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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

COAL-CUTTING machines are finding great favour in our northern collieries, one of these machines being able to cut twenty feet per hour in very hard coal. As many as seventeen are used in one colliery.

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It seems probable that the Panama Canal may yet be completed. The Columbian Congress has closed its extra session, and it is stated that the Canal question has been arranged to the advantage of both the State and the proposed new company.

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The various trade combinations throughout the United Kingdom are busy in an agitation to urge upon the Home Secretary the necessity of increasing the staff of factory inspectors, so that the existing Acts should be more efficiently enforced. There is little doubt that evasion of the Acts does occur, owing to the smallness of the staff, and certainly this is a cause which can be remedied to the advantage alike of employer and employed.

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At Leicester during the past year there has been a great revolution in the shoe industry. Working in factories has been substituted in place of working at home, which has come to an end to the benefit of master and workman alike. In a great measure this is the result of the further introduction of machinery, which is computed to be greater in Leicester than in the whole of the other districts in England and Scotland combined.

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The Common Council of Middleton, Ohio, recently granted the Middleton and Cincinnati Railway Company the right to carry their railway across Sixteenth Street. As soon as the permission was given, a large body of men was set to work and the crossing completed in one night, much to the astonishment of a committee of citizens, who appeared in the morning armed with an injunction to restrain the railway authorities from proceeding with the work.

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The electric lamps used in the vehicles of the London General Omnibus Company are specially designed to occupy as little space as possible, and one is suspended horizontally in the centre of the conveyance it is intended to illuminate. The battery weighs about eight pounds, and is put in a wooden box under one of the seats. The box is fitted with two brass spring terminals, which automatically make contact with the battery when it is lowered into position.

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Commodore Melville, of the United States Navy, now proposes the use of "nickel steel" for parts of marine engines and boilers. Its tensile strength of 90,000 lbs. per sectional inch, as compared with 65,000 lbs. for ordinary steel, with an elongation before fracture practically the same, would seem to offer great advantages in affording means of lightening the machinery without reducing its strength. Some practical experiments are to be made in this direction.

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In Austria-Hungary slate as a material for billiard tables is being displaced by marble slabs in single pieces for each table. The ordinary sizes are about seven feet by three feet six inches by one inch thick. These slabs are not polished; they are merely dressed and ground on both sides. The cost is from thirteen to fourteen francs per square metre, free on board at Buda-Pesth. Up to the present time Carrara marble only has been used, the veined qualities being unsuitable for the purpose.

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The iron ore from the mines at Tiehshau yields on various assays an average of nearly sixty per cent. of pure iron. So plentiful is iron ore in this district that it has been used for economy to ballast the line of railway from Huangshihkang to the mine—about seventeen miles long—though there is limestone all along the line. In former times the iron mines of this district were largely worked as indicated by hills of slag, but when the country was disforested the Chinese were prevented from smelting for the want of charcoal.

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It is sometimes necessary to force to an elevation boiling water or other liquids by means of a pump. At first this would seem impossible, on account of the vapour rising from the surface of the liquid and destroying the vacuum created by the pump. To get over this difficulty, sink the pump below the lowest level of the vessel containing the boiling liquid and connect the suction of the pump to that vessel. On the plunger or ram of the pump being lifted the liquid will follow it, and thus the pump barrel will be filled, the force of gravity causing the liquid to endeavour to find its own level. On the ram descending the liquid will be forced beyond the delivery valve and the object is accomplished.

* *

The results of recent armour-plate trials appear to have completely assured the adoption of nickel as a constituent in steel armour-plates, and the use of this metal may be regarded as a certain feature of the steel trade of the future. The effects of the adoption of nickel steel are likely to be felt in the heavier trades of Sheffield. The tests which have been successfully withstood by armour-plates of this material altogether upset the idea among military and naval authorities that it was no longer necessary to further develop the size of heavy guns, as the existing weapons were more than equal to the penetration of the heaviest armour. The consequence is that the huge hydraulic forging plants laid down by the Sheffield steelmasters are likely to gain more employment than at one time seemed probable.

* *

In the United States nickel steel is now being applied to the construction of heavy guns, the Ordnance Bureau having succeeded in making an alloy of steel with twenty-five per cent. of nickel, that possesses all the best qualities and strength of steel with high elasticity, and almost entire non-liability to corrosion. The American authorities assert that nickel steel will become the recognised material for naval gun construction, as well as for armour-plates, and also for many other purposes. In the lighter Sheffield trades nickel steel is likely to exert a wide influence. A French metallurgist claims to be able to alloy the two metals so as to produce a material which will compete both in price and appearance with electro-plating. The qualities which nickel, in different proportions, imparts to steel are so varied, that it will be at once understood what an important part it will play in the future of the Sheffield trades.

ABOUT BORDER ORNAMENT.

BY CHARLES KELSEY.

ANTHEMION BORDERS.

INTRODUCTION—MODIFICATIONS: THEIR CAUSES—ADVANTAGES OF THE STUDY OF ORNAMENT—DESCRIPTION OF THE ILLUSTRATIONS—CONCLUSION.

Introduction.—The preceding paper on Anthemion borders dealt chiefly with the Greek varieties of this type of ornament, the examples illustrated being taken exclusively from the works of that nation. The present paper deals with the modifications made by the workers of other nations who subsequently adopted the type.

How universal was this adoption may be gathered from a glance at the various sources of the specimens shown in the accompanying illustration. This general adoption was due, no doubt, in a great measure to the inherent beauty of the variety of radiation these patterns exhibit: a point dealt with more fully in the preceding paper.

Modifications: their Causes.—Every civilised nation of the past has utilised these patterns, and have evolved varied modifications of them, these variations being due to the influences of changed race or creed.

The influence of the religions of nationalities was, in the past, the most potent agent in the development of changes in ornament. To trace these variations and to note these influences cannot but prove interesting and instructive to modern workers.

Advantages of the Study of Ornament.—The study of ornament thus pursued adds additional interest to every-day work. It causes familiar patterns to no longer appear as meaningless arrangements of lines and curves, but each differing variety observed, ofttimes proves a witness to some influence which was powerful enough to affect the lives and work of those who produced these relics of the past.

To modern designers the observation of these varieties is very helpful: they suggest further possible modifications along the lines of variation indicated.

This is a legitimate use to which to subject these old examples. The modern student of design will be foolish indeed if he does not make the best possible use of them, and endeavour at the same time to discover and absorb for future use the underlying principles of the craft which they exhibit. The systematic study of ornament becomes a necessity in those cases where the production of a work in a particular style is aimed at. The knowledge will prevent the introduction of incongruous forms, anachronisms which would detract from the purity and beauty of the work.

Description of the Illustrations.—Fig. 1, the most ancient example illustrated, is an Assyrian specimen from the ruins of Nineveh.

Most authorities fix upon these Assyrian examples as the prototypes of the modern varieties. They certainly exerted a powerful influence upon the Eastern varieties—notably upon those of Persia and India, and in a lesser degree upon those of China. The varieties of the Western nations appear to owe most to Greek influence, many specimens of which were illustrated with the preceding paper.

Some authorities consider the radiating form in the Assyrian examples to be a conventionalised rendering of the date-tree, and to have had some symbolic reference to Asshur, the supreme deity of the Assyrians, the lord and giver of life. The fruit of the date-tree forms the staff of life in the region of the Euphrates valley, and hence that tree would naturally be consecrated to Asshur as the "Sacred Tree" or "Tree of Life." Specimens of these "sacred trees," made up of similar radiating forms, frequently with winged figures of priests or kings on either side, kneeling in attitudes of worship or adoration, may be seen upon the Assyrian sculptures now exhibited at the British Museum.

Fig. 2 is a Persian example of the sixteenth or seventeenth century, taken from pottery in the South Kensington Museum.

Fig. 3 is a Chinese example from the same source.

Much of this early Persian pottery is decorated with forms copied from the finer porcelain of the Chinese, specimens of which found their way into Persia as articles of commerce. Almost identical forms may be seen upon Chinese works in the same collection. In both these figures the Assyrian influence may be traced.

Fig. 8 is a Pompeian specimen—a stencilled wall decoration. The workers who decorated the villas at Pompeii were mostly Greeks, engaged to beautify the summer residences of their Roman conquerors. This accounts for their striking resemblance to Greek specimens. They are frequently more elaborate, but that is in deference to the luxurious taste of the Roman employer, who was not content with the simple grace of pure Greek work. They also exhibit a certain thinness of character: probably due to the method of their execution and the technical limitations of the stencilling process.

Some fine remains of Pompeian wall decoration are exhibited in the British Museum, which will well repay careful observation. Zahn's "Pompeii" is also a veritable mine of wealth in the decorations of this period.

In Fig. 5, a Byzantine specimen, a further change of character will be noticed. This is partly due to the contact with Oriental art and artists, which the transference of the seat of government of the Roman Empire to Constantinople brought about. The religious influence was also brought into play. Christianity was fixed as the State religion, and classical art was looked upon with distrust as a relic of Paganism. The artists were thus under the necessity of changing the appearance of the traditional forms of decoration, and presenting them in a new guise when utilising them to decorate Christian churches. Symbolism was largely used in early Christian art. It was not until Paganism began to be a thing of the past that the classic forms were used to any great extent, and then only in their changed form.

Figs. 9, 10, and 16 are modern Indian examples from articles in South Kensington Museum. The first is from painted pottery; the second, silver damascened work; the third, engraved work on brass. The latter example has a marked Byzantine appearance.

Figs. 4 and 6 are Arabian examples, the originals of which appear in the decorations of the Mosque of Touloon at Cairo, erected A.D. 876 for the followers of Mohammed.

Here religious influence has again worked its part in the change of the character of the ornament. The Arabs, possessing neither artists or art of their own—if a certain love of finery inherent in most uncivilised races be excepted—employed Byzantine Greeks to build and decorate these early mosques. They were charged to observe the commands of Mohammed, forbidding the representation of any natural object in the decorations. The result was the still further conventionalising of the Anthemion form. These decorations were executed in stucco, the plaster being brought to a smooth surface, and the ornament traced upon it, whilst still in a plastic state, with some blunt instrument, which rounded the edges in its course.

Not a little of the special character of the ornament is due to this method of execution. The scroll, which in the Greek examples encloses and connects the radiating forms, becomes transformed into an intervening leaf. This change will be apparent by comparing them with the Greek specimens of the preceding paper.

Fig. 15 is a Turkish example, the original from one of their mosques in Constantinople. Based upon Arabian examples, it yet has a character sufficiently distinct to mark it as the work of a different race, although dominated by the same religion.

Fig. 7 is the late Gothic ornament, known as the "Tudor flower," frequently met with in Gothic buildings of the Perpendicular period. It exhibits a character which stamps it as a remnant of the old Byzantine art of the early Christians.

Figs. 11, 12, 17, and 18 are specimens from the Italian Majolica, exhibited in South Kensington Museum, dating about A.D. 1500, the period of the Renaissance. They show the process of elaborating the ornament intervening between the radiating Anthemion form until it becomes the principal feature in the pattern. They are in character most closely akin to Roman work. In Italy the Renaissance was essentially a revival of Roman classical forms; the earlier and more pure Greek art was at that period almost unknown.

Figs. 13 and 14 are examples of the French Renaissance. The former is from the pottery of Rouen in the South Kensington Museum, a relic of which type of design may be seen upon the outer border of the well-known "willow-pattern" plates. The latter is from carved wood in the Hôtel Cluny of the time of Francis I. The Anthemion form in this latter example is tending towards the development of the hollow shell, which forms so prominent a feature in the Rococo decoration of the time of Louis XV., a revival of which style is just now in vogue.

Conclusion.—With these remarks on the development of this type of pattern through many centuries, the matter is left in the reader's hands. The remarks should prove instructive to many students of ornament and design, and the illustrations will enhance their stock of patterns from which to draw helpful suggestions for future work. To those readers of WORK in want of patterns for embellishing objects, those given will prove useful; they, no doubt, will be able to turn them to good account in various ways, which will almost suggest themselves. It may be stated, in conclusion, that in addition to serving as horizontal bands or borders, nearly all may be utilised also for borders for circular objects, with a little alteration in the spacing of the various parts; indeed, all the pottery examples are in the originals upon circular objects, such as plaques, etc. They have been represented in a horizontal position simply to economise valuable space.

AGATES.—These have taken their names from the river Achates, in Sicily, where it is said they were first found. This is quite likely, for an agate is only a variety of pebble.

SCREW-CUTTING IN THE LATHE.

BY J. H.

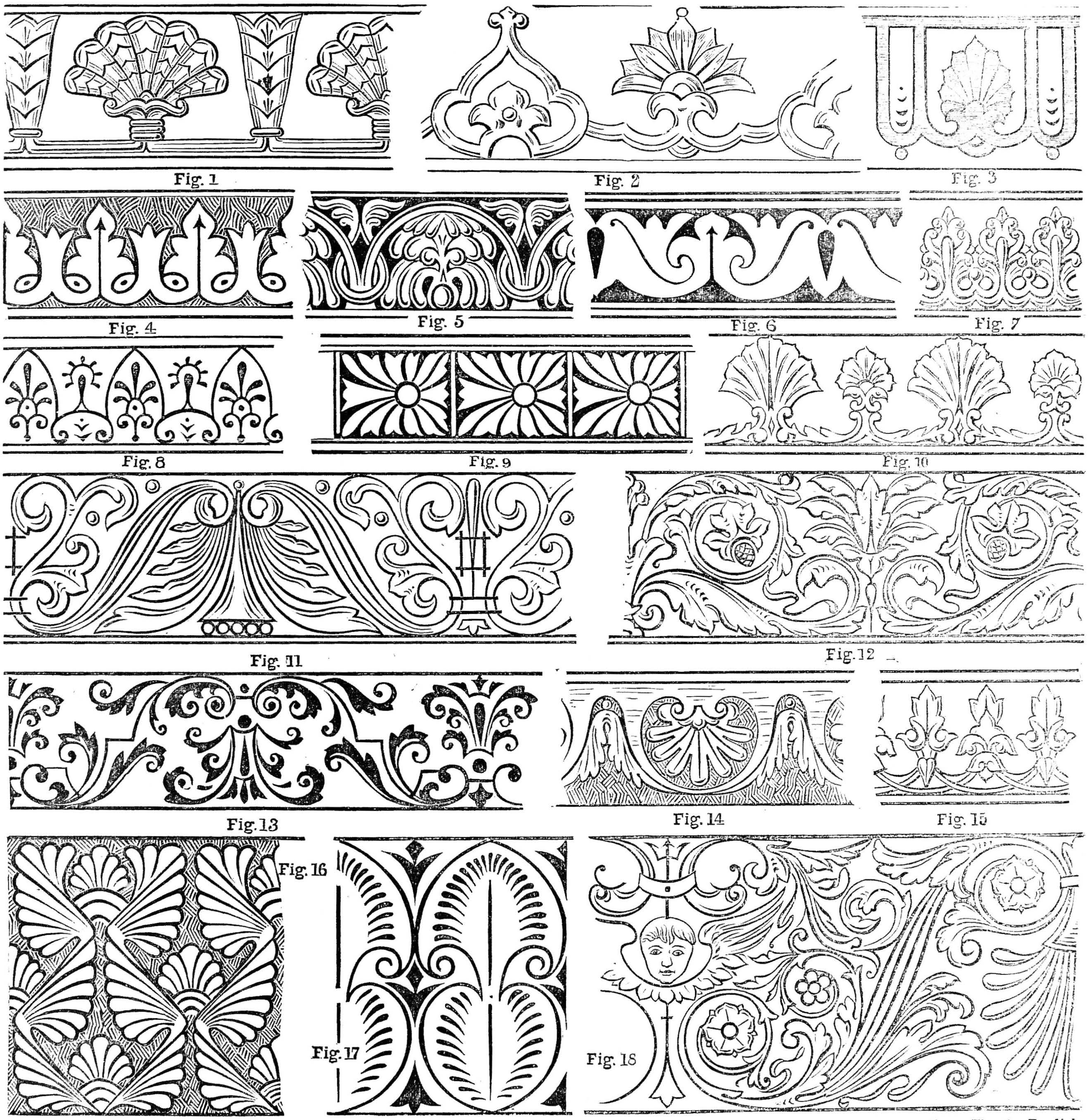
Miscellaneous Examples.

The Case of Coarse and Fine Screws — How to Prove Wheels—Millimetre Pitches—Position of Saddle — Double and Triple Threads — Range of Choice in Change Wheels—Prime Numbers.

The Case of Coarse and Fine Screws.—Take now the cases of screws coarser and finer than the example just given. Say we want to cut a screw of three-inch pitch, and then one having thirty-five threads to the inch. First, When we have to cut screws coarser than one-inch pitch, it is necessary to introduce into the vulgar fraction the number of threads contained in that distance of the leading screw, which corresponds with the pitch or length of the screw to be cut. Here, having a leading screw of four threads per inch, and a screw to be cut of three-inch pitch, we must write $4 \times 3 = \frac{12}{3}$; twelve representing the number of threads in the length of three inches on the guide screw. Then, adding a cypher $\frac{12}{3} = \frac{120 \text{ driver}}{30 \text{ driven}}$, and these will cut a screw of three-inch pitch.

Second, to cut a screw of thirty-five threads per inch, we say $\frac{4}{35} = \frac{40 \text{ driver.}}{350 \text{ driven.}}$

But there is no wheel of 350 teeth, so we must obtain factors for other numbers. Thus, for example:— $\frac{40}{350} = \frac{5 \times 2 \times 4}{5 \times 7 \times 10}$, adding cyphers and cancelling $\frac{\overset{25}{\cancel{50}} \times 20 \times 40}{50 \times \underset{35}{\cancel{70}} \times 100}$. We cancel one 50 above the line, because there are not two 50-toothed wheels in a



Examples of Anthemion Borders. Fig. 1.—Assyrian. Fig. 2.—Persian. Fig. 3.—Chinese. Figs. 4 and 6.—Arabian. Fig. 5.—Byzantine. Fig. 7.—English, late Gothic. Fig. 8.—Pompeian. Figs. 9, 10, and 16.—Indian. Figs. 11, 12, 17, and 18.—Italian Renaissance. Figs. 13 and 14.—French Renaissance. Fig. 15.—Turkish.

set, and to preserve the ratio, we cancel 70, and have 35 below the line; and then 25, 20, and 40 will drive, and 50, 35, and 100 be driven wheels.

