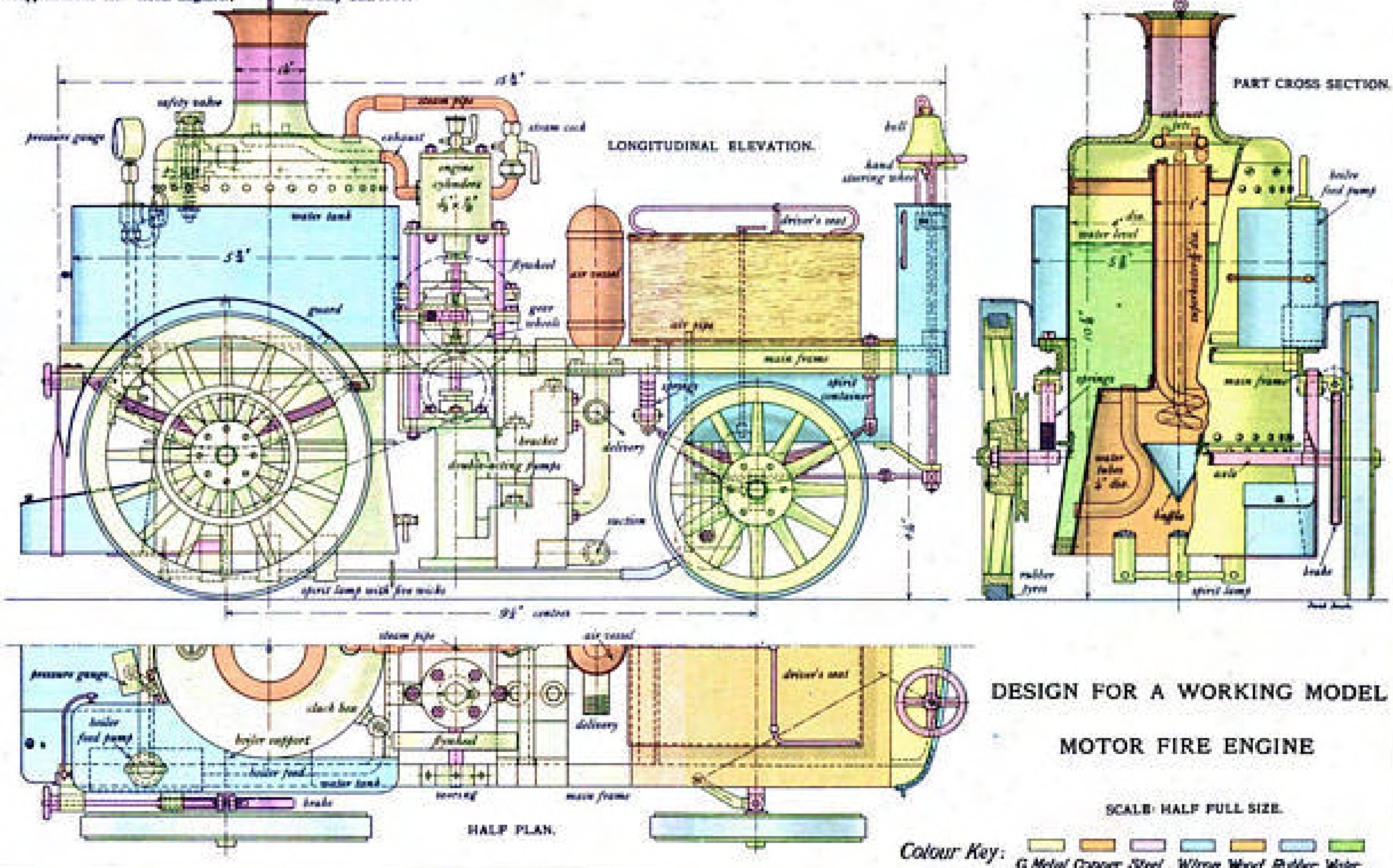
Supplement to the "Model Engineer," January 2nd 1908.




DESIGN FOR A WORKING MODEL

MOTOR FIRE ENGINE

he should find a pleasure in acquiring mathematical and scientific knowledge. He should have a sufficient liking for working with tools to enable him either to make machinery or apparatus himself, or to judge the workmanship of others who may be carrying his designs into practice. The training for such a lad should be a judicious combination of practical experience with workshop tools and processes and theoretical study. The latter ought to include practice in making engineering drawings and acquaintance with cost of materials and labour.

Thus three broad kinds of engineering careers are open to a lad, and each is divided into a variety of branches. Commencement is easiest when the lad leaves school, say at about the age of sixteen years, without having entered any other business. It becomes more difficult as age increases, though with means a person may take up this occupation when he has reached years of manhood.

*(To be continued.)*

## The Junior Institution of Engineers.

A NUMEROUSLY attended visit of this Institution was recently paid to Woolwich Arsenal, appropriately arranged to follow the striking Inaugural Address on " Some Comparisons between French and English Artillery," which had been delivered by the newly-elected President (M. Gustave Canet), the eminent French artillerist.

The Chief Superintendent of Ordnance Factories (Mr. H. F. Donaldson), received the members, and under the guidance of the chief mechanical engineer (Mr. Douglas Heap) and other officials, several hours were spent by the visitors in an inspection of the interesting processes of manufacture involved in the production of metal time fuses ; bullets for the magazine rifle ; siege, field quick-firing and machine-gun carriages ; mountings for heavy ordnance ; woodwork for carriages ; small arm and quick-firing ammunition boxes ; wheels ; heavy breech-loading guns, including the hoops and tubes for them. Rifling operations were shown, and working models of breech mechanisms of heavy breech-loading guns. The process of wire-winding was also seen, and in view of M. Canet's observations on that topic in his address, attracted particular attention.

The Chairman of the Institution (Mr. Frank R. Durham), expressed to Mr. Donaldson the members' appreciation of the special arrangements which he had kindly made for their reception, enabling so much to be seen in the limited time at disposal.

At the ensuing meeting on January 8th, a paper on " Recent Improvements in Electric Conduit Construction " is to be read by Mr. FitzRoy Roose, of the London County Council Tramways Reconstruction Department.

ACCORDING to *The* American *Machinist,* the first attempt to establish iron and steel works in India has just been started by a rich firm in Bombay, supported by other wealthy individuals and by the Government of India. The district in which the plant will be situated will be near Sini Junction on the Bengal -Nagpur Railway, where there is abundance of water, and where iron ore, coal, and limestone can be assembled at low cost of transit.

# Design for a Model Motor Fire Engine.

*( With Coloured Supplement.)*

By FRANK FINCH.

IN selecting the above subject for the design of this year's supplement, the writer is assured of its favourable acceptance for two reasons-firstly, because of the enthusiasm displayed for the fire engine by a.11 classes of individuals ; and, secondly, on account of it being something comparatively new in so far as model engineering is concerned. The fire engine--in its own way-is as fascinating to the general public as the railway locomotive. In actual fire fighting the now popular motor engine has come to stay, and it is thought that the design and construction of models of this type, although scarcely thought of yet by readers of " ours," may develop an interest and popularity, at least approaching, that displayed in model locomotives.

There has not been published until now a design of a model of this class of engine, although it must be stated that a few models of the old style, viz., horse-drawn engines, have been made and described in these pages from time to time. By way of introduction, it is as well to study briefly the general principle adopted in the design. It may have already appealed to the notice of readers that in general outline an effort has been made to resemble in miniature one of the now well-known Merryweather types ; although, so far as scale is concerned, it has been found impossible to adhere strictly on account of a great difficultyin securing the exact leading dimensions of the prototype-an obstacle which doubtless accounts for the lack of any previous designs of this nature. Generally, however, it is to a scale of 1-1/4 in. to 1 ft. An encroachment upon the proportional width of the engine has been forced owing to the boiler space necessary to render the steaming powers of the model efficient.

The location of the various featnres of an actual engine has been more or less maintained. For instance, the tanks to carry the supply of water for boiler-feed are situated on either side of boiler, and rest upon the frame (the water is fed into boiler at intervals, by means of a simple hand-pump in the right-hand tank, the two tanks being connected by a small tube across the front of boiler). The tank containing the methylated spirit for firing the boiler through the five-wick lamp is situated as in the prototype, at the fore-end of the framework, under the driver's box, and between the front pair of wheels ; the admission of spirit to the wicks is via an air-valve actuated by a turn of the small handle at the back of the driver's seat. Those who have studied the motor fire engine will recognise that the position of engine and pumps in the design corresponds with that of the original, but the double-acting pumps are necessarily more bulky in proportion. There are two simple engine cylinders, each 5/8in. bore by 7/8in. stroke, and the slide-valves and eccentrics are placed between the cylinders ; the piston-rods drive the pump plungers direct through the medium of the slotted crossheads shown in the drawing. It is thought that the air-vessel, being of polished copper, will add greatly to the attractiveness of the model when completed, and for that reason it has not been covered up by the wooden box arrangement, as in the case of many of the Merryweather class of engine. A continuous jet of water of 9 to 10 ft. will be thrown by this pump.

Propulsion is effected by a dual method, as follows : To release the pump from the engine the pump rods are unscrewed below the crossheads, and by means of a small clutch (to be subsequently described) a tooth wheel on the crankshaft is brought into gear with a similar wheel on a pinion below. On the said pinion is also a grooved wheel, which, in turn, transmits the power by a gut band to a grooved wheel attached on the inner side of the rear wheel, as indicated in the drawing. A driving wheel is shown on one side only, and a band brake occupies the corresponding portion on the opposite side. Of course, a driver on either side would be more effectual, in which case it is feared the band brake must be substituted for the block pattern rim brake, usual on horse-drawn vehicles, and, indeed, the writer has observed them on some of the earlier types of motor engines ; but of this more anon. The principle of steering is copied somewhat, and is exceedingly simple, the front wheels being actuated to the right or left by a slight turn, in the desired direction, of the hand-wheel, and clamped in any required position by the small " compass " screw shown dotted in the longitudinal elevation. Thus are the main features of the model described.

In subsequent *issues* details will be dealt with more fully. For the present, drawings are given showing construction of the framing.

Two lengths of brass channel section should be obtained from any metal merchant. The writer has not been able to procure the exact section-viz., 1/2in. by 3/8in.-the nearest being1/2in. by 1/2 in., which, being 1/8in. too wide, must be filed down, unless the builder of the model does not object to the deep channel. One end of each length is to be roundetl off as shown. A casting will form the front end of the frame, and, for the sake of lightness, it is proposed to make it of aluminium-this will answer the purpose equally as well as heavier metal. The dimensions given are finished sizes. Other cross members of the frame, it will be seen, are small pieces of angle brass attached to the sides by means of small angle brackets and riveted as indicated : the cross piece, shown about midway, should be a casting. No great difficulty presents itself in this piece of work, and by the time some have completed it, the construction of a more interesting part will be given.

*(To be continued.)*

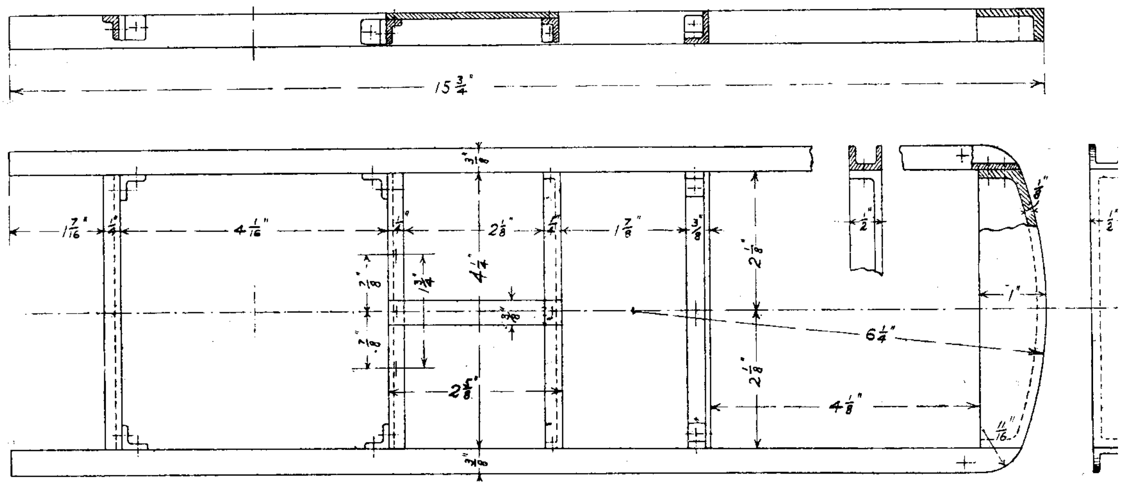


Fig. I.-DETAIL OF MAIN FRAME FOR MODEL MOTOR FIRE ENGINE.

