to make saws run satisfactorily.

Now whether a sawyer or filer desires to master the process of hammering, there are general principles that should be understood, in order to talk intelligently about the subject or explain to others the conditions that demand consideration or improvement. And there are occasions in every mill or factory, no expert hammerer being employed, where the application of a few well directed blows will level or tension a saw so that its operation will be decidedly improved.

One must have a good idea of what constitutes a saw properly "put up." This will vary according to the gauge, speed and feed. A small heavy-gauge, slow-speed saw will be stiff or show very little tension. A 7-gauge log saw from 56 to 72 inches diameter, running at a speed of 700 to 800 will show considerable tension, will not stand straight, but remains dished when in repose, and requires a considerable pull to force the center back and forth. A thin high speed saw will require more tension than a similarly speeded heavy-gauge plate. The average log saw for ordinary speeds should be put up sufficiently loose or open through the center, so that when standing up and given a quick shake, the center will vibrate, more than the rim, and when leaning over, the center will drop through. The amount of this dish or tension will measure up variously. A saw in perfect tension will show as in Fig. A, to greater or less extent according to the speed and feed for which it has been tensioned. The long straight edge when applied across the saw touches only on the edges, but shows a gradual drop of the saw away from the gauge as you leave the edges. A saw that has lost its tension will appear as in Fig. B, in which the tension or drop of the saw has in part or wholly disappeared. When testing for tension be sure to have the straight edge held at right angles to that part of the board or bench from which the saw is being raised with the left hand, and the opposite edge, while the straight edge is held and pressed down with the right hand. Do not lean or tip the straight edge unduly when testing the saw. When the saw is in proper tension the straight edge applied from eye to rim will show as in Fig. D, indicating that the center of the saw is stiff, and if a short straight edge was pressed directly over the center it would show the saw to be approximately flat across the collar bearing. It is rarely necessary to hammer the portion of the saw under the collars.

The drop of the middle portions of the saw hammered for tension should show uniform all the way around. If the drop is not uniform, those parts that do not drop perfectly must be marked and equalized by hammering. To test the tension of a saw let the center rest on anvil. Raise the edge with the left hand and apply the straight edge on radial lines all around the saw. The straight edge will touch the saw at center and rim. If a slow-speed saw, the middle portions between center and rim will drop away but little, but the higher the speed, and the thinner the gauge, the more will be the drop.

In the case of circulars 7 to 8-gauge, 60-inch, speeded for 700 to 800, a good test for tension is to apply a 5-foot straight edge across the saw, tipping it a foot from perpendicular. The eye should drop through. Or with saws across anvil slightly raised, the eye follows up to the straight edge the same as the rim, and in the entire length of straight edge, three points touch straight edge, the two on rim and the eye, but the eye touches the lightest. A saw thus put up will generally give good service in either hard or soft woods, north or south.

TREATMENT OF BLUE SPOTS IN A SAW

A blue spot in a saw is caused by the existence of a lump at the spot which is heated and blued by constant friction in the cut. If it shows in the form of a round lump it may be reduced by use of the doghead hammer; but if it extends in the form of a ridge, the long-faced hammer marks will be required. Such ridges usually extend from center toward rim. In hammering it is well to put saw through slightly at the spot so as to require a little treatment on the reverse side, for if the blue spot is hammered down only just flat, it may reappear whenever the saw gets hot.

CRACKING OR BREAKING OF SAWS AT COLLAR LINE

The occasional cracking or breaking of saws at the collar line is due to the fact that the saws have been put up for a certain speed, but owing to various causes, such as insufficient boiler, engine or belt power, the proper speed for the saw is not maintained in the cut or the sawyer does not properly control his steam feed, and forces the log unduly to the saw, and as a result the saw runs in or out of the log (most generally out) so that the log forms a sort of wedge between the saw and the headblocks, eventually cracking or breaking the saw at or near the collar line by forcing it over this rigid point. If the feed is not properly diminished when the speed of the saw is reduced from any cause, the saw will be almost certainly crowded out just as if the tension was not properly adjusted for the usual speed at which the saw is calculated to run.

Cracks throughout the body of the plate are generally caused by improper tension or feeding beyond the endurance of the blade. Cracks at the rim are for the most part due to improper fitting of the teeth or angular filing in the gullets. As soon as a crack is discovered it should be immediately checked by drilling a 3/8-inch hole at end of each crack; and if the crack is over ten inches long it may be well to drill a hole in the center also. Then ream each side and put in a hot rivet, but don't strain the saw in so doing.

LUMPS, BENDS, RIDGES, TWISTS, ETC.

Hammering to remove lumps or ridges must always be done on the high side of the saw or on that part of the saw which stands up to straight edge. Lumps or ridges on the edges may be found by examining that part of the saw with the center resting on anvil. Lumps in the body of the saw may be found by examining that part of the saw, with the saw standing perpendicularly upon the floor, marking the direction and extent on the high side with a piece of chalk. Figs. H-J, K.

If the lumps are to be taken out upon the anvil it is well to pad it with a thin piece of leather or with a couple of thicknesses of heavy wrapping paper. Allowance must be made for the tension, when removing lumps, as every blow struck tends to stretch the part hammered, and if the tension is altered it requires considerable exercise of skill and care to restore it. Some filers use a slightly oval wooden block for knocking down lumps, for in hammering upon this the tension will not be affected. The object to be attained in knocking down the lumps is simply to straighten the plate without expanding the metal. Adapt the blows to suit the gauge and temper of the saw, for thin or soft plates require lighter blows than heavy hard plates.

Lumps are apt to extend into ridges, and should be knocked down with the crosspene hammer letting the pene follow the direction and extent of the lump, as indicated by the straight edge examination and chalk marks. Round lumps may be reduced by the use of

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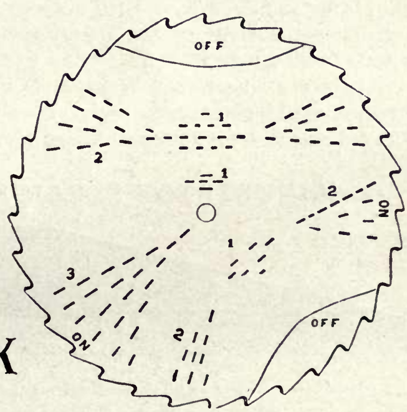


Forms of Lumps or Twists

the doghead hammer or with the crosspene, by changing the hammer over after each blow, so that the strokes cross each other. Put the blows in exactly the right spots, directly upon the lump or ridge, and nowhere else. Test the entire surface of the saw with straight edge, rolling the saw about and marking the lumps with a (X) and the ridges with a (———) in the direction in which they run. Knock down the big lumps or ridges and oftentimes the little ones will disappear during the process. Practice alone makes perfect in either leveling or tensioning a saw, and this alone can make one familiar with the force or number of blows requisite to reduce any fast spot. There are numerous forms of bends and twists, the direction and extent of which will be found in testing to be exceedingly various. These will show as high and low sections on application of the straight edge, and may show numerously quite close together, and even right up to the base of the teeth. When on the rim they will cause the saw to rattle and heat in the guide. These places must be tested by the application of the straight edge in every direction. At one position the saw will show up full or stand up to the straight edge, while in a transverse position it will show hollowing (Fig. K). Always attempt to keep the center and rim true. In opening a twisted saw always hammer nearer the center and rim than on a straight saw. Sometimes the expansion of a twisted saw right down to the eye, will stiffen it and improve its condition materially. Sometimes the saw may show a good condition of tension and will be lumpy or full of small twists on the rim, giving it a sort of corrugated appearance. In such case the saw must have very careful treatment on the rim to bring it practically straight and true.

After a saw is level and free or open all around, tension to suit the speed, striking about equally hard blows on both sides. These blows should be struck on diametrical lines and on circles from two to three inches apart through the middle portions of the blade. (Fig. F.) The closeness to rim or center at which the greatest amount of force is expended must depend upon the conditions affecting the operation of each saw.

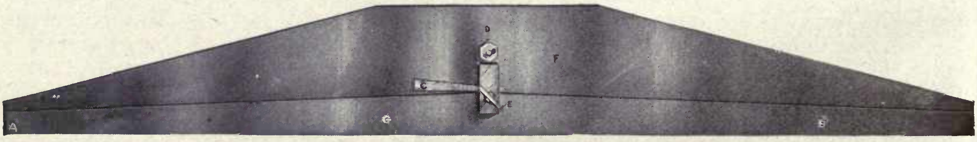
It is very important that you properly distribute the blows for if you hammer too much at one spot a loose spot or lump may result that will be difficult to take out, or if unnoticed will burn a blue spot on the saw in the cut.

If a saw standing on the floor is shaken and the center and rim both vibrate, it needs a little more hammering on lines nearest the rim. A skilled hammerer will stand the saw on floor, taking hold of the top edge, and by giving the saw a sudden shake, if the center vibrates and the edges stand stiff, he knows it to be open toward the center. He will also tip the saw over and see if it falls away from the straight edge sufficiently.

When you get the saw fairly flat or level, if the tension appears to be in properly, put saw on the mandrel and if fitted for the speed, it will then run stiff and rigid and stand up to its work. Observe the motion of saw when running up to high speed on the mandrel. If it runs wavy or shaky, and heats on the rim while at work, it is put up for low speed, and the body of the saw needs opening a little. If it leads in or out of the log, heats or appears weak in the center, it is put up for too high speed, and should be stiffened by a little hammering on the rim. If a saw runs steady out of the log, it is the fault of the hanging, lining, fitting or management, if it does not run steady in the log.

In cases where it is necessary to go over the saw more than once for tension, it is best to avoid placing the new series of blows on the same circles already hammered, but rather on lines between those already operated upon.

ADJUSTABLE STRAIGHT EDGE AND TENSION GAUGE



Suitable for Leveling or Adjusting of Tension for Any Speed

STANDARD SIZE—24 inches long for saws 44 to 60-inch diameter.

SPECIAL SIZES—18, 20, 22, 27, 30 or 33 inches long, will be made to order.

To reach a high state of perfection in any of the mechanical arts requires painstaking effort and long continued practice in a particular direction, and saw hammering is no exception to this rule, but the greater part of the difficulty or uncertainty in this art is entirely eliminated by the use of an Adjustable Gauge. It will show as near a perfect opening as long practice and careful experimenting will demonstrate. The amount of such opening or tension depending upon speed and feed.

The object to be attained in the hammering of a circular saw is to tension or level it so that it will revolve in a perfect plane when in full motion. It also requires a reserve amount of tension to compensate for the resistance of the cut. This is not so apparent in saws put up for medium or slow speed with light power, as in high speeded saws in fast mills.

The Wiremire adjustable tension gauge in 24-inch standard length consists of two strips of 14-gauge polished tempered steel, one strip being 3 inches wide, the narrower strip, ¾ inch wide, ground to serve as a straight edge for leveling, or adjustable to a convex outline, variable at will of operator, by means of a steel wedge or key that can be driven in varying distances, thus springing the edge convex to serve as a correct measure or test for the tension of a circular saw at any speed. The two steel strips are riveted at "A" near one end and at "B" about 4 inches from opposite end. The adjusting key can be made fast in any position by means of a thumb screw. The ready adjustment of the gauge to varying convexities enables the saw hammerer to use the device with equal success, no matter what the diameter of the saw (within reasonable limits according to length of gauge) or what the speed at which it is run, whether 400 or 600 or 800 or 1,000 r. p. m., or otherwise.

Every one knows that a straight edge and eye test is not an accurate measure for tension of a circular saw no more than it is on a band saw and this circular tension gauge is of actually greater utility to a circular saw hammerer than a band saw tension gauge is to a band saw filer.

The most expert saw hammerers consider a tension gauge indispensable for either band or circular saw work.

One of these gauges will last a lifetime and will pay for itself over and over again,—the mill operator in having his saws tensioned uniformly and correctly, according to speed, to cut straight lines on a minimum kerf; the saw hammerer in the saving of time and labor and the satisfaction and wage scale likely to result to skilled men whose work makes their services more highly appreciated by employers.

CIRCULAR SAW HAMMERING AND USE OF ADJUSTABLE TENSION GAUGE

E. C. WIDEMIRE

In the following brief instructions in saw hammering I have not attempted to go into details as to the removal of the many defects found in circular saws, but to give some general ideas that will be helpful and a guide in using the gauge successfully.

For tensioning a saw use a round face hammer and do the same amount of hammering on both sides of the saw. By placing the blows as nearly opposite each other as possible, much leveling will be avoided.