How to Prove Wheels.—Mistakes will sometimes occur in working out the wheels, especially in compound trains; and it is, therefore, always safer to prove the accuracy of the results before beginning to cut the thread, lest the work should be spoiled. There are two methods by which the wheels can be proved, each involving a reference to first principles. One is as already laid down in Art. 1.: The same ratio must exist between the driver and driven wheels as exists between the guide screw and screw to be cut. Thus, taking the first example of the coarse thread, the product of $\frac{120 \text{ driver}}{30 \text{ driven}}$ must equal $\frac{12 \text{ guide screw}}{3 \text{ screw to be cut}}$ = 4, which is the case. Again, in the second example of the fine thread and compound train, $\frac{4}{35} = \cdot114$, and $\frac{25 \times 20 \times 40}{50 \times 35 \times 100} = \cdot114$. The other rule is:—Divide the driven by the driver; or, if a compound train, the *product* of the driven by that of the driver. Multiply the quotient by the number of threads of the guide screw; the result will equal the number of threads in the screw required to be cut. This is essentially a proportion or ratio sum, thus:—As driver : driven : : guide screw : screw to be cut. In the first example, a screw of three-inch pitch; $\frac{\text{driven}}{\text{driver}}$

$\frac{30}{120} = \cdot25$
4 guide screw

1·00
3 inches = length of pitch

3·0 inches = screw to be cut.

In the second example:—

$\frac{\text{driven } 50 \times 35 \times 100}{\text{driver } 25 \times 20 \times 40} = 8\cdot75$
4 guide screw

35·00 screw to be cut.

These examples will be sufficient.

Millimetre Pitches.—The case of millimetre pitches should not be omitted. Few possess lathes having a guide screw of a metrical pitch; yet it is desirable sometimes to cut threads of millimetre pitches on ordinary English lathes. It is very simple, and is done as follows:—The metre is equal to a length of $39\frac{3}{8}$ inches—more exactly, 39·37079 inches, and this contains 1,000 millimetres. A leading screw of the same length of $\frac{1}{4}$ inch pitch contains $157\frac{1}{2}$ threads = 157·5, so that the ratio between the two stands thus: $\frac{157\cdot5}{1{,}000}$; or reduced $\frac{157\cdot5}{1{,}000} \div 2\cdot5 = \frac{63}{400}$. If we have a 63 prime wheel, therefore, we can cut millimetre pitches in a lathe with a leading screw of $\frac{1}{4}$ inch pitch. The error caused by using such a wheel will only amount to $\frac{1}{240}$ of an inch in the metre length. This number 63 must be multiplied by the number of millimetres in the pitch of the screw. If the screw is of 3 m.m. pitch, multiply 63 by 3; if of 10 millimetres pitch, multiply 63 by 10, the number 400, of course, remaining constant. Evolving the figures in the usual way, we may write in the first case named $\frac{63 \times 3}{400} = \frac{63 \times 30}{4{,}000} = \frac{63 \times 30}{40 \times 100}$. Since 3 m.m. is finer than the pitch of the leading screw, the wheels 63 and 30 will drive and 40 and 100 will be the driven. In the second case named $\frac{63 \times 10}{400} = \frac{63 \times 100}{4{,}000} = \frac{63 \times 100}{40 \times 100}$; and not having two wheels of 100 teeth in a set, we alter $\frac{63 \times 100}{40 \times 100}$ to $\frac{63 \times 50}{20 \times 100}$; and since 10 m.m. is coarser than the pitch of the leading screw, the wheels 63 and 50 will drive, and 20 and 100 will be driven.

The proof of the correctness of the wheels lies in the fundamental rule already given in the first article: that the ratio existing between the driving and driven wheels is the same as that which exists between the guide screw and the screw to be cut.

In the first case, that of $\frac{63 \times 30}{40 \times 100}$, the ratio of the driving and driven wheels is $\frac{63 \times 30}{40 \times 100} = \frac{1{,}890}{4{,}000} = \cdot4{,}725$ and the ratio of the guide screw and screw to be cut is $\frac{63 \times 3}{400} = \frac{189}{400} = \cdot4{,}725$; therefore the wheels $\frac{63 \times 30}{40 \times 100}$ are proved to be correct.

In the second case, $\frac{63 \times 50}{20 \times 100}$, the ratio of the driving and driven wheels is $\frac{63 \times 50}{20 \times 100} = \frac{3{,}150}{2{,}000} = 1\cdot575$; and the ratio of the guide screw and screw to be cut is $\frac{63 \times 10}{400} = \frac{630}{400} = 1\cdot575$; therefore the wheels $\frac{63 \times 50}{20 \times 100}$ are proved to be correct.

Position of Saddle.—In many instances the position of the saddle for commencing a cut is a matter of indifference. But in others there is only one position at which it must be set for commencing a cut. These instances occur in the case of screw threads, which are neither multiples nor aliquot parts of the pitch of the guide screw, and also in the cutting of multiple-threaded screws. It is usual in these cases to make a certain mark upon the change wheels, or to place some kind of stop on some portion of the lathe as a guide for the starting of the saddle for each cut.

Double and Triple Threads.—In the case of double and triple threads, the mandrel wheel is chalked in two and three equal divisions of teeth respectively, and these marks are brought successively opposite the corresponding space in the driven wheel for the starting of the cut for the second and third threads respectively; the rocking plate of the lathe being lowered for the purpose.

Range of Choice in Change Wheels.—There is much range of choice possible in an ordinary set of change wheels. A set usually numbers 22 wheels. There are 21 wheels, ranging from 20 teeth to 120, advancing by 5 teeth; and there is one duplicate, usually a 40 or 60, for cutting threads of the same pitch as that of the leading screw. Having obtained the required ratio between the driving and driven wheels, it is very necessary sometimes to be able to substitute some wheels for others in compound trains; either because two wheels having equal numbers of teeth occur in both drivers and driven, or because some wheels which came out in calculation do not happen to be included in the set. It becomes necessary to halve, double, or take away, or add fractional parts, and the ultimate result is not affected in the least; provided that the *total products of the drivers and the driven wheels are altered in exactly the same ratios.* Thus, in the case of $\frac{50 \times 20}{100 \times 20}$ as we have not two wheels of 20 teeth in a set, we must alter above and below the line. We cannot halve, because no wheels run so low as 10 teeth. If we double, we get either two of 100 teeth or two of 40 teeth, which we may not have in one set. But we can add one-half to two of the wheels thus:—$\frac{50 \times 20}{100 \times 20} = \frac{75 \times 20}{100 \times 30}$, 75 and 30 being substituted for 50 and 20 cancelled. In this way many new combinations are often possible.

Prime Numbers.—In certain cases none of the change wheels in a set are available for cutting the thread required. This happens in the case of some of the prime numbers which cannot be broken up into factors, and in these cases it is necessary to have a change wheel having a prime number of teeth. This does not often occur in engineers' practice. The prime numbers above 23 up to 100 are 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.

I have thus briefly laid down the leading principles of screw-cutting, but the details of the practice are so extensive that a bulky treatise would not exhaust the subject.

AN ORGAN FOR THE COTTAGE.

BY MARK WICKS.

The Pipes.

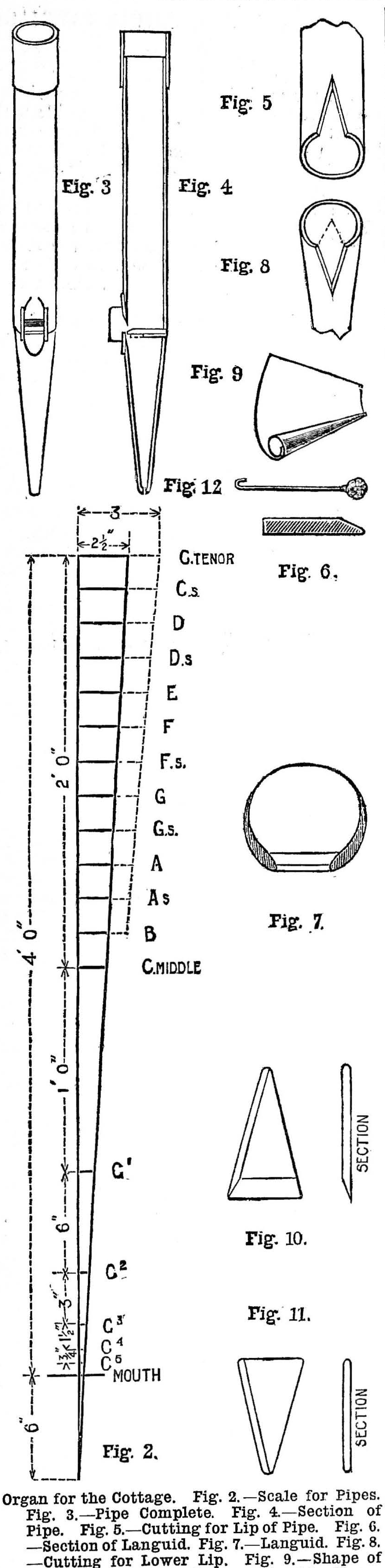
The first thing we shall require to enable us to make a set, or stop, of pipes is a scale by which we can at once determine the length and diameter of every pipe. I may say that the one scale may be used for making all the stops by adapting it as I shall hereafter explain. First draw a perpendicular line 4 ft. 6 in. long on a piece of board. The diameter of our largest Dulciana pipe is $2\frac{1}{2}$ in., so at the top of the perpendicular line set off a line $2\frac{1}{2}$ in. long at right angles, as shown in Fig. 2. From the end of this short line draw a sloping line down to the bottom of the first line, then commencing at the bottom of the perpendicular line, mark off 6 in. by a line right through that and the sloping line, and write against it the word "mouth;" from that point mark off 12 in. by a line joining the two others, and mark that c^1; mark off another 12 in. above that, and write against it "Middle c," and you will then have 2 ft. left. The bottom space above the mouth line must now be sub-divided at 6 in., 3 in., $1\frac{1}{2}$ in., and two $\frac{3}{4}$ in., and these points marked c^2, c^3, c^4, and c^5, respectively. This will give you all the c's in the scale from tenor c upwards. Each of these divisions (between each c) must now be divided into twelve equal parts, and the names of the tones and semitones in the scale written against each, as shown in the top division of the sketch. It will be seen that the lines in the top division are 2 in. apart, in the next 1 in., then $\frac{1}{2}$ in., $\frac{1}{4}$ in., and so on, each octave being half the length of that above it. The speaking length of a pipe is measured from the line marked "mouth" up to the horizontal line of the required note, and the length of that horizontal line will give you the internal diameter of the pipe; and these dimensions are those of the cylindrical tubes of the pipes shown in Figs. 3 and 4. The stopped diapason will be 4 ft. long and 3 in. diameter for its lowest note, and by setting off 3 in. at the top of the scale, and carrying a sloping line down to the point, as in the first instance, and then dotting the cross lines as far as this sloping line, we get the scale for this stop also. As it only consists of twelve pipes from C C to B, there is no need to carry the scale any lower than is shown in the sketch. This scale must be carefully preserved, and the sizes taken from it for all the pipes.

The pipes now about to be made are paper pipes, and we shall, therefore, require a stock of paper for the work. For pipes up to 2 ft. long, cartridge or stout writing-paper will be suitable. The pages of an old ledger or account-book answer the purpose admirably. For longer pipes, stout brown paper is best. At many stationers', general stores, and oil-shops it is possible to obtain brown paper 4 ft. 6 in. wide in continuous lengths, at from 2s. 3d. to 3s. a dozen yards, and this is excellent for the purpose, as it is rolled up and contains no creases. The very small pipes can be made of the leaves of an old copy-book or any other smooth paper that is not too thick.

Some kind of a mandrel is obviously necessary to roll the paper on when forming a pipe. All that is necessary for the smaller pipes is to roll some smooth paper tightly up, so that it forms a cylinder as thick as the diameter of the pipe, but it should be a good bit longer, so that it can be used for others by simply rolling more paper round it to make it thicker. The size having been obtained, glue the outside of the edge of the paper and fasten it down smoothly, rubbing it well with a round stick to secure this result. Make four or five of these templates of different sizes up to about 2 ft. or 2 ft. 6 in. long. It is as well not to tackle either the very small pipes or the very large ones until you have acquired the knack of working; you will find the medium-sized ones the easiest, and therefore affording the best practice for a novice.

We will commence on the 12 in. C pipe, and following the same general instructions will enable you to make any other. Take a sheet of smooth cartridge or account-book paper, and having made a mandrel about 18 in. or so long, and the same diameter as the length of the cross-line on the scale, marked C^1, cut the paper to about $1\frac{1}{2}$ in. longer than the distance from the mouth up to this line, which will make it $13\frac{1}{2}$ in. long, and it must be wide enough to roll say four times round the mandrel, so it must be cut about 12 in. wide. Give it one turn round the mandrel, and mark that distance on the paper by a pencil-line; lay the paper flat, and cover all the rest of the paper with thin hot glue, using a good brush so as to brush it quickly and smoothly over the surface. Leave no lumps or hairs on the paper. Allow about a minute for the glue to soak in and the paper to stretch, and then take the paper up, lay it on a flat bench or table, and place the template on the unglued part and roll it up tightly and carefully, rubbing it down well with a round stick as you roll it up, so that every thickness adheres smoothly to the other, and rub well down when you come to the outside edge. Slip it off the mandrel, and stand it up endwise to dry, but not near a fire, or it will warp in drying.

While it is drying you can make the conical foot. Cut a piece of paper to the shape of Fig. 9, and roll it up to a conical shape, commencing at the bottom, as shown in the sketch. The paper must be long enough to make a cone about 8 in. long, and wide enough to have about six thicknesses when rolled up to the requisite size. You need not be particular as to the exact



Organ for the Cottage. Fig. 2.—Scale for Pipes. Fig. 3.—Pipe Complete. Fig. 4.—Section of Pipe. Fig. 5.—Cutting for Lip of Pipe. Fig. 6.—Section of Languid. Fig. 7.—Languid. Fig. 8.—Cutting for Lower Lip. Fig. 9.—Shape of Paper for making Cones. Fig. 10.—Upper Lip. Fig. 11.—Lower Lip. Fig. 12.—Sponge Mop for painting inside of Pipes.

diameter of the cone, providing it is large enough, as it will be trimmed down at the top and bottom when finished. After rolling it up, open it again, glue it all over on the inside, and roll it up again—it will readily assume the conical shape now—and then rub it down (with a round-pointed stick, like a meat skewer) inside and out.

While this is drying you can prepare the lips and languids. The lower lip is merely a conical piece of thin wood, but the upper lip is chamfered off at the wide end, as shown in Figs. 10 and 11. The languid is shown in Fig. 7; it is merely a piece of thin wood the same size as the outside diameter of the bottom of the pipe, the front edge being cut square and then chamfered off. Make the wood a complete circle first, then mark off a straight line rather less than a quarter of the circumference in length, cut it off, and chamfer the top edge, as shown. By this time the tube and cone are dry, so take them, and trim them up with the scissors so that the ends are square; lay a piece of glass-paper flat down on the bench, and holding the pipe upright on it, rub the ends smooth. Mark on the bottom of the pipe the place where the ends of the straight portion of the languid come, and with the scissors cut out a triangular hole in the pipe from these points, about 1 in. high. (See Fig. 5.) Glue the languid on to the bottom of the pipe, and while it is drying you can attend to the foot. Make a circular languid the same size as the one on the pipe, but instead of cutting it straight across, cut out a triangle extending to about the centre; trim the wide part of the cone down to the exact size of the straight tube, cut out a triangle similar to that in the tube, but not quite so long (see Fig. 8), smooth off the top and glue the last mentioned, or under-languid, as it is termed, on to the top of the cone, making the triangle in it correspond with that in the cone, as shown by the dotted lines. When dry, fold a piece of glass-paper round a flat block of wood, and by rubbing it across the pipe flatten the edges of the triangle so that the upper lip will lay flat on it. Do the same with the lower lip on the cone. Trim off the bottom of the cone so as to make the length of it about 6 in., and chamfer off the bottom end with a penknife. Wet the chamfered part, then take a china egg-cup, and put it on the end of the cone like an extinguisher on a candle. Work it round gently, and the foot will be coned inwards; with a pointed stick (a lead pencil will do) make a hole in the bottom of this coned-in part about $\frac{1}{8}$ in., or rather more, in diameter, inserting the point with a screwing motion. When dry, this part will be quite hard.

Now tie the upper lip on to the front of the pipe so that its lower edge is about one-fourth of its width above the edge of the languid, and tie the lower lip on to the cone so that it projects slightly above the under-languid. Place the two languids together so that the lips are parallel, and having a very narrow windway between the edge of the lower lip and the languid (about wide enough for a thin visiting card to pass), blow gently through the pipe, and you will be rewarded by a musical note. A very little adjustment of the pipe and lips will enable you to determine the exact position required for each, and you can glue the lips on, binding them with tape or thread to keep them in position, and finally glue the foot on to the pipe. You can test and adjust the parts before the glue is set, and so make sure that it is all right. When dry, rub down the edges of the lips with glass-paper so that they are level with the face of the pipe, and look neat and true. Then glue two little pieces of thin wood on each side of the mouth to form the ears, as shown in Figs. 3 and 4. These prevent the wind coming through the foot from being wasted.