*(Scale : One-third full size.)*

**GAS FROM MINERAL OILS.**-The experiments at the Caledonian Brass Works, Barrhead, in connection with a patent for the manufacture of gas from refined paraffin, petrol or other mineral oils, have been continued with success (says the *Gas* Engininеers' Magazine). By the Bruce system of manufacture and installation it is claimed that it is possible to obtain gas from refined paraffin or petrol at a cost of a IS . per 1,000 cub. ft., and that the light, besides being less trying to the eyesight, is twice as powerful as that of ordinary coal gas. The light is given off from incandescent mantles.

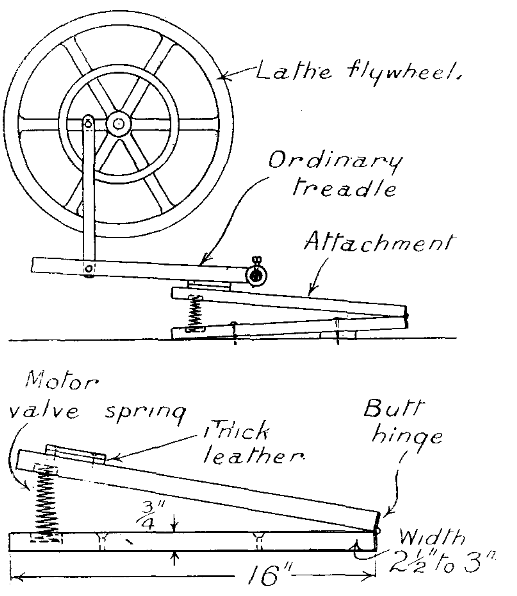
A WRITER in a contemporary states that he examined the envelope of a balloon which burst at the International Exhibition at Milan in 1906 A number of spots were visible' on the envelope, and at these places the material could be easily torn, whereas at other parts it showed great resistance to tearing. These spots were found to have been caused by phosphoric and arsenic acids, produced by oxidation from arseniuretted and phosphoretted hydrogen contained in the hydrogen gas. The presence of these impurities is due to the use of impure materials in the preparation of the hydrogen, and the author recommends that the preparation of the gas for filling balloons **should be** under strict chemical control.

arms mill work similar to a pair of calipers. On inserting blade B between cam and body and through arms, and then passing cam down on the blade, it will be found to be quite rigid enough for practical work. Figs. 3, 4, 5 and 6 show the application of the tool for various purposes.

### Dead Point in Lathe Flywheel.

By A. H. W. NORGATE.

Having been accustomed for some time to a counterbalanced flywheel on a lathe, when I purchased a Drummond lathe I found that the wheel, being constructed to come to rest at a dead point, was to me a source of irritation. The makers explain this by saying that it gives greater evenness in rotation. I constructed the following device in a few minutes, and it has worked admirably




REMEDY FOR DEAD POINT IN LATHE FLYWHEEL.

and will bring the crank over the dead points at all times. The drawing explains itself. It is exactly right for the treadle of a 3-1/2in. centre lathe ; for others, it will have to be adapted accordingly.

### A Composition for Grinding.

By C. COVENTRY.

In grinding valves in place on their seats or oscillating cylinder faces, slide valves in the steam chests, and similar work, a very useful preparation has been found in what is known as "R.R." rifle-cleaning composition. It may be purchased at most gunsmiths in 6d. collapsible tubes. It may be usefully followed by " Matchless" metal polish as a finisher, and saves a lot of time and makes a good clean job.

### Fireproofing Woods and Cloths.

A French formula for the fireproofing of woods and cloths consists of sulphate of ammonia, 135 grammes ; borate of soda, I5 grammes; boric acid, 5 grammes ; water, 1,000 grammes.

### Blueing Steel.

A common method of blueing small steel goods by dipping, according to American practice, is to melt saltpetre in an iron pot ; then immerse the previously polished and cleaned articles until sufficiently blued ; remove and cool at once in paraffin 61, and afterwards dry out in sawdust.

## Design for Model Motor Fire Engine.

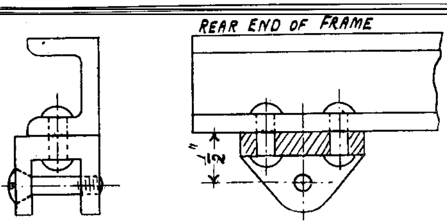
By FRANK FINCH.

*(Continued from page 8.)*

SPRINGS AND FITTINGS.

ACTING upon the principle of doing the simplest things first, the builder of this model, before laying aside the frame, as described in the last article-pending the completion of other parts of the model-should proceed to make the small fittings by which the springs are to be attached to the frame. Details of these, shown full size (Figs. 2. 3, 4, and 5), are given herewith, and but a few words are needed concerning their construction. There are two brackets required for each of the springs carrying the rear shaft-one as shown in Fig. 2, and the other as Fig. 3. These small fittings will be best filed from solid brass or gunmetal, but before filing out the hollow between the lugs the required holes for the pins should be drilled right through whilst there is greater substance to withstand the strain of drilling. Finished sizes are indicated in every case on the drawings. Each fitting should be finished off smooth and clean, and the necessary holes tapped, as shown. The fittings should then be attached to the under side of frame by two 1/8in. rivets. To secure the rear end of the springs in their respective brackets, two setscrews will have to be made to the size given and having countersunk heads. The bracket for the forward end of the rear axle spring (shown in detail in Fig. 3) has on each side a slot. The spring is held in each of the said brackets by a small bolt and nut. The fittings shown in Fig. 4 connecting the rear ends of the forward springs with the transverse spring are filed up out of the solid in a similar manner to Figs. 2 and 3. Fig. 5 shows detail of the finished forging for the forward end of the front pair of springs. A piece of tube is fitted as a sleeve between the flanges of the main frame, and the bolt is taken right through ; this is done for the purpose of rigidity.

Regarding the springs, the designer has endeavoured to adhere to the prototype for appearance' sake, and consequently there will be an absence of resiliency ; but this is compensated to some extent by the application of rubber tyres to the wheels. which will be referred to in a future article. It will he noticed by the sketches that it is proposed to build up the springs of laminations, these being strips of steel 1/4in. wide, 3/64ths in. thick, and forged accurately to the curve required, the extremities of each lamination being sharpened off to come flush with its adjacent lamination in preference to leaving the square ends. In the top lamination sufficient length should be allowed for bending over to form an eye at each end for attaching to the fittings described above. The laminations of springs (Figs. 6 and 7) are held laterally in position by the small staple bolts, as shown, and a



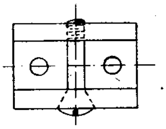
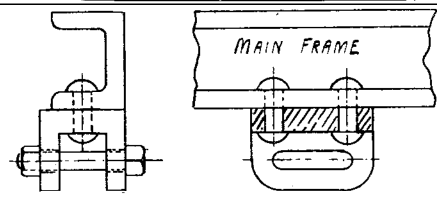



***FIG. 2.—TWO THUS FOR REAR SPRINGS.***
*(Full size.)*



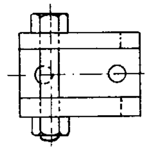



***FIG. 3.—Two THUS FOR FORWARD ENDS OF REAR SPRINGS.***
*(Full size.)*

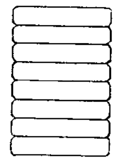


FIG. 9. ENLARGED SECTION THROUGH LAMINATIONS, SHOWING THE CHAMFERING.

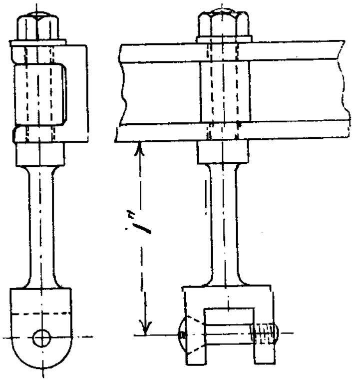



***FIG. 4.—Two THUS FOR FORWARD SPRINGS.***
*(Full size.)*

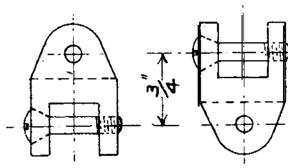



FIG. 5.—TWO THUS FOR COUPLING FORWARD SPRINGS TO THE TRANSVERSE SPRING.
*(Full size.)*

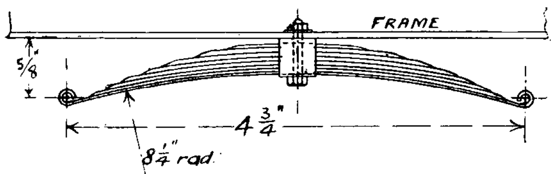
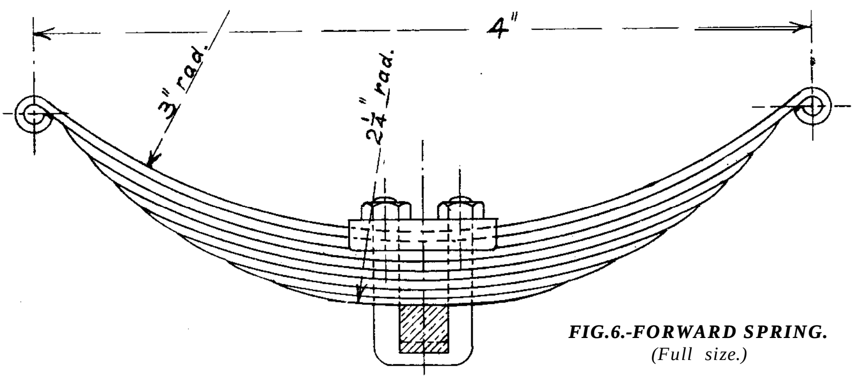



***FIG. 8.—TRANSVERSE SPRING.*** *(Half full size.)*



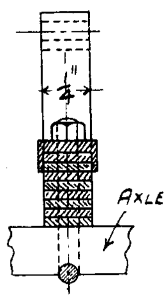




***FIG. 6.—FORWARD SPRING.***
*(Full size.)*

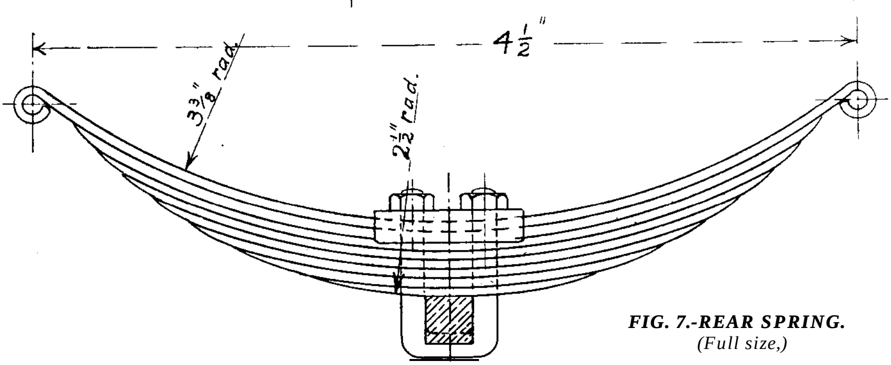



***FIG. 7.—REAR SPRING.***
*(Full size.)*

***DETAILS OF SPRINGS AND FITTINGS FOR MODEL MOTOR FIRE ENGINE.***

special washer to overlap on two sides. The transverse spring (Fig. 8) has a wide band encircling the body of laminations in the centre, and through this is placed a single bolt, which holds the whole spring to the cross-member of the frame. (See Fig. I in the last article). Fig. 9 is an enlarged section of the eight laminations, to show how each edge of the strips should be chamfered ; this may be done with a file before bending, and will greatly add to the realistic effect of the spring.

It is perhaps hardly necessary to state that instead of building up, as suggested, a casting in one piece could be used for the " springs " if preferred, from patterns made in accordance with the dimensions already given.

*(To be contimed.)*

# Locomotive Notes.

By CHAS. S. LAKE, A.M.1.Mech.E.

THE CAPACITY OF THE " SINGLE-DRIVER."

A correspondent writes as follows : " It seems difficult to reconcile the generally held opinion that the 'single-driver' type of locomotive is unsuitable for the needs of modern railway traffic with the work which is being daily performed on the Midland, Great Western, and other lines by engines of this description. The train by which I travelled northwards just before the Christmas holidays consisted of eight of the latest Midland corridor bogie carriages and two six-wheeled vehicles, with a four-wheeled guard's van next the engine. This load would represent quite 270 tons behind the tender with all aboard, and the weather was such as to hamper the engine in its work, which consisted of hauling this heavy train to Leicester, gg) miles, in 117 minutes. The engine was one of the 7 ft. 9-in. single-drivers (No. 2,602), with double-bogie tender, and the run was performed in the allotted time apparently without any difficulty whatever. The slight amount of slipping at starting had no effect on the observance of punctuality, and some of the passing times between London and Bedford were better than those I have experienced with the more powerful coupled engines of later design."