In leveling or straightening a saw, use a cross face hammer and work only on the high places as they show up under the straight edge. These high places are usually in the form of ridges, and should be carefully traced and the long way of the face of the hammer should follow the direction of the ridge. Lumps may be leveled down with the round face hammer or with the cross face, striking lightly with each face of the hammer, thus crossing the blows. Do not strike heavy blows. It is better to go over the saw several times by working lightly than to attempt to do too much work at one operation and many times make the saw worse than before commencing. With these few observations we will now follow the process of hammering a circular saw.

We will suppose you have a 60-inch saw, 7-gauge straight and run 600 revolutions per minute, which is about the standard speed. The gumming necessary to maintain the shape of the teeth, and the expansion of the rim by motion, together with the resistance of the cut, have all worked together to permanently stretch the edge of the saw, causing it to lose its tension. Now, there is no known process by which this rim may be contracted, so the central portion of the saw must be stretched to compensate for this enlargement.

This saw has been running for some time, and is beginning to make some bad lumber. When started in the morning it will wave more or less at the rim and runs in and out when cutting; that is, makes "snaky" lines. After it becomes warm in the center, either by crowding the log or from heat transmitted from the arbor, it will do fairly well in small timber until it cools off again. This saw needs hammering, and to do it property will require much of the skill necessary to hammer a saw in its worst condition.

A saw seldom loses its tension evenly. If it did so the work of restoring it would be very much simplified. This uneven effect will result from a variety of causes. It may be from an uneven temper of the plate, but it more often results from a little unevenness of the tension of the saw when new. Another fruitful cause is the excessive amount of hammering certain portions of the plate get more than others in the process of manufacture. Whatever the cause, however, the unevenness can be remedied with the hammer.

Place this saw upon the anvil and, with the back edge resting upon a board extending from the anvil to the wall, raise the front part with the hip and left hand until the center of the saw is clear of the anvil. Proceed to examine the saw with the gauge used as a straight edge, by applying it between the center and the rim at exactly right angles with the supports. Any other angle will show a bend of the plate, instead of the condition of the tension.

Examine the saw all around carefully and note the difference of the parts of the saw as they appear under the straight edge. A certain part may drop away some from center of the edge. This shows a degree of tension and perhaps enough for that part of the saw when finished, for such places always show more tension when the balance of the saw is equalized to it. Another part may come up to the edge or show perfectly flat. This part of the saw is stiff and needs hammering for tension. Still another part may show full, that is, the rim may drop away from the straight edge. This part of the saw is in a condition that is termed "fast" and needs more hammering for tension than any other part. Examine the center also. This will show flat, or, perhaps, a little full, which indicates that this part of the saw is too stiff.

Now, proceed to lay off this saw for hammering. Describe a number of circles three inches apart, making the outside one four inches from the rim or roots of the teeth, and the inside one an inch or two from the collar line. By examining with the straight edge mark those parts which show fast or stiff by enclosing them with marks like a parenthesis, thus ( ), of longer or shorter length according to the fast or stiff parts. The fast places in such a saw will generally need hammering on all the circles described, while those which are stiff may not extend so far out towards the rim. Hammer both sides alike, spacing your blows about three inches apart on the circles between your other marks. The circles are intended as a guide to uniform work. After doing this much, erase all your marks and proceed to level by standing the saw upon the floor in a perpendicular position and examining both sides of the saw with a straight edge. Mark all high places as they appear under the edge. These will generally be in the form of ridges. Trace carefully with chalk and after going over the saw carefully place it upon the anvil and level these places down with the cross face hammer, the long way of the face following the direction of the ridge. Go over both sides of the saw three or four times until the saw shows flat in any way the straight edge may be applied. Always apply in the same relative position as to the rim. Not an inch or two in, one time, and out, the next, but exactly at the rim or the bottom of the mouth pieces of inserted tooth saws. As you test the rim, slide your gauge towards the center until it meets the collar line. This must conform to the gauge, too. Mark all the full places as before, and hammer alike on both sides, but work more lightly than at first. If the work has been properly done, your saw will now show quite an even tension and enough to cause the center to drop through either way when inclined a little from a perpendicular position. In this condition the straight edge will not be a good guide by which to level.

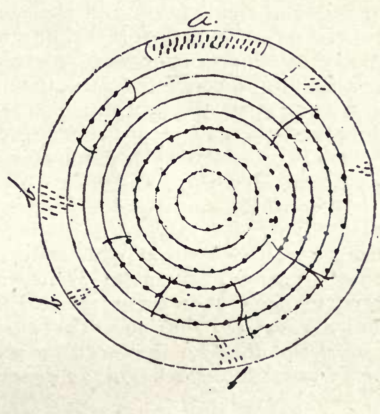
With the saw on the anvil again, use your gauge as before, for the purpose of both equalizing the tension and leveling. Mark the high places as they now appear under the gauge and hammer down lightly. Do the same on both sides of the saw, but do not do too much on either side without changing the saw over, but aim to keep the saw as nearly in balance as possible. Repeat this on both sides of the saw three or four times until it conforms exactly to the gauge.

I have said nothing so far in regard to the center of the saw, but my practice is to give a trifle more opening across the center than on the radius for a cold arbor. But for an ordinary arbor that runs hot a gauge or two less is right. The gauge can be used for this test by reversing it, as it is more convenient to look under the gauge to the left of the eye than to the right. In tensioning about the eye, do not go inside the collar, unless this part shows full under a short straight edge. The gauge in this position can be used to detect ridges that may have been overlooked by drawing it from the eye to circumference on the line of supports. Such ridges must be carefully removed, as they are twists and greatly affect the running of the saw. The operator will readily see the many advantages of the gauge in working out the uniform condition of the saw.

In finishing the saw be very careful to remove all lumps and ridges near the rim, but work lightly at this part. The more evenly and carefully this is done, the better the saw will run, for the rim is the part that guides the saw in the cut.

In regard to the amount of opening for different size saws at different speeds, it is not possible to give a rule that will answer all conditions, but in the examples given the amount is about right. For each additional 100 revolutions per minute, give one degree more on the scale. For a 56-inch saw with the same periphery speed you will not need to vary more than one degree from the standard for a 60-inch saw. For strong power the same amount will not be too much. Thinner saws require more opening than thick ones, and the stronger the power the more tension required. For hardwood a saw needs more opening than for soft wood.

Beginners in saw hammering would much rather see a practical illustration of the work than a supposed case, and I give here a figure showing the manner of laying off and work done. In my work I do not often describe circles, but did this for the purpose of illustrating. This was a 62-inch, six-gauge saw, and run 850 revolutions per minute. It was a new saw and made but one short run to satisfy parties concerned that it was not in proper condition. Under a short straight edge the tension did not show so very uneven, but it would not stand the gauge test. It was also too firm across the eye, as the work indicates. The first circle was six inches from the rim. As a rule, it is not necessary to go as near the rim of a new saw as in one that has been running for quite a while and has lost its tension.



(A) denotes a loose place under the rim and the manner of removing it. This loose place was about seven or eight inches from the rim. (bb) were ridges and show the manner of removing them. Quite a number of these were prominent in this saw and indicate the saw was not properly smithed in the manufacture. It hammered the guides badly when first tried, but ran quiet and steady when I finished hammering it.

This saw was tensioned at the shop so that when leaned about three feet from a perpendicular line the center would drop through. When I finished hammering it, it would bear more than its weight. It showed about seven degrees of the gauge on the radius and eight across the eye and it stood right up to its work.

With the above as a guide the operator can readily adjust the gauge to suit the particular saw at hand.

I do not recommend the use of a pad on the anvil except in leveling a saw that has been bent over the collar by crowding the log. In this case, use a pad and hammer the saw through from the log side and level back lightly. This will restore the saw to near its original condition and not affect the tension much.

In all you do about a saw work carefully. Aim to make the saw run steady and true on the arbor, and if the hammering is properly done a gauge of clearance in the guides is all that is necessary.

You are now ready for the finer adjustment of the tension. Place the saw upon the anvil again and describe circles as before, only between the former ones, making the first 5½ inches from the rim. The key or wedge on gauge which serves to spring the narrow adjustable strip from a straight to a convex outline, is marked in eighths and sixteenths of an inch and for a saw as above described, the gauge should be adjusted by driving in the key until it shows about 5 full notches or degrees on the scale, and the key should then be made fast with the thumb screw, so it will not change position while being used. This will measure the amount of the opening necessary and the tension or drop of the saw should exactly conform to the gauge, when finally hammered. Now go over the saw carefully as in the first operation and mark full places. Apply the end of gauge which has rivet about 4 to 5 inches from end, toward rim of saw, the other end of gauge having rivet close to end, toward collar line, the key and bracket at opposite side of gauge from you as you work.

NOTE BY B., T. & B. (A 60-inch saw hammered with a 24-inch Widemire Gauge applied as above, will show the most opening about 14 inches from the rim or about midway from teeth to arbor hole, the saw having a flat rim, there being practically no tension for several inches inward from bottom of gullets. We are sometimes requested by a customer, in connection with his order, that we adjust the gauge before shipment in a manner most suitable for a saw at 650 or 750 or other speed as the individual case may be, on the theory that we must know the very best adjustment for tension in each case, regardless of the varying conditions, as regards the saws themselves, the speed, whether constant or variable, the condition of the saw itself as regards its swaging, sharpening and sidedressing, the temper and standing up qualities, the character of the woods being sawed, and the condition of the saw as regards leveling and uniform tensioning. We therefore decline to arbitrarily adjust the gauge for a given speed in advance of shipment because to attempt this would be in effect claiming that we possess an infallible knowledge as to the proper amount of tension for each individual saw, no matter what the working conditions may be. We do not possess this knowledge. Moreover, the gauges are themselves slightly variable in their make-up, although made as closely as practicable, duplicates of each other. We would therefore like to impress upon each user, the fact that his own judgment and common sense must govern in part if not in whole, and we consider it to be the best practice for each user to adjust the gauge, by driving in the key whatever number of notches or degrees may be needful, to afford a convexity that will fairly measure the amount of tension he has been accustomed to carry in the past. Then equalize the tension and run the saw. It will certainly do better work than when formerly hammered with straight edge and eye test, because of this equalized tension. The question of whether more or less tension may be desirable, can then be answered by practical operation, and by an increase or decrease in the amount of the tension, as experience or experiment may suggest.)

SELECTION OF SAWS

It is just as essential to have saws of good quality as it is to have a good mill, and in ordering saws, the kind of work to be done, the amount of power at hand to drive the saw, the skill of the saw filer and the character of the saw fitting equipment must all be taken into account.

THE GAUGE OF SAWS

For mills of ordinary capacity, doing general work, circular saws, 7-gauge straight, or 7-gauge at center and 8 on the rim, are recommended. In valuable timber and with skilled sawyer and filer, 8 x 9-gauge or even 8 x 10-gauge saws are used with success. The use of saws thinner than 8 x 10 gauge for log sawing may result in disappointment for more than ordinary skill is required to handle thin saws and the lumber saved by the reduced thickness of the saw and kerf is more than offset by the waste from bad cuts arising from inexpert sawing. The cheapest saw with respect to the gauge is one that will stand up to its work in all kinds of timber without any favoring. More teeth are necessary in a thin saw than in a thick one.

The greater the speed and feed used, the heavier must be the gauge of the saw to stand up to the work expected from it, and consequently in most of the large and fast mills, where the saving of time and the quantity of the daily output is more important than the saving of saw dust, saws of 6 or 7 gauge are principally used.

THE NUMBER OF TEETH

A high-speed, fast, steam feed saw requires the greatest number of teeth that can be conveniently included, for the saw having a maximum quantity of work to do, requires more teeth with which to do it, in order that the strain may be evenly distributed. The number of the teeth will therefore depend not only on the thickness of the saw, but also on the kind of timber sawed and the speed and feed of the mill. Twelve teeth to the inch of feed in hardwood and 10 teeth to the inch of feed in softwood is considered good in general practice, although fast mills may crowd a saw down to 6 or 8 teeth to the inch of feed. Thus a 60-inch saw 6 or 7-gauge should have from 80 to 90 teeth for fast work, but if the power is limited a reduction in the number of teeth will better adapt the saw to the power at hand for use.

The more teeth in a saw the smoother it will cut and the less set it will run with. Also the more hook the better and the smoother the lumber will be. The greater the feed the greater the hook required.

In addition to the regular specifications necessary to give in ordering saws the purchaser should always give full details regarding the number of revolutions per minute, greatest feed at each revolution of the saw, kind of lumber to be sawed, and all details that will assist the sawmaker to adapt the saw to individual conditions of use.

THE SPEED OF CIRCULAR SAWS

The experience of many of the best sawyers and filers in the country recommends a speed from 9 to 10 thousand feet per minute as a medium rim speed for circular saws, and the following table of revolutions per minute for the various sizes of saws is based on a 10,000 feet rim speed.