Cut off about 1½ in. from the top of the tube, and keep it for further use, trim off the pipe, and slightly chamfer the outside top edge with glass-paper. The tuning-piece should be about 1½ in. long, and is simply a bit of tube made round the pipe itself, so that it fits tightly on it, but can be slipped up and down. Chamfer the top and bottom edges of this piece.

In making the pipes generally, we make each about 1½ in. in the foot longer than speaking length, as the piece cut off will form the tuning-piece for a smaller-sized pipe, and thus save the trouble of making them separately.

I should have stated that the pipes must be protected with two coats of paint inside and out. The outside can be painted with a brush, the inside with a mop, made of a piece of sponge tied on a cane, the sponge being cut so that it just goes easily into the pipe. Dip it in the paint, and work up and down two or three times in the pipe, and you will find it smoothly and very quickly done. Of course, this must be done before putting the pipes together. Voicing the pipes will be dealt with in the next chapter.

NEW BLEACHING PROCESS.

A NEW bleaching medium for silk and wool, or for fabrics containing those fibres, is a compound of sodium superoxide, which would probably be represented by the chemical formula $Na2O_2$, and is analogous to barium and hydrogen peroxides in its properties. All these bodies bleach by virtue of their containing an excess of oxygen ready to act upon any colouring matter with which it may come in contact. The advantage which the new sodium superoxide has over the old peroxides can be seen when the amount of active oxygen contained in each is compared. Hydrogen peroxide of the usual twelve volume strength contains 1·5 per cent. of active oxygen; barium peroxide contains 8 per cent., while the new sodium peroxide contains 20 per cent. It is sent out in the form of a white powder, readily soluble in water to a strongly alkaline solution, which, on adding acids, forms a clear neutral liquid containing peroxide of hydrogen. This can be used for bleaching by the ordinary well-known bleaching processes. A method of working consists in taking from 10 to 30 per cent. of the sodium superoxide, adding 30 per cent. of Epsom salts, the percentages being of the weight of the fibre which is being bleached. For wool and ordinary silk, about 10 per cent. will be required; for tussur silk, 30 per cent., on account of the darker colour of the fibre. It takes from two to three hours to bleach with this new material—a much shorter time than is required for peroxide of hydrogen, while the bleach is just as effective. It is rather hygroscopic, and, therefore, has to be stored with great care; but, with proper storage, it is very stable, being much superior in this respect to either hydrogen peroxide or barium peroxide. It is also said to be cheaper.

WHITE-LEAD should never be used as jointing material for acid pipe joints, or the joints of acid cisterns. Red-lead, mixed with boiled linseed oil, makes a good joint.

ENGLISH AND AMERICAN CARRIAGE WORK.

I SELECT work in carriages for comparison; we have them on the spot, side by side with English carriages, or I should have preferred buildings for comparison. It would not be consistent to compare vehicles of a distinctly different manner of build.

I can at once, with pleasure, testify to the lightness of American carriages generally, and their adaptability to stand the strain and shock of bad roads, and to their neat finish and excellent painting, lining, and varnishing.

In carriages by the best makers of the two nations the difference is not appreciable, except, perhaps, in some perch or spring proportions, or automatic head-lift actions, which are mostly English specialities, which the Americans adopt as soon as their merits are detected.

But coming to work of second-class, the difference is favourable to the English work in some material points, due more to the system of piece-work than to inferior make in their respective departments of work; or in other words, the body-work, carriage-work, and iron-work. Leather, lining, paint-work, and wheels may be of equal make to the English; but in America, with the isolation of each distinct branch of work that has afterwards to be so intimately blended, to stand excessive strain and exposure to the weather, the good work is greatly spoilt, and rapid wear and decay result.

Say a Landau body is sent to the carriage-maker to fit his carriage and undergear to, which has been made, sometimes by the score, to certain fixed patterns to suit Landau, Brougham, or Victoria. The wrecking begins; holes are bored through seat, bottom-sides, somewhere between panel and edge-plates, the root-bolt of back-loop mostly cutting through the corner-pillar tenon—for this form of framing is used by second-class workmen; perhaps the boring cuts through an edge-plate screw or cuts away half a bolt—if some sort of edge-plate has been adopted. The loops are at last fixed, and their accuracy to take the springs tested. The fore-carriage, in like manner, is bored on to boot bottom-sides, and if an arch slopes where the bolt-heads come, a large piece is roughly gouged out for the head.

A foot-board stay is fixed on to the hunter-bolt in wheel-plate. Being piece-work, hurry and drive is the rule; the heavy hammer drives and starts joints the body-maker took such pains to make perfect.

Springs are fixed; axle to springs. Wheels with axle-boxes truly bored in hubs are put on, and the carriage is on its wheels. But with second-rate work the axles have not been set for truth, perhaps. It is nobody's job, so it is left undone.

Wing-stays, lamp-irons, and incidental iron-work are fixed with as little care as the carriage, so long as the job can be knocked off quickly. Smash, push, drive seem to be the words suited to the work by the "piece." The master does not care so long as he can turn out quantity, nor the man so long as his work will pass muster somehow, and more rapidly come to hand.

Now the painter takes over the carriage, and gets his job done as fast as he can, so as to earn all he can in the shortest time. The trimmer, in like manner, works against time to turn out a showy job. The plater and beader put the embellishing points on, and the thing is wheeled into the show-room. Anyone with a critical eye can see it is a second-rate-built piece-work job, by a glance at the wheels, which do not line or track, and throw out differently, and the tires do not rest flat on the floor, but ride on the front edges; showing that cylindrical tires have been put on coned wheels, which will cause the wheels to fail soon in fair work. The door-handles are not fast in the locks, but play a little, soon to rattle. The lamps, to look pretty, are quite upright, or "near enough," and throw the reflected light in a line with the horse's head instead of on to the road in front of him; the steps may be level, or one may droop at the front edge. The shafts may be a good or bad fit; the pole the same. Each man has done his part, regardless of the requirements of the other branches of the trade. The master may be a workman used to this system, and all seems right to him; or if ignorant of the trade, except the money-getting part of it, he is ignorant of the way to make a first-class carriage: to carry out a system that shows bad results.

In England the same system prevails where piece-work is the rule; but with day-work, and no motive for doing things "anyhow, so long as it will pass," there is a genial feeling between the various branches of the trade. The body-maker will consult the smith about his edge-plates, and the carriage-maker about boring-on. The carriage-maker will consult with the foreman as to the best form of body-loops and spring-stays, and their easy taking apart and putting together for paint-loft arrangements and "hanging." Bolt-heads will be dotted or notched, to show their cant in putting together easily.

The trimmer will be asked by the body-maker about what wood shall be left on or taken off bottom-sides, pillars, and elbows, so as to have a proper amount and surface for trimming, nails, and lining bearing. The painter will suggest the sharp angles being off iron and wood, where rubbing or wear would soon cut them through.

The master would not shout bullyingly to men to stick to their own bit, and not interfere with other workmen, but join in, and aid the aim to turn out good work; even though it might not be first-rate at all points, each workman would be doing his level best with a pride in his efforts, and a knowledge that the whole was aided by his good work.

Having seen the system of coach-making and cart-making at work, and having been engaged in the supervision of scores of men, as well as the teaching of youth singly, in all branches, I unhesitatingly condemn the scamping piece-work system, when adopted as a general rule. In some mechanical work it may be partially adopted, but it is debasing if made the rule of work. The workman's mind becomes mechanised; he often works in ignorance of results, and does things wrongly from habit or hurry—as, for instance, a man working at a particular job in getting out parts of wheels by machinery, which is often faulty in construction.

In some crafts a man may go on for a time at a task without even knowing what his particular bit of work is for: as a smith was set to make several gross of irons of a small size. He made them without a thought, till asked if he knew what they were for. His answer was: "I don't know, and don't care; but I suppose they may be for buckets."

"No," said his questioner; "they are for pack-saddles."

The answer was: "All right. Now I know that, I shall not be so particular."

And the rejoinder was: "You are making them so badly, that I do not see how they can be worse."

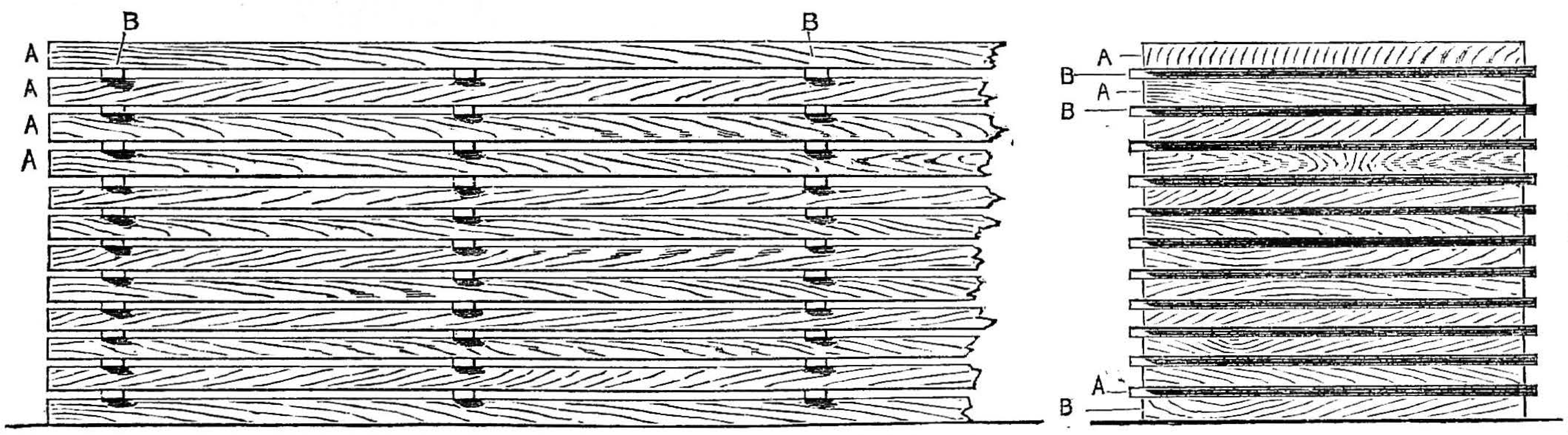
Piece-work coach-making may be summed up as a combination between employer and workmen to get work together by scamping, and all try to avoid detection; day-work coach-making the combination of master and men to do the best work in a reasonable time, and to be proud of it when done. Day-work is more general in second-rate carriage-building in England than America, and the work is of a higher and more lasting grade in consequence.

THE SELECTION OF TIMBER.

BY J. H.

Remarks Comprehensive only—Seasoning—Soundness—Knots—Grain—Sap—Mode of Sawing.

Remarks to be Comprehensive.—I am not going to write about the selection of standing timber trees or of logs, but of boards and planks already cut up in the timber-yard. Neither can I write about the numerous kinds of timber in use, but must make my notes of a comprehensive character, applicable to timber in general.



Timber stacked and stripped.

Points to be Considered.—In the selection of timber many matters have to be considered, such as (1) seasoning, (2) soundness, (3) freedom from knots, (4) condition of grain, (5) sap, (6) mode of sawing.

Seasoning.—Seasoning signifies the drying of boards, and their consequent freedom from the fluids originally present in the tree. Timber will take from one to two years in seasoning. First, it will lay on the ground for a good while—several months, at least, after felling—then, perhaps, for a few months in its squared condition, or in balk, and always for a very considerable time after having been sawn into boards or planks. After valuable stuff has been sawn out, it is stacked horizontally in piles, and stripped for several months previous to being used. Mahogany, yellow pine, birch, and furniture woods are thus treated. Spruce deals, flooring boards, and rough builders' materials are not so treated, but are simply stacked vertically on end in timber racks, or laid, variously, crosswise, horizontally in piles.

Stripping is performed by laying the boards, A (see figure), horizontally one over the other, with thin-sawn strips of wood, B, from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick, between. These strips are laid at intervals of from 2 ft. to 4 ft. A pile may consist of from twelve to twenty-four boards. Stones or weights are laid on the top board to load the mass.

The boards being kept apart by the strips, the air currents circulate freely between and carry off moisture from the face of each board. The boards are, therefore, preferably stripped in covered, draughty sheds, exposed to wind, but not to rain. Also, the stuff does not warp or curve by unequal shrinkage, but each board being coerced by the load above it, and by the straight strips, dries in the position in which it is stripped. Excessive local shrinkages are prevented, and, when the boards are removed, they retain the true form imposed upon them during stripping and drying. They are then ready for stacking vertically in the shop racks for use.

In the more valuable hard woods it is also customary to nail strips on the ends, to assist in preserving the boards from becoming warped.

All boards, however, are not dried in this efficient manner: timber merchants will not afford the time necessary. A novice should, therefore, know that a board may look and feel dry, and yet not be well seasoned. The best way to tell whether a board is dry throughout is by lifting it, and judging by its weight. This, of course, requires some experience, but it is experience that is soon gathered. It is not even an absolute test in itself, because the specific gravity of one pine or mahogany board may be, and often is, greater than that of other pine or mahogany boards from other logs; but this is a matter also for judgment, and a practised hand judges by weight more than by any other means.

But there are also other signs, not to be neglected, that assist one in forming a judgment. A board whose surface-skin only is dried will generally feel colder to the touch than one which is thoroughly well-dried throughout; or there will be streaks of damp here and there visible over the surface; or, if the boards are thick, the damp will show at the central portions of the ends. Moreover, any sawdust that may still cling to the surfaces will not be fine and powderish, but will feel dampish or fluffy, and incline to cling to the surface of the wood. These, therefore, are lesser tests, which, taken in conjunction with the principal one of weight, indicate, after a little experience, the internal condition of well-seasoned or partially seasoned boards.

Soundness.—Of (2) soundness, little need be said. Shakes are usually visible when they exist in well-seasoned boards, being already open. In wet boards, however, the lesser shakes are not visible to a casual glance; but a close scrutiny will usually reveal them there. The common qualities of boards will seldom be entirely free from shakes; but boards can always be had perfectly free from both shakes and knots by paying a first-class price.

Knots (3) are always visible. Whether they are hurtful or not depends, of course, upon the purpose to which the boards are to be put. Small knots are of little importance. In most work, knots running perpendicularly, or nearly so, through a board are less objectionable than those which run a considerable portion of the way across or diagonally. Knots may run so badly that a board may be, practically, severed by them.

Grain.—(4) The condition of grain may or may not be a matter of much importance, being dependent on the purpose to which the timber has to be applied. In most cases, however, a crooked disposition of the grain should be avoided. It is difficult to plane crooked stuff, and the strength of the timber in which cross grain occurs is also impaired. It is easy to observe the course of the grain fibres in any sawn wood. Some woods, of course, are seldom, others are never, found with straight grain. I may instance Spanish mahogany, walnut, oak, lignum vitæ, etc. In some cases the curving and interlacing of fibres is an advantage, either on the score of beauty or of utility, but for structural and builders' work, and for patterns, the straighter the grain the better; and if, as is often the case, cross-grained stuff has to be used in positions where it is better that it should not be used, then all that can be done is to put, if possible, the more cross-grained portions in positions where they will be subjected to the least strain.

Sap.—It is very important that (5) sap-wood should be avoided as far as possible. It is good for nothing, and, except for the roughest work, must needs be wasted. A little edging of sap-wood cannot always be avoided in timber of second-class quality and price, but it should not be accepted when purchasing the best stuff. It is also difficult to obtain large squared balks altogether free from sap. There is no mistaking sap-wood. It is green, or greenish, in colour, is sharply separated in appearance from the heart-wood, and cannot be cut cleanly with the planes and chisels.

Mode of Sawing.—(6) Lastly, there is the way in which the timber is sawn. It should be evenly cut, and the boards be of equal thicknesses. In some stuff, badly cut, there will be quite $\frac{1}{8}$ in. difference in the thicknesses in different places—sometimes more than that. This means loss of time in planing, and waste of the material, consequent on having to reduce the thicker down below the thinner-gauged portions. Also, stuff is sawn hollow crosswise and crooked lengthwise, and uneven, due to the saws being in bad order, badly sharpened, or badly set, or being improperly fixed in the frames. Some of the commoner material is cut with circular instead of with frame saws, and then the surface is often badly scored and grooved.

To Fasten Leather to Iron.—First paint the iron with some lead colour, say white-lead and lamp-black. When dry, cover it with a cement made as follows:—Soak glue in cold water until it is soft, then dissolve it in vinegar at a gentle heat, add one-third of its bulk of white turpentine, mix thoroughly, and use hot. Apply the leather quickly, and press it tightly in place.

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WORK correspondents are wanted in every Town.