The experience of this correspondent is only what everyone will find who interest themselves in the matter of locomotive performance to the extent of investigating what is daily being done upon our railways. The single-driver type of engine is in reality a highly efficient type, but the efficiency, it must be remembered, gains as the speed increases. It is impossible to place sufficient adhesion weight on one able to make the engine really reliable at starting, and rapidity and certainty in accelerating heavy trains has to be depended upon very largely for the punctual observance of the scheduled timings. In the case referred to by the correspondent. as in many others, the engine made a good start, but the natural tendency for the single engine is to lose time in the initial stages by slipping of the driving wheels, due to lack of adhesion. With cylinders 19-1/2 ins. in diameter by 26-in. stroke, and under 19 tons of adhesion, it would indeed be astonishing if undue slipping did not at times occur, and a thing which is very noticeable with single locomotives is their propensity *to* slip the driving wheels almost imperceptibly, but nevertheless continuously, when running on up grades. The weak point with these engines is that they cannot be relied upon to give such average good results as the coupled types, and with the heavy loads of the present day it is of the greatest moment that only locomotives which are able to do this with regularity should be employed.

A quotation from a well-known text-book on this subject is interesting here. This reads as follows : " The opinion is very commonly expressed that this class of engine (the single-driver) must suffer from lack of adhesion, but this is really not the case, except when starting. A modern engine has generally about 18-1/2 tons on the driving wheels, and with the steam sanding apparatus a co-efficient of adhesion of 450 lbs. per ton can be relied on, giving an adhesive force of 8,325 Ibs. At a speed of 25 miles per hour this represents 555 effective horse-power at the rails. Supposing the mechanical efficiency to be 80 per cent., this represents nearly 700 i.h.-p., for which the boiler would be unable to supply steam at such an inefficiently low speed. Hence, at speeds of over 25 miles per hour the adhesion will be ample, and in modern expresswork the smoother running and greater economy of this type more than compensate for the slight loss at startmg.

A NEW AMERICAN " ATLANTIC " LOCOMOTIVE.

Towards the end of last year the American Locomotive Company delivered to the New York, New Haven, and Hertford Railroad some " Atlantic " type express passenger locomotives which they had built at their Schenectady Works, and of which one, No. 1,100, is illustrated on the opposite page. The design, in all its general features, is similar to that of most American locomotives of the same type, but the employment of Walschaerts' valve gear actuating balanced slide-valves, working on top of the cylinders, helps to distinguish the engine from others of equally recent build. It is one of the most noteworthy indications of the direction which thought is taking in the United States in connection with locomotive engineering -this general adoption of the Walschaerts' valve gear for almost all classes of engine, for the practice hitherto observed in that country on all railways has been to use link motion, with rocking shafts. The Walschaerts' gear *is* used to greatest advantage in conjunction with outside cylinders, or, rather, it is the best type of gear to carry on the outside of the frames ; and as nearly all American locomotives have outside cylinders only, the method is likely, having once started, to find the widest application.

The N.Y.N.H. and H. "Atlantic" locomotive is fitted with a boiler of the coned pattern, having a wide firebox. The total heating surface is large, and there is an ample area of firegrate, while a high working pressure is carried. The cylinders have a diameter of 21 ins. and a stroke of 26 ins. The diameter of bogie wheels is 3 ft., of coupled wheels 6 ft. 7 ins., and of trailing wheels 4 ft. 3 ins. The coupled wheelbase is 7 ft. 3 ins., rigid base 16 ft. 9 ins., and total of engine 28 ft. 2 ins. The boiler, outside first ring, is 5 ft. 7-1/4 ins. diameter, and it contains 347 charcoal iron tubes 16 ft. long by 2 ins. diameter. The heating surface of the tubes is 3041.3 sq. ft., and fortunate enough, by the courtesy of Messrs. Arkell, to be able to give photographs of the new boat, so that intending competitors may have an early glimpse of their new 'rival. The two MODEL ENGINEER medals gained in 1906 and 1907 by the *Moraima were* also on view, and were much admired.

Another petrol motor boat on view was the Speedwell, built by Mr. A. Shead. This has a horizontal double-cylinder petrol motor, developing 1-1/4 h.-p., and is fitted with tandem screws. The boat is 7 ft. long, and her trials will be awaited with much interest.

The large model seen in the centre of the photograph of the exhibition room is the liner *Fairholme,* built by the Hon. Secretary of the Club, Mr. G. F. Young. She is a model of one of the Royal Mail Steam Packet Company's boats, and is 10 ft. 6 ins. long. The propelling machinery consists of a Siemens enclosed type electric motor driven by accumulators, and the speed obtained is 7 miles per hour. Mr. Young is evidently a lover of big models, for he also exhibited another 10-ft. model, the *Minnehaha ;* this, as the name implies, being a model of one of the Atlantic transport liners. It is also propelled by a Siemens electric motor, and gives a speed of 5 miles per hour. The scale and general proportions of both these large models are excellent, and when they make a trip on the Long Pond they create something in the way of a sensation among those visitors whose ideas of models are limited to impressions gained from toy-shop windows. Mr. Young also had several other models on view, including a pretty steam yacht and a fine scale model of *H.M.S. Essex,* this being 6 ft. long.

The *Myra, a* 4-ft. steamer, was shown by Mr. H. C. Saunders, and the fact that this was the Club's fastest steamer of last season attracted considerable attention to this exhibit. The other steam and electric models were all worthy of careful inspection, and redound greatly to the credit of the Club members in point of workmanship and finish. Particular commendation may be bestowed on the torpedo destroyer, No. 44, a 5-ft. electric model, shown by Mr. G. A. Smith ; the racing boat, *Damilr III,* by Mr. Stowell ; the Cunard liner models, *Margaret,* by Mr. H. C. Saunders, and *Florida,* by Mr. A. Lawson ; and a beautifully finished model of the destroyer, *Thresher,* with electric lighting installation, by Mr. F. G. Glover.

The model Thames tug, by Mr. Parkins, was a nice piece of work, but suffered rather from the fact that above deck she did not resemble the prototype. The destroyer *Ealing,* shown by Mr. F. Bothwell, possessed two special points of interest. The first arose from the fact that at one time in her career she lay for eighteen months at the bottom of the Round Pond, Kensington, and was afterwards recovered practically undamaged ; while the second was to be found in an ingenious electric buzzer with which she was fitted, and which was worked with great -effect from time to time during the exhibition.

Of pure engineering work there were several good examples, one of the best being a fine set of twin-screw engines, made by Mr. J. W. Palmer. A very pretty and effective model of a Thames lock was constructed by Mr. T. Whitmore. This was shown complete, with a dainty model electric pleasure-launch, and a glass peephole in the lock retaining wall enabled the working of the launch's screw in the water to be very clearly seen, electric light being fitted for this purpose.

The show of model sailing yachts was very fine, and, indeed, there were so many of really excellent workmanship and design that it is difficult to select any individual boats for mention. The present exhibition showed conclusively that the Clapham Club boats can bear comparison with those of any other club. The sailing boats included 5-, 10-, 15-, and 20-rater cutters, as well as one 36- and one 42-rater. There was also one representative of the metre class, and several schooners and punts.

In concluding this notice, we may say that the indefatigable Hon. Secretary, Mr. G. F. Young, and the Stewards, Messrs. G. Arthur Smith, A. J. Upton, H. C. Saunders, and T. Whitmore, are deserving of every congratulation, both in the arrangement of the exhibits and of the success of the event. There were over 1,000 visitors on the Friday, while on the Saturday the doors had to be repeatedly closed to prevent overcrowding.

# Design for Model Motor Fire Engine.

By FRANK FINCH.
(Continued from page 102.)

ROAD WHEELS.

HAVING dealt with the frame and springs in the preceding articles, it is in order now to describe the making of the road wheels. According to the colouring of these on the general arrangement drawing (presentation supplement, January 2nd issue), they are indicated as being made of brass or gun-metal: but there

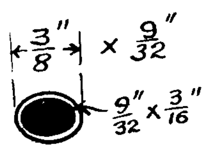



*FIG. IIa.*
*SECTION THROUGH REAR WHEEL SPOKES.*

*Section c.d.*

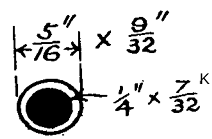
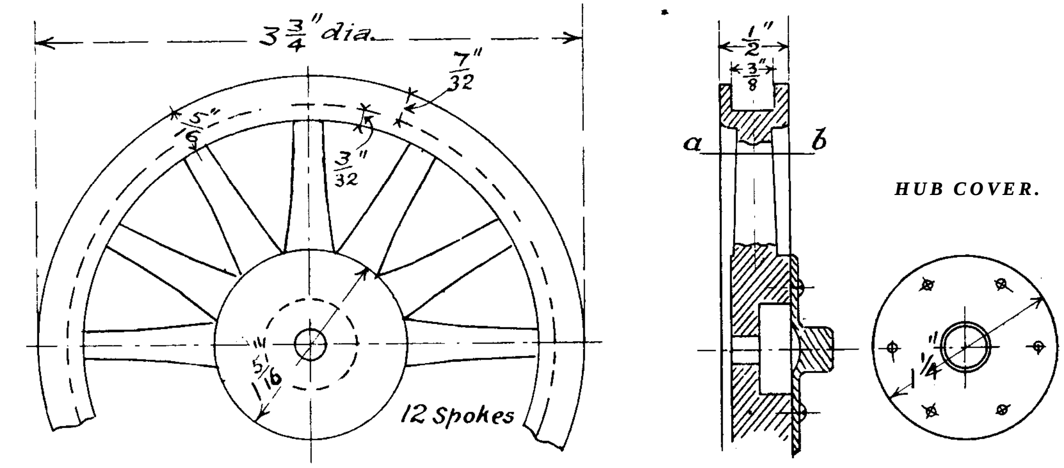



*FIG. 10a.*
*SECTION THROUGH FRONT WHEEL SPOKES.*

*Section a.b.*

is no reason why-for the sake of lightness-the wheels should not be cast in aluminium. Builders of the model may suit their individual fancy in this respect. The fact of departing from the prototype in so far as casting the wheels instead of building up of wood may displease the eye of some. Of course, as a rule the actual wheels of a motor fire engine are built up of ash-boss, spokes and rim segments. Some who construct this model may feel inclined to build up the wheels, but in this case the dimensions may remain the same, Such a departure would entail much more work, and it is thought that most readers would prefer casting each wheel in one piece. The patterns-one for front wheels and one *for* the rear wheels face of wheel, leaving the boss to the required dimensions.

The groove shown in the faces of the wheels for the insertion of tyres is turned out from the solid rim of the casting, as also the circular recesses in the bosses of each pair of wheels. Referring to the patterns again,




***Inside Elevation.*** ***Section.***

***FIG. 10.-FORWARD WHEEL. (2 THUS.)***

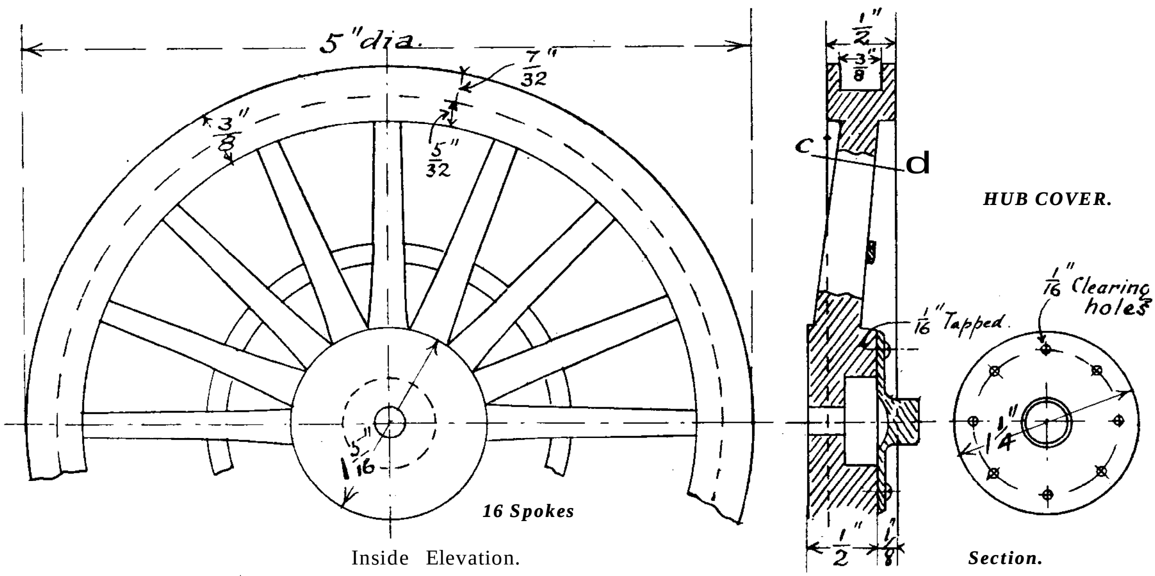



***FIG. II.-REAR WHEEL. (2 THUS.)*** *(Scale :Three-quarters full size.)*

can be made from a piece of hard wood and, in the case of the rear wheels, Fig. II, of sufficient thickness to embrace the face of boss and outside face of wheel rim, and for the forward wheels, Fig. 10, the width of rim only. After marking off the rim and spokes, holes should be drilled between the latter, and then by means of fret or bow saw, the corners made sharp. The wood should then be fixed in the lathe and turned down to the desired the spokes should be shaped to the sections shown full size in Figs. 10a and 11a. No difficulty will be presented to the amateur in the moulding as the parting line would cut longitudinally through the centre of the spokes. The narrow ring shown round the spokes of the rear wheels is of no practical use on the model, but should be added for appearance sake. A strip of brass, 1/8 in. wide, can be carefully bent round into a circle and attached by a spot of solder to each spoke.