Inches Diameter	Revolutions Per Minute	Inches Diameter	Revolutions Per Minute
8	4,600	40	980
10	3,920	44	890
12	3,260	48	815
16	2,450	52	750
20	1,960	56	700
24	1,630	60	640
28	1,400	64	600
32	1,225	68	560
36	1,080	72	530

The above speeds may be found too fast for an old or rickety mill, and in such case should be lessened accordingly. Keep the belts neatly laced and straight and look to everything that will prevent or lessen vibration. If power is lacking reduce the feed that the motion may be kept more nearly uniform. But in such case it is better and cheaper to increase the power for there is no profit in a mill handicapped by lack of power.

Attention to proper speeding and maintenance is one of the most important elements contributing to successful saw operation. If the speed of the saw is too high it cannot be made to do good work, and is besides very liable to damage or accident. Too high speed will generate heat in the saw, make it limber, and it will only run and do good work on light feed, while the teeth are in perfect order, with keen, sharp corners, etc. As soon as such conditions are departed from, the saw will snake or dodge upon contact with the least obstacle. Then too, a speed not uniform or too slow, a slowing down in the cut, from lack of power or overfeeding, is likewise objectionable and is attended with ill effects upon the saw and the lumber, although a saw may be hammered to withstand a low or variable speed to some extent.

Saws used on light portable mills are commonly speeded about 450 revolutions per minute, and those run on high-speed, fast, steam-feed mills, from 600 to 900 revolutions per minute.

THE PROPER FITTING OF THE TEETH

The most perfect saw is one that will cut the easiest, the smoothest and the most in a given time, with the least expenditure of power. When the teeth are presented to the timber with just the right hook and pitch on the back, they will cut the kerf out in shavings and not scrape it into fine dust. But this does not mean that all of the dust will be cut into long shavings, for all timber is not sufficiently tough to hold together.

A light set, teeth short as possible, with plenty of dust room, all the hook they will stand, and there will be no trouble even in the hardest frozen maple.

In the care of saw teeth, proper attention must be given to hook, swaging, side-dressing, shape of the gullet and sharpening, and these details are exclusively within the province of the saw filer.

Fast feed saws usually have the hook line about half way between center and rim. Saws subjected to light feed will stand more hook and a slimmer tooth. Soft woods require more hook than hardwoods.

Use as much hook as possible up to the point where the strength of the tooth is not impaired, for plenty of hook facilitates cutting and is easier on the power. A saw with too little hook acts on a tearing or scraping fashion rather than a cut, and greatly taxes the power. But the hook affects the strength of the tooth. Too much hook, while easing the labor of cutting, reduces the strength of the tooth, making it liable to break out or dodge and lead out of line; too little hook unduly adds to the burden of sawing. The greater the feed the larger should be the gullet and the lower the back of the tooth to give easy clearance and room for the dust. But you must avoid teeth too thin on the point or they will crumble on edge and lose corners. Teeth to run in frozen timber must have the back raised up or strengthened more than is required for summer sawing. But never allow the backs to get higher than the point or the hook to become too extreme.

A saw properly balanced from the standpoint of fitting must be perfectly round, must have teeth of equal size and shape and round gullets of equal depth, and must be swaged and sidedressed uniformly, or one portion of the saw will be heavier than another, causing it to leap and tremble, and make bad cuts. There is no excuse for running a dull saw, one dull not only on the extreme point, but also on the cutting edges of the tooth under the point. The points of the saw teeth are the only parts of the saw that should properly come in contact with the lumber, and require the most careful swaging and sidedressing.

GENERAL OBSERVATIONS ON CIRCULAR SAWS

If a saw is properly adjusted and everything about the machine right, it should run cool or nearly so.

If the saw heats at the center, it is usually either the fault of the mandrel heating or the collars not being properly turned, or the carriage being out of line, or the saw being run with too little set.

If the saw heats at the rim it may arise from leading too much into the log, causing it to bear too hard against the outside guide, or the backs of the teeth may be too high, or the saw may be trying to cut more than it will chamber.

If a saw is run at a higher rate of speed than that for which it is adjusted, it will be too large on the rim and will run in and out or "snaky." On the contrary, if the speed for which it is adjusted is not kept up, it will be too large in the center and is disposed to dish or run out of the log.

If a saw inclines to run out of the log, give it a little lead, and if tight on the rim increase the motion to expand the rim.

If it inclines into the log, lead out by filing the points of the teeth or adjusting the mandrel.

If it runs in and out, lead into the log, file the points of the teeth to lead out, and if necessary reduce the set of the teeth. This will cause the saw to warm a little and expand.

If it heats at the center while the mandrel runs cool, line into the log a trifle and increase the set. If it heats at the rim and not at the center, line out of the log a trifle.

As the saw enlarges on the rim by wear, lead out a trifle to expand the center and equalize the tension of the rim.

The track must be solid, level and straight.

The carriage trucks must be free from end play, and the set works accurate and positive.

The saw arbor must be abundantly heavy, level, with very little end play, and the saw must hang plumb.

The saw must have an easy, close fit on the mandrel and lug pins have a good fair bearing.

The tight collar should be slightly concaved; the loose collar flat.

The saw should stand straight on the log side, when the collars are screwed up and the saw running at the required speed.

The saw must be in line with carriage and lead a trifle into the log.

The saw must be in perfect round or balance.

The gullets must be properly shaped and sufficiently large to chamber the dust.

The backs of teeth must not be higher than the points.

The teeth must be filed or sharpened perfectly square on face and back.

The swaging must be sufficient for perfect clearance, and should be evenly balanced

The guides must be perfectly adjusted when the saw is standing still or lightly running.

The saw must have sufficient teeth for the amount of feed.

The saw must be properly thick for the character of the work.

The teeth must have proper pitch for fast, free cutting.

The mandrel and carriage must each be free from spring.

The mandrel must not be allowed to heat in the bearings.

The saw must be kept sharp, and not run when dull.

The teeth must be sidedressed to make the extreme point and face of the tooth the widest with a proper taper or clearance down and back from point.

The spread of the swaging must be sufficient to properly clear the blade of the saw to prevent friction.

The speed ought to be uniform both in and out of the cut.

Do not lead the saw with the guide pins, but by slueing the mandrel or proper filing.

Reduce the set or spread of the swaging if you wish the saw to run warmer at center.

Increase the set or spread of the swaging if the saw runs too warm at center.

Increase the gullet or lower the back if the saw heats on the rim.

Increase the motion if the saw is too tight on the rim. Keep it cool in the center.

Don't set the guide pins too close or the saw will heat at the rim and run snaky. Keep the saw free from gum by proper swaging and the use of water, or the rim will heat from undue friction.

Keep your swage and saw sharpener constantly in good order. Fair, evenly balanced swaging, taper side dressing and perfect sharpening, are essentials to a fine cutting saw.

Keep all gum and saw dust off the tracks.

Don't use over $\frac{3}{32}$ set equally divided on the saw.

Do not attempt to straighten a saw until it shows about the right amount of tension for your work.

In testing a dished saw lean it over until it shows as nearly straight as possible, and then test with straight edge. Otherwise you will not be able to locate the lumps.

Heavy blows must be carefully avoided, and blows unduly hard near the eye have a greater tendency to dish the saw than if placed near the rim.

You may get your saw too open for your speed, in which case you have only to reduce the amount of the expansion by blows around the rim, as previously described.

The use of the sharpener, and the constant strain on the saw near the rim will presently enlarge it here and so render necessary the expansion of the central portions until it is necessary in hammering to go right down to the eye.

A saw with the tension too near to the eye is not likely to slab well. A saw when put up for its speed will cut well in any kind of timber and without special adjustments of the guide for various woods.

A saw used for work in frozen timber needs more tension than for summer work.

With many small mills it is a common fault that the power is insufficient for the load and the speed of the saw is therefore far from uniform. The motion is up when the saw enters the log and is down when it leaves the log. The next cut starts before the saw has recovered its normal motion. If then the saw runs out, you get a thin board, or if it runs in, a thick one. If saw heats on rim but does not snake you have too much lead; if it warms on the eye there is not enough lead. Saws that are laid over or dished out will warm on the eye; if dished in, will warm on the rim. If motion is steady in any cut, and the saw snakes, the saw is not open enough. When saw is too open you get thick and thin boards.

Saws should run at high speed to accomplish the best results. Short, slim teeth can be run on lighter cuts. High-speed saws will stand heavier feed in proportion to the length of the teeth than low speed. Long teeth will not hold corners well.

The use of water on circular saws is helpful in keeping the saw cool and free from gumming. The piping may be so arranged that if the water is required at any particular part of saw it may be there applied. Water is also used successfully running into the journals of the saw shaft. A small rather than a large stream will do the work, and a tiny jet is often all that is needed.

POINTERS ON CIRCULAR SAWS

A stiff circular saw will not do for high motion, because it has no steel to permit of the necessary expansion. Conversely, a circular saw must be limber for high motion, although the degree and location of the tension must vary according to the feed and speed. A saw need not be as limber for hard as for soft wood, because the latter cuts more easily and freely, and the saw, therefore, requires more expansion on the rim.

A saw operated exclusively in hardwood should be limber, but straight, whereas for softwood, it should be dished to an extent that it has abundant tension or steel in the center, that is, between center and the rim.

A circular saw may "run in" on one board and "run out" on another, due to the lack of proper opening in the center. If the rim is too long the central portions of the blade will have no control over it, and hence, the cutting edge of the saw is liable to dodge or "run" in or out.

A saw that shows a tendency to "snake" in or out of a log is too tight and should be opened to suit the speed and feed.

It sometimes happens that saw dust will stick to the sides of the saw or to the sides of the wood, the result of too much set, or because the edge or point of the teeth are not properly sharp or the saw tends to run in or out, or the throat or gullet outline is too small or on account of the timber being frozen.

After a saw has been running for some period of time without re-hammering, the steel toward the rim tends to expand, leaving the central portion of the blade too tight. This expansion may be due to crowding against the guide pins, or to undue heating of the gullet outline during the resharpening process.

If a circular saw shows a tendency to tremble when coming out of the cut, this may be caused by the guide pins holding the saw in one direction when the pull is in the opposite direction, or it may be caused by the saw being in a wind or twist, or out of balance. Sometimes there are lumps on the rim or near the eye which tend to throw the saw out of true, and so also if the collar is not true or if the mandrel is sprung.

The purpose of the guide pins is to steady the saw and keep it from dodging in rot, shake, or knots.

If a circular saw has teeth with throat outline too small to accommodate the heavy feed employed, in such case the saw will have a harsh vibrating sound when leaving the cut and such action unduly increases the strain at or near the rim.

If a saw shows a tendency to run in on a log or out at the same place during each cut, this may be due to the track, being out of line or to the foundation of the track at the particular spot not being perfectly rigid or unyielding. It is also sometimes due to faulty condition of the offset.

Where a saw shows "too open" it leans in or out, and if it leans toward the log, it will throw saw dust, make the last board too thin and cause a heating and consequent expansion of the rim. On the other hand if it leans from the log, it will make the last board too thick, is apt to heat the central portion of the saw and at the same time will appreciably increase the load on the engine.

In the case where a saw leans over while running because of being too open around the eye, it is a good plan to tighten up the guide pins slightly and increase the feed.

A circular saw that is tight or fast should be opened at or near the eye or between the eye and the rim. Conversely, a saw that is too open between the eye and rim should be expanded at or near the rim, although knocking down or leveling of lumps near the rim will sometimes satisfactorily overcome the trouble.

For leveling, some filers make use of a pad made out of leather belting, which can be readily placed over the anvil for leveling and removed for tensioning purposes. There are also some who favor the use of a hardwood block properly surfaced, for leveling, just as formerly many band filers employed a hardwood block which at this time has been almost universally superceded by an iron leveling block. A circular saw can be leveled on a padded anvil or hardwood or iron leveling block without affecting the tension.

Heating of a circular saw in the central portion may be due to a number of causes, for example, a weak track such that when the log passes over this weak portion the track will sag, causing a tendency to crowd the saw in the center and causing heating of both mandrel and saw.

Heating may also be caused by the track not being perfectly straight so that the log in its travel moves laterally, due to the imperfection in the track and the forced carriage movement. The saw may also become heated from the mandrel if the latter becomes warm, or from lack of sufficient set or swaging, or from the saw being lined out of the log, or dished from the log. It may also be caused by improper lead, the result of sharpening or filing out of square, or because the saw is too open in the center.