The recent accident to the Cunard steamer, the *Umbria*, has proved a powerful object lesson in giving a practical denial to the repeated statement that British artisans are depreciating in their ability, and it has also been an excellent example of what a practical workman can do under great difficulties. Engineer Tomlinson is the hero whose knowledge, combined with perseverance, enabled him to carry out repairs which were necessary to save a magnificent vessel and about 500 human beings. The facts appear, that in mid-ocean and a terrific gale the propeller shaft, which was twenty-five inches in diameter, and made of solid steel and strengthened with collars, became fractured, and although the vessel was rolling and pitching in a heavy sea, Mr. Tomlinson was, by dint of great ingenuity, equal to the occasion. He drilled three holes out of solid steel in the collars, and fitted steel bolts into them. These bolts were five inches in diameter, and Mr. Tomlinson was compelled to shorten them and reconstruct the massive nuts. He then fitted their ends so that they should not interfere with the machinery. All this was done with *hand drills, hammers,* and *cold chisels.* A better piece of work was never done at sea. A start was then made of the machinery, and after two hours' trial one of the heads of the connecting bolts gave way and was wrenched off under a tremendous strain, when Mr. Tomlinson prepared another bolt which fitted into the place, the machinery was again started, and the *Umbria* was able to enter New York harbour. When we look at the difficulties of working on the ocean, combined with, so to speak, primitive tools, Englishmen may well be proud of Mr. Tomlinson's successful achievement. The fact that the *Umbria* is coming back to England with this makeshift shaft, in order to obtain a new one on this side, speaks highly for the supremacy of English shipbuilding and machinery industry. It is estimated that the cost of a new shaft in England would be less than the price of it in the United States. The accident to the *Umbria* rudely disposes of the pleasing assumption that our ocean-going steamers had reached the highest point of safety, as well as comfort and speed. It can no longer be supposed that a steamer equipped with one shaft only is anything like as safe as one furnished with two. A daily contemporary boldly asserts that no ship of the class to which this vessel belongs should be allowed to cross the ocean unless it is fully provided with the machinery which experience has proved to be necessary as a safeguard against accidents. The *City of New York* and the *City of Paris*, as well as the *Majestic* and the *Teutonic*, are all, it is said, provided with two shafts, and if one shaft should snap, each of these ships would still be under control and able to proceed on her voyage. The question of providing two shafts instead of one in a ship of sufficient size is only a matter of expense, and so many of our big ships on the Atlantic and other routes run the risk of going to the bottom.

Shoemaking for corpses is a curious industry which, for nearly a decade, has been carried on most successfully in Chicago, and in one factory where the trade is the exclusive industry no less than 20,000 pairs have been turned out in one week. The shoes are certainly nice to look at, and are not expensive, the cost being from one pound to three pounds per dozen pairs. The soles are cut out of pasteboard, and are covered with grained paper. The uppers are a combination of quilted satin and crochet work. A ribbon, inserted at the top and tied in a neat bow-knot, holds the shoe to the foot. Men's shoes are always black, and shoes for women are always white. At this factory during the dull season the average monthly output is 13,000 pairs.

The Manufacture of Oil-Gas.—In a paper read before the Institute of Civil Engineers by J. B. Ball are given some interesting particulars of the manufacture of oil-gas at the Holloway works of the Great Northern Railway Company. The method of manufacture is the Pintsch System, and the apparatus is designed to produce 60,000 cubic feet of gas per day; at present the make is only 15,000 to 18,000 cubic feet. The 10 in. D retorts are made of 1 in. metal, and are 6 ft. long; they are worked in pairs, and are kept as nearly as possible at a cherry-red heat. Each pair will make 300 to 400 cubic feet of gas per hour, and 600,000 to 700,000 cubic feet of gas before they require renewing. The furnaces consume 160 to 180 lbs. of coke for every 1,000 cubic feet of gas produced. The oil used is a once-refined shale oil, and is stored in a galvanised cistern of fifty-gallons capacity; from this it runs, by means of a 1 in. supply-pipe, regulated by a micrometer cock, into a ¾ in. syphon pipe, 12 in. deep, connected to the retort; it then falls on to a loose tray in the retort, and is immediately vaporised. The gas issuing from the retorts passes to the hydraulic main; then through air condensers, washers, and purifiers, into the gasholder. The cylindrical steel store-holders are 17 ft. 6 in. long, 4 ft. 3 in. diameter, and are tested by hydraulic power to 300 lbs. per square inch. There are six men engaged at the works, and the total cost of buildings and machinery amounted to £14,740.

HOW TO MAKE A TOILET GLASS.

BY LAUNCELOT GUBBINS.

Here is an article indispensable to every household—a toilet glass; not a very heavy job, but an easily constructed affair, and one within the scope of almost every reader of this paper.

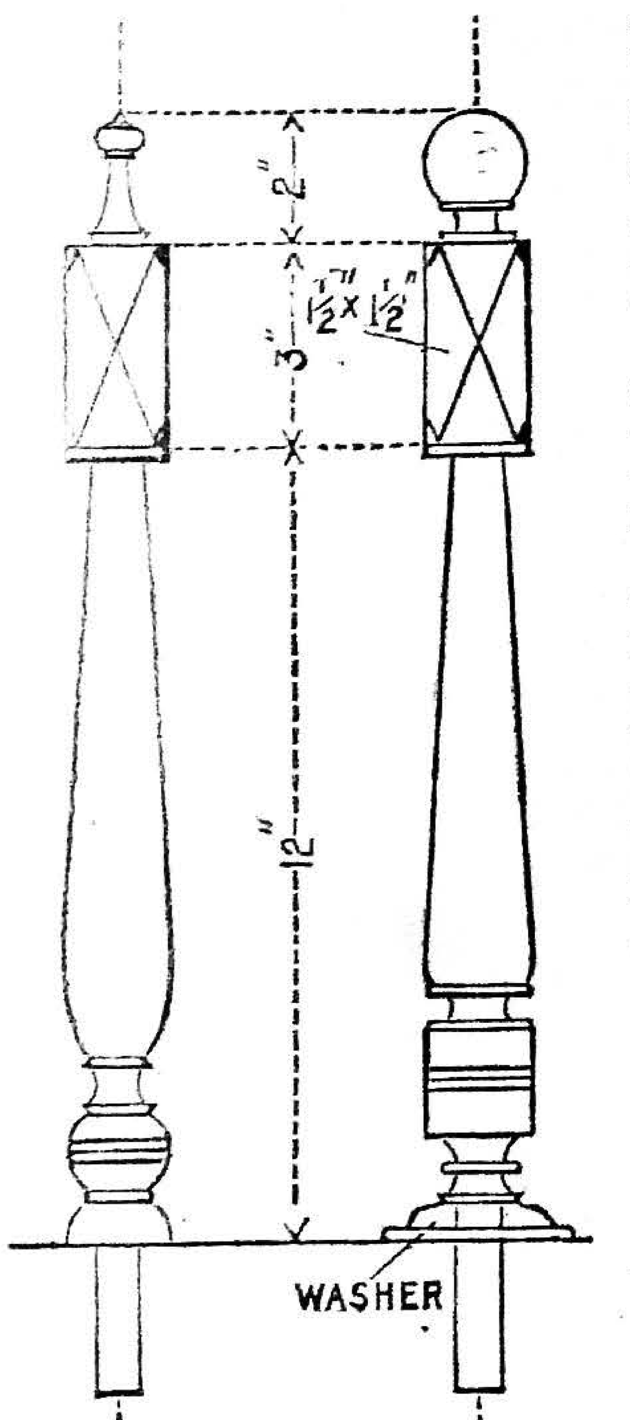


Fig. 1 Fig. 2

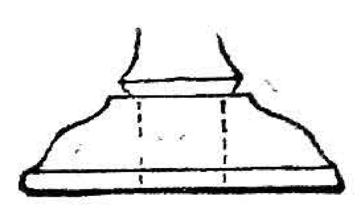
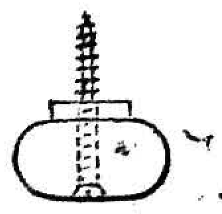


Fig. 12



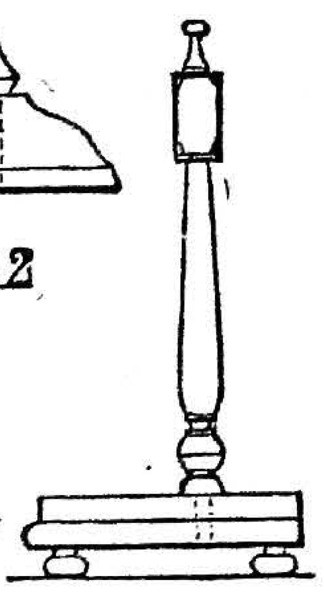


Fig. 11 Fig. 5

Figs. 1 and 2.—Uprights. Fig. 5.—Side View. Fig. 11.—Foot. Fig. 12.—Washer for Fig. 2.

The glass I am about to describe is in existence, having been made by me, mostly of pieces of an old packing-case, in a few hours. I mention this in order that my amateur friends may be induced to try small obs of this kind oftener.

First get the silvered plate-glass. This is now very inexpensive plain (bevelled glass is about twice the price of plain). To anyone, however, to whom price is no object, I would say, Get it bevelled. Let it be $17\frac{1}{2}$ in. by $12\frac{1}{2}$ in. Make the frame (Fig. 3) to hold the glass of the sizes and shape shown in the drawings. The side pieces and bottom are $1\frac{1}{4}$ in. wide, and the pillars are $\frac{5}{8}$ in. and $\frac{3}{4}$ in., respectively, top and bottom. All are 1 in. thick when planed up. The sides are mitred to the bottom and the joint is tenoned—that is, a saw-cut is made on the edge of the corners when fitted, and a thin chip of wood is glued into the saw-cut, and left until set. This does not form a *very* strong joint, but, there being no strain in this case, it is strong enough for our purpose. Should any reader prefer a more solid joint, it is quite easy to have a hidden mortise and tenon-joint with the wedges inserted before driving home as usual. Care must be taken, however, that the cheeks of the mortise are not burst in driving home the tenon. The joints of the top cross-bars are made in this manner, but with the top rail there is no need to use wedges; the end pieces are merely sunk into the mortise, and firmly glued into position. The top ornament is now cut out with a fine saw, and glued on to the rail. The pillars (see Figs. 7 to 10) will now be turned and inserted before the frame is finally glued up. These are turned from $\frac{3}{4}$ in. stuff, and the holes into which their lugs are inserted are bored in such a manner as to allow of the rails being flush with the face of the work. The side uprights (Figs. 1 and 2) are next to be done. They are first to be planed true, $1\frac{1}{2}$ in. square, then centred, and put into the lathe and turned to the design in the drawings, or to whatever fancy the turner prefers. The square pieces near the top must be left, however the lower part is turned, for the reason explained hereafter. The lower

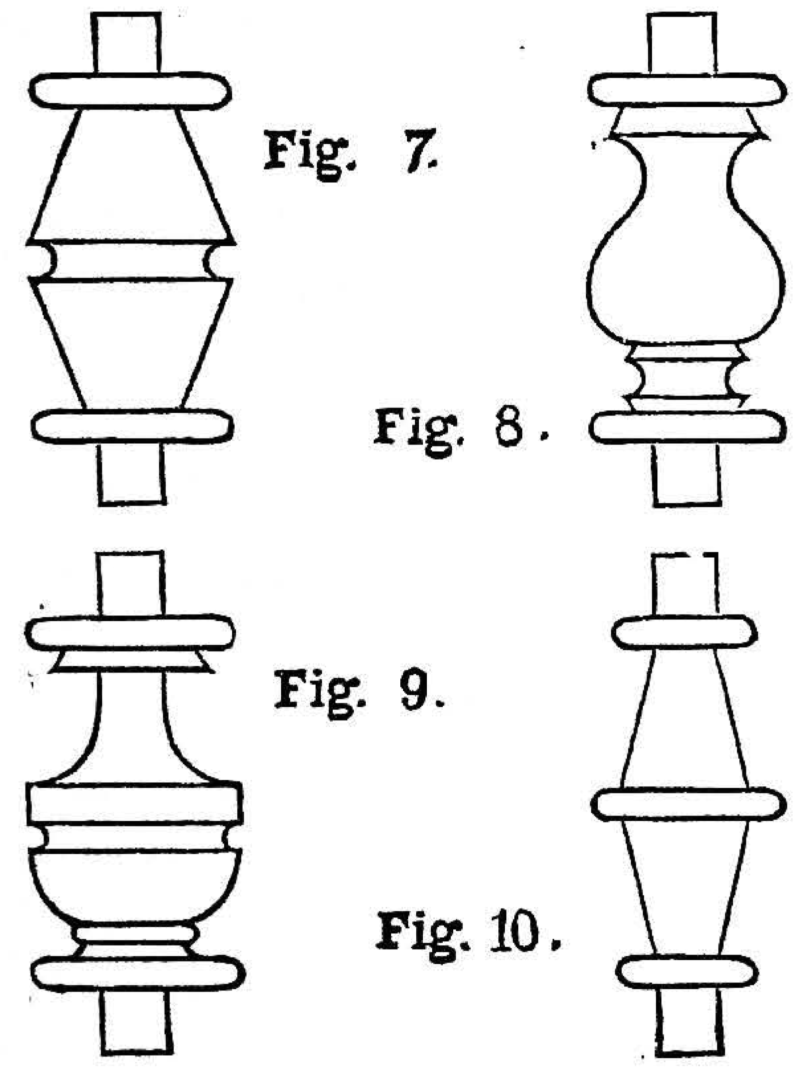


Fig. 7. Fig. 8. Fig. 9. Fig. 10.

Figs. 7, 8, 9, and 10.—Various Designs for Pillars.

end pin must be turned a perfect fit for the $\frac{3}{4}$ in. hole that is to be bored in the base, so that the uprights will be as steady as possible. Next we have the base (Fig. 4), which is comprised of two flat pieces, each 1 in. thick, of the shape shown in the drawings. The bottom piece is $\frac{3}{4}$ in. wider on three sides than the top one, and this $\frac{3}{4}$ in. projection is rounded off to form a nosing. Both may be shaped out, for sake of appearance, as shown, and, besides being glued, are screwed together from the underneath; but in the one I have made the pieces are left quite straight. I left them so in order that I might be able, after a time, to separate the two pieces that comprise the base, and, by inserting a thin piece on edge on each side and back, form a recess, and make a drawer to fit it, if ever I felt inclined to do so. When the base is done, we will bore the two $\frac{3}{4}$ in. holes, and glue the uprights into them. Use Jennings' double spur-bits; they make a very perfect hole. Be sure that the holes are bored quite square with the base. Now turn the feet (Fig. 11), and fix them on with a screw to each, countersinking for the screw-heads, and gluing them before finally screwing them home. The next thing now is to insert the glass into the frame; and as we have made the frame with an opening of the same size as the glass, we must tack on a narrow beading, of $\frac{1}{4}$ in. in thickness and about $\frac{3}{8}$ in. wide, to the inner edge of the frame, to form a rebate to hold in the glass. These beadings will be rounded on the outer edges, and be mitred neatly into the corners and be set true, so that the glass will rest on all the four pieces evenly. They are to be glued and tacked into place, and, when finished, the glass is to be laid in and held in with a sheeting for a back made exactly a true fit, so that in driving the sprigs the back will not rub the silvering off by shifting. A clean piece of blotting-paper inserted between the glass and back is an improvement. All that remains now is to fix the frame to the uprights. This may be done with the ordinary knobs or with the ball-clamps, which is much the better plan. The square pieces at the top of the uprights are purposely left to sink the clamps into in this case; or in case the knobs are used, they form a kind of platform for the edge of the frame to work on—this latter arrangement, however,

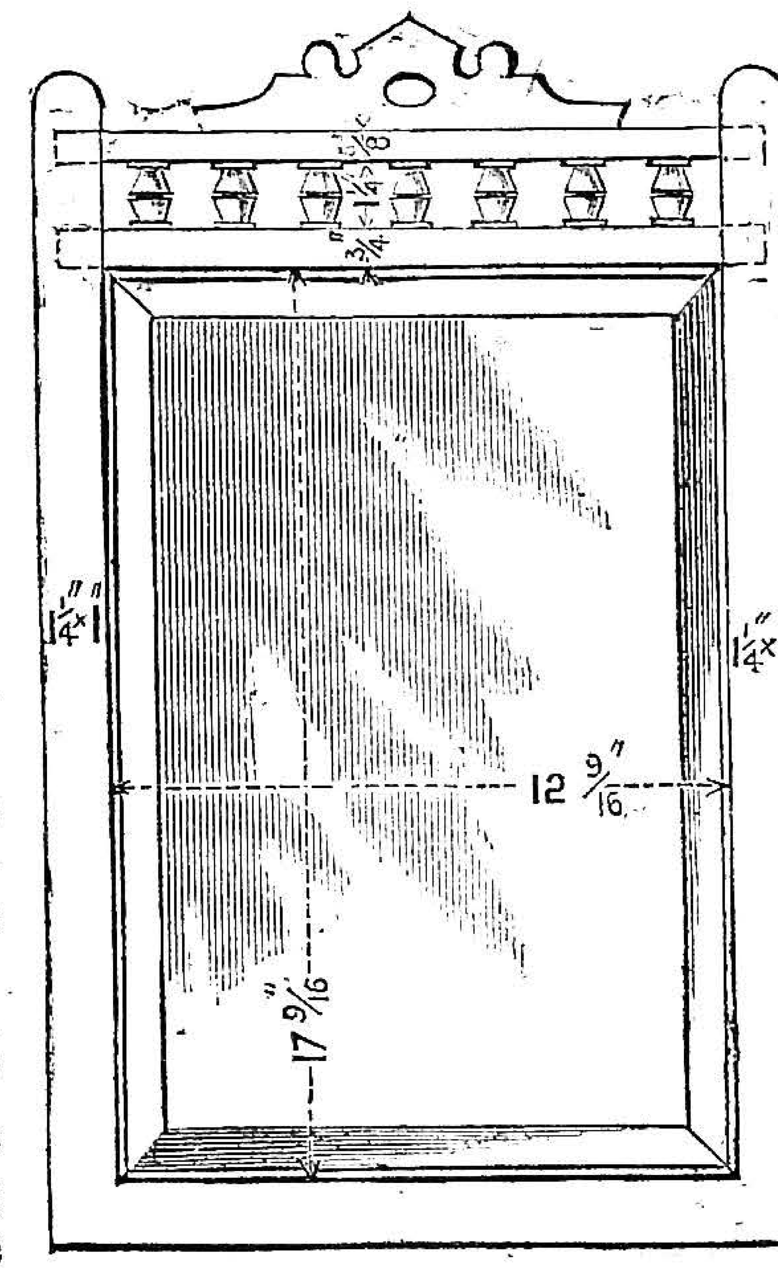


Fig. 3.