One pattern will suffice for the caps of the hubs, and these are to be cast in gun-metal, and finally polished and left bright-being the only portion of the wheels unpainted on the prototypes. In one pair, six holes are drilled as indicated, each to clear a I-16th in. screw, and in the other pair, eight similar holes are required. Corresponding holes are tapped in the outside face of the hubs, to take small round-headed 1-16th in. screws.

The writer must confess to some difficulty in obtaining rubber rings or tyres of the required diameter and section, unless they are ordered to be especially made for the job. He has found, however, that rubber section 3/8in. sq. can be obtained in lengths, and it is possible to make one's own complete " tyres " by cutting the necessary length, and joining the two ends of each by a careful and patient manipulation of rubber solution.

*(To be continued).*

# Practical Letters from our Readers.

### *Re* Motor for River Boat.

To THE EDITOR OF *The Model* Engineer.

DEAR SIR, - Through the pages of your most useful and instructive journal, THE MODEL ENGINEER, I would like to ask the kind assistance of any of its numerous subscribers to advise me as to which make or kind of oil engine or petrol motor they would consider safe and recommend as being most suitable for a 14-ft. boat, which I use for trout fishing on a fresh water loch. I do not want higher speed than, say, about 6 miles an hour.-Yours truly, A. N.

### *Rc* Model Ship Building Trade.

To THE EDITOR OF *The Model Engineer.*

DEAR SIR, - In reply to " H. B. H." (No. 18,561) who asks about Model Shipbuilding. I have read " H. S. S.'s" letter replying to him and I am afraid I must differ greatly in opinion. In the first place, he says they are mostly drafted from the yard: well, in this point to a large extent he is right, but there are a large number who have never been in a shipyard to work. The metal fittings are in all cases made by outside people, who also in two or three cases make and supply the model complete, as the shipbuilders get a better job in this way, as it is a business which, if a man is not, shall we say, gifted with the ability to imitate to the smallest detail, he would be a failure. The models called working models are all made in the builders' yards. I might say that in the construction of a ship's model there are two distinct trades. Your correspondent being a joiner, would, I expect, want to go in for the woodwork. I am sure he would not be able to get into a shipyard as one, unless he had a lot of experience and I am afraid geometry does not enter much into the matter, as I know personally some of the finest modellers, and some do not, outside of their business, know B from a bull's foot. The only way he could join the trade would be to write to some of the model firms who do make all the model. I am myself a model maker in both branches, and am earning my living at it, and think it one of the nicest trades there is. I must say there are not a lot of men in the business, and the wages are good and the employment constant. I do not know that the wage of £2 per week is a bad wage, as there is no society to pay and the work is light. I would suggest that "H. S. S." was not as successful in the business as he is in the present one, and as the business is advancing by leaps and bounds, he would soon be hopelessly out of the race. If your correspondent writes to Kelso & Co., Glasgow, or the Britannia Model Works, Sunderland-the two largest people in the trade-I have no doubt they would give him a reply, and that would possibly assist him. If " H. S.S. " goes to the exhibition to be held in London, he will see whether model making is going back or not. I have the pleasure to be busy with several myself, so I think I ought to know. You will find the details worked out to a fine degree. I got a gold medal in 1904 at Newcastle for the brass fittings, and a gold medal at the Crvstal Palace, in 1906, for model complete.-Yours faithfully,

J. J. P.

## The Junior Institution of Engineers.

AT the last meeting of the Institution, held at the Roval United Service Institution, Whitehall, the Chairman, Mr. Frank R. Durham, presiding, a useful paper, entitled " Practical Notes on the Testing of Gas Engines," was read by Mr. Gilbert Whalley, of Walton-on-the-Naze.

The author,. in his introductory remarks, referred to the increasmg number of gas engines which *were* being installed year after year, and cited the necessity for and objects of testing. He then dealt with the methods of carrying out tests, showing how to obtain expeditiously all the data required, including detailed measurements of cylinder, length of stroke, main and outer bearings, crank-pin and piston pin hearing, etc. The mode of checking the settings and lifts of all valves, electric ignition settings, etc., was entered into, and the various systems of determining the B.H.-P. by means of a dynamo, prony brake and rope brake were illustrated. Some interesting particulars with reference to the attachment of indicators and the computation of I.H.-P. from the cards were given, and reference was made to processes for the determination of fuel consumption when running on producer or town gas. The reduction of results to standard temperatures and pressures, water circulation details, preparation of report, including schedule of conditions, charts and diagrams to be submitted, formed concluding sections of the paper. In the discussion which followed, Messrs. W. A. Tookey, Stanley Hughes, George Lyge, C. G. Evans, R. W. Brewer, W. H. Stevens, and R. H. Parsons took part, and the meeting closed with a vote of thanks to the author.

# The Society of Model Engineers.

FUTURE MEETINGS.-The next meeting is fixed for Tuesday, April 7th, at the Cripplegate Institute, when a Sale of Models (finished and unfinished), Parts, Tools, Electrical Apparatus, etc., will be held. Members only will be allowed to include articles in the sale or to purchase goods. Members of the Society who have not as yet been present at one of these sales will do well to attend, as apparatus of all kinds can usually be purchased at very **low** prices. Particulars of the Society and forms of application Can he obtained from-HERBERT G. RIDDLE, Hon. Sec., 37, Minard Road, Hither Green, S.E.

# Design for a Model Motor Fire Engine.

By FRANK FINCH.

*(Continued from page 308, Vol. XVIII)*

## STEERING GEAR.

HAVING dealt with the wheels in the last article, it is as well now to describe in detail the parts which are required for the steering gear and front axle, seeing they are so closely associated with each other. A full-size drawing of each separate limb is given, and the construction of the gear is so simple that it should not prove a difficult task to fit the respective limbs. The front axle is a steel forging with bifurcated ends (Fig. 12). Into eithcr end is fitted respectively a right gunmetal casting as shown in Fig. 13,

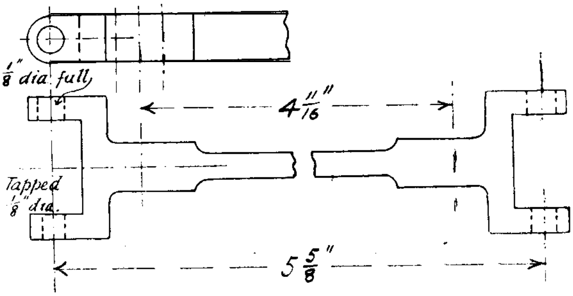



FIG. 12.—FRONT AXLE

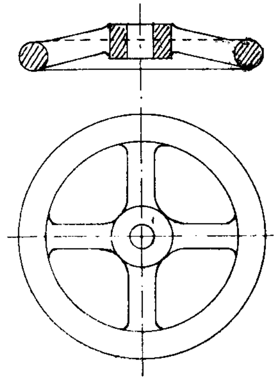
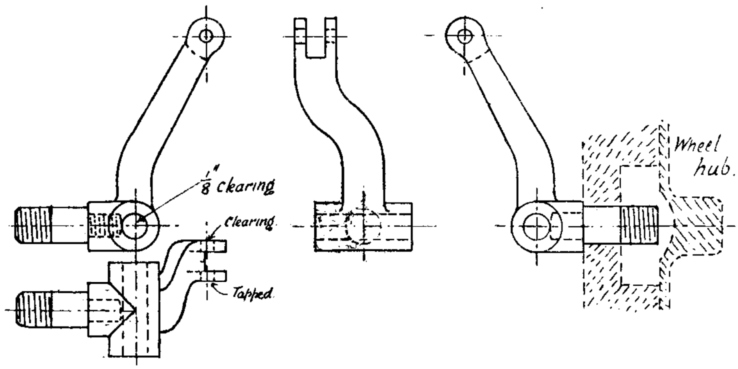


FIG. 18.—HAND WHEEL.




*One left hand thus.*

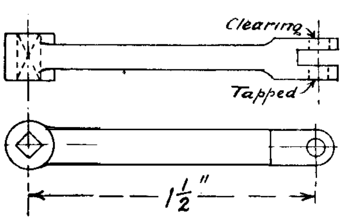
*One right hand thus.*

*(Full size.)*

***FIG. 13.-GUN-METAL CASTING.***

***FIG. 15.***

*(Full size.)*



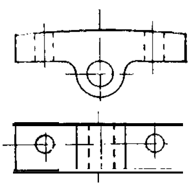



***FIG. 17.***

***GUN-METAL BEARING FOR STEERING ROD.***

*(Full size.)*

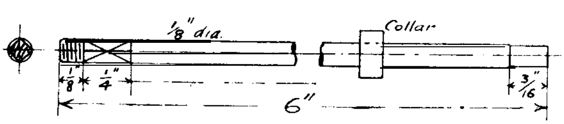



*FIG. 14. (Full size.)*

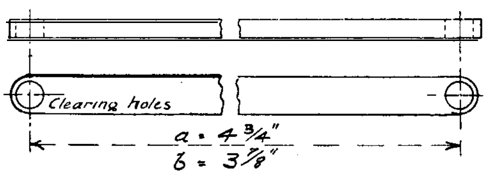
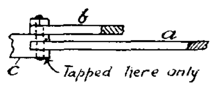



***Fig. 16. -MAIN STEERING ROD.***

***DETAILS OF PARTS FOR MODEL MOTOR FIRE ENGINE.***

and at c in Fig. 19; into the main bars a steel stud is screwed, upon which the front wheels revolve. The end of the arm in both cases is bifurcated, the lower lip being tapped for a small screw, whilst the upper lip has a hole to clear the screw. The rod for connecting the right and left arms and thereby actuating the opposite wheel is a plain steel bar as shown in Fig. 14, and at a in Fig. 19. Each end is inserted into the end of the curved arm and kept in position by a setscrew which fits loosely through the top lip and connecting-rod, and screws into the lower lip of arm. The fitting d is shown in detail at Fig. 15. and as will be seen, has one end bifurcated, and at the opposite end a boss with a square hole, in order to securely hold the steering rod. Connection is made between d. c and a by



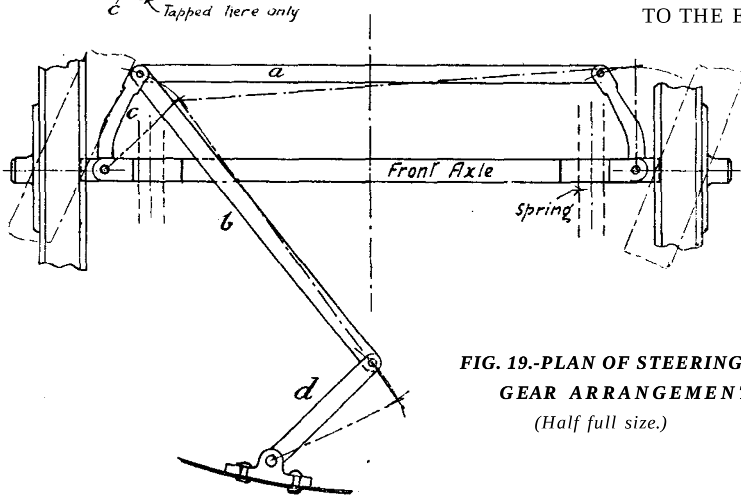




*FIG. 19.-PLAN OF STEERING GEAR ARRANGEMENT.*

*(Half full size.)*

a plain strip b (Fig. 14), having a clearing hole in each end. The main steermg rod (Fig. 16) is held by two gun -metal bearings shown in detail (Fig. 17). The position of the steering angle is

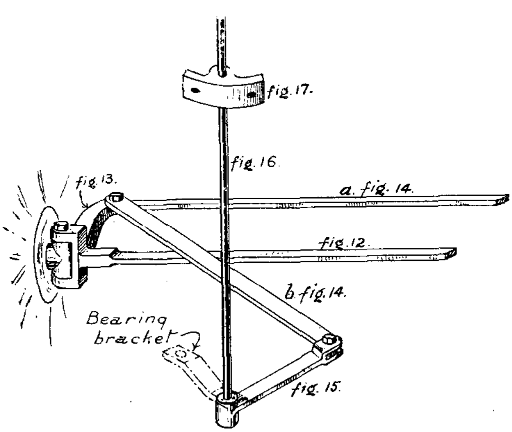



***FIG. 20.-PERSPECTIVE SKETCH OF PORTION OF STEERING GEAR. (Not to scale.)***

retained by a small screw in the upper bearing, as shown in the coloured general arrangement drawing (see issue for January 4th, 1908). The hand-wheel (Fig. 18) to be fixed to the top of steering rod needs no description. It may be possible to secure a suitable wheel from the " scrap " box. A perspective sketch (not to scale) is given in Fig. 20 in order to make the arrangement more easily understood.