Special attention should be paid to avoid or remove lumps around the eye, because a lump at such spot will tend to throw or distort the saw to a greater extent than if located outward towards the rim portions.

The loose collar for a circular saw should be concaved about 1/64-inch; indeed some successful filers favor concave for both loose and tight collars.

Buckling or kinking at the rim is most commonly caused by guide pins or slivers or shaky spots in the log.

The majority of filers guide a circular saw to lead into the log, because the wear on the log side is more severe than on the board side. Corners tend to wear off more quickly on the log side and there are more chances for crowding the saw out of the log.

The lighter the gauge or thinner the saw, the more frequently must it be hammered, changed, swaged and sharpened, and the work of keeping up a thin saw is, therefore, relatively greater than in keeping up a thick saw of the same diameter operated under similar conditions. Thin saws are commonly given a greater number of teeth and as such a saw wears down on the diameter, there will come a time when the spacing and gullet outline may become too small, assuming that the saw when new had a proper number of teeth with suitable gullet outline.

The face of the saw anvil for a man of average height should be about 33 inches above the floor line for convenient hammering.

A circular saw under usual conditions should have one-third hook unless the timber is frozen, in which case a less amount of hook will be preferable.

After a saw has been running for some time and is taken off the arbor, lumps or high spots will show up bright under a proper light on the saw. Saws fitted with spring set require a greater number of teeth than if fitted with swage set.

If a circular saw is thrown over the collar, this generally occurs on a circle just about the collar line and the saw should be straightened on a padded anvil and then again opened as may be desirable.

In hammering, about the only difference between thick and thin saws is that thin saws should be run faster and consequently with a greater amount of tension.

A saw that has been tensioned for high speed is usually dishing when not up to proper speed, and this tends to cause heating and expansion, forming a wedge between the saw and head blocks that may evidently result in cracking. Slabs and splinters between log and saw may also produce the same trouble.

If the saw arbor does not run cool, the saw should be hammered a little stiffer towards the center. In hammering a circular saw start on the board side first and finish on the log side.

A saw running three hundred revolutions per minute will be affected by heat about twice as much as if running six hundred revolutions.

A circular mill saw should be swaged every second or third run. A circular saw that is not regularly sharpened on an automatic machine may be rounded by holding a piece of emery wheel or brick square across the points of teeth when saw is in motion.

A saw should slip on the mandrel easily, not too tight nor too loose. If saw is forced on the mandrel it will be made full on the log side.

If you find a small burr on the arbor, file it off.

The collars for log circular saws on up-to-date mills are usually 8 to 10 inches diameter. Regularly the pins should be in the loose collar, the holes in the fast collar. When putting pins in loose collar, the hole should be drilled clear through the collar so that if the pins break off, they can readily be driven out for replacement. For an 8-inch collar use a 7/8-inch pin on a 5-inch circle.

For ordinary log sawing in the average mill, saws of 6, 7, 8 and 9-gauge are employed, while in a few cases saws up to 10 or 11-gauge and to 60 inches diameter have been employed, but such thin saws are not practicable excepting with the most expert fitting. For 11-gauge saws, $\frac{3}{32}$-inch set equally divided is the least that can be run. Indeed, thin saws need almost as much clearance as thick ones. In proportion to the thickness a thin saw is subjected to greater strains than a thick saw.

The difference between an 8 and a 10-gauge saw is $\frac{1}{32}$ of an inch.

For portable mills with saws speeded 400 r. p. m., a 40-inch saw should have from 30 to 40 teeth and a 54-inch saw as high as 60 teeth.

It is not a good plan to remove a circular saw from the mandrel while running hot, because if allowed to run until it cools it will come back to its original shape with greater facility.

If a circular saw is not open enough in the center, it may be held out of the log a trifle or by heating the center in any way that is convenient or by reducing the set, you may be able to get along without immediate hammering.

The standard number of teeth on a 60-inch circular saw ranges from 80 to 90 for heavy feed in hard or soft wood, although some saws are being run with as many as 100 hundred teeth. But in mills where the power is limited, fewer teeth must be employed, unless in a case where spring set is used, in which case a larger number of teeth will be necessary.

For portable mills saws of 6 to 8-gauge are in general use, although the thinner the saw with same number of teeth, the less power it will take, and so there is a real advantage in operating thin saws if the man in charge possesses adequate skill.

The tire on a circular saw is much like the tire on a wagon. It steadies the inner portion of the saw in much the same manner as does tire on a band saw.

Orders for saws to manufacturers ought to give the most explicit information possible with reference to speed and condition of the power, so that they can hammer or open the saw intelligently with regard to the local working conditions.

The amount of set or swaging should range from 5 to 6 gauges for the best results.

Among causes for heating on rim are the following:

Back of teeth too high for clearance; guide pins too tight; gullets too small for the dust; not enough set or swaging; accumulation of gum on the teeth; saw not open enough in the body for the speed; saw tending to run out while the guide pins tend to hold saw in.

Do not throw water on a saw when hot as it may cause the saw to become hard in spots or may in some instances even cause cracking.

A saw of low or mild temper will expand more from centrifugal force than from the strain of feed, and should have relatively greater tension than would be needful in a hard tempered saw. Hammer clear into the eye of the saw and clear to the rim if the saw requires it.

A saw run with spring set may be left stiffer than if swaged. A small circular saw requires comparatively little tension, but should be kept stiff and flat.

Too much tension for the speed or slabs getting between the saw and the log, or logs rolling over on the saw, may cause cracking over the collar.

No circular saw can be made to run satisfactorily without rehammering whenever necessary.

A circular saw should not be removed from the arbor when hot, especially when hot in the eye. If you do remove under such conditions, stand it perpendicularly. It is liable to dish if leaned over. The best way is to let the saw run until it cools off before removal from arbor.

You can tell if a collar is defective by placing the saw on mandrel, tightening up the nut so that the collar will just touch saw. Then with straight edge, test the saw to see if it hangs properly, then tighten the nut on collar until the saw is ready to run. Then again test with straight edge and if the position of the saw has been altered, the trouble must be located in the collar.

You can tell whether a circular saw is too open towards the center by holding the top edge with saw standing perpendicular, giving it a sudden jerk and if the center vibrates while the rim stands still, it is proof that the opening near center is too great.

A saw will not slab well with tension too near the eye. A saw for frozen timber needs more tension than for summer sawing. Straight gauge saws are preferable to taper ground saws for log sawing.

A right hand straight gauge saw can be changed to a left hand with a few blows of the hammer struck on the left hand side of the saw. Fit the saw so that it will lean toward the log. Similarly a left hand saw may be hammered to work right hand.

Some filers hang a circular saw, packing with rings of paper, but a few blows with hammer properly located will throw the saw the right way and make paper unnecessary. The use of paper is apt to produce an extra strain on the saw.

A circular cross-cut saw that "howls" can usually be remedied by taking the bevel on front of teeth out of the saw, and filing the face square across. Many filers have for years employed a hammer set on their cut-off saws, cutting out the laborious hand setting process, filing the teeth square across on face, with the result that their saws ran quietly, smoothly and easily. It is obvious that if the teeth are filed square across, each tooth will act as its own raker. But if beveled in front the teeth draw sidewise, first one way and then the other, causing vibration with its attendant ear-splitting noise. As soon as the teeth become a little dull the center of teeth rides the kerf and the teeth burn their way through the wood instead of cutting. The spring set bends the teeth sideways, ready to gouge into the timber at the least vibration. After continuous hand setting, the points are no wider than face of tooth some distance below the point, thus causing a shoulder bind. This remark applies less to hardwood than to softwood sawing. Almost any shape of tooth, if sharp, will work in softwood until it strikes a knot, then it will chatter the same as in hardwood, if the knot be hard and large enough.

Don't run too thin saws. The lighter the gauge, the less metal is there for strength and to withstand strain.

Don't run with too much swage. There should be just enough swage to give the saw clearance.

There are a number of causes for a circular saw heating on the rim. Among these may be mentioned too much or too little tension for the speed of the saw; teeth filed out of square so as to give the saw lead in the wrong direction; too high on back or with too little clearance; saw out of level or dished. When trouble occurs it is a good plan to try to locate the difficulty by a process of elimination, that is, consider each of the conditions that, applied to the particular saw, might cause such a trouble and as rapidly as you determine that the contributing cause must be something else, eliminate such item from further consideration.

Small factory cross-cut saws will sometimes fail to stand up and cut smooth for any period of time due to the use of too much bevel on face and back of tooth. Teeth with extreme bevel are apt to spring outward when striking knots and in such cases it will often result in an improvement if the face of teeth are filed square across.

Spring set for small circulars is easier to put in but will not afford the results obtainable from full swage. One filer of an experimental turn of mind, converted an old log band swage and swage shaper into tools suitable for circulars, obtaining splendid results in fast and smooth sawing. A spring set circular saw is more apt to throw stock than a swage set.

Cracking of small circular saws is mainly due to manner of filing at base of gullet, that is to angular filing which does not divide up the strain, or to bevel filing on face of teeth or to the peculiar shape or size of the gullets, length and slimness of the teeth, which all occasion excessive strains.

Splitting of teeth is commonly due to thickness or bluntness at point, case hardening or to excessive swaging, all of which subject the steel to exceptional strains.

A circular saw must fit its arbor to get the best results. A saw may be sharpened perfectly round and true with automatic sharpener, but if it is loose on the arbor, it will hang to one side so that only part of the teeth will cut. If the arbor is worn smaller next to the collar, dress with a file while running slowly till all is same size. Then bush the saw with a bushing tool or if the looseness is too great, make the eye larger and put in a bushing.

The bevel on cross-cut saws should be evenly balanced. Pulp saws require a maximum amount of bevel.

Edger saws ought to be run in sets of even diameter.

It is not a fact that a cut-off saw must have the teeth fleamed on both sides in order to cut well.

CAUSE FOR HEATING ON THE RIM

Saw not open enough in the body for the speed.

Accumulation of gum or pitch on the teeth.

Teeth without sufficient swaging or set.

Backs of the teeth too high for clearance.

Gullets too small to chamber the dust.

Guide pins set too close to the saw.

CAUSES OF HEATING AT THE CENTER

Saw too open in the body or center for the speed.

Teeth without sufficient swaging or set.

Mandrel running hot.

Saw lined too much into or out of the log.

Saw lined too much out of log.

Speed insufficient to expand the rim.

The remedies for above should suggest themselves.

Use large collars not less than 8-inch diameter for a 60-inch saw.

It is said that for every 1½ inch you add to the size of your collar you can take 1 gauge off the thickness of your saw. A 10-gauge 60-inch saw with 9-inch collars will do as good work and as much of it as an 8-gauge saw on a 6-inch collar. The collar should have from ⅝ to ¾ inch bearing surface on the saw, the balance turned out clear; the collars should be of good tool steel, for loose collars made of cast iron are not stiff enough, as the center is liable to be squeezed in by the nut and the saw is not properly clamped.

The guides should be as near to the cut as possible and rigid, with as little opening as possible, although the sawyer must regulate the guides according to the condition of the saw. Cow's horn makes one of the best and most durable guide pins known. The guides should be within about 1 inch of the throats of the teeth.

Small, light mills having too many teeth in the saw for a full swaging, should run half swage and half set.

THE COMPARATIVE VALUE OF SECOND-HAND SAW FITTING MACHINERY

The practice of purchasing second-hand machinery of any kind is not a good one, unless it becomes evident that such machinery is up-to-date in construction and unimpaired by wear. While this proposition is generally true, it applies especially to saw fitting machinery. The saw is the life of the mill and upon its fitting must depend in large measure the product. It has become absolutely necessary for a company to avail itself of the latest and most approved saw fitting machinery the market affords. If a portion of the filing room outfit for a mill or factory is composed of second-hand machinery, it is not reasonable to suppose that the manufacturer can compete with those equipped with the latest and best machinery, and if the general machinery of the mill is also second-hand, his handicap is all the greater. Many a millman has assumed or been assured that one machine was just as good as another and that a reduction in the first cost was just so much money saved, only to find the use of such machine a constant source of annoyance and expense in maintenance, to say nothing of the loss in actual results, and has finally been compelled to replace it with the machine that should have been first purchased. An unwise economy in first cost often passes into a lavish prodigality by reason of subsequent cost. During the years just passed there have been many important changes and improvements in saw fitting machinery and the efficiency of machines for the several services has been largely increased in the direction of heavier and more positive, exact working, and readily adjusted machines. Machines that were a standard of excellence a few years ago are now outclassed, and it is economy to scrap them or replace them by exchange for up-to-date equipment. The new mill, equipped with modern machinery throughout, has many points of advantages over the older mills with which it competes. But the builder of a mill, whose complement of machinery is made up of machines worn out or displaced by older plants and whose output is necessarily below the average in quality although at a higher average cost, is at exceeding disadvantage. Some machines are discarded when brand new for the evident reason that their lack of quality and efficiency makes their use unduly expensive. Saw fitting machinery if fairly serviceable will be used as long as its use is satisfactory and profitable. Then it will be replaced by new machinery that is more satisfactory and profitable. The largest and most progressive firms make it a practice to replace any machine the moment its work becomes in the least degree questionable by reason of wear and lost motion. Their plant is therefore always new and the character of its output the best in quality and quantity.