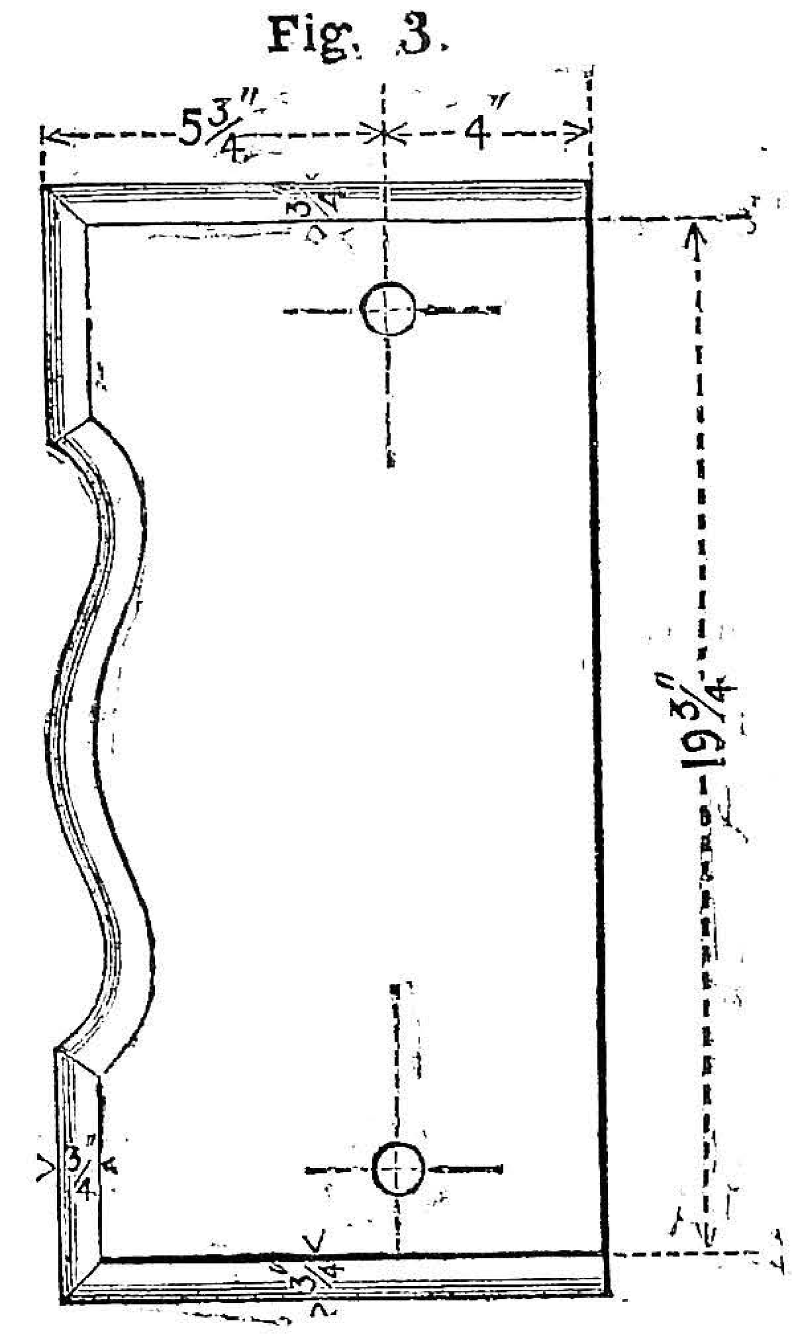


Fig. 4.

Fig. 3.—Frame. Fig. 4.—Base.

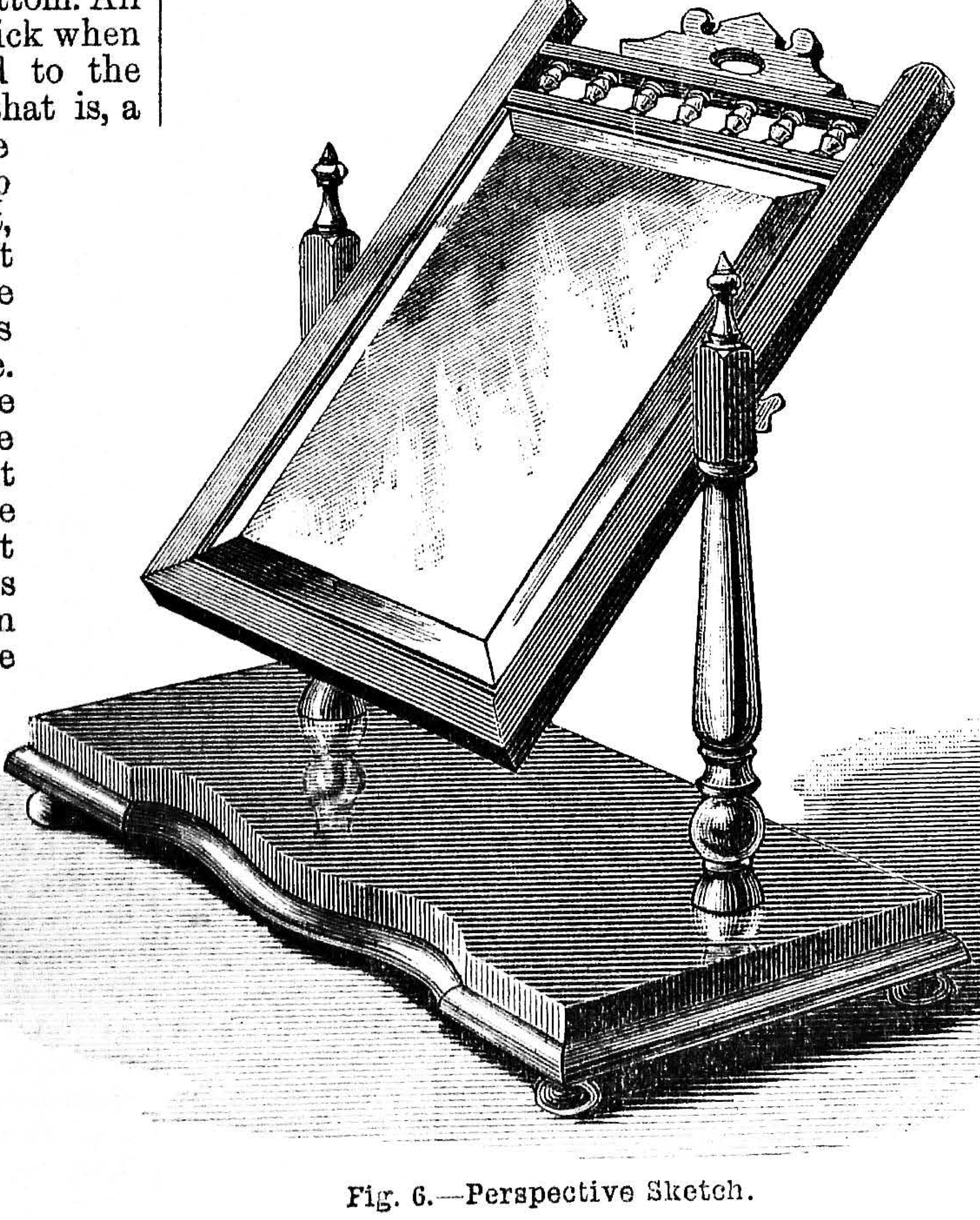


Fig. 6.—Perspective Sketch.

causes the paint to rub off—and a small thin brass washer on the screw is an improvement. Clean off all now with sand-paper, and give a coat of glue-size and two coats of Aspinall's hedge-sparrow egg tint, and we have a very pretty toilet glass indeed, the materials for which have cost us only about 5s.; or if with bevelled glass, 7s.

COUNTRY CARPENTRY.

BY CHOPSTICK.

FARMYARD GATES: HOW TO MAKE AND HANG THEM.

TECHNICAL NAMES FOR THE VARIOUS PARTS OF FARMYARD GATE—SETTING OUT GATE—FORMS OF MORTISES AND TENONS—PUTTING GATE TOGETHER—HINGES FOR HANGING—HANGING GATE—STAPLE AND PIN FASTENING—AUTOMATIC LATCH AND CATCH.

THE subject of this chapter is a very familiar one to the carpenter who has lived all his life in agricultural districts, and who has, most probably, made them by the dozen. To such I will only say: Pass it over, as you will not see anything fresh in it; but to those who have learnt their trade in a smoky town, and have drifted into the country, as a great many do from various causes, this chapter may be of some service; for if such an one were shown a pile of timber, and told to make it up into gates, some of each hand, he would find himself in a quandary without some instructions; and employers do not relish wasting time on instructing journeymen, and I am afraid that the apprentices nowadays have to do without it in too many cases.

Having said so much by way of introduction, I will show how to make those very necessary articles—farmyard gates. I think I had best give the technical term for each part, and hereafter throughout the chapter each part will be known by its own name—if a piece of timber can be said to have a name.

All the following are shown in Fig. 1: A, the "har;" B, the "beam;" C, the "head;" D, the "brace;" E, the "slits;" and F, the "downrights," or, as sometimes called, the "uprights." Gates are sometimes made with four slits, and sometimes five slits. The one I have drawn is a "four-slit" gate; and as the mode of procedure is the same in each case, the only difference being placing the slits closer together to make room for the extra one, my instructions must be taken as applying to the four-slit.

The part to commence on is the beam. This is usually about 9 ft. 6 in. long, 10 in. deep at the wide end, tapering to about $8\frac{1}{2}$ in. or 9 in. at the "frank" (G, Fig. 1), which is about 33 in. from the end. The depth of the remainder of the length tapers from $5\frac{1}{2}$ in. or 6 in. at the "frank" to $3\frac{1}{2}$ in. at the small end. In thickness, the beam tapers from $3\frac{1}{2}$ in. to $2\frac{1}{4}$ in. The first thing to do is to cut a tenon on the large end of beam. Here the iron square comes in useful, the 1 in. part being used to mark the distance of tenon from side of beam, and the $1\frac{1}{4}$ in. part being used for the tenon itself. The shoulders must also be squared off about 6 in. from end of beam. This tenon can be cut, and then the bottom of it cut off so as to form a taper tenon in width. (See dotted lines at H, Fig. 1, and also Fig. 2, which is a perspective sketch of the tenon we have been cutting.)

Some old-fashioned carpenters make the tenon taper in thickness as well as width; but this I consider a very bad plan, as in driving the gate together there is a danger of splitting the har, and with a wedge-shaped tenon I always think that the pins have too much responsibility on them. But this is a digression.

The large tenon on beam being finished, cut another one at the small end. This will only require to be $\frac{3}{4}$ in. shoulder and 1 in. tenon, and must be left parallel, not tapered. Now take the har (this is 4 ft. 6 in. long, $5\frac{1}{2}$ in. by $3\frac{1}{2}$ in.); lay it flat on the ground, and lay the tenon of beam on it, leaving about 7 in. of the har projecting above top of beam, and keeping the shoulder of tenon in close contact with edge of har; then mark along each side of tenon; remove beam and squaring over the marks on each edge of har; strike the mortises with the square in the same way as the tenon was marked; then bore three or four holes through, and knock out mortise, turning the har over and working from each side. Now bore two pin-holes ($\frac{3}{4}$ in.) in the positions shown in Fig. 1, and fit the har and beam together. If all has been done correctly, they should fit on both sides, but it is a great chance if they are sawn exactly square; and if not, then one shoulder will be up before the other. If so, this one must be "saw-scarfed"—that is, the saw must be run in at the joint of beam and har. This must be continued until a good joint is obtained; but be careful and not run saw in beyond the shoulder, or you may find the tenon cut half-way through. The pin-holes should now be "pooked" for draw-boring (see first chapter of "Country Carpentry"), and leaving the beam and har still together, the head must be laid under the tenon on small end of beam, keeping it close up to the shoulder, and about 6 in. projecting above beam. Then mark the tenon across on the head in the same way as the har was marked, and, without moving any part of the gate, lay on the four slits. Place the bottom of the bottom slit 3 ft. 6 in. from top of beam at the har end, and 1 in. less at the head. Then even out the other three slits, leaving a space of 4 in. between first and second, $4\frac{1}{2}$ in. between second and third, and $5\frac{1}{2}$ in. between third and fourth, counting from the bottom. Now mark the length of slits. The bottom one should go through the head, and about 3 in. into the har; the other three should only go $1\frac{1}{2}$ in. into each (see Fig. 1, dotted lines). The slits should now be numbered and taken off the gate, and the brace laid on in about the position shown in Fig. 1, though the exact position does not matter, some preferring to bring it forward nearly to the front end of the gate; but my opinion is that it should be at about an angle of 45°. Anything flatter than this reduces its utility—or, at least, I think so.

Whatever position it has to be in, it must be placed there, and lines marked on the *top*, as it lays, for the shoulders. The tenons being barefaced, it will require no shoulders underneath. A mark must also be made along each edge of brace on both beam and har, and then the whole can be knocked in pieces.

The har can now be finished. Square over each mark made on the side, across the inside edge, and draw a centre line up through. This will show where to bore for the slit mortises. These are simply two holes bored, and the wood knocked out between them. They are shown at I (Fig. 5).

The brace mortise, K (Fig. 5), must be done differently. Mark on thickness of brace for inside of mortise (this is usually $1\frac{1}{2}$ in.), then mark off $\frac{3}{4}$ in. from that mark for the mortise itself. The top part of mortise must be sloped in to the same level as the brace will be when in its place, and which is shown by the mark made on side of har; but the bottom of mortise must be made in square with edge of har.

Of course, in speaking of top and bottom, I mean as it will be when the gate is hung, and not as it lays flat. A glance at dotted lines at K in Fig. 1 will help to make my meaning plainer.

When making the slit mortises in har, do not forget to make the bottom one in about $3\frac{1}{2}$ in. and the other three about $1\frac{3}{4}$ in. The har can now be laid on one side, and the head mortised. This will be done in the same way, the mortise into which beam fits being set out the same as its corresponding tenon was, and knocked out square, from both sides, of course; also a pin-hole bored. The bottom slit mortise must be made through the head, but need only be knocked out between the two holes; and the remaining slit mortises only need to go in a full $1\frac{1}{2}$ in. This finishes the head so far, and it can be laid aside with the har while the beam is got on with. The mortise for the brace is made in this in just the same way as in the har; so we will pass over it as done with, and proceed with the mortises for the downrights.

These are made the same as the slit mortises, but, as will be seen, the first and second from the har must be made at the back side of centre mark; otherwise, they will come in contact with the brace. The front one next the head can be made the front side of centre, so as to be on same side of gate as the brace is. Fig. 1 and Fig. 6 (which is a plan of under side of beam) will explain what I mean. A $\frac{3}{4}$ in. hole must be bored through the brace mortise to take pin, and then the brace itself can be taken in hand. The shoulders of this are already marked at each end. The brace can be cut off about 2 in. longer than these, and to the same bevel, and the tenons struck from the opposite side to the shoulder marks. They can then be cut, and the extreme point cut off square with the shoulders. (See Fig. 3, which shows one end of brace with tenon cut.)

The "frank" of beam can now be finished. The usual shape to make it is shown in Fig. 4, though sometimes it is simply rounded off. It really does not matter which way it is done, but the "O.G.," as Fig. 4, looks the best, and it can be easily struck out with the compasses.

The tops of head and har can now be cut. For the former, square a mark all round, 4 in. above mortise, and another 1 in. above that. Then make diagonal marks from the centre of the latter to the outside of the former, and cut the pieces outside these marks off. Then centre the thickness, and mark and cut again. This forms a point in the centre, and looks very neat. The har can be done in the same way, except that it must be left 1 in. longer, and the point can be made $1\frac{1}{2}$ in. high instead of 1 in.

Fig. 7 shows the top of har finished in this way. The beam, har, head, and brace must now be chamfered on the corners, as shown in Fig. 5, and more clearly in Fig. 7, stopping it neatly at the ends, and also where the various parts come together, as shown. The brace will only want chamfering on one side, as the slits come to the other side. The drawing-knife is the proper tool to do this chamfering with, and, if necessary, a smoothing-plane can be used to finish with. The latter tool should also be run along each corner of the slits, to take off the sharp edges. The pin-holes should now be made in the tenons of the beam and brace, allowing proper draught, so that the pins will pull up the joints, and the gate can be put together.