(To be continued.)

# Practical Letters from Our Readers.

***[ The Editor Invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desirred, but the full name and address o/ the sender MUST invariably be attached though not neccssarily for publication.]***

## Model Screw Propellers,

TO THE EDITOR OF The Model Engineer.

DEAR SIR,--I was glad to see Mr. Arkell's expression of opinion anent above in your June 4th issue, and heartily re-echo his wish that more readers would open their hearts on the subject. of screw propulsion.

But " there's the rub," and my case. How can they contribute their quota to progress if they follow the hit-and-miss methods advocated in twisting sheet-metal blades ?

If inverse dies of hardwood are carefully swept up beforehand to likely data for the bending of the blades in the first case for a new propeller, and subsequently altered to the acquired likelier data for increased speed, then I grant that a sheet-metal screw would be the better job, as a job, owing to the metal being thinner than it could be cast, but this method is not so direct or interesting.

Simply bending by guesswork may be tricky sport, but it is not educative to the individual, nor does it add to the collective sum of our scanty knowledge of basic principles.

After two or twenty misses one hit may be judged to have been attained, but how is one to be sure that finality in efficiency has been reached, or profit by his labours leading up to it, if he has no data to go upon.

He cannot be confident he has got the most efficient screw for that individual boat, and may be afraid to alter further without a guide in direction in case he cannot go back on his tracks.

The nearer one gets to efficiency the less alteration is required, and therein lies the fascination, likewise the instruction and experience to be gained, by making cast screws according to the methods shown. They would furnish the experimental experiences and data whereby one could progress in every subsequent effort, and, not only that, but what is very important from a collectively scientific standpoint is that they would enable the student to report progress, and how it was gained, for the benefit of fellow-readers. I am convinced that THE MODEL ENGINEER and its steamer builders could become a power in this connection.

# Design for Model Motor Fire Engine.

By FRANK FINCH.

*(Continued from page 65.)*

THE part front elevation shown in Fig. 21 should be studied, together with Fig. 20 in the last article ; it will assist in simplifying the arrangement of rods, etc., for the steering gear and their relation to the front axle. The positions of bearings for supporting the vertical steering-rod are also indicated. It is very essential for the appearance of the model that the front plate should be well curved and even. The sketch at the top of the figure gives the radii for this plate. A piece of Russian iron about 18 B.W.G. will be of ample strength, and it might be hammered round the front casting of the frame, over which it is placed when in its final position. A strip of half-round wire 5-7/8 ins. long (about 1-16th in. in diameter), soldered along the top edge of the sheet, will give a finish resembling the prototype. A quantity of I-16th-in. brass wire should be obtained, as various small lengths will be required to complete the model. For instance, the handles on each side of the front plate are made of two 1-1/2-in. lengths ; the ends to be filed flat on one side and bent over with a pair of round-nosed pliers, so that the flat sides can be soldered on to the plate in the position indicated.

The Boiler.-For the boiler shell a piece of brass tube 4 ins. diameter by 5 ins. long, No. 18 B.W.G. should be obtained from the metal merchant, also a 2-in. length, which should be expanded out so that one end remains 4 ins. diameter and gradually tapers to 4-1/2 ins. diameter. This forms the bottom or outside of firebox end of boiler. The foundation-ring, which is of brass, is shown in full size half-section at Fig. 22. The T-section ring for connecting the upper and lower boiler shells is shown in Fig. 23, and 1-16th-in. rivet holes are to be drilled right round, above and below the

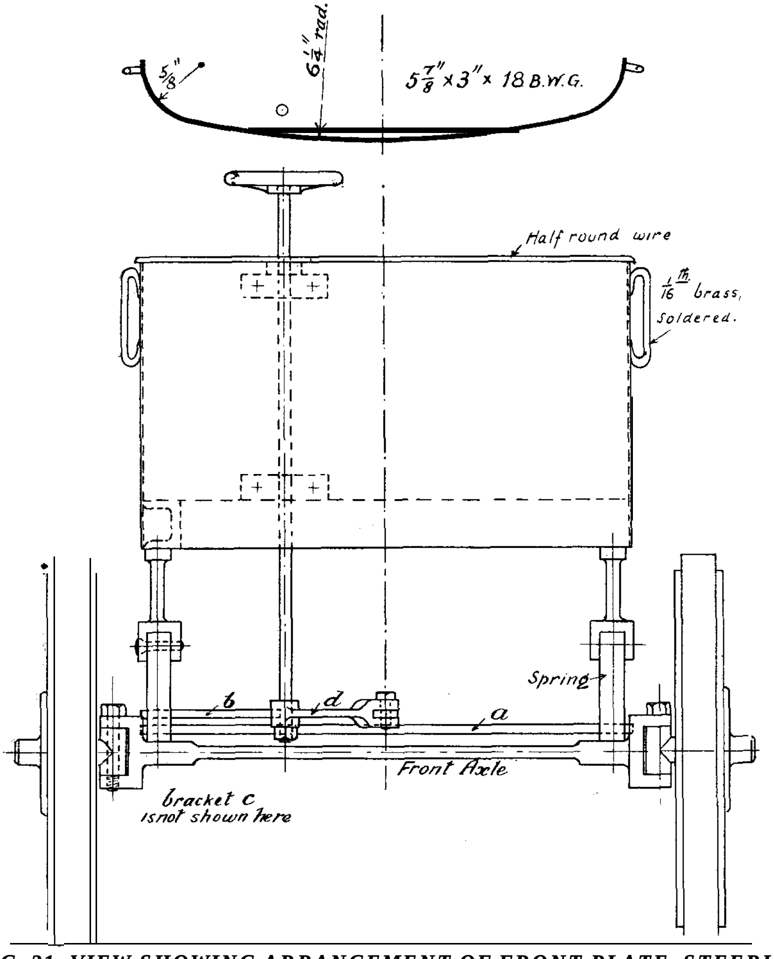



*FIG. 21.-VIEW SHOWING ARRANGEMENT OF FRONT PLATE, STEERING GEAR, AND FRONT AXLE. (Half full size.)*

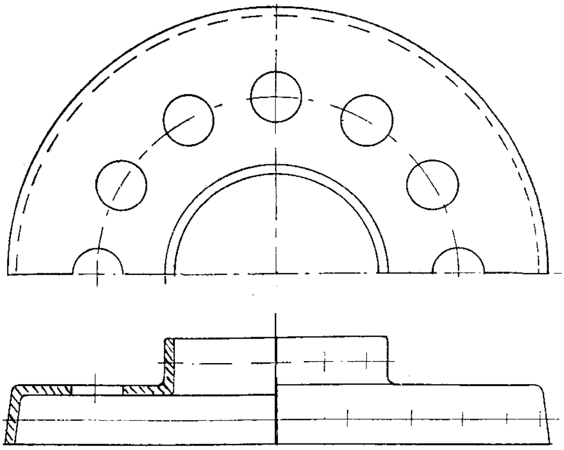


*FIG. 26.-FIREBOX CROWN.*

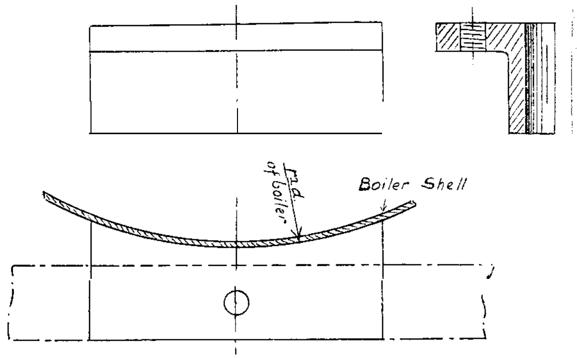



*FIG. 27.-CASTING TO SECURE THE BOILER TO THE MAIN FRAME.*

*(Two thus : Full size.)*

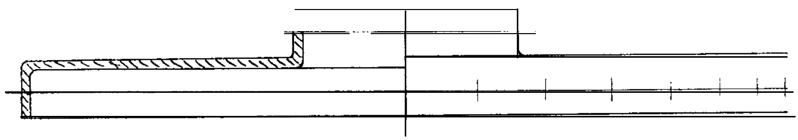


*FIG. 25.-CIRCULAR PLATE TO FORM SMOKEBOX. (Full size.)*

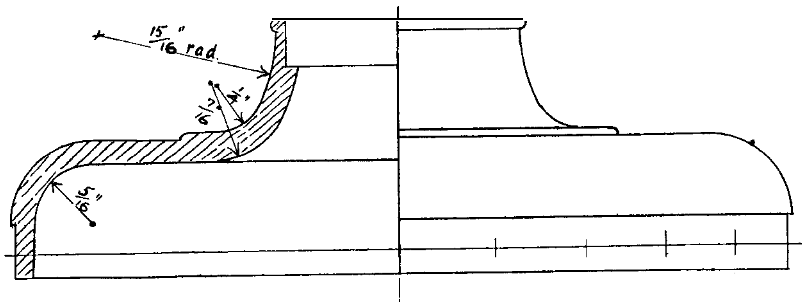



*FIG. 24-BOILER DOME. (Full size.)*

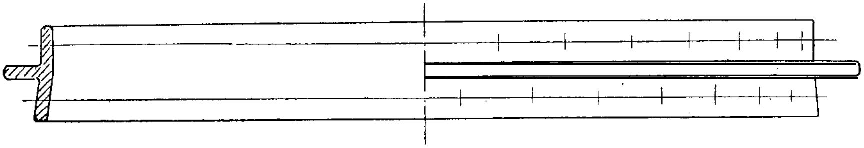


*FIG. 23.-T-SECTION BOILER RING. (Full size.)*

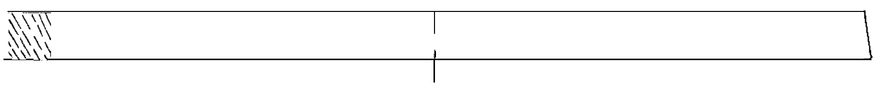


*FIG. 22.-FOUNDATION RING. (Full size.)*

**BOILER AND FIREBOX DETAILS FOR MODEL FIRE ENGINE.**

**By FRANK FINCH.**

middle web, about 3/8-in. centres. The boiler dome is, of course, a brass casting, and the half-section gives the finished sizes (Fig. 24). A set-off about 5-16ths in. wide is turned on the circumference, in order to bring the boiler shell flush with the dome. Holes are to be drilled and tapped for 3-32nds-in.

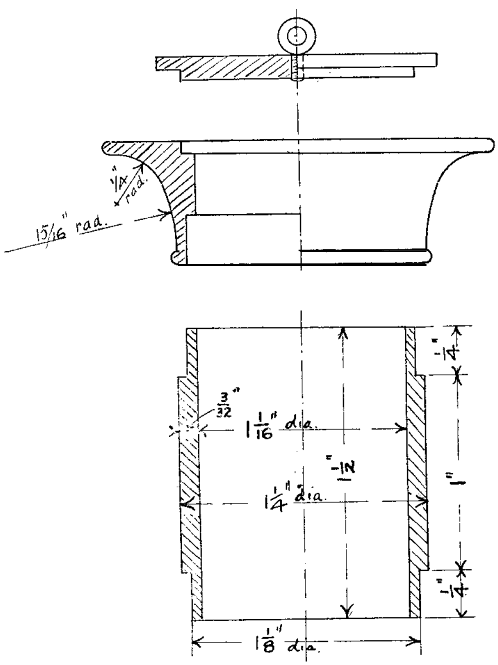



Fig. 28.-CHIMNEY PARTS.

screw (about 5/8-in. centres) all round this recess, and corresponding holes must be drilled round the upper end of boiler shell.