As between cheap or good machinery new, or machinery second-hand or new. the new and the most expensive for saw requirements is almost invariably the most profitable. We receive numerous impossible requests from mill and factory operators for propositions contemplating that we furnish new and up-to-date machines of our manufacture with an allowance for whatever they may have in second-hand or unused machines, which by reason of poor design or workmanship, are in effect almost worthless even though but little used. Sometimes the owner of such machinery has had it in place for several years although unused and unwilling to replace it with something serviceable, because of the fixed investment. All this serves to demonstrate the fact that the time to use discrimination in filing room machinery is preferably before rather than after buying. However, there will always be millmen ready to buy filing room machinery second-hand or on the single ground of cheapness, who even on such cheap basis, rarely get as much in intrinsic value as they pay for.

THE FILER AND THE JOB

The Millman

In view of the fact that there are always millmen and factory operators who are in want of a good saw filer well qualified to care variously for bands, gangs, circulars or band resaws, we are led to suggest that we can sometimes furnish on request the names of saw filers for saw fitting.

It is not uncommon for a millman to want a filer on short notice, and while there are always filers to be had, he may not have the addresses of any or many such with whom to correspond and as a result a shutdown of the plant becomes inevitable.

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Then too there are always filers seeking employment to whom we can perhaps be of service by supplying names of vacancies when known to us, or names of mills building or refitting, correspondence with which frequently results in engagements.

It may be understood that we make no charge to anyone for information, assume no responsibility for it, as we assume that filers of ability can recommend themselves either by past records or by practical display of their ability, and we expect all communications pertaining to employment to be conducted directly between the interested parties.

THE DEVELOPMENT DURING TEN YEARS OF SAWING MACHINES, SAWS, AND SAW FITTING MACHINERY

Recent years show marked improvement in both machinery for saws having to do with lumber manufacturers or wood conversion, but the principal progress has been made along the line of band saw work. First, with respect to the width of band saws employed, there has been an experimental tendency to increase the width of log band saws up to 16, 18 or 20 inches wide, ranging as heavy as 13 or 12-gauge and with the length of the saws used increased up to 65 to 70 feet in some of the Pacific Coast mills, with the teeth spaced up to 2½ or 3 inches from point to point, with a depth of gullet 1 inch or over; in short a gullet outline and a saw adapted to produce the largest possible output on a minimum kerf and to approximate or surpass the best work of high-speed, fast-feed circular saws. The manufacture of such large band saw mills has called for the manufacture of much heavier filing room machinery with which to fit the saws and for the best effort and skill of the saw manufacturers throughout the United States, and there has been a disposition on the part of the more prominent manufacturers in all of these lines to meet the demand, however extreme it may have been. There is, however, little likelihood of any introduction of band saws wider than 14 inches x 14 gauge in any locality other than the Pacific Coast where timber of exceptional size is common.

In the manufacture of band resaw mills, to supplement log band saws in sawmills, there has been a change in the direction of wider saws on heavier machines than ever before. 10 to 12-inch band resaws are not uncommon and in woodworking plants the use of band resaws up to 8 or 10 inches wide is constantly on the increase. Band rip saws are likewise meeting with a considerable introduction, these machines carrying light-gauge saws ranging up to 4 or 5 inches wide. In short, the thrifty operator, by reason of the increased value of stumpage or sawed stock, is more alert to the making of less saw dust and more lumber than ever before, and well he may be.

Better band saws are being manufactured today than ever before, both as regards the quality of the steel, its temper and the perfection of its fitting before shipment to mill or factory. The rivalry between machinery and saw manufacturers has come to be a rivalry in quality and intrinsic value.

In filing room machinery there has been a marked improvement in the construction of many of the different machines, particularly in the matter of weight, increased strength and power and in the development of entirely new machines of greatly increased capacity to care for the exceptional large saws referred to above. The variety of machines or tools for particular uses has been increased in part by the invention of new tools for one purpose or another and in part by a tendency to group up full sets of machines suitable variously for band saws up to 4, 6, 8, 10, 12, 14, 16, 18 or 20 inches wide, so that the individual buyer can order an outfit in size and at a price fairly relative to the width of saws that he actually has in use and thus save on the outfit cost without loss in its efficiency. Filing room machinery has better construction, more attention paid to fit and finish of the working parts, to the quality and temper of the steel of all parts used on saw teeth, than ever before.

Then, taking into account the increased material and labor costs and the many years of service that filing room machines afford, it will readily appear that the buyer of such machinery gets better value at a lower cost than at any previous time. Thousands of band saw mills or band resaw mills are now used where hundreds were employed and the introduction of band sawing machinery is almost certain to continue at the same relative pace as these past years have set.

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The double cutting band saw can hardly be said to be distinctly more popular. Some concerns formerly operating double cut band have abandoned them for the single cut saws.

There are now plenty of skilled filers for either single or double cut saws throughout the United States and Canada and the competition between skilled men has brought about some tendency downward in the wage scale, although the large and most successful operators show little disposition to quibble over the wage scale of a filer if he has demonstrated satisfactorily his expertness.

The best types of Band Saw Sharpeners are now manufactured with marked features of improvement and in the larger sizes with special adjustment of arbor as a means to prevent the burning or case hardening of point of tooth should there be any variation or lack of evenness in the feeding of the saw past the emery wheel.

Saw stretchers with the rolls movable are generally in use on the wider band saws.

Band Saw Lap Grinders or Lap Cutters, Filing Clamps, Brazing Clamps, Shearing and Retoothing Machines, Brazing Forges, Patch Machines, Swages and Shapers and the miscellaneous small tools have not been radically modified excepting in the direction of such slight improvements as long use has demonstrated desirable.

Saw swages and swage shapers have had improvements in dies, leverage, and wearing qualities, and it is remarkable that these tools will undergo such severe usage and last so long.

These tools have a well defined popularity and will do fine work if properly adjusted and kept in repair. Each of them will fail absolutely if not well adjusted or not kept in good repair. Much of the breakage of dies, anvils or tooth stops is not due to defective steel or temper but rather to the faulty adjustment of the user, whereby he exerts an undue working strain on parts that are small at best, have very hard usage daily, in the swaging of hundreds of teeth on each saw, and the wonder is not that these parts break or wear out but that they last so long, working as they do on tempered saw plate that is not infrequently case hardened by emery wheel.

Don't find fault with such tools or the working parts thereof unless you are sure that they are hopelessly bad and that as a user, you are not the principal cause of the trouble.

Band wheel grinders are now quite generally recognized as one of the indispensable machines, not only for log bands but also for band resaws. Filers can save themselves much hard work, lessen the expense for new saws, and insure much better lumber by watching carefully the condition of the band mill wheels, and seeing to it that they are refaced from time to time as needful.

Filers should lose no opportunity to talk over their practice with brother craftsmen. "Reading maketh a full man, writing an exact man, and conference a ready man."

There has been a remarkable advance in woodworking plant practice, in the general understanding on the part of factory operators that a well equipped filing room for the care of narrow band saws, small circulars and machine knives, is highly important. Each sale of filing room tools, instead of lessening by so much the chance for business, paves the way for additional sales to others not equipped.

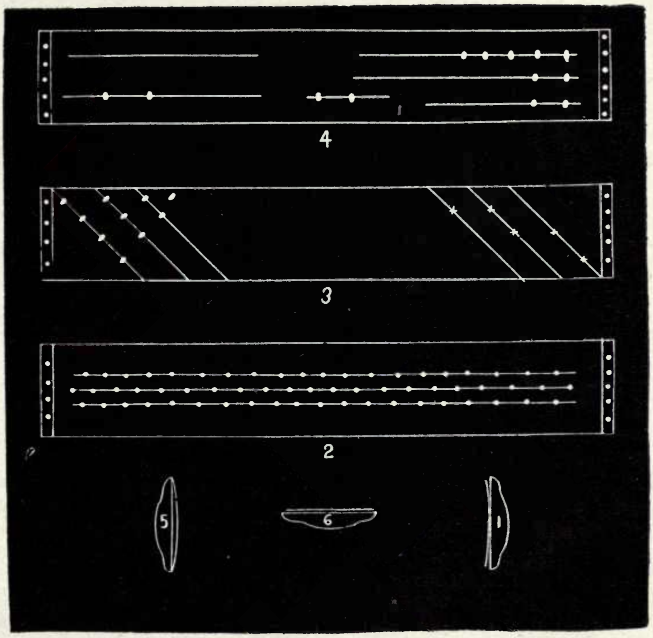
We wish to thank our many thousands of customers in all countries for the increasing volume of business tendered us from year to year, and for the many commendatory letters with which they favor us.

GANG SAWS

There is some number of types of gang mills in use in the United States and Canada, and the gang or frame saw is extensively used in Europe, especially in the Northern countries. Moreover, in the United States there has been some introduction of small gangs using shorter, narrower and lighter gauge saws than are used in regular lumber manufacture, these small gangs being used in particular by manufacturers of yellow pine flooring. Suitable gang saw filing room outfits will comprise an automatic sharpener, stretcher, filing clamp, swage, swage shaper or side file, hammers, anvil and straight edges.

In the operation of a gang mill, proper care must be had to the hang of the saws and there should be no lost motion that will cause pounding, excessive vibration, unusual wear of the machinery or breakdowns.

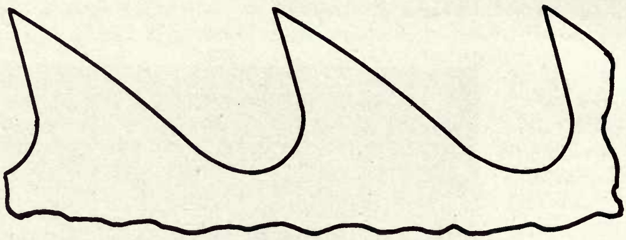
The teeth on gang saws must be shaped properly for length, hook and spacing. The spacing is commonly, 1, 1¼ or 1½ inch, and the depth of tooth should be as a rule one-half the spacing. The degree of the hook will rarely exceed 15 to 18 degrees from a perpendicular. The height of the back must be suitable to afford proper strength and the throat room must be sufficiently large to carry the saw dust without choking. It is essential that gang saws should be hammered or rolled for tension, in order to give them the proper amount of strain so that they will cut to a line.



Referring to the plate, Fig. 1 shows the short straight edge applied crosswise of saw, both edges of saw dropping away, one end of saw during this test, resting on bench, the other end supported by left hand, with the center of saw dropping from its own weight. The straight edge will show the saw when applied to the opposite side of saw. Fig. 2 shows the saw resting flat on anvil on bench, as laid out ready for hammering. The saw shows tight in center and open or long on both edges and a saw in this condition cannot be properly strained, because the edges being long, the strain comes principally in the center, leaving the edge loose so that the saw will snake from the dodging or buckling of the toothed edge. Such saw will not begin to carry the feed that a saw tensioned as shown in Fig. 5 will do, which has the edges short and the center long. As a means for the proper expansion of the gang saw, Fig. 2 shows three lines of hammer blows through the central portion. Hammer first along the center line, then on the other two lines and then reverse the saw, hammering the same on opposite side. If on test the saw does not show proper opening, hammer again but more lightly. It will be readily obvious that such expansion can be secured more quickly and far more evenly with a saw stretcher, which will neither mark nor crystallize the saw. The saw should drop away from the straight edge all that it can from its own weight, but when held straight up, and with straight edge applied, no light will show as in Fig. 6.

If the saw is opened too much through the center, this excess of opening must be counteracted by hammering along the edges.

Fig. 3 shows a twisted saw and the manner of applying the straight edge for ascertaining the length and direction of the twist. The long face of the hammer should cross the lines of the twist at right angles, substantially as illustrated; and the end showing crosses should be turned over and the hammer blows applied on opposite side, striking the saw on the full spots or rounding side. Gang saws may become bent or twisted from bark or slivers wedging in between the saws and some filers remove bends or twists in gang saws in much the same manner as from band saws, by use of wooden block and lever. Fig. 4 may represent a bent saw, the dots representing the full spots and these may be reduced by blows of the hammer. Gang saws must be perfectly straight, that is without lumps, bends or twists in them and the saws should be tested as often as possible with short straight edge. Do not gum a gang saw with a punch press or punch gummer. After the teeth have been punched in at the saw works, and the saw put in proper condition, the gullets should be maintained with an automatic emery wheel sharpener, invariably.