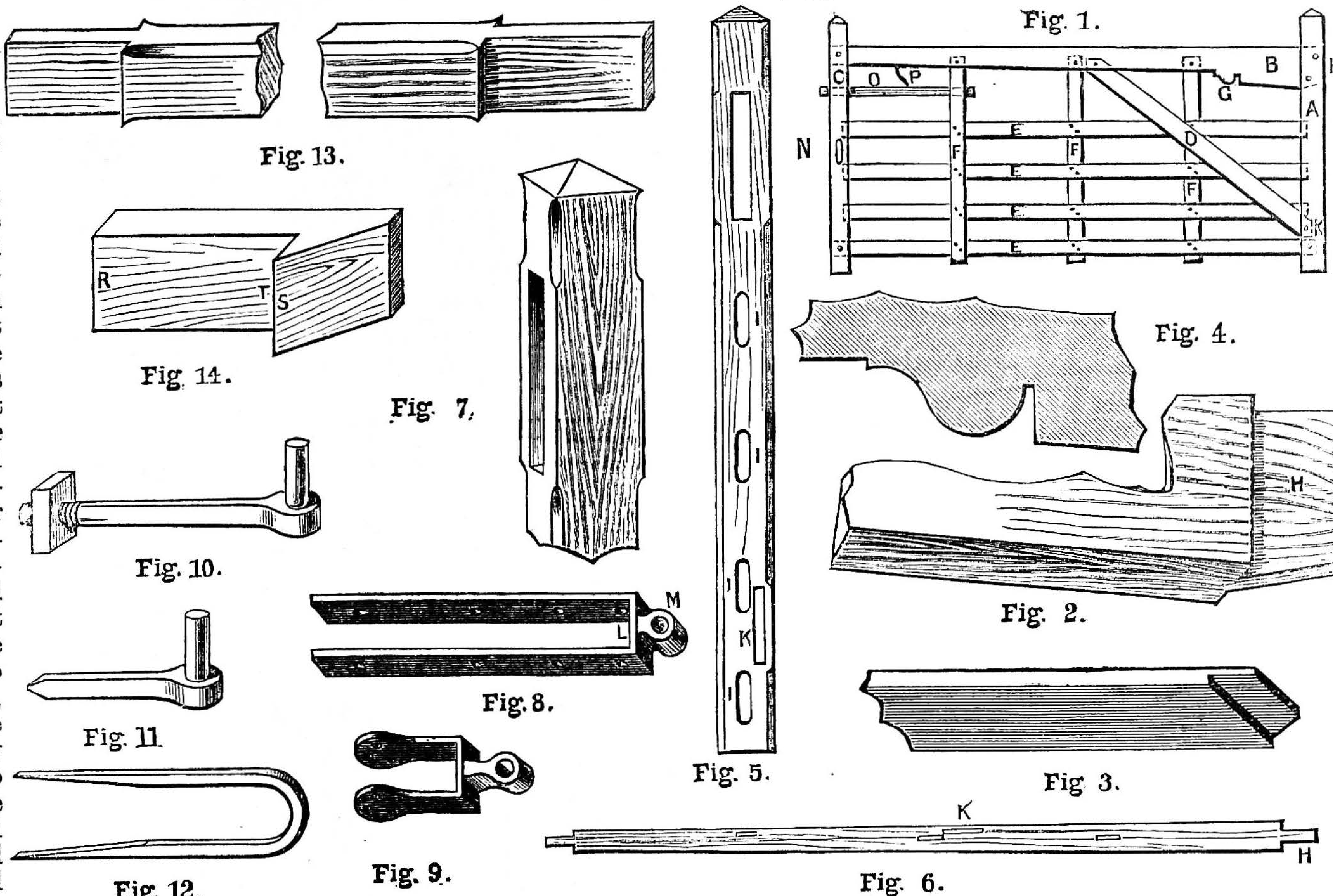
To do this, first drive the har on to the beam, putting in the brace and driving it up at the same time. These three pieces can then be pinned together, after which the slits must be driven in, and finally the head driven on. A $\frac{3}{4}$ in. hole must be bored through both har and head, and a pin inserted to hold bottom slit. The three downrights can then be driven in and pinned, and two nails driven in at each place where they cross the slits, and well clinched. Both slits and downrights must also be nailed well to the brace.

The head and har can now be cut off 3 in. below bottom slit, and the downrights 2 in. below; and the pins and ends of tenons which project through the mortises being cut off, the gate may be said to be finished as far as the making is concerned, and the next thing to be done is to hang it, which we will now proceed to do. The hinges used are called hooks and rides. The hooks are shown in Fig. 10 (the top one) and Fig. 11 (the bottom), and the rides in Fig. 8 (the top) and Fig. 9 (the bottom). The top ride is fixed first, along near the top of beam, the part marked L (Fig. 8) fitting close up to har. Holes are then bored in beam and har corresponding with the bolt-holes in the ride, and the bolts being inserted, the fixing is complete. The gate is then blocked up against the posts in the position it has to occupy, and a hole bored in the post just under the eye (M, Fig. 8) to fit the hook (Fig. 10). This hook can then be put in and screwed up, and the gate hung on. The bottom ride (Fig. 9) can then be put on the har at about 3 in. from the bottom, but not nailed, and a hole for bottom hook is then bored in the post, and the hook driven in. The gate can now be tried, and if it swings correctly and is the right height (the front should be about 3 in. higher than the back), the bottom ride can be nailed; but if the gate requires raising or lowering at the front, it can be easily done by placing a small block between har and bottom ride in the former case, or cutting a small piece out of har in the latter case. By this means any little mistake in boring for the hooks can be easily rectified.

The gate now requires a fastening. For farmyard gates there is no better one than a large staple (as Fig. 12) driven into post, and a mortise made in head of gate to slide over it (N, Fig. 1). An iron pin, being fixed to gate with a short piece of chain, is then passed through, and there is no chance of cattle opening it.

Another method of fastening is shown at O (Fig. 1), which, if made properly, has the merit of acting automatically. A mortise is made through head of gate, midway between beam and top slit, and a short piece of board nailed on to beam and first slit, opposite the front downright, thus forming a slot the thickness of the slit. A piece of wood long enough to project, as shown at O (Fig. 1), and about 2 in. by $1\frac{1}{2}$ in., is then taken, and a tenon cut on each end small enough to slide easily in the slot before mentioned. The distance between shoulders being about 2 in. shorter than the distance between the head of gate and the first downright, the edges must also be chamfered off, as shown in Fig. 13, which also shows the tenons. This is then placed in the mortise and slot made for it, and hung there with a short piece of chain and staples, as shown at P (Fig. 1). A wood catch is then made, as Fig. 14, and the part R mortised into post, so that the gate will just close without the catch, S, touching the head. If the gate is now allowed to fall to, the bevelled part of catch, S, will force the piece, O, back until it is past the catch, when it will fall forward into T and fasten the gate. In order to ensure this fastener working right, the chain, P, must be placed on the bevel, as shown, thus giving the handle a good fall. If this is attended to, it will always act properly. There are other methods of fastening, and also other kinds of hinges in use, but I have shown those most common, and the others will be easy enough to get at if required.

In my next paper I will show some other simple forms of farm gates and how to make them.



Farmyard Gates. Fig. 1.—Elevation of Farm Gate. Fig. 2.—Shape of Tenon of Beam. Fig. 3.—Shape of Tenon of Brace. Fig. 4.—Shape of O.G. worked on "Frank." Fig. 5.—Edge of Har, showing Mortises and Chamfers. Fig. 6.—Plan of Under Side of Beam, showing Mortises for Downrights and Brace. Fig. 7.—Sketch of Top End of Har, showing Method of cutting Top and also Chamfers. Fig. 8.—Top Ride. Fig. 9.—Bottom Ride. Fig. 10.—Top Hook. Fig. 11.—Bottom Hook. Fig. 12.—Staple for Fastening. Fig. 13.—Sketch of Alternative Form of Fastening. Fig. 14.—Catch for ditto. References to Letters—A, Har of Gate; B, Beam of Gate; C, Head of Gate; D, Brace of Gate; E, Slits of Gate; F, Downrights of Gate; G, "Frank;" H, Tenon on Beam; I, Mortises for Slits; K, Mortises for Brace; L, Part of Ride to fit against Har; M, Eye of Ride; N, Mortise in Head for Staple Fastener; O, Bar of Automatic Fastener; P, Chain forming Fall for ditto; R, End of Catch to fix in Post; S, Bevel of Catch; T, Notch of Catch which holds O.

CEMENTS.

The following recipes will be found useful to many of our workers:—

Cement of Pompeii, or Universal Cement.—Dissolve 8 oz. of sugar in 24 oz. of water in a glass flask on a water bath, and to the thin syrup add 2 oz. of slaked lime. Keep the mixture at a temperature of about 70–75° C. for three days, shaking frequently; then cool, and decant the clear liquor. Dilute $6\frac{1}{2}$ oz. of this liquor with as much water, and in the mixture steep 16 oz. of fine gelatine for three hours after heating, to effect solution. Finally, add to the mixture $1\frac{1}{2}$ oz. of glacial acetic acid and 15 grs. of pure carbolic acid. The latter will serve as a preservative.

Diamond Cement.—Fine gelatine, 5 oz.; water, 4 oz.; glacial acetic acid, 1 oz. Let these stand together for several hours; then heat, to effect solution, and add 10 grs. of carbolic acid to preserve the cement.

Liquid Glue (Sydetikon).—For this use 4 parts of the above-mentioned saccharated solution of lime, and dissolve 6 parts of glue or gelatine in it, as there directed. Then neutralise the lime with a third part of oxalic acid, and add carbolic acid in the above-mentioned proportion, as a preservative.

Cement for Porcelain.—Twenty parts of white-lead and 12 parts of pipeclay, carefully dried, are incorporated with 10 parts of boiled linseed oil, heated on a water-bath. The cemented articles are dried slowly in a warm place.

TRADE: PRESENT AND FUTURE.

, *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

Flannel Trade.—One firm in the Rochdale district having given notice of a reduction in wages, the operatives threatened to come out on strike unless it was withdrawn. This the firm declined to do, and the consequence is that about 120 weavers are out, about half of which number belong to the Weavers' Association. This is the only case of dispute in this trade in the district.

Engineering Trade.—The prospects for the new year, so far as the Lancashire section of the engineering trade is concerned, are not of the brightest. Boiler makers are somewhat better off for work than they have been for some time, but they complain greatly of the new railway rates, which, in many cases, represents as much as 30 per cent. increase in cost of carriage. As a set-off, they intend to form a syndicate for purchasing a steamer to carry boilers and heavy work. Stationary builders continue fairly busy, but in most other branches continued scarcity of orders is reported.

Iron Trade.—There is little business doing in the iron trade of the Lancashire district, but prices still exhibit a tendency to harden. For good foundry brands 46s. is being quoted.

Steel Trade.—Raw material remains low in price, and ordinary foundry qualities in hematites do not reach more than 55s. 6d., and steel billets £4 6s. 6d. In manufactured steel, however, a decided hardening tendency is noticeable, and £6 12s. 6d. now represents the average price for good boiler-making qualities.

Cotton Trade.—The somewhat improved outlook in the cotton trade has led to the consideration of the situation by the masters. It is suggested that reduced wages and short time shall be accepted until the condition of trade warrants a return to the previously existing rates. There are signs that the crisis is coming to an end. The situation may be summarised as follows: The masters say, "There is no profit in the business; we must reduce wages. You men are well paid, and can easily afford to work for a little less in order to keep the trade going." The men say, "We admit that we are well paid; but if you reduce our wages the saving will be infinitesimal, and you will have to reduce the price of yarn in corresponding ratio, and neither masters nor men will gain thereby. Reduce the output—work three days a week; prices will harden, and all will be well." The masters reply, "We cannot afford to run our mills three days a week. The standing expenses—rent, rates, interest on capital, managers' and other salaries, etc. etc.—all go on as usual. It really cannot be done." The compromise is likely to be as follows: The men will work at the reduced rate for three days a week, until stocks are sufficiently clear to enable full time to be run at the old rate. The contest has been conducted with the utmost good feeling and propriety on both sides. The operative spinners are well able to hold out for a lengthy period, but, in view of the distressful condition to which the card-room hands and other members of the trade, out of the union, are reduced, they are willing to strain a point: an evidence of sympathy with their fellow-workmen which should be noted by other trades.

Ivory Trade.—Owing to the increasing scarcity of ivory, manufacturers are putting on the market quantities of plated knife handles, known in the trade as "solid-handled, hard-soldered" work, which are being made to carry steel blades. These present a most durable appearance, and for ships, hotels, and restaurants are serviceable. They are, however, inferior to ivory or whole handles of any description. The tone of the ivory market for 1892 has been much firmer, yet the uncertainty which attends the acquisition of a supply sufficient to meet the great demand is such that manufacturing cutlers will have to look for a substitute in order to make themselves safe from possible surprises, as ivory is in increasing request.

Boot and Shoe Trade.—The handsewn bootmakers at Northampton and district have commenced the year 1893 under most favourable circumstances. A new statement of wages to be paid has been adopted jointly by masters and men, which gives an increased wage to the worker, and the master has an equivalent in more uniformity in the different classes of work, and thereby has the beneficial effect of weeding out the unscrupulous manufacturer who could hitherto, through want of uniformity, undersell the manufacturer who acted fairly with his *employés*.

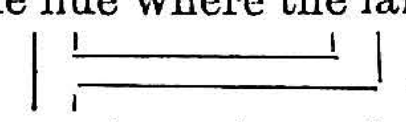
SHOP:

A Corner for Those who Want to Talk It.

, *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all questions and replies, which will in future be dealt with week by week as received.*

I.—Letters from Correspondents.

White Bricks.—A Reader.—It is a very difficult matter to remove stains from white brickwork, especially if they have been on for any length of time. You must first have the gutter cleaned out and the joints made watertight; then scrub the stains with a brush, soap and water, and wash off. If this does not remove all, rub the face of the stained bricks with a soft brick of the same kind, using alum water, but do not wash off. If this, when dry, is not the colour of the other bricks, there will be nothing but painting. The paint should be mixed with turpentine, and the bricks should also be dry when the paint is laid on. It will be advisable, in either case, to try a few bricks at first, and allow them to dry, to see the effect before doing the whole. The alum water should be kept from the joints. See that the downpipes are clear, as, if stopped, they will cause the water to overflow.—M.

Incubator.—F. B. (*King's Heath*).—Your machine is known as the "British Farmers' Incubator," and is supposed to need no regulator. An incubator without one is, however, an expensive toy. From its construction it is somewhat difficult to adapt my regulator, unless you have two egg-trays, and room between to stand a glass tube. If so, see my article in No. 143, on "An Atmospheric Incubator." If this will not do, Durnford's regulator might, perhaps, suit you. In this case, you will need to lengthen the flue where the lamp enters, making it this shape:  , so that the heat, when the temperature rises above a given point, may pass straight away, instead of going through the tank; or you might ventilate the egg chamber by making a tube about 2½ in. in diameter, long enough to reach from 1 in. above top of case to ½ in. below the bottom of tank, cutting a hole through the tank and soldering the tube in. In either case, you will need another tube, say, ⅛ in. in diameter, which must be soldered in where required to allow the lifting-rod of regulator to pass through. You also want a damper, made of ribbon brass, fixed across top of case in a line with the centres of the tubes fixed, working on knife-edges at a point about 1 in. beyond the small tube on the side farthest from the large one. At one end a circular flange of sheet metal must be fixed to cover the large tube, and a suitable balance weight adjusted at the other end, allowing the flange end to be slightly the heavier of the two. When the heat rises beyond its limit, the regulator-rod will rise and lift the damper, thus allowing the lamp heat to pass straight away, or, if the second plan is followed, allowing a current of air to pass through the egg chamber.—Leghorn.

The Disposal of Town Refuse.—J. T. (*Bishop Auckland*) writes:—"The disposal of town refuse is a problem which, in many towns, will have to be dealt with in the near future. It has been an almost general custom to cart it on to the land within a distance of two or three miles, but, owing to the accumulations and to the rough nature of the material, farmers are declining to take it. In districts where coal is cheap, a good many cinders are thrown out which might be burnt. A grating might be fixed in front of the kitchen fire, over which all the ashes might be passed, the finer portion falling through, and the rougher being burnt again; or, where this is not practicable, a screen could be fixed over the dustbin, and the ashes passed over it—the cinders falling into a box from the screen to be reburnt. In some towns 'destructors' are being used. These consist of large furnaces connected to a tall chimney for inducing a draught and carrying off the burning fumes. The furnaces are fed through an opening in the top, regulated by a door. The material burns to a slag or clinker, which is ground and used for mixing with concrete, or for road-making or ballasting. Another method is to grind the material to powder in a disintegrator, which makes it suitable for use as a manure. It has been found, from experiments, that the cost of grinding is about 6d. per ton. To this must be added the cost of carting to the machine, interest and depreciation on the plant; but if a market can be found for the material, at a considerably less price than any artificial manures in use at present, this method would yield a profit; it might also be mixed with chemicals to suit different kinds of crops."

Circular Saws.—A. R. (*Scorrier*) writes to A New Reader:—"It is not true that four high teeth in a circular saw, the difference being but little, will cause it to run out of truth. Experience teaches me that a saw may run perfectly true with even eight or nine or more high teeth on one side (or range, as we term it), while another saw may, with four or five high teeth, deviate from a true path. (1) *The Diameter of Saw.*—A New Reader will know that a circular saw, with the exception of the packing, is self-supporting. Therefore a saw, say, 50 in. diameter, with the same number of high teeth, will deviate from a true path quicker than a saw of half that diameter—the distance from point of teeth to centre of saw being greater, and having to pass through a greater depth of timber. (2) *The Thickness of Saw.*—Two saws may be of the same diameter and driven at the same speed, both having the same number of high teeth on one range. One saw is of No. 11 gauge, the other of No. 9 gauge. While the latter is running quite true, the one of No. 11 gauge runs out of truth; for the simple reason that the stouter saw requires more friction to heat it similarly to the thinner saw, and, being stouter, the high teeth do not have the same effect on the saw plates. (3) *Space of Teeth.*—A saw with teeth 3 in. from point to point, same gauge, diameter, etc., will draw thick or thin, as the case may be, while one with teeth 2 in. apart will be running perfectly true. In the one saw sixty teeth are passing through the timber; in the other ninety teeth pass through. The lesser number having the same amount of work to do in the same time, consequently, will be more liable in this saw to run out of truth. (4) *The Bevel and Rake of Teeth.*—Two saws may be of the same diameter, etc. The rake and bevel of teeth in one may be more than in the other. The saw having the teeth with most rake and bevel, and the same number of high teeth, will deviate from a true path while the other may be running quite true—the cut being so much faster in one than in the other. (5) *The Speed of Saw.*—A saw with high teeth, at a speed of 6,000 ft. per minute, may be running perfectly true, but if increased to the standard speed of 9,000 ft. per minute will at once run out of truth. Again, a saw of a certain gauge at a speed of 6,000 ft. may run out of truth, while one of stouter gauge at same speed will run true, both having the same number of high teeth. (6) *How the Saw has been Packed.*—This is a very important point. If a saw is not properly packed it will be liable to run out of truth, whether the teeth are uniform in length or not. A saw may be so packed that, with several high teeth, it will run for a while perfectly true; or it may be so packed that it will run out of truth as soon as set to work, with rake, bevel, etc., of teeth uniform. Therefore, it will be seen that care has to be taken in the packing, as well as in the sharpening, of a circular saw. If a large number of high teeth are one side, the saw will run out of truth. My advice is that the teeth be kept as uniform in length, etc., as possible. A saw that is being worked time after time with high teeth will soon become crippled, the high teeth causing undue strain on the saw-plate. Very thick saws are often preferred by sawyers, because so much care is not needed in their working and sharpening as with thinner ones. The teeth should be kept at uniform length by holding a piece of medium hard grindstone against the teeth while the saw is revolving, so grinding off all high points. When all the teeth have been touched with stone, the saw will be round. File top of teeth carefully until places caused by the stone disappear."