The circular plate shown in the coloured plate, and forming the smoke-box, is also shown full-size in Fig. 25. This is of stout sheet copper 4-1/2 ins diameter by No. 16 B.W.G., and may be beaten into the desired shape, the centre ring to be riveted to the smoke-flue, and the outer ring to be drilled for 1-16th-inch rivets (about 3/8-in. centres) for outer barrel. In Fig. 26 is shown, in half-section, the plate forming the firebox crown ; this is of copper sheet about 3-1/2ins. diameter by No. 16 B.W.G. A ring of holes should be drilled upon each flange similarly to the plate (Fig. 25) and, in addition, upon a centre 1-7/8 ins. diameter, scribed from the centre, should be drilled at equal distances twelve holes, to take the ends of twelve water-tubes, as shown in the coloured plate, and as indicated in Fig. 26. To secure the boiler firmly to the frame, castings should be made to the dimensions and shape shown in Fig. 27. One 1/8-in. screw will be sufficient to attach each casting to the side frame through the bottom of the water tanks. The curved surface should be brazed to the side of the boiler. A 4-in. length of 1-in. diameter copper tube constitutes the smoke-flue, and should be drilled top and bottom to coincide with the middle flanges of Figs. 25 and 26. The firebox wall may be formed from a 3-in. length or copper tube 2-3/4 ins. diameter, tapered out to 4 ins. diameter, and riveted right through the foundation-ring (Fig. 22). Twelve holes are to be drilled at equal distances 3/4 in. from the bottom end of firebox, to take the other end of water-tubes. Each water-tube is 3-1/2 ins. long and bent to the shape as shown in the general arrangement. It is proposed to construct the chimney in parts, as shown in the drawing (Fig. 28), especially to add to the effect of its appearance when finished. The main body is a piece of steel, turned down at each end as shown, the remainder of the circumference is left dull. The top ring is of copper and polished, whilst the cap may be turned from a piece of brass plate. The form of superheater is clearly shown in thegeneral arrangement drawing. Boiler fittings are the usual standard patterns obtainable from advertisers in THE MODEL ENGINEER, with the exception of the safety valve, a detail drawing of which will be given in a subsequent article.

The engineer's platform and tool-boxes, which are situated at the rear of the model, are details which,, although simple, call for careful workmanship. It is often such minor accessories as these that spoil the effect of a model. The drawings given in Fig. 29 are half full size, and may be accurately measured off. The main

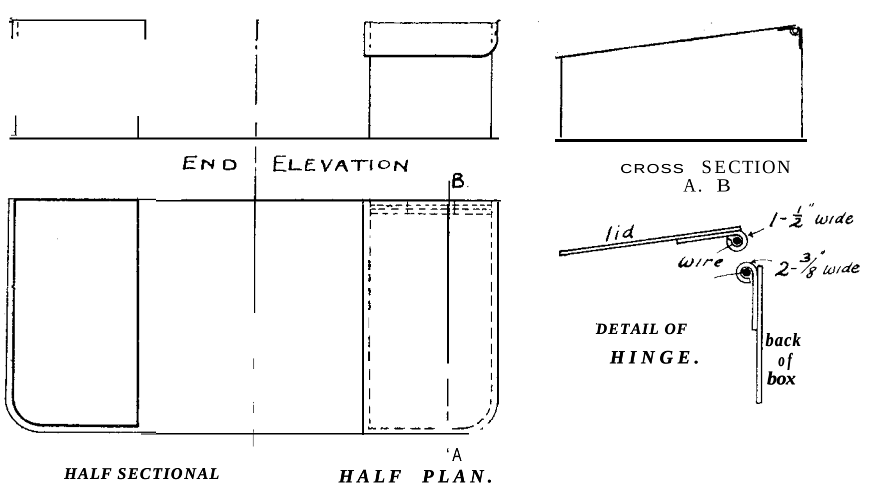



**FIG. 29.-ENGINEER'S PLATFORM AND TOOL-BOXES.**
*(Half full size.)*

piece or platform forms also the bottom of both boxes. The sides for each box are constructed in one piece, allowance being made for the ends to overlap at one corner for soldering. A simple form of hinge is shown in the enlarged sketch. These

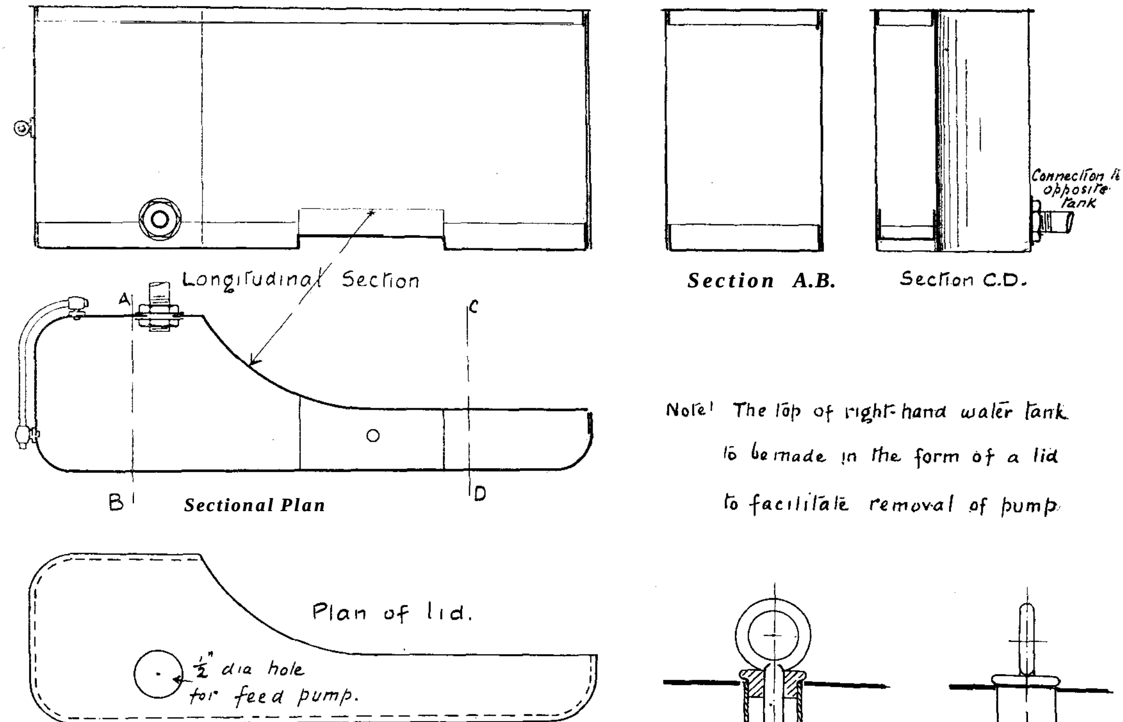



***FIG. 30.-DETAILS OF FEED-WATER TANKS.***
*(Half full size.)*

boxes are used for tools, etc., on the prototypes, and will be found useful on the model for placing odd screws, etc., when manipulating the model. In the general arrangement drawing *a* sling is shown by which this platform is suspended. A strip of flat metal, as shown, will suffice. To further steady the platform, two small strips attach it to the foundation-ring of boiler, as indicated.

Dealing now with the water tanks, it will be observed that these occupy the same position in the model as in the real engines. The sketches (Fig. 30) are reproduced to exactly half full size, and may be scaled off; both tanks are alike, excepting that they are right- and left-handed. The curved side is obviously to fit round the boiler, and the radius should equal that of the boiler. The step-up portion in the bottom of tank is to cover the casting which supports the boiler, the screw for same going right through bottom of tank, and thus securing the tank firmly. The small pipe, screwed at ends, and connecting the tanks, also acts as a tie-rod. In the right-hand tank it is proposed to place the feed-pump, and in order to do this the top of the tank should be made in the form of a movable lid, which can be placed on after the pump is in position. A hole should be cut in the lid, as indicated in the plan (Fig. 30). to allow for the top of pump to protrude.

Feed-pump.-Following the water tanks, we are now to deal with the hand-operated pump for

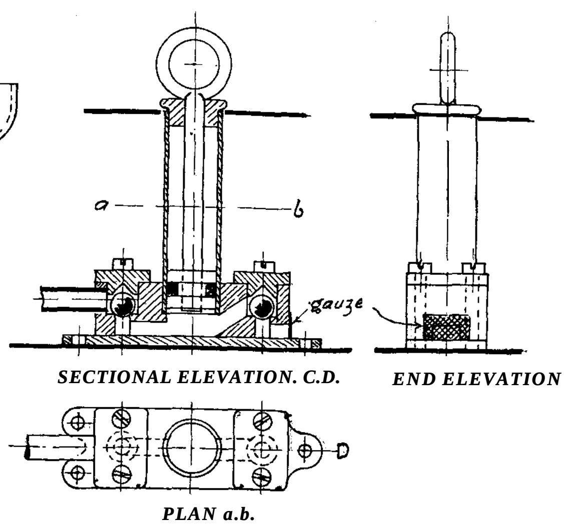
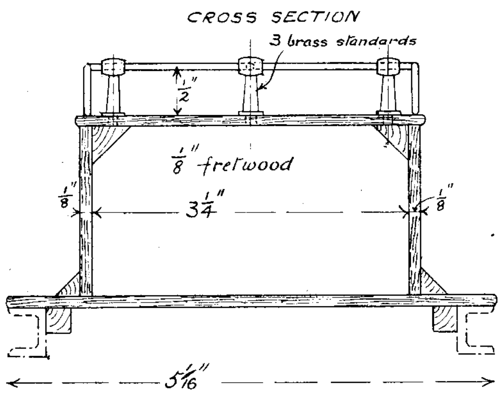



***FIG. 31.-HAND-PUMP FOR FEEDING WATER TO*** *BOILER. (Half full size.)*

feeding the water as required, into the boiler. The pump is clearly shown in the drawings (Fig. 31), which are reproduced exactly to half full size. Little or no explanation is necessary for this. Suffice it to say that the two caps are screwed to. the pump body by two screws each, which go right through to the foundation-plate: the latter is held to the bottom of tank by three small screws..

*(To be continued)*

FIG. 31b.



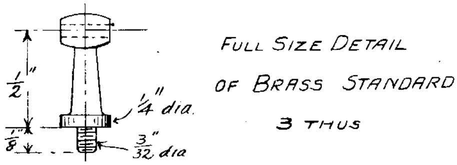




FIG. 31a.

SIDE ELEVATION

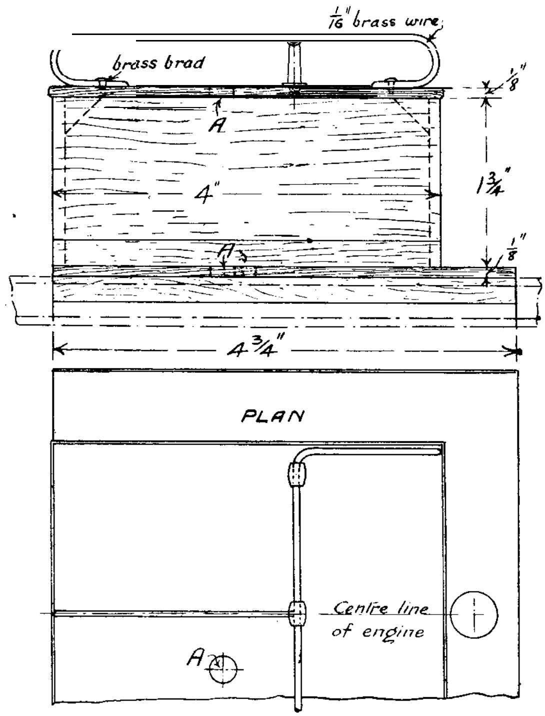



FIG. 31b.-DETAIL OF DRIVER'S WOODEN SEAT

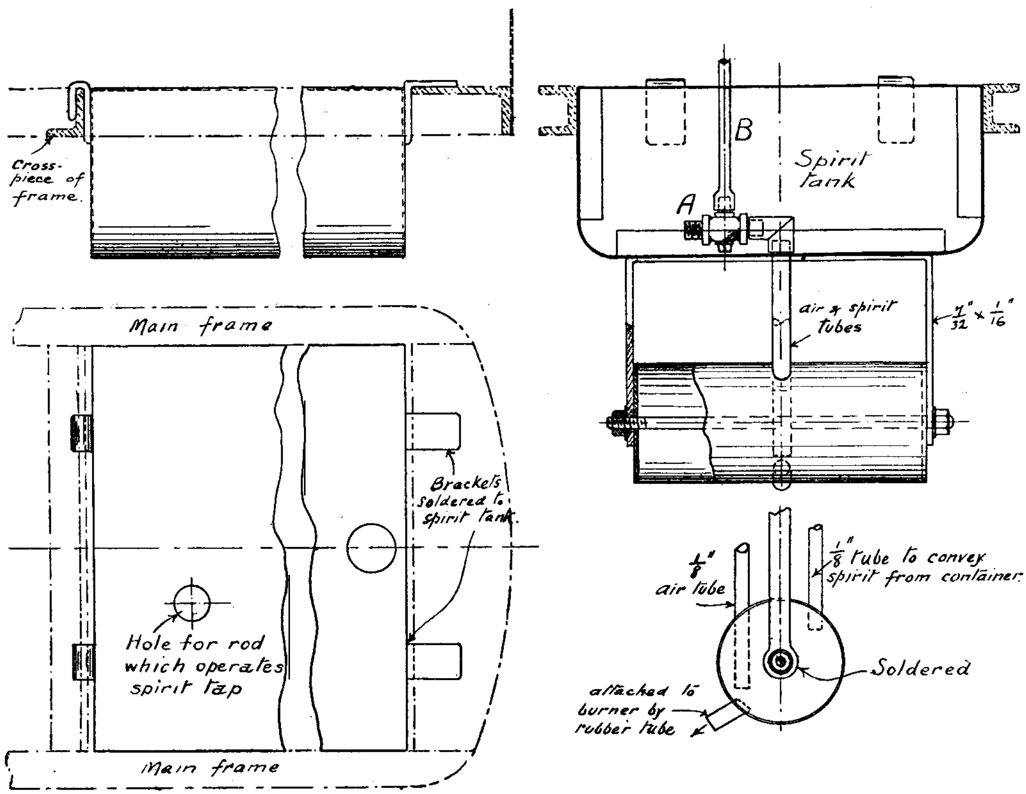



Fig. 32.--ARRANGEMENT OF SPIRIT RESERVOIR AND SUPPLY, SHOWING METHOD OF SUSPENSION BETWEEN THE FRAMES.