THE FITTING OF GANG SAWS

"I am filing for a No. 1 Wickes gang, in which we run forty-two 14-gauge saws, 8 inches wide and 48 inches long, cutting yellow pine. Stroke of gang is 20 inches. We carry ¾-inch feed to the stroke on 10-inch cants and gang runs 335 r. p. m. Teeth are spaced 1½-inch and are ⅞-inch long as per sketch. I swage to about 7-gauge and shape to 8-gauge strong. After swage shaping I go over the teeth on each side with a side gauge and line up the teeth, seeing that they are exactly centered or balanced, before grinding; this is very important, as saws will not give satisfaction if some teeth are out of line, or if the swage is wider on one side than it is on the other. I grind the teeth sharp and do not use the file, except on teeth that do not come up, or on crippled teeth that have a corner gone as sometimes happens. Another very important matter is keeping the gang saws straight. Each time the saws are changed I look them over, taking each saw up in my hands and glancing down it, first one edge, then the other, to see that there are no kinks in it. The lower ends of the saw are the most liable to bend, as knots and short slabs get wedged between saws and force them out of line, and often cause a permanent bend down near the lower end of saw. These bends or kinks should be hammered out each time, or the saws will not cut to a line. As to tension, I roll the tension in the saws with stretcher so that light will show under straight edge clear across the saw from edge to edge, dropping away from straight edge in center of saw $\frac{1}{32}$-inch full. When saws are in the gate they have about ½-inch overhang; that is we put gang on top center, exactly, then by putting a plumb on the saws, they hang ½-inch ahead at the top. But the amount of overhang can be varied to suit conditions. We run from 900 to 1,100 cants through the gang in ten hours, the cants ranging from 8 to 14 inches thick and from 12 to 20 feet long. We change saws twice a day and make good lumber.

Gang saws may be swaged with a Rhodes or Kinney top swage or with a Hanchett eccentric die face swage. They will do the best work if the teeth are sidedressed with a swage shaper because of the bevel or clearance afforded to the sides of the teeth. However, some filers still use the side file with good success."

An 8-inch gang saw should be hammered to a 36-foot tension gauge. A gang saw should ordinarily have about ¼-inch hook to an inch of width, varying somewhat according to the hang of the saw.

A twist in a gang saw may be removed in substantially the same way as from a band. Find which way the twist runs, going over it with a long-faced hammer. When you get to the end of the saw, pull it back and turn it over. Do not change position of hammer, but in striking blows be careful that you do not strike too much so as to produce an opposite twist. Note when saw lies flat on leveling block.

A gang saw may become concave on back either from grinding on the tooth edge or from extra strain on the tooth edge or from hammering more along the tooth edge. A gang saw should be kept as nearly straight on back as can be produced and maintained, although a slight concave or convex outline will do no harm, because the saw can be set a little ahead or a little back in the sash to overcome the concave or convex, if all of the saws are practically alike. Hammer a gang saw so that it will stand alone; that is so that the center of saw will not drop either way when standing perpendicularly on floor.

Gang saws wear thinner in the center because there the principal work and frictional contact come. If not strained properly the saw will have side motion, thus increasing the tendency to wear. If the set is too little, this will increase the wear. If a saw shows undue wear sideways, it may be subject to the fact that the sash is not dropping straight through the cut, or that the saws are not properly lined with each other.

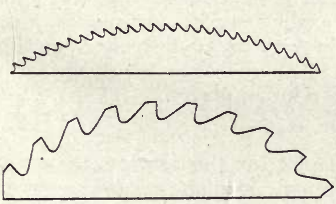
Some filers fitting saws that have worn unduly thin through the central portion, carry a small amount of set to supplement the swaging.

Six to seven gauges of set are commonly carried on gang saws operating in white pine, hemlock or yellow pine. A gang saw requires a little more set than a band, because the saw is continually in the cut and is normally subject to a greater tendency to heat.

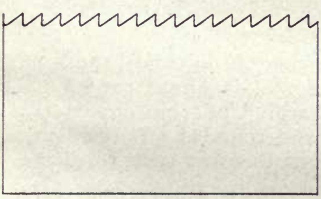
If a cant when passing through a gang mill, leads one way or the other, it indicates that the feed rollers are not in line with the sash or that the saws in sash are out of line with the feed rollers, or that the saws are ground and fitted out of square.

Gang saws should be kept of even width, but if there be any variation it is preferable to hang the wider saws at the outside, this depending upon the size of the logs.

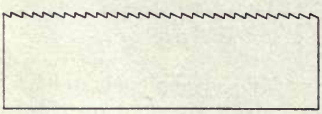
METAL SAW TOOTH OUTLINES



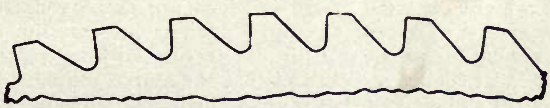
Slitting Saws



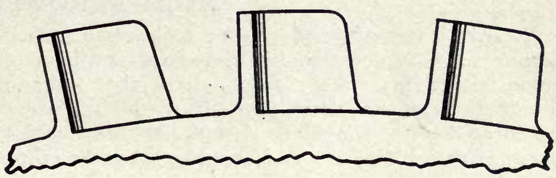
Metal Cutting Band Saws



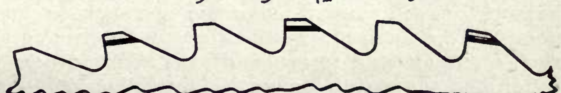
Hack Saw.



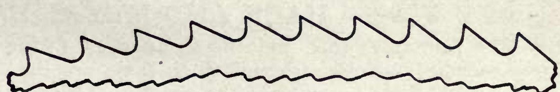
Tooth Style. Fig. 1



Tooth Style. Fig. 2 (Q. & C. Bryant)



Tooth Style. Fig. 3



Tooth Style. Fig. 4

We can supply efficient sharpening machines for practically all types of metal cutting saws, whether hack, band or circular, for all of which an automatic grinding wheel sharpener is alone suitable.

SUCCESSFUL SAWING

Success in metal sawing depends absolutely on the condition of the sawing machine and the temper and fitting of the saw teeth. Metal saws are without warranty and great loss results to many operators from breakage of the saws, which to a large extent may be overcome by the use of efficient sharpening equipment. A saw having teeth correctly and uniformly shaped will not readily break, because the working strains are so well divided that no tooth or part of the saw is subject to any undue strain or liable to expansion from undue friction in the cut with consequent heating and impairment of temper.

Circular metal saws should fit the mandrel perfectly and if the latter is sprung or if the saw is out of round, these defects should be immediately corrected. New saws ought not to be put to a full feed until after the first or second sharpening so as to be sure that the saw is in perfect round and all teeth uniformly shaped. Carelessness or non-attention to these matters will result in much useless loss from breakage or delay.

TOOTH OUTLINES

There is a considerable variety of tooth outlines employed on metal cutting saws. It is generally agreed that the harder the metal, the finer must be the teeth, but the spacing from point to point must also be governed by the thickness of the saw plate. Thus small diameter, thin gauge slitting saws have very fine teeth, with an increase in spacing and size as the saws increase in diameter and thickness. Saws that run at a high speed, cutting soft bars or structural iron, are usually fitted with teeth spaced from ⅝ to ⅞-inch, with large gullets to chamber the chips. In such cases it will be obvious that a small gullet would quickly fill up, before the saw had finished its cut, and if the saw wedges in the cut, breakage of one or more teeth or of the saw plate itself, is almost certain to occur, unless the blade is powerful enough to withstand the driving power of the machine and stop the operation.

The circular saw tooth outlines in most use are Higley, Bryant, Brown & Sharpe or Cochrane-Bly, and the common rip saw gullets employed on numerous sizes and types of wood or metal cutting saws.

There are numerous types of metal sawing machines on the market, on which saws of widely different tooth outlines are employed, and it will be readily apparent how necessary it is that the most specific information and exact templets or rubbings on paper be furnished to us in connection with an order or inquiry for a sharpener suitable for local requirements, and that the actual number of teeth on each saw be given in the case of sharpeners that must be provided with one or more index plates.

MOST IMPORTANT

Given saws of good temper with teeth correctly shaped for the service, the most important consideration for successful sawing is that the saw shall be properly sharpened with a fast free cutting wheel, that will not fill up or glaze over in a manner likely to heat the teeth and draw the temper. For dressing thin hard wheels to required bevels, the Metcalf and Universal Grinding Wheel Dressers are by far the most effective dressers and should always be employed.

The hook line on face of tooth and the landing or backing off on top of tooth, must be such as will impart maximum strength to the tooth and facilitate cutting. The points of the teeth must be uniform in length and kept sharp. Under no circumstances should one attempt to run dull saws with corners worn and rounded off. Under such conditions successful sawing is impossible and wedging of the saw with breakage of teeth is practically certain.

HACK AND METAL BAND SAWS

The principles that underlie the perfect fitting of ordinary band saws, apply similarly to metal bands, although such saws are usually tempered so hard that this fact, coupled with the narrow widths employed, limits the need for and use of saw fitting machinery.

However, we supply automatic emery wheel sharpeners for sharpening metal band saws and also for hack saw blades. But such saws cannot be set over and over again as can wood-cutting bands.

NO. 26 AUTOMATIC METAL CUTTING BAND OR HACK SAW SHARPENER

Adapted to grind satisfactorily narrow scroll or metal-cutting band saws from ¼ to 2½ inches wide, rapidly and with the greatest possible accuracy. The range in capacity as regards width and spacing, from 5 to 22 points per inch, or otherwise if specially required, enables us to meet the requirements in all industries.

This machine is indispensable for metal band saws, as the hardness or temper, renders filing by hand or with a power machine impossible. It is very expensive to discard such a saw, after the original setting and sharpening are worn out, although many have done this, replacing with new saws. The moment a saw becomes dull, it ceases to cut, heating and impairment of temper result, and the blade becomes a friction saw instead of a cutting saw. Resharpening is the only remedy and this becomes a very simple and inexpensive process, restoring the saw to its original efficiency in all respects, at practically no cost. If the saw is allowed to run until the teeth are nearly worn off the blade it is then not practical to resharpen, and about the only remedy is to discard the worn saw and buy a new one. But if the automatic sharpener is used to resharpen the teeth as soon as they become dulled and while part of the original set remains, the cutting capacity and life of the saw are greatly increased, and much added service can be secured from metal-cutting band saws if properly cared for in this way. Resharpening maintains uniformly the width spacing, length and shape of teeth, so that each tooth does its proportional part of the cutting, with no undue strains likely to cause breakage of teeth or the saw itself, and the action of the grinding wheel leaves a rounded outline at base of gullet, instead of a sharp V angle so that the strength of the saw is maintained to the utmost.

The greatest possible care has been taken in the construction of this machine to have all working parts conveniently located, for quick readjustment as needful. The feed mechanism has been designed to afford the most rapid action practicable according to the spacing from point to point. A feed cam on the back part of cam shaft works against a horizontal lever which rocks the shaft at the left of machine, thus moving the feed arm forward and backward. The stroke of the feed lever is adjusted by moving the horizontal lever in or out. This adjustment is simple and easily made, while machine is in operation, and insures smooth action at the highest speeds. The feed pawl is adjustable by a screw at top of the feed arm. Two fingers are provided so that correct feeding of the saw will result even if teeth have been broken out. These pawls are adjustable and may be used independently or together.

The grinding wheel spindle is driven by a belt from the main shaft of the machine running over a pair of idlers mounted on a frame so that the tension of the belt is kept uniform by means of an adjusting spring.

Two cams are employed, one to operate the feed arm and the other to operate the lift arm for the emery wheel head, and by varying the size and shape of these cams, the desired shape of tooth may be produced.

The feed pawl pushes the saw forward, bringing the face of tooth exactly in line with the right side of the grinding wheel, while the lift cam acting against the lift arm, raises the grinding wheel as the saw feeds forward, thus grinding the back of tooth, and then causing the grinding wheel to lower into the next gullet, each revolution of the cam serving for one tooth. The proper setting and timing of these cams and adjustment of the feed mechanism, will readily adapt the machine to varying requirements.

All important working parts are amply heavy, rigid, well lubricated and protected from emery dust, so as to insure long life to the machine.