II.—Questions Answered by Editor and Staff.

Bootmakers' Drag Knives, etc.—Amateur.—Your best plan is to get a set of kit files, or one or two half-round fine files, and when your knives get blunt take them out of their holders and file them on the concave side, holding them firm in the pincers or vice, with the cutting edge towards you, and taking strokes with the file in a direction from you, holding the file very flat upon the blade, so as not to make it thick. This can be done with a medium file and then repeated with a very fine one. If you do not let them get too unfit, you may be able to dispense with the files and only use the following, which, if the files are used, must be resorted to as finishing touches:—Take about a foot of a thin broom handle, and paste a piece of fine emery cloth round the centre, about five or six inches wide; this will leave about three inches each end to form the handles. This you use in the same way as stated above for the files, and will be handy as it has a handle each end. This is best for heel shaves, while an edge knife would need a finer stick. To finish, a stone must be used to give them a keen edge, but, as you say, "they cannot be laid flat upon it," therefore you must make the stone round, to suit the knives, and use that as above stated. The judge-wheel and seat-wheel are slightly heated before use, and the parts that they are going to be used upon should just be damped a little first, more particularly where the judge is about to be used, and you should use these tools very firmly and steadily, pushing them and bearing upon them with the same pressure the whole time they are in use.—W. G.

Welding Cast Steel.—Tom Doctor.—Fluxes, composed of ground bottle-glass and fine sand, and of finely powdered limestone or marble, are used in welding cast steel. The steel must be heated in a clear fire to a creamy heat, and kept from burning by a frequent application of the flux.—G. E. B.

Bronzing Iron Frames.—Two Years' Subscriber.—It will be necessary to first fill up all minute holes and prevent suction either by giving a coat of paint, or, if a better result is desired, mix whiting with patent size, and give several coats, allowing it to dry between each coat, and smoothing down with fine glass-paper. A coat of japanners' gold size is then generally given as a medium for fixing the bronze; but as bronze applied thus will soon tarnish, which you wish to avoid, I would advise giving a coat of copal varnish instead. When this is just tacky to the touch, apply the bronze powder by means of a piece of new washleather, camel's-hair brush, or wadding. When all is dry, you may still further prevent it from tarnishing by giving a coat of parchment size or clear varnish.

The former is made by dissolving parchment cuttings in warm water till it forms a jelly when cold. By the way, a cheap, quick method is to mix the bronze powder with French polish or spirit varnish and apply with a brush like paint.—LIFEBOAT.

Ebonising Wood.—TWO YEARS' SUBSCRIBER.—Use any of the ebony stains as advised in "Shop," Vol. III., p. 332. When smoothing down any black work, use a little linseed oil on the face of the glass-paper. Mix a little vegetable or common black with the "filling in," and when "bodying up" use a little gas black or Frankfort black in the polish, which, for black work, should be what is called white or transparent, made by dissolving white shellac in methylated spirits, taking the precaution to well crush and dry the gum before adding the spirits. Finish off with clear polish, without any black.—LIFEBOAT.

Gassner Dry Battery.—R. S. (*Felixstowe*).—The outer zinc case may be of any shape or size, but should be proportioned to the height and shape of the carbon element employed therein. The thickness of the zinc may vary from $\frac{1}{16}$ in. to $\frac{1}{8}$ in., or may be thinner than $\frac{1}{16}$ in. if preferred. It should be best rolled Belgian zinc plate, and the case must be made watertight. In the ordinary size of Gassner cell, the case has a height of 7 in., and a diameter of 3 in. A glass disc is placed in the zinc case, and coated with melted paraffin. On this insulated false bottom rests the cylinder of specially prepared porous carbon. The space between the outer sides of this cylinder, and the inner sides of the zinc case, is packed with the depolarising mixture of zinc oxide, lime sulphate, ammonium chloride, etc., which forms the subject of the Gassner patent.—G. E. B.

Electric Light Installation.—H. McD. (*Glasgow*).—(1) To replace the gas lights in your two rooms with electric lights of equivalent lighting power, you will require, in the room 12×12×10, an electrolier of three 8 c.-p. lamps, or three brackets with the same number of lamps, one on each bracket. In the room 14×12×10 you should have an electrolier of three 8 c.-p. lamps in place of the gaselier, and a 16 c.-p. lamp on a bracket, or two 8 c.-p. lamps on two brackets, to replace the No. 5 burner at present in use. (2) If you employ 25 volt lamps, you will require a current of 8 ampères, at a pressure of 25 volts, to keep the lamps all alight at once. (3) The 200 watts of current required may be supplied from a Gramme or a Manchester dynamo direct, driven by $\frac{1}{4}$ h.-p. gas engine, or it may be furnished by thirteen accumulator cells of the E.P.S. L type, charged with current from the dynamo during the day, and used to light the lamps at night. I have recently had the pleasure of inspecting a private installation in a gentleman's house, fitted up by this method with electric lights. The gas engine and dynamo are in a small shed at the bottom of the garden, and cables lead from this to another shed near the house, containing the accumulators. These are charged by running the engine for a few hours twice or thrice in the week, and are switched on at night to the lamps. The installation gives great satisfaction, and has been running for sixteen months at very little cost. (4) The Gramme or Manchester dynamos will be superior to the Siemens for this purpose. In ordering the castings, state fully your requirements, and then they will be sent of a size suitable to the work. You will need about 4 lbs. of No. 16 cotton-covered wire, and from 8 lbs. to 10 lbs. of cotton-covered No. 22 wire. The larger size enclosed in your letter is No. 22, and this will do to go on the fields if coated well with paraffin. The smaller size is No. 25, and is too small to be of use in this work. The castings may cost 35s. If you order them from Mr. Bottone, he will give you instructions respecting the quantity and size of wire for winding the machine.—G. E. B.

Armature for Dynamo.—H. J. C. (*Uxbridge*).—You should have no difficulty in getting laminated iron punchings for an armature to go in a tunnel $3\frac{1}{2}$ in. by 6 in. Write to Mr. Bottone, Wallington, Surrey, and state the case to him. He will, probably, be able to furnish you with the requisite number of punchings for either a Siemens H or a drum armature. The number required to make up the length are strung on the spindle of the armature, and held together by nuts on each end of the spindle. When these are tightened, the whole may be turned down in a lathe if the diameter is too full. With a Siemens H armature you will only require a two-part commutator. With a drum armature you must have as many parts on the commutator as you have coils on the armature. In winding a drum, some six, eight, ten, or more separate coils are wound over the discs side by side. Get some coloured cottons or silks, and tie the ends of each coil with a scrap of separate colour. When all are wound, connect the finish end of one coil to the starting end of its neighbour on the same bar. The coloured scraps of cotton or of silk will aid you in locating the right ends.—G. E. B.

Incubator.—E. B. (*Leicester*).—It is a vexed point as to whether help should not be given at hatching time to chicks unable to extricate themselves from their shells, but for my own part I always give it, although I believe it is only the weaklings that need it, and consequently they are not so robust as those which require no help. I prefer to keep the temperature the same throughout the whole period. The size of tube is immaterial, provided there is a sufficient surface of mercury presented to the float to overcome the small amount of dead weight there is in the damper. The larger, up to a certain point, the better, but it should not be less than $\frac{3}{8}$ in. At hatching time the live chicks can easily be distinguished by placing them in warm water as advised. If they are not out twenty-four hours after, chip the shell slightly and remove gradually.—LEGHORN.

Wardrobe.—NIL DESPERANDUM.—(1) Three feet or 3 ft. 6 in., as preferred. (2) Fig. 1 will explain, in plan, how to unite the frame to adjoining horizontal boards; and Fig. 2 further assists understanding by representing a front view of the frame. (3) Yes; satin-walnut is very suitable. (4) Yes; you should experience no difficulty in getting wood the desired width.—J. S.

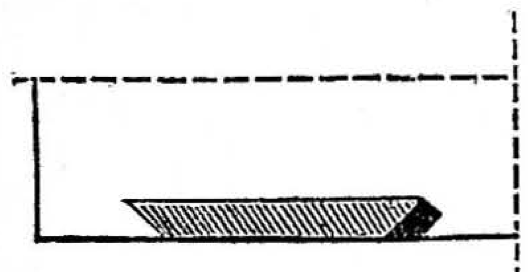


Fig. 1

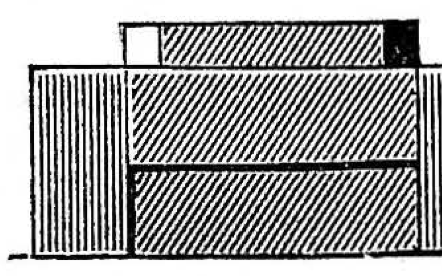


Fig. 2

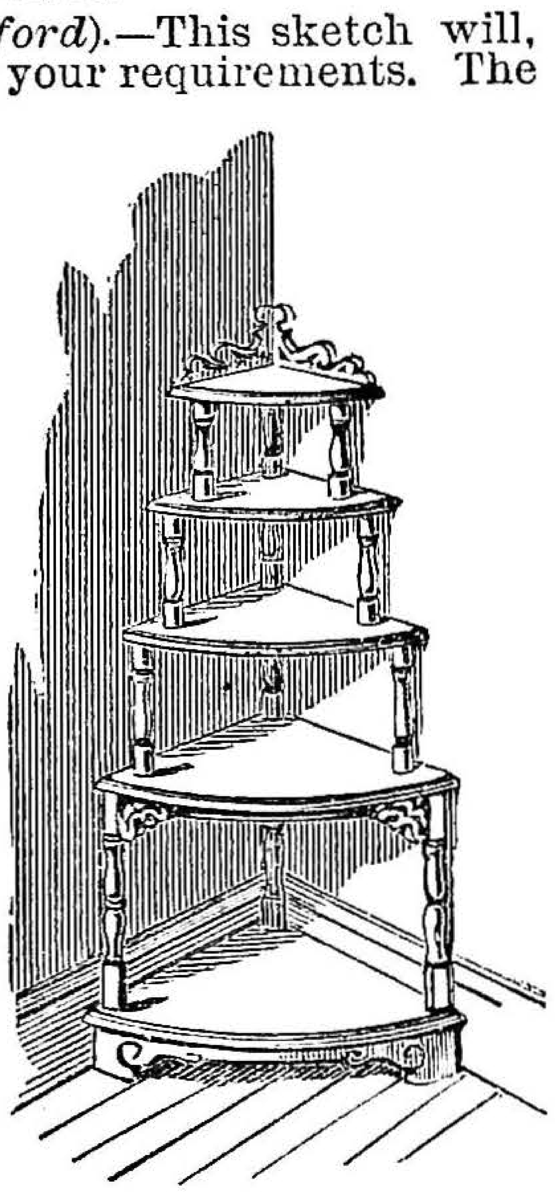
Fig. 1.—Method of joining Frame to Horizontal Boards. Fig. 2.—Front View of Frame.

Electric Indicator.—H. W. R. (*Kilburn*).—An electrical indicator, with mechanical replacement, is described and illustrated in No. 20, Vol. I., at p. 313. Mr. Dale is now doing business in Dyer's Buildings, Holborn.—G. E. B.

Carved Furniture Designs.—E. C. J. (*Kyneton, Victoria*).—By all means send your articles on approval. We shall be glad to peruse your MSS.—ED. WORK.

Parts of Electric Battery.—CONSTANT READER.—If you do not know of any druggist or metal dealer in Penzance who will get the parts of electric or galvanic batteries for you, send to a dealer in London or other large town, and have them forwarded to you by rail.—G. E. B.

Whatnot.—L.G. (*Bradford*).—This sketch will, I daresay, be sufficient for your requirements. The radii of shelves are from 8 in. to 20 in., and the total height is 4 ft. 6 in. The shelves should be fixed at graduated heights to taste, and supported on 1 in. turned posts.—F. J.



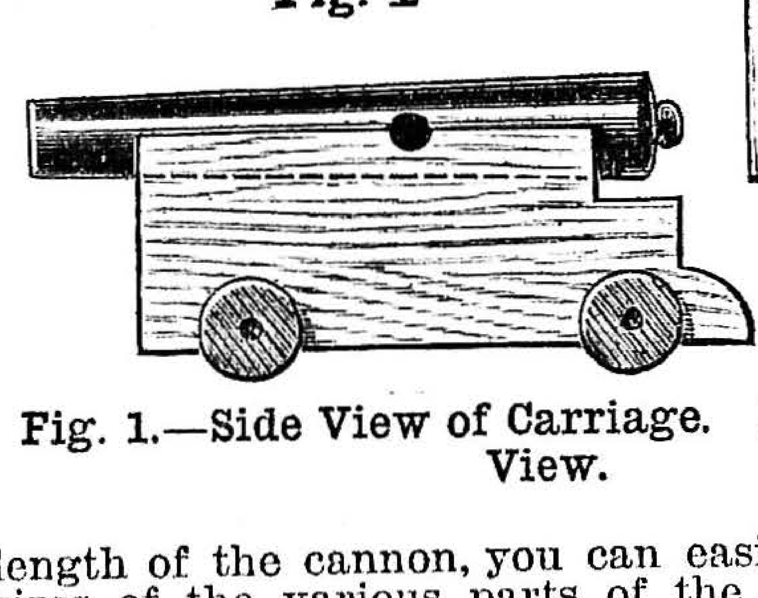
Whatnot for Corner.

Electro-motor for Yacht.—F. J. H. (*Stoke Newington*).—I am afraid you will not find the little electro-motor described on p. 783, in No. 154, Vol. III., of WORK, sufficiently powerful to drive a model yacht 3 ft. long. The nearest thing described in WORK is the model motor mentioned in No. 108, Vol. III. Even this would be scarcely suitable to the purpose, as it has only a two-part commutator, and, therefore, would be liable to stop on a dead centre. You want a motor with a six-part commutator, such as those made by Messrs. King, Mendham & Co., and this should be connected direct to the propeller shaft and furnished with a thrust block. We have not described in WORK such a thing as you require.—G. E. B.

Electric Bell Maker.—J. H. W. (*Halifax*).—Good electric bells at reasonable prices are obtainable from the Electric Stores, London.—G. E. B.

Carriage for Model Cannon.—In answer to your letter it seems the cannon for which you require design for carriage must be a fortress or ship gun, as it is too heavy for a field gun. Fig. 1 is an illustration of the kind of wooden carriage on which model cannons are generally mounted. As you know the length of the cannon, you can easily calculate the sizes of the various parts of the carriage. It is chopped out of a block of oak or boxwood, and is furnished with four wheels and a wedge, which latter is used for levelling the cannon, and is attached to the carriage by a small length of chain. Fig. 2 is a section of the front of the carriage.—R. W. C.

Fig. 1



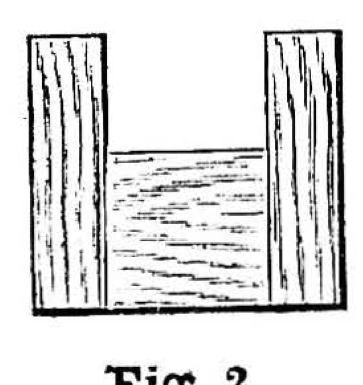


Fig. 2

Fig. 1.—Side View of Carriage. Fig. 2.—Front View.

Wire Coupler.—A. E. N. (*Broadstairs*).—Wilcox's patent wire coupler is an American invention, but it is to be had of G. N. Marsh, 29, Temple Street, Bristol.—B. A. B.

Clock Materials.—J. J. J. (*Morriston*).—I find Messrs. Haswell & Sons, 49 and 50, Spencer Street, Clerkenwell, and Messrs. Grimshaw & Co., 35, Goswell Road, Clerkenwell, E.C., very good; but if you require trains, castings, forgings, etc., of clocks only, then J. Mayes, 55, Red Lion Street, Clerkenwell, would probably be the best, as he makes a speciality of them.—A. B. C.

Incubator.—M. F. (*Oldham*).—The disc R D (Query R D D) (see No. 143, p. 609) is "not made to radiate;" it serves to radiate the heat passing up the lamp flue against the sides, and thus to heat the water contained in evaporating-tray. The thickness of the rod R R may be about the substance of a fine knitting-needle, which article will answer very well for the purpose, although brass or copper would be preferable.—LEGHORN.

Bevelled Plate.—A. B. C. (*Alnwick*).—You could certainly get the pieces of bevelled plate-glass through a cabinet-maker, but nearly any of the glass manufacturers would supply you. As to cost, it is difficult to say; there are at least four qualities of glass, and the price varies on each of these for nearly every superficial foot; again, bevels run from $\frac{1}{4}$ in. by eighths up to about 2 in., and not only is a different price charged for each, but it varies according as the glass is small, large, or medium; so you see it is nearly impossible to give you an idea of the cost without knowing full particulars.—W. E. D., JR.

Motor Connections.—S. T. (*Londonderry*).—As to connecting up the small model motor in Vol. III., No. 154, with a battery, you will, doubtless, before seeing this, have noticed answers to other correspondents upon the same subject.—J. B.

German Silver Tubing.—F. S. B. (*Queensbury*).—German silver tube of any diameter can be procured from Messrs. Smith, metal merchants, St. John's Square, Clerkenwell.—G.