# Design for Model Motor Fire Engine.

By FRANK FINCH.

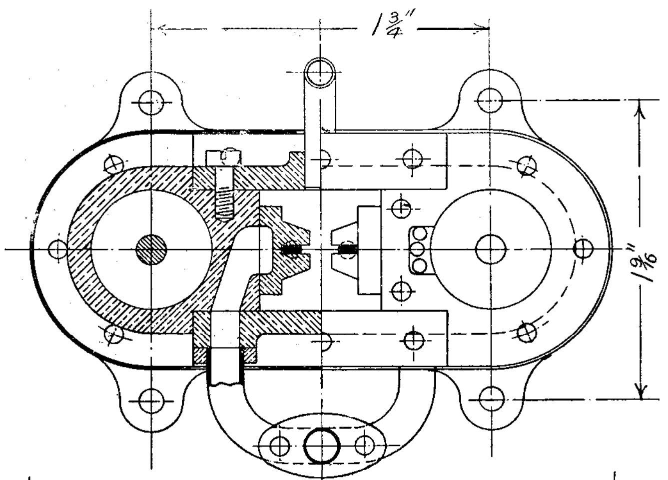
*(Continued from page 462.)*

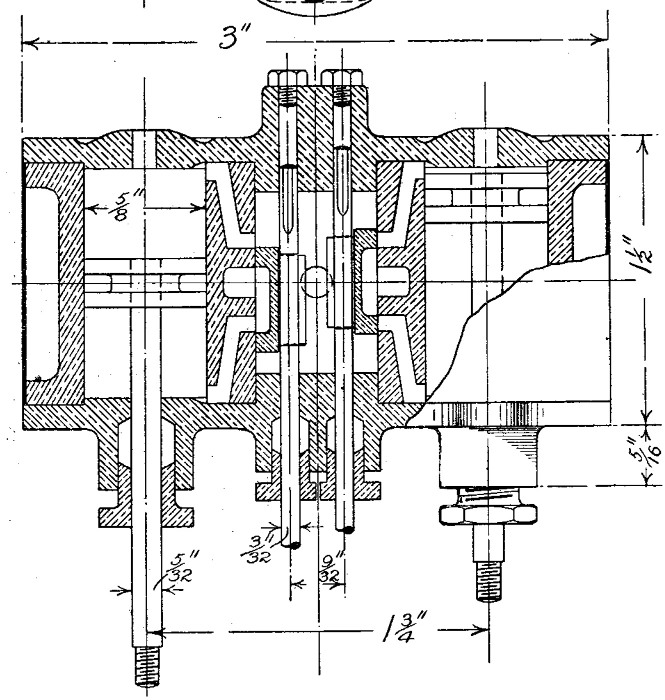
THE only woodwork in the model, apart from the pattern-making, is the driver's seat. Thin mahogany fretwood, about 1/8 in. thick, will serve for this. Fig. 31h illustrates a strong method of construction. For the hand-railing I-16th in. brass wire is used, and attached in the manner shown in the sketch. Full-size details of the three standards for carrying the railing is given herewith (Fig. 31a). These may be turned up from a piece of 1/4 in. diameter brass or steel rod, 3/4 in. long, or cast in brass from a pattern. Referring to the driver's box or seat, the holes A shown in Fig. 31b should coincide with the long stem B, Fig. 32, of the cock, for regulating the spirit supply from tank. Another hole is shown in the footboard. This should coincide with the hole in the spirit tank, which is intended for the filler.

From Fig. 32 the method proposed for supporting the spirit reservoir is shown. It will be observed that the spirit tan in the reservoir is fitted in the following manner : The top of the supply pipe is threaded, on to which a small brass elbow is screwed, and into this the cock A. The rod B has an enlarged end with a square hole to engage with the squared top of plug. The elbow and tap must, of course, be fitted before the top of tank is soldered on. Two designs of burner are shown in Figs. 33 and 34. The latter is to be preferred for stability. The brass plate shown at A has two holes drilled through to take the tubes, and acts as a drip catcher. The two plugged ends should lit firmly into brackets or clips attached to the bottom ring of boiler.

The steam cylinders are shown in full size detail in Figs. 35, 36, 37, 38, and 39. The drawings are so clear that further description is superfluous. The ports are gun-metal castings. The top cover for the two cylinders is in pieces, as is also

***Fig. 37.-HALF~SECTIONAL PLAN***




Fig, 35.---LONGITUDINAL SECTION **OF CYLINDERS,**

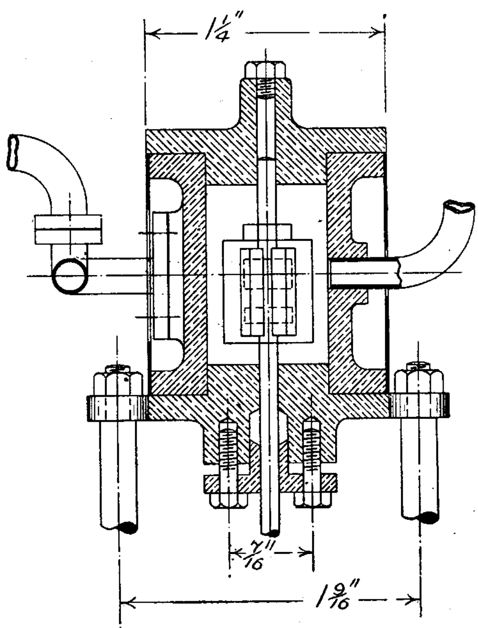



**Fig. 36.---CROSS-SECTION.**

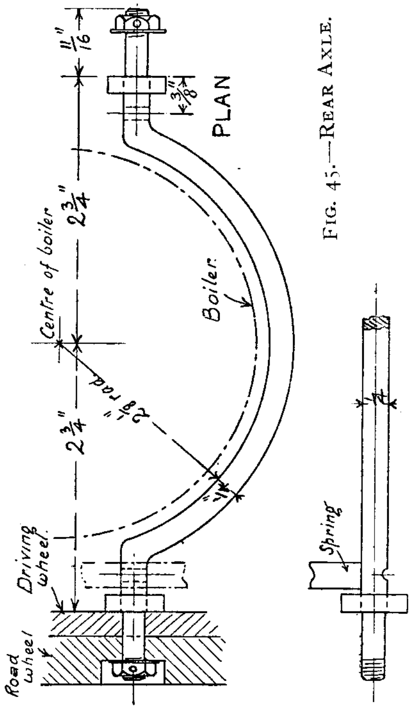



FIG. 45.—REAR AXLE.

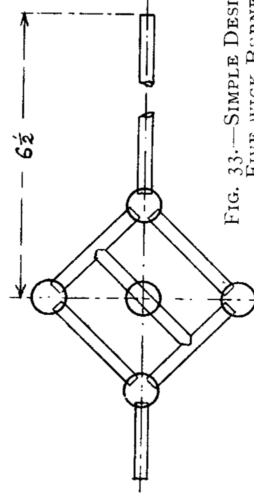


FIG. 33.—SIMPLE DESIGN FOR FIVE-WICK BURNER.

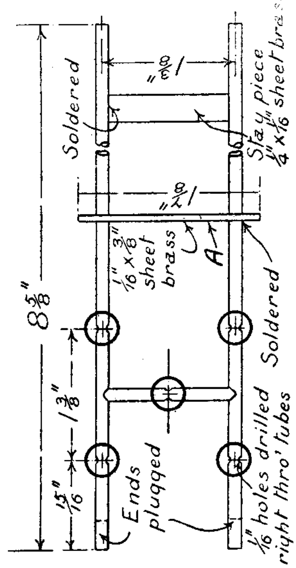



FIG. 34.—ALTERNATIVE DESIGN FOR FIVE-WICK BURNER.

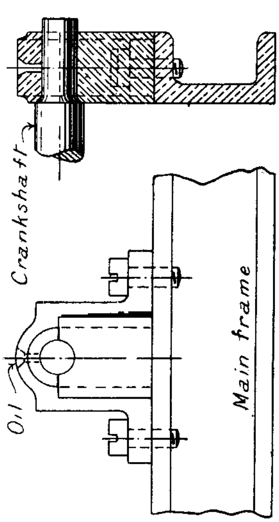



FIG. 43. DESIGN FOR CRANKSHAFT BEARINGS. (3 *thus*.)

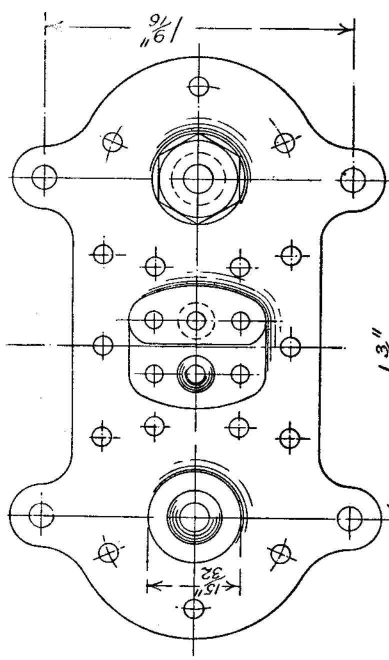


FIG. 39.—PLAN OF BOTTOM CYLINDER COVER.

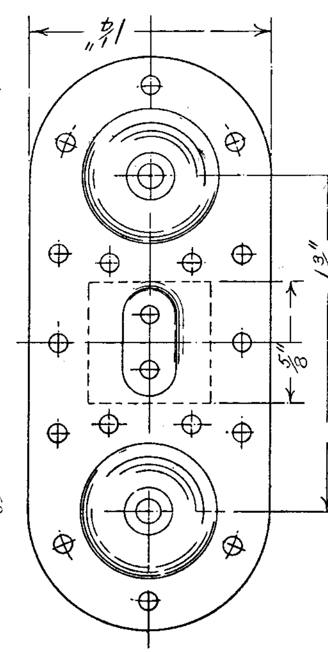


FIG. 38.—PLAN OF TOP CYLINDER COVER.

the bottom cover. This latter, it must be noted, differs from the top cover so much that it will be better to make a separate pattern for each, rather than make the same pattern do. There are four lugs, by which the cylinders are carried in steel columns from the top of the pumps. The cylinders are lagged in the usual way, and one sheet of thin brass is wrapped round to come flush between the top and bottom covers.

pump rod from the engine, the top of rod is fitted with a milled collar, so that the rod may be easily unscrewed, and the pump rod drops to the bottom of the barrel. It will be advisable to have a pair of flywheels, as indicated in the general arrangement drawing.