The Metcalf and Universal Dressers are veritable wizards for turning down and shaping grinding wheels of all kinds within the range of sizes for which these dressers are designed. It is difficult for one who is not familiar with this type of dresser to understand wherein it is so superior, and even after practical use, one can hardly believe one's eyes.

The Metcalf is intended for wheels 14 inches or less in diameter, and the Universal for comparatively thin wheels up to ⅜ inch thick. For thin or delicate wheels the work of the Metcalf or Universal is immeasurably superior to that of an ordinary dresser or diamond.

The Universal is much smaller and lighter than the Metcalf, for use on lighter wheels, and does not require the added weight of the balls supplied with the Metcalf. The Metcalf consists of two heavy knobs at the ends of a short shaft, with an abrasive wheel 3½ inches in diameter by 1½ inches thick, of special grade and grit mounted on a sleeve between the knobs. The knobs are of iron to give weight and are held in the hands when the dresser is in use.

For bringing up a sharp corner on thin wheels used on fine tooth saws or for any other work, we find these dressers have no equal, as a diamond or an ordinary Huntington dresser is apt to break off the corner of the wheel, even when handled with extreme care, while the dresser will bring it up as sharp as a razor in a moment's time.

THREE WHEEL AUTOMATIC SHARPENER

Designed for fast cutting metal saws having alternate long and short teeth, with the long teeth beveled on both sides, as employed on the Cochrane-Bly Metal Sawing Machines. Also furnished for sharpening metal saws having all teeth of uniform shape, ground square on face and back.

The new style of metal cutting saw with alternate short and long teeth, ground square on front and with a double bevel grind on the top of alternate teeth, has created a large demand for a high class automatic sharpener, adapted to grind the teeth with absolute uniformity and accuracy. This sharpener was developed and perfected at the request and with the co-operation of a very large metal working plant, that uses thousands of these saws, where the test conditions surrounding operation are the hardest or most difficult to be found anywhere, and as a result the quality of construction, features that make for accuracy, convenience and speed of operation, and for general efficiency, have all been very carefully perfected.

The grinding of the saw teeth is absolutely uniform. The two styles of teeth thus accurately ground, insure smooth cutting, with minimum strain on the saws and with reduced heat and friction in the cut, making a more rapid feed and increased sawing capacity readily possible. The high and narrow tooth takes a chip from the center of the cut, while the full width tooth takes two chips, one from each side, causing the chips to drop freely from the slot with results far superior to those obtained from the operation of a saw inaccurately sharpened such that there are variations in the teeth, uneven strains, vibration, friction and heat, all in varying degrees. The action is entirely automatic, requiring little attention from the operator.

The sharpener has a very heavy, rigid and well fitted frame, free from vibration. The important working parts are within the heavy base column, protected from dust, with ample provision for taking up wear and for insuring absolute accuracy of action and long service without deterioration. An adjustable cam for shaping the teeth is employed with which it is easily possible to produce and maintain uniformly the exact style of tooth calculated to afford the best service.

The beveling wheels are adjustable to afford the desired bevel on the long teeth.

The emery wheel head which carries the grinding wheels is equipped with ball bearings to prevent wear and the machine throughout is given a very high standard of construction. All movements are automatic so that the saw teeth are fed around past the grinding wheels, gummed and sharpened and the long teeth properly beveled, all complete as the saw revolves. Three grinding wheels of standard shape and size are employed and the movements are so timed as to insure smoothness and accuracy of operation.

Uniform feed movement and spacing of the teeth are insured by the use of an index plate, with teeth accurately cut and of same number as are employed on the saw, so that broken out or injured teeth will not affect the uniformity of the feed or grind.

One index plate is furnished regularly and additional index plates will be supplied on order if needful, to accommodate saws having a different number of teeth, subject to additional charge according to the nature of the requirement.

NO. 71M METAL OR WOOD SAW SHARPENER

Adapted for the sharpening of circular saws of all types having teeth uniformly shaped as commonly employed in plants of every description. Also adaptable to 3-inch diameter, fine tooth slitting saws, wabble saws, hack and metal saws, etc. We invite the sending of sample saws for experimental sharpening and will give the fullest possible information concerning the adaptation of the machine for particular needs, in advance of order. Direction pamphlet will be mailed free on request. The machine is practically universal in its adjustment to accommodate varying hook or shape of gullet needful, can be made to equalize irregular spacings, keeps the saw in perfect round, and fine tooth saws, so difficult of satisfactory sharpening by hand, may be perfectly sharpened subject to the use of suitable wheel and correct adjustment. The machine is splendidly efficient for hollow or concave-ground saws.

The adjustments are relatively simple and may be readily mastered by men of average mechanical ability. The machine is as simple and free from complication as it is possible to make it, and properly accomodate the wide range of saws for which it is marketed.

The utility of the machine, in saving time, keeping saws in perfect round and balance, with teeth uniformly shaped, and in the best condition for cutting straight and smooth on a minimum kerf, will be readily apparent to all familiar with or desirous of the best results.

The investment cost will be spread over a long term of years, the upkeep cost from year to year is small, and the advantages and economies that result, put this machine in the indispensable class for the majority of plant operators.

Hand filing should be dispensed with. All expense for files and a large amount of time are saved, and this saving will soon pay for a sharpener, without taking into account the improvement in sawing efficiency.

A heavy, rigid and carefully fitted frame, free from vibration, wheel arbor with two long bearings, hand-wheel adjustment to bring center of saw directly under center of wheel, cup and cone device to accommodate a wide range in arbor holes, convenient adjustments and a fine construction throughout.

THE MANUFACTURE OF SAWS

The tendency of saws to split, check or crack is traceable in part to flaws caused by cavities called blow holes, sponginess or honeycombing that form in the interior of the original ingot at the time of casting. It is impossible to detect all these flaws in the ingot or plate after rolling and hence saws sent out containing these concealed defects may in time manifest the defects in the form of split teeth. Such a saw plate has the appearance of two pieces improperly welded. The process of manufacture of saw steel is essentially as follows: The steel is made into square ingots, then hammered into billets, which in turn are triple welded and hammered into slabs and subjected to the special refining and toughening process; they are then hot rolled into long straight lengths, and finally cold rolled into long plates, the ends and edges pared, trimmed and paralleled, then carefully tempered and passed on to the tempering departments, where the responsibility of the saw-maker commences and his skill is put to a crucial test. Steel may be easily ruined in heating even by the most careful and experienced workman if he will not have the foresight and patience to first find out the right, and therefore the best, heat at which to harden steel, and as no two brands of steel are alike it becomes essential for the temperer to find out for himself just what heat the steel will stand, or what temper suits it best. A uniformity of temper is very important and can be attained only by those who have had long experience and who are accustomed to harden and temper large quantities of steel daily, continuously, and by automatic arrangements and appliances.

Plates are hardened in lengths sufficient for one saw only, or in coils varying from 200 to 1,000 feet long. It is obvious that the sawmaker, taking the plates either in the black, untempered form or in polished, tempered blades, cannot make amends for defects in the original manufacture. He is presumed to exercise the greatest care in tempering and fitting, and if one sawmaker is more successful than another, it must lie either in the use of better steel, or in a more successful tempering or in a finer tensioning and fitting of the teeth. There have been marked improvements in the manufacture of band saw plates during the past twenty years, but the severity of the work to which saws are subjected has probably increased in an equal ratio. High speed, big feed, and thin kerf are all essential characteristics of the modern mill, and the saw that is not made to stand such tests is almost certain of condemnation. But there is a limit to the strength of steel, and the number of saws hanging in the mills filled with center or edge cracks are a demonstration that undue demands have been made upon them. It is quite possible that there are more saws that show defects arising from improper tensioning and fitting, or from defective condition of the mill, than from original defects existing in the steel. If a millman or a filer will persist in running a saw beyond the limits of endurance, or will use improper methods or lack of methods in fitting, he alone and not the sawmaker should stand the loss.

WHY ONE SAW IS BETTER THAN ANOTHER

No manufacturer knowingly sends out poor, imperfect saws, but if any class of manufactured goods requires the very best material, and the most skillful workmanship in every process of the manufacture, it is the band saw. A cracked, twisted or broken saw is the surest evidence of something radically wrong and calls for searching investigation into the cause. The quality of the steel and the temper are measurably experimental and not fully disclosed until the saw comes to be run on the mill or perhaps reduced in size. It is impossible for any sawmaker to guarantee a saw against cracking or splitting of teeth or to run well, in advance of its trial, but the character of the processes undergone in manufacture are of the utmost importance. A band saw fresh from the rolling mill bears little resemblance to the finished blade, tempered, polished, toothed, tensioned and fitted ready for lumber manufacture or conversion. In the saw works the processes in manufacture include tempering in a whale oil bath, grinding the sides, grinding the edges parallel, smithing or hammering out the various forms of bends and twists assumed by the saw in the process of tempering, expanding the back edge, expanding the central portion for tension and the final process of swaging, sidedressing and sharpening the teeth. These several processes certainly call for men of applied as well as theoretical knowledge, and the sawmaker who, possessed of the best shop practice, can combine with that a large amount of experience in the every day operation of saws on different mills, at different speeds and in different woods, is emphatically the lumberman's sawmaker. Each sawmaker claims superior excellence for his processes in rolling, tempering, polishing and grinding. His methods are the best and all makers endeavor to keep up-to-date in these respects. But when it comes to the final fitting, it may be suggested that too much care cannot be taken to the end that the saw shall be put up with all possible regard to its use and the conditions under which it is to run. It is sometimes observed in practice that saws fresh from the shop are not in good condition to run well without refitting. Possibly some millmen are over critical and exacting in this direction, but every saw maker can well afford for his own success in making sales to endeavor to make each saw meet the special requirement. It would be much better for both maker and user if every order for saws were accompanied by the fullest information covering every detail regarding its use that can be conveyed. Thus, in addition to the usual specifications of width, gauge, spacing and hand of saw, let a templet be furnished showing the exact style of tooth and gullet used, with statement of speed, shape of face of wheels, kind and size of timber sawed, average feed, degree of tension and convexity of the back, that are found in practice to be the best for the mill in question. Every filer that is at all competent becomes familiar from his daily fitting with the best conditions into which he can put his saw for successful operation, and there are no reasons why this information should be withheld and every reason why it should be conveyed. Given a saw thus put up closely to meet the special requirements it will follow that upon a fair trial it ought to run well, and in most instances it will run well. If defects manifest themselves in the form of split teeth, or in cracks or crumbling corners, a loss ensues that must be borne by someone. Don't suppose that when you order a saw from a maker stating that it must be a "good one and just like the last," that this means much if anything, for it does not unless all saws are treated and come out precisely alike. But the sawmaker may say that we suggest an extra amount of labor and experimental work for which he gets no pay, and which he can ill afford. The importance of such objection must depend on whether it is better to put up good saws carefully fitted to the requirements of each user—saws that will "go" and give satisfaction and be paid for and insure further orders or whether it is better to make saws in the abstract, incurring the material, manufacturing and selling costs. and then by having them ill adapted to their use, and perhaps submitted to severe and unfair trial tests, crack and break and be rejected, a loss with practically no salvage.

If one saw is better than another, or one general manufacture of saws is better than another, it must lie either in the steel, or the tempering, or in the final manufacturing and fitting.

THE MANUFACTURE OF SAWS IN THE MILLS

There are a number of sawmill operators who buy the black, untempered blades and tooth and fit them in the mill filing room. Such saws will not long hold their tension or cutting edge, and their only recommendation is the lower cost and the consequent inexpense in replacing them when stripped of teeth by iron or impaired by cracks. These black saws are rarely found in use except along some of the rivers where iron rafting dogs are extensively in use and where as a result the saws are exposed to frequent accidents and impairment.

There are also millmen and factory operators who buy the tempered, polished blades in rolls or cut lengths, of American or foreign manufacture, and fit up the saws in the mill filing room. Such saws only require proper tensioning and fitting to prove serviceable. The processes involved in such "home-made" saws are such as are regular features of modern fitting room practice. The blank blade cut to desired length will be toothed with a Retoother, fitted with dies to cut teeth of desired spacing, and of special shape to produce the desired outline of gullet or throat. The machine is provided with an adjustable spacer and guide for back of saw, which enables the filer to space the teeth uniformly and make them alike in hook, depth and general outline. The process is simple and rapid, and from 10 to 20 teeth per minute can be cut, thus requiring from 10 to 30 minutes to tooth a saw, according to its length and spacing. Lap making consists in beveling or scarfing the ends of the saw preparatory to brazing. The lap may be produced by hand filing, emery wheel grinding or milling, but a machine accurate and rapid in its operation is necessary to a quick job and a perfect lap, and such a machine should be an adjunct of every filing room. Hand filing is a slow, laborious process and is open to the important objection that, unless a perfect surface is formed, the joint may not be perfectly formed, and as a result the entire work is lost and must be done over. Having the saw toothed, and jointed, there remains the final fitting of the teeth and the correct expansion of the blade, which involves both leveling and tensioning. These processes are accomplished by the use of machines and tools which require only proper care and intelligent adjustment and operation to afford results that are absolutely unapproached by hand labor. Indeed, by their use many unskilled men, especially in the woodworking plants, are enabled to take up band saw fitting and accomplish successful work almost from the beginning. However, we do not assert that the purchase of a complete outfit of machines will insure successful saw fitting, regardless of lack of skill of the filer, because there are instances that disprove it, and no machinery salesman or mill or factory operator should fall into the error of assuming that saws will run or fit themselves on certain machines, or advise or undertake the employment of saw filers wholly unfamiliar with band saw practice. For in just such cases there is always liable to condemnation of the mill, and saw fitting machinery, and the spoiling of a number of saws and a quantity of lumber.