Organette Paper.—HARRISON.—I think you would obtain the paper you require for American organette from Brown, Brough & Co., Warwick Lane, City.—G.

Polish, Varnish, and Bookcase.—NEVER SATISFIED.—(1) French polish is made by dissolving about 6 oz. of shellac in 1 pint of rectified naphtha or methylated spirits. If the work is to be done in the domestic workshop, the latter is the most agreeable; in cold damp weather or cold shop use the naphtha. If you get the best orange shellac—the cheaper are dark-coloured—you will have a light-coloured polish suitable for most purposes; but for the white woods, such as holly and sycamore, you will require white shellac. This gives a semi-transparent polish, but is more difficult to make. The shellac, being kept in water, must be crushed up fine, spread on paper, and allowed to stand in the sun or in a warm room till dry, previous to adding the methylated spirits. (2) Varnish is made by adding to the polish something to make it brighter and stronger. It is generally sufficient to add to each pint of polish 2 oz. or 3 oz. of gum benzoin, or if a cheaper varnish is preferred, a small quantity of resin is added instead. I do not advise the making of varnish in small quantities; I would rather advise you to go to a respectable oil and colour merchant's (not chemist's), and buy some best brown hard spirit varnish. This may be used alone; but if you use equal parts of this and polish of either kind, you will have a varnish suitable for all practical purposes. (3) The red and brown stains and varnish, as used on walking-sticks, etc., have already been given in "Shop." (See No. 131, p. 429, Vol. III.) (4) The size you give for a bookcase—2 ft. 6 in. by 2 ft.—is not a suitable one to stand on the floor; it is more the size of a hanging bookcase. Have you seen the design in No. 44 for "Our Prize Bookcase?" If not, I strongly advise you to get it, as you want one with a fair amount of work in it. You will have there a design sure to please, with details of size and construction. By omitting the shelves at the sides and bottom, using only the centre portion, and adding a plinth at the bottom about 4 in. deep, you will have a design for one to stand on the floor.—LIFEBOAT.

Tin Goods.—MAC.—You can obtain tin goods of excellent quality from either of the following firms: Wilson & Co., Wardour Street, London; Henry Loveridge & Sons, Merridale Works, Wolverhampton; Perry & Co., Limited, Wolverhampton; S. H. Hopkins & Sons, Granville Works, Birmingham. If you state requirements, no doubt the firms will give you their terms.—R. A.

Copper and Zinc Plates.—H. Y. W. (*Bromley*).—To polish copper and zinc plates has not as yet been successfully accomplished by machinery as far as getting them up to a *true surface* goes. Whatever machine method is to be employed, it must be a *grinding* one. First anneal the plates, if copper, and pass them through a pair of rolls; this will take out all the buckling, but will impart a slight sweep to them. This can be taken out by putting them through another pair of rolls; this will make the plate perfectly flat. Now make a similar arrangement of machine that you can see at any plate-glass works for grinding plate glass. These lapidary machines have scrubbers similar in shape to those shown in the figure, but a number of them all geared to one another; the scrubbers in this case to be made of good chilled cast iron, and fine flour emery to be used to grind up the surface. You will better see what I mean if you pay a visit to any large plate-glass works; there the scrubbers are made of copper, but in your case they will have to be made of good chilled cast iron.

The experiment is decidedly worth while trying first on a small scale, and I may say that I shall take great pleasure in giving you any assistance that I am able.—T. R. B.

Electric Lamps for Shop.—W. W. (*Gravesend*).—A butcher in my neighbourhood has fitted his shop with electric lights supplied with current from a dynamo driven by a gas engine. The shop-front is illuminated by a fine arc lamp, and the interior by a number of 16 c.-p. incandescent lamps. He has done all the work himself. You may do likewise. Your shop will require lamps giving a total light of at least 180 c.-p. These will absorb nearly 1 h.-p. to drive the dynamo. If you use a gas engine for other purposes during the day, you may use it for the lights at night.—G. E. B.

Salt for Electric Battery.—Reader.—A piece of flannel, or blotting-paper, or similar bibulous substance, dipped in a solution of any salt, and placed between a plate of copper and a plate of zinc, gives evidence of an electric current. Common table salt is as good as any for this purpose. Sal-ammoniac is also a good salt to use in an imitation voltaic pile.—G. E. B.

Electric Light Engineering.—Motor.—My reply to Suspense, on p. 300, No. 175, gives a few ideas respecting the steps to be taken in qualifying for an electrical engineer. Replying to your question, if you wish to increase the voltage without altering the machine, drive the armature at a higher speed, but the alteration in speed would be very great to raise the voltage from 10 to 35 volts.—G. E. B.

Japanning Tea Urns.—G. H. (*Oldham*).—Please state wants more definitely. The most suitable colour certainly depends on the owner's taste.

Paint for Glass of Conservatory.—W. H. (*Plaistow*).—For the purpose of partially obscuring the light in a conservatory, I would recommend zinc white (ground) mixed with turps and gold size—about equal parts of the two latter. Add sufficient brunswick green to give the colour a faint tint of green; this will be found an agreeable tone, although the smell is rather disagreeable for a few days. Great care should be taken to see that the glass is perfectly dry at the time of painting, or the paint will not adhere; neither should the paint be put on thick enough to blister; it dries very quickly with a dead surface.—C. M. W.

Paint for Damp Walls.—D. P. (*Birstall*).—Whether brick or plaster surfaced, nothing can eradicate the evil of a damp wall save the removal of the primary cause. The two only cures are: *external*, slating (assuming the shuting and roof have been thoroughly overhauled); and *internal*, matchboarding. The former, of course, is wisest. Cement facing to a wall is seldom a *thorough* cure. When a wall is thoroughly dry, then it should be painted. Otherwise, it is money thrown away. "Patent knotting" is a good preparatory internal coating. So far as external coatings go—if this is determined upon—I would only advise using tar, or, if not a large surface and desired a lighter colour, to give two coatings of old "smug" paint, to be purchased at any firm of house-painters, before using the white-lead paint.—F. P.

Hydrostatic Accumulator. — H. T. (*West Bromwich*).—The circumstances cannot be as you indicate. The pressure per square inch at the outlet must be the same as that at the inlet, as water presses equally in all directions. The ratio of the velocities of the water at the inlet and outlet will depend upon the rate at which the pumps are driven as compared with that of the presses or other machinery served by the accumulator. This latter will depend on the resistance offered by these machines. If the resistance is less than 100 lbs. per square inch the water will flow out more quickly than it enters, and the accumulator ram will fall, but if the resistance is greater, the ram will rise. The pressure in the accumulator is constant while the load ram is at rest; to lift it, a slightly higher pressure is necessary than that which will hold it stationary.—F. C.

The Winter Ring.—J. M. (*Nantwich*).—The ring is merely an enlargement of the prime conductor, consequently the position is not of very great importance, but the usual plan is by far the most convenient. Sealing wax could be used, but it is not nearly so satisfactory as the wooden ring. Indiarubber also has been tried, but was discarded in favour of the wooden ring, which has never been equalled.—C. A. P.

Heelball. — J. W. M. (*Sheffield*). — For "fake," get one hard heelball and half a white one (Ullerthorne's); break them up small, and put them into a tin, and cover them with naphtha or turps (the former is best), and let the tin stand on the hob, but not near a flame, until it is of even consistency. Stir, and let it get cold. It can be put on with a brush, but the finger is all that is necessary. Let it lay on a short time, and then rub it off lightly with the heelball cloth. The edge should be well ironed before applying. A "fake" tin can be bought; the rim of the lid reaches down to the bottom, to prevent evaporation of the spirit.—W. G.

Watch and Clock Cleaning Tools.—D. C. (*Godalming*).—For the principal tools required for watch and clock cleaning and repairing, see Work, No. 179, p. 356.

Trousers Stretcher.—R. D. (*No Address*).—A description of trousers stretcher has recently been sent to "Shop." Doubtless it will have appeared before this reply is printed (see No. 197, page 654).—B. A. B.

Chair Making.—T. H. (*Blackburn*).—I am not aware of a book treating solely on chair making, but there are interesting chapters in Spon's "Mechanic's Own Book." Hair-seated chairs—that is, chairs covered with hair-cloth—are upholstered in a manner similar to that for leathers, etc. The framing for upholstered chairs is put together as described in Hall Chair, p. 518, Vol. IV., the exception being that the front, back, and side rails are rebated about ½ in. in and 1 in. deep to take the binding and studs.—E. C. R.

Photo Printing.—E. P. (*Islington*).—There is no work published treating especially on this subject. Almost all firms make a secret of their methods of procedure, and possibly have some speciality of their own they estēem an improvement on those of other printers. An impression is taken of the screen on the same plate as the subject, and both developed together; it is immaterial which is impressed first. With regard to retouching, the plate is rolled up, a print made, and retouched with the graver wherever it may be deemed necessary.—D.

Working Sketch of Small Lathe.—W. H. B. (*Stockport*).—You will find what you require on p. 621 of Vol. I., the number of Work for Dec. 14, 1889.—F. A. M.

Making a Coloured Cast of Foot.—D. J. D. (*Manchester*).—(1) In No. 88 (Vol. II., p. 579) are given full directions for making such a cast, with diagram of mould for foot. (2) Full information about plaster, methods of mixing it, etc., will be found in No. 74 (Vol. II., p. 319). (3) Tint by dissolving colouring matter, of the kind and shade you desire, in the water with which you mix the plaster for your cast.—M. M.

Watch and Clock Cleaning.—D. C. (*Godalming*).—Articles appeared in Work, Nos. 179, 180, 183, 188, and 190.

Varnish for Signboard.—E. J. S. R. (*Linwood*).—Remove all dust by carefully washing with clean water. Wipe dry with a window leather, and apply carefully one or two coats of the best outside oak varnish. Avoid the cheap variety; use that costing from 12s. to 16s. per gallon.—Lifeboat.

Handrailing Papers.—G. S. (*Montreal*).—I have to thank you for your complimentary remarks. In reference to handrailing papers, your wish is anticipated, as a series is now well in hand.—G. F. C.

Electric Battery. — K. Z. Y. (*Lincoln*).—An electric battery is composed of a number of stoneware jars containing acids and materials for generating an electric current. The acids and the materials differ in a large number of various forms, the battery being constructed for a definite purpose. No one variety of battery will suit all requirements. If you will tell me what you wish to do with the battery, I will tell you how to make one to suit your requirements. Several different batteries have been described in back volumes of Work, as you will find by consulting the indices.—G. E. B.

Magnets for Belts.—Samael.—Mr. Bonney, Avenue Road, Lewisham, S.E., will get you any magnets or studs for experiments in making magnetic and electric belts. Materials for this purpose can be obtained from Mr. A. Caplatzi, 3, Chenies Street, Tottenham Court Road, London, W., who advertises in Work.—G. E. B.

IV.—Questions Answered by Correspondents.

Barometer.—J. H. (*Stonehouse*) writes to W. T. T. (*Houghton-le-Spring*) (see No. 189, p. 526):—"My father has used two bottles for, to my knowledge, twenty years. One is a large sweetmeat bottle, the other a hair-oil bottle. The neck of the hair-oil bottle is turned upside down into the neck of the other bottle, which is sufficiently full of water—preferably rain water—that the oil bottle is immersed ⅜ in. in it. In a few days, if weather changes, the water will ascend for fine weather and descend for rain; also, for fog or wet weather, the upper bottle will be covered with mist and drops, in addition to the water going down. I have known the water ascend as much as 2 in. for fine weather."

Oval Drawing.—Eddifra writes, in reply to Oval (see p. 446, No. 184):—"An oval is a plane figure, bounded by a continuous line formed by arcs struck from the four points of a rhombus. A rhombus is formed by placing two equal equilateral triangles together, base to base. In Fig. 1 two equal equilateral triangles are drawn, forming a rhombus drawn on the line A B, which is the major axis or greater diameter of the proposed oval, and the line C D, which is the minor axis or smaller diameter of the oval. To describe an oval on any given line which is the major axis of the oval, draw A B the given length, and C D an indefinite length, bisecting line A B at E. Draw rhombus as in Fig. 1, but let the lines C H, C I, D F, and D G be of indefinite length, bisecting line A B. Set compasses to the distance from A to J, or K to B, and, with J and K as centres, strike arcs L A M and N B O, and then set compasses to the distance from D M or D N, and, with C or D as centres, strike the arcs M N and L I, and thus complete the oval. To describe an oval on any given line which is the minor axis of the oval, draw lines A B and C D with rhombus, as in Fig. 2, and on line C D, Fig. 3, mark the required length of minor axis, as E F. Set the compasses to the length from E to D and E to C, and, with C and D as centres, describe the arcs G E H and I F J. Then set them to the distance from G to K or H to L, and, with K and L as centres, describe arcs G I and H J, thus completing oval. It will be noticed that the larger the rhombus drawn, the longer will be the major axis in proportion to the minor axis, as the points K and L, Fig. 3, are placed wider apart than the points I and K in Fig. 2, in proportion to the lengths of the axis majors. Or the distance from I to K in Fig. 2 equals one-third of the length of the line A B, whereas the points K to L equal, in Fig. 3, more than one-half the length of line A B."

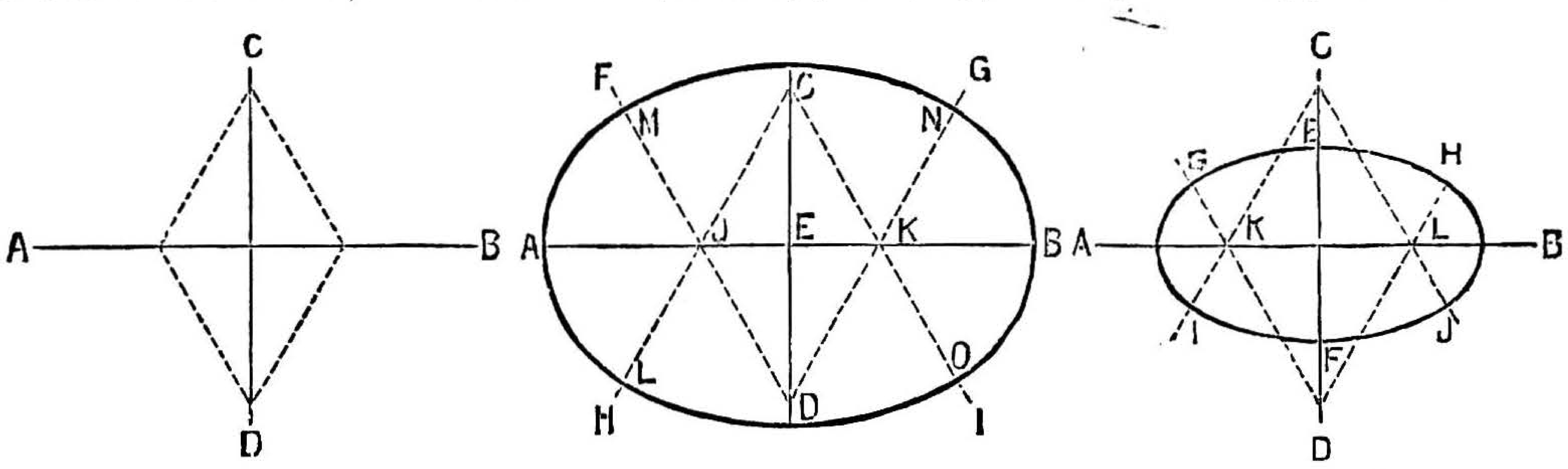


Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—Two equal Equilateral Triangles, forming a Rhombus. Fig. 2.—Oval drawn from the Four Points of a Rhombus. Fig. 3.—Another Example.

V.—Letters Received.

Questions have been received from the following correspondents, and answers will appear in an early issue:—W. B. (*Deptford*); C. W. (*Sutton*); A. P. (*Tooting*); R. McQ. (*Anfield*); W. S. C. (*Glasgow*); W. C. (*Wallsend-on-Tyne*); Boiler (*Pimlico*); A. P. (*Wigan*); C. C. (*Bathgate*; T. D. (*Oldham*); W. S. (*Longsight*); F. L. (*Leeds*); J. W. B. (*Huddersfield*); C. H. (*Islington*); J. P. (*Glasgow*); A Subscriber; W. C. (*Hurst*); McC. & S. (*Londonderry*); T. G. (*Kirkgate*); Binder; J. O. P. (*Wrexham*); J. O. N. (*Manchester*); Constant Friend of "Work;" J. B. (*Peterboro'*); C. H. L. (*Greenhithe*); Waiting; Organ Builder; Latent; J. P. (*Dowanhill*); P. A. de P. (*South Kensington*); W. S. (*Pendlebury*); Anxious; H. O. (*Seaford*); E. T. L. (*Bath*); T. J. O'C. (*Dublin*); J. C. (*Southampton*); S. H. (*Windsor*); An Apprentice Cabinet-maker; W. M. (*Plaistow, E.*); E. P. S. (*Stoke-on-Trent*); F. J. D. (*North Camberwell*); C. W. S. (*Isle of Dogs*); J. J. (*Camden Town*); Seybor; J. A. (*Glasgow*); J. K. (*Manchester*); E. E. (*London, E.C.*); J. H. (*Newcastle-on-Tyne*); P. T. (*London*); M. H. F. (*Camberwell*); F. B. (*Warlington, S.O.*); J. T. (*Brixton*).

Notice to Subscribers to "Work."

NOTICE.—An Index to Volume IV. of "Work" has been prepared, and can be purchased by weekly subscribers, price One Penny. It is issued in the Monthly Part for February.

N.B.—Volume IV. will consist of Nos. 157 to 200 inclusive; or Parts 37 to 46 inclusive, and is published in cloth at 6s. 6d.

SPECIAL NOTICE.—The next Weekly Number of "WORK" (forming the First of the Enlarged Series) will be issued on Friday, January 20th.

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