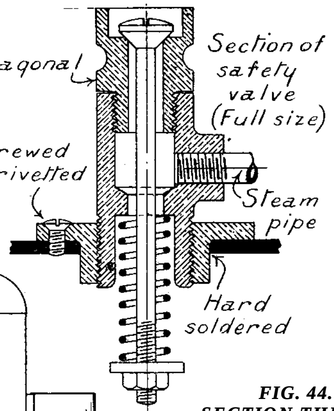
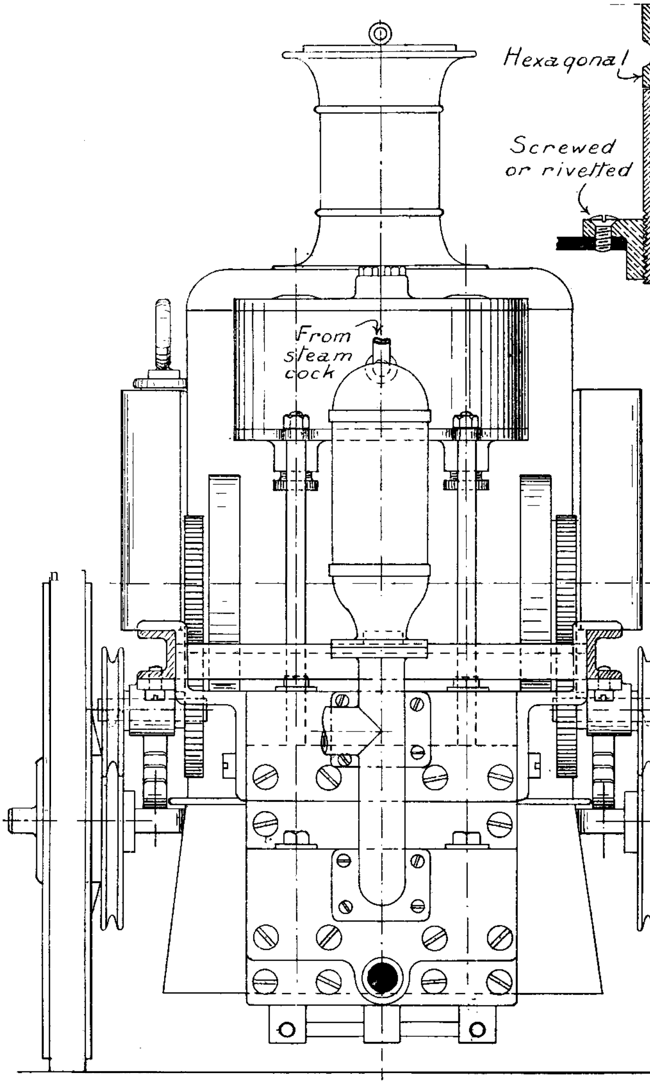



***FIG. 44. SECTION THROUGH PROPOSED SAFETY VALVE.***



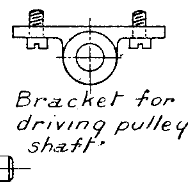




***FIG. 42.-SECTION THROUGH MODEL, SHOWING ARRANGEMENT OF ENGINE, PUMPS, AND GEARING.***

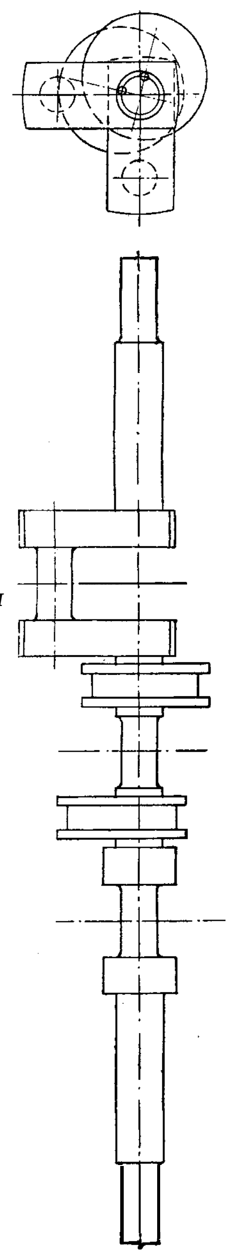


***FIG. 41.~--DETAIL OF CRANKSHAFT.***
*(Full SIZE.)*

The crossheads are of gun-metal, and made in two parts, as shown in Fig. 40. These are steadied in their movements by surrounding at each end the steel supporting columns. The lower end of the piston-rod is screwed into the boss on the upper part, and the pump rod is screwed into the boss on the lower part. To allow for disconnecting the

Forpropelling the model, after releasing the pump rods as described, the method of gearing is as follows, and is shown by dotted lines on the longitudinal elevation on the coloured plate. At each end of the crankshaft-which, by the way, is shown at Fig. 41-is fitted fast a gearwheel about 1-3/8 in. diameter by about 1/4-in. face ; these will come just within the main frames of the model. The spur wheels will gear into another pair of wheels from the same pattern, supported by a bearing immediately below the main frames, and keyed to a small countershaft. On the opposite side of this countershaft bearing there is a small grooved pulley, which transmits power by means of a gut driving band to the larger grooved wheel attached to the large road wheels. In the coloured designs of the model a band-brake is shown on one side ; but it is thought advisable to dispense with the brake and obtain a more efficient drive by putting both the rear road wheels into gear. When it is desired to work the pumps, the connection of the pump rod to the engine is made by means of the milled collar, and the gut driving band is slipped from the grooved pulleys.

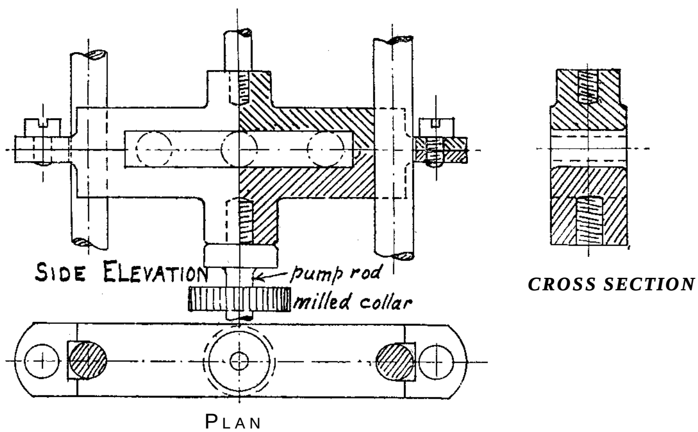



*FIG. 40.-TRUNNION CROSSHEAD. ( Two thus.)*

The use of plummer blocks on small working models, as a rule gives a clumsy appearance to the work. The design shown in Fig. 43 for the main bearings of the crankshaft will be much neater. It is comprised of two parts-a kind of gun-metal seat of block, with a strap formed to fit over and allow for screwing to the frame ; thus two unsightly screws are avoided. There are to be three of these bearings-one on each main frame, and one in the middle resting on a special metal bar, which rests from one crosspiece to another.

Attention may be called just here to the neat form of safety valve, the construction of which is made quite clear by the full size section shown at Fig. 44. It is designed with a view to neatness when in position on the boiler; it is compact, not difficult to construct, and easily adjusted.

The rear axle on the actual motor tire engine is usually bent a little in order to clear the boiler fire-door. In this design for a model it has been found necessary to give it rather a large sweep around the boiler firebox. The maker of the model may, however, prefer to bend the axle so that it passes under the boiler instead of encircling it. Details are given in the drawing (Fig. 45).

The most difficult part of the model, viz.. the pumps, now remains to be takeu in. These will be dealt with in the concluding article next week.

*( To be continued.*

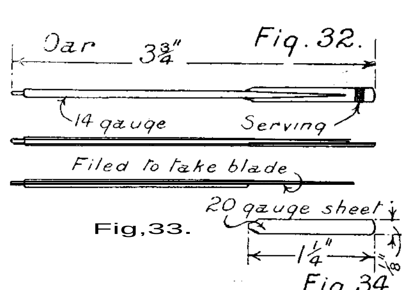
# The Making of Ship's Model Fittings.

By " X. Y. Z."

*(Continued from page* 472.)

WE now proceed with the making of the oars for the small boats (Fig. 32.). These are generally made in wood, but when made in brass are stronger and easier to make, as well as being nearer to scale. Put a piece of 14-gauge wire in chuck and turn down one end to form handle 1/8 in. long, as shown in sketch (Fig. 32). Cut off about 4 ins. long, and gently taper the opposite end, as shown in Fig. 32, 3/4 in. from the end. File 1/2 in. round, as shown (Fig. 33), and then make the blade out of a piece of 20-gauge sheet brass, 1-1/4 ins. long by 1/8 in. wide (Fig. 34). Soft-solder into position and trim carefully off. Now, with a piece of fine wire, serve the end of blade as shown in sketch, and soft-solder. This operation finishes the oars, which, as in the case of lifebuoys, are painted white, and the served part painted black.

The next fitting we propose to construct is a hencoop (Fig. 35). The making of this fitting calls for a fair amount of constructive ability and patience. Cut a piece of 20-gauge sheet brass 1-7/8 ins. long by 3/4 in. wide ; then draw 'a line down centre lengthwise, take a square file, and cut nearly through and bend. This is for the back and bottom (Fig. 36). Next cut two pieces of 20-gauge sheet brass about 1/2 in. by 3/8 in. to form the ends, lay one of these ends on pumice stone, and lay the bottom on end and soft-solder with the blowpipe, taking care to see that some of the solder runs along the joint cut through with file; repeat the operation for the opposite end. Now file level at back, and then tile the end to the shape shown in end view of sketch (Fig. 35) to form the feet. Now take a piece of so-gauge sheet to form the top, slightly longer and wider, so as to allow it to hang over all round, and soft-solder on. The hencoop




should then be placed on a block of mood held in a vice, and filed and emery-papered all over. The coop itself being complete, we have to form the bars for the front of coop ; these are made by making a piece of sheet to fit the front of coop, and setting-out to leave a bar I-16th in. wide and then a space I-16th in. wide, and leaving a piece for a door at the end, as shown in sketch (Fig. 37)

Fig. 6 shows the connections of the electric bell transmitter, which is fitted up as follows: First the bell is removed, and then a small adjustable contact-screw A is placed against the outside of the bell hammer to control its vibration, after which it is connected up as shown in Fig. 6, where M is the electro-magnet. B the contact-screw, and C the contact-spring.

The contact-spring is connected to terminal H: and thence to the aerial wire L. The contact-screw is connected to terminal H' and to the other aerial wire L'. D is a 4-volt accumulator, of three or four batteries, and E is a Morse key (an ordinary electric bell-push will do instead of this).

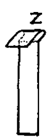



Fig. 3.

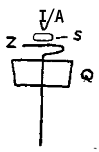



Fig. 4.

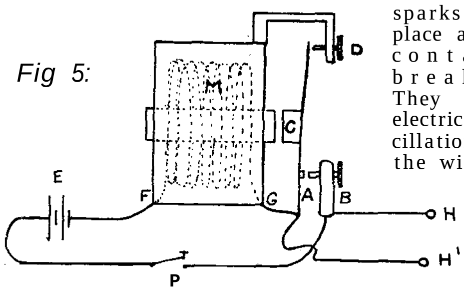



Fig 5:

Every time the key is pressed a current flows through the coils of the magnet, and a spark or number of sparks take place at the contact-breaker. They cause electrical oscillations in the wires L and L', from which waves travel outwards, and in turn set up oscillations in the receiving aerials G and G' of the receiver, and anyone listening at the telephone will hear a long or short buzzing noise, according to the signals being sent from the transmitter.

Of course, as with all other forms of wireless telegraph apparatus, much greater distances can be attained by earthing one terminal, and if this is done H' is the best terminal to connect to earth.

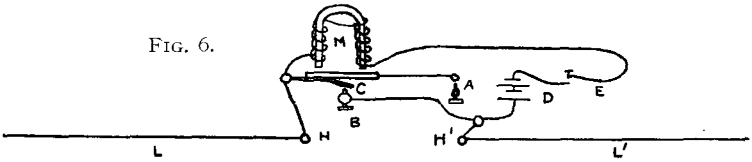



Fig. 6.

Fig. 5 shows a more powerful form of primary spark transmitter. M is a large electric magnet, in front of which is' a contact-breaker A B, the iron armature C of which is fixed in the centre of the spring A. opposite to the iron core of the magnet. The vibration of the spring is controlled by an adjustable screw D. E is a battery which is connected to one end of the coil of the magnet F ; the other end of the coil (G) isconnected to the contact-spring **A.** The circuit is completed through the contact-screw B. P is a Morse key, which is placed between the battery and the contact-screw.

H and H' are the two aerial terminals. H is the best one to connect to earth.

The receiver can, if desired. be worked by the secondary spark from an induction coil; for any distance over about 1 mile this would be absolutely necessary.

# Design for Model Motor Fire Engine.

By Frank Finch.

(Concluded *from page* 492.)

THE most difficult parts of the model we have yet to deal with now are the pumps. It is no easy matter to get a double-acting two-cylinder pump in such a limited space. Three main patterns must be made-one for the barrels, from which two castings will be required exactly similar, and the upper and lower valve chambers. They are to be of gun-metal. With a view to lightness, the upper and lower castings are connected by a tube screwed at each end. The barrelsare closed at the lower end by a screwed plug. The valve chambers are attached to the pump barrels by means of long cheese-headed screws, as shown in the plan views. There are no less than eight valves, and small cycle bearing balls are advised for these. They are kept from going astray by the protruding piece at the end of each screwed plug. To grasp

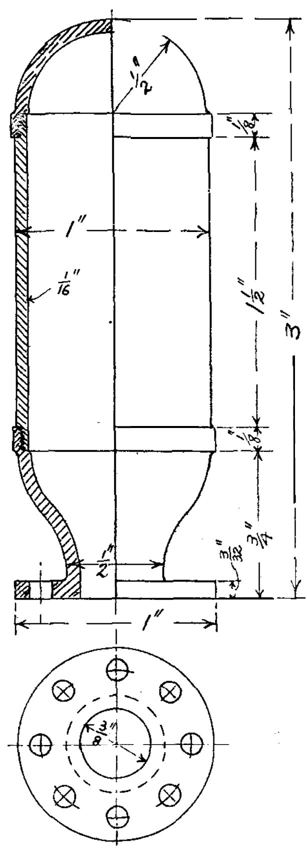