MOTOR DRIVE FOR FILING ROOM MACHINES

The method of individual or group motor drive for sharpening and grinding or other power operated filing room machines such as sharpeners, stretchers, lap, band wheel and knife grinders, filers, setters, etc., is recommended and now meeting with increasing favor on the part of the leading industrial plants, such as car shop, ship yards, pattern shops, all government plants and a considerable number of sawmills and high-class woodworking plants, more recently established.

A motor with variable speed control is obviously preferable, in that it will enable the operator better to accommodate the speed of a grinding wheel to its actual makeup or grinding efficiency, but constant speed motors are largely employed with fine success.

A motor drive practically insures a uniform continuous speed for the grinding wheel during the grinding operation; whereas in many filing rooms owing to lack of steam and variation in load on the engine, the filing room machines are operating subject to constant and wide variations. A motor drive also enables the fitting of saws or knives whenever needful, regardless of the operation of the main power plant, by taking power from a lighting circuit or a commercial generator, if such be available.

Motor installation may be in the form of a group drive from line or jack shafts, or by belting direct from machine to motor, the latter mounted variously on floor, ceiling or a special wall or floor bracket, as may be preferable, or by direct connection of motor with machine.

The cost is variable according to the type of motor selected, whether constant or variable, the local current conditions and the manner of connection.

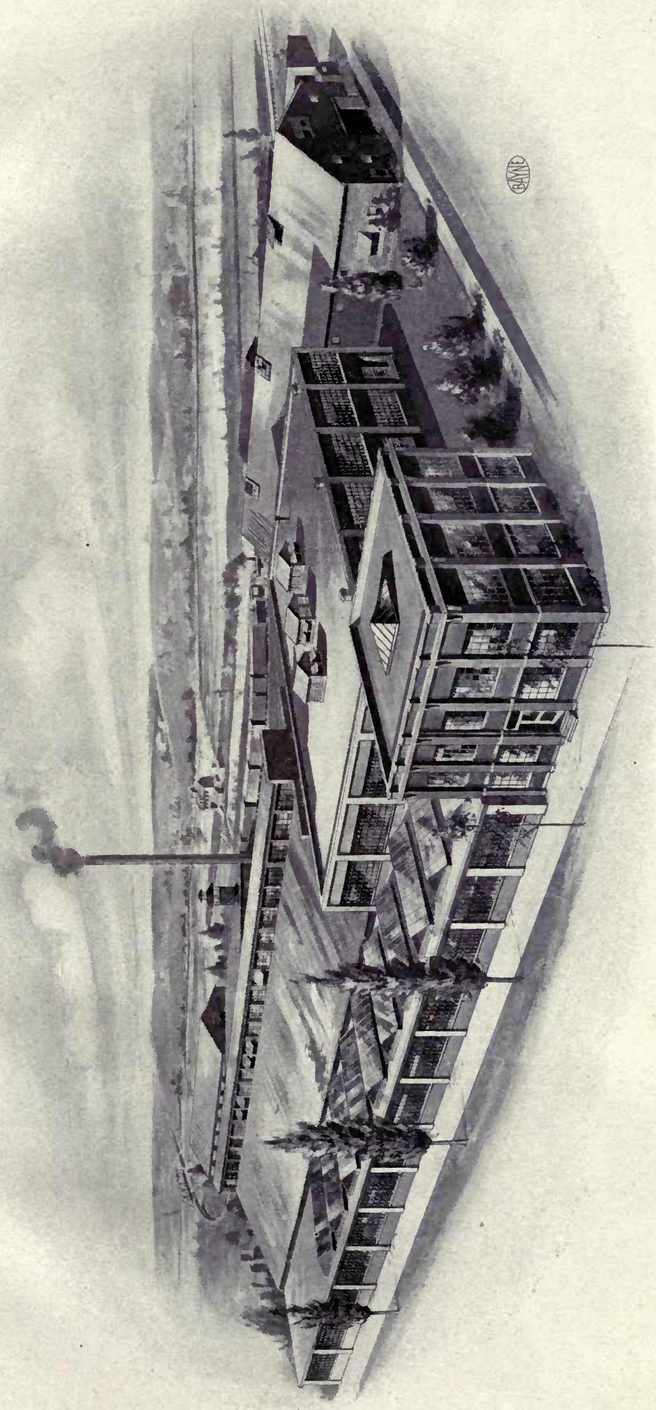
Customers interested in motor drive installation are requested to write us giving full particulars of the local current conditions, mentioning the machines in which they are interested, and we will then give all information possible as to actual or approximate costs and the various ways in which the problem may be worked out.

The direct connection of motor with machine by means of cut gears or silent chain drive is perhaps best calculated to save space, do away with expense for belting, belt guards, etc., and facilitate the taking down of motor for repairs, should this become necessary.

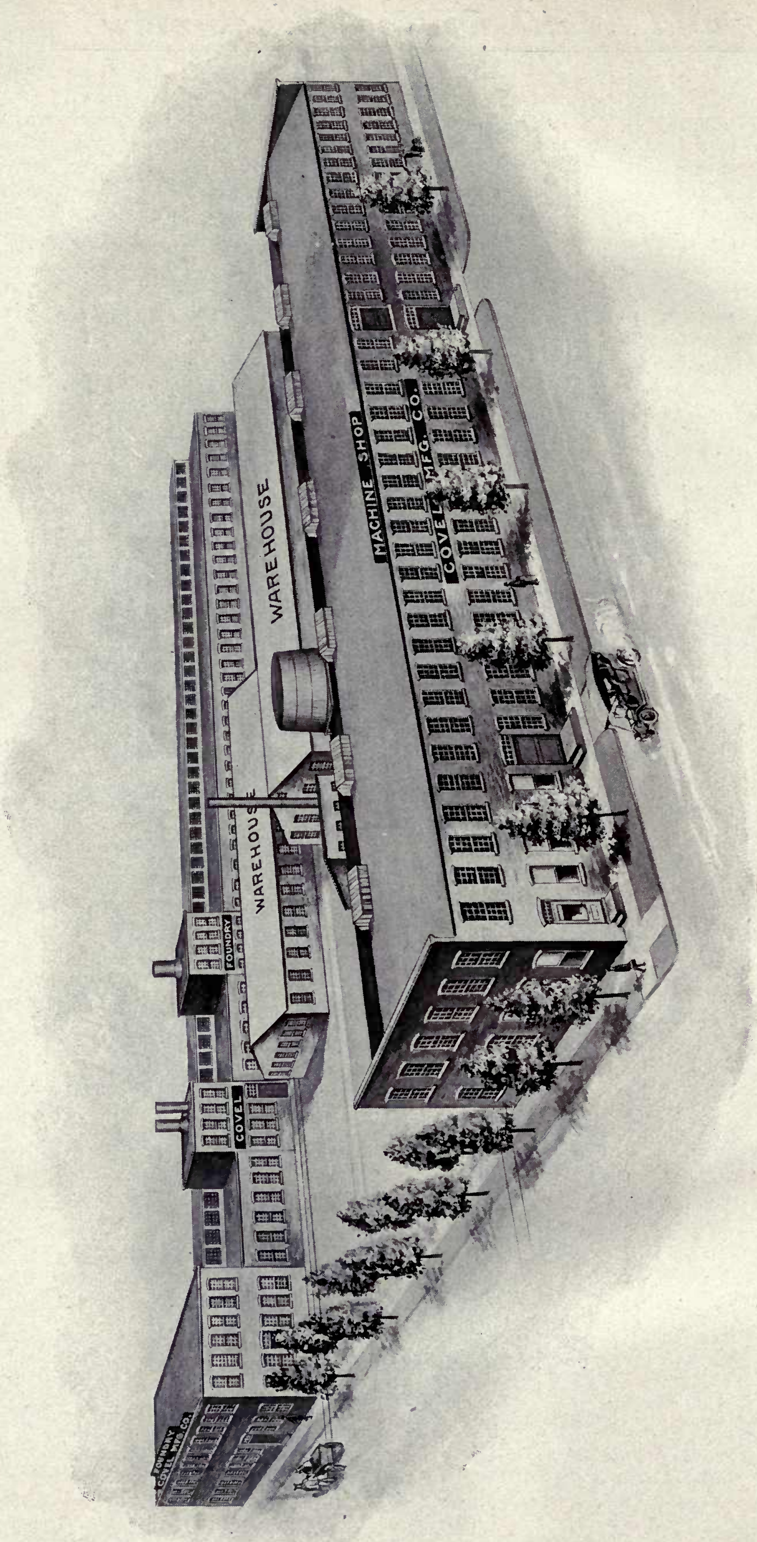
Local conditions must govern, to a large extent, but an installation should be planned out beforehand as carefully as possible with reference to the mill, factory or shop conditions.

Flexible couplings for direct shaft connections relieve the motor of the jar incident to rough, hard service.

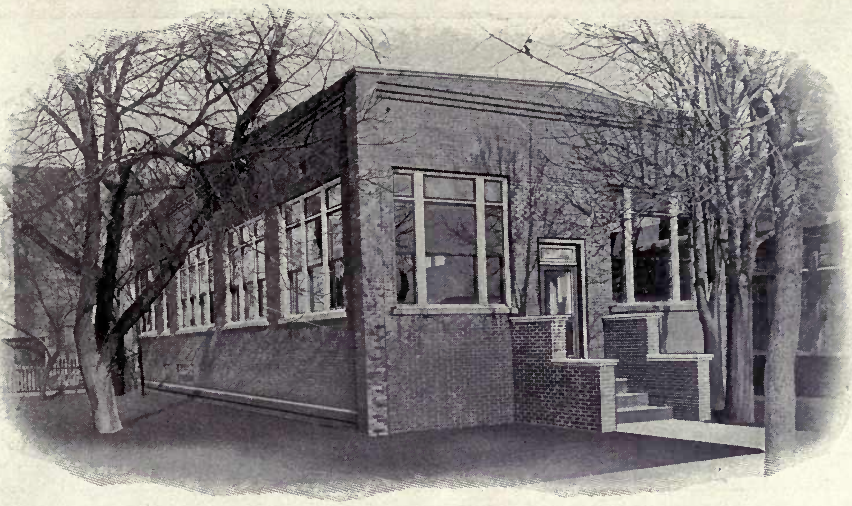
Supply wires should be brought to motors in conduits running under the floor, if possible, and all ground floor motors should be mounted on substantial concrete bases.

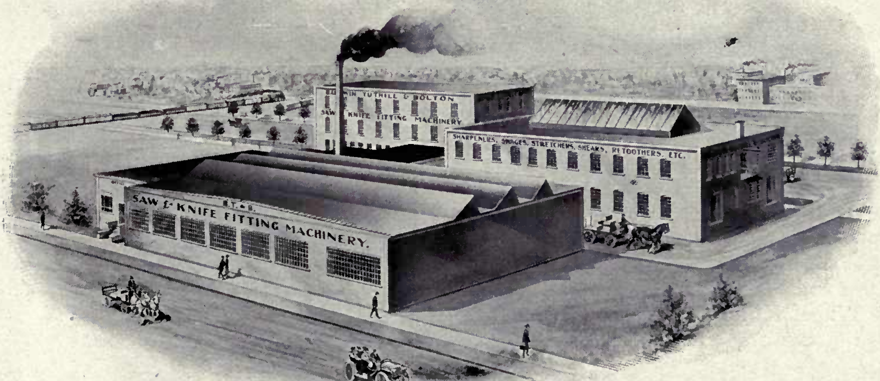


HANCHETT SWAGE WORKS, BIG RAPIDS MICHIGAN, U. S. A.



COVEL MANUFACTURING COMPANY, BENTON HARBOR, MICHIGAN, U. S. A.





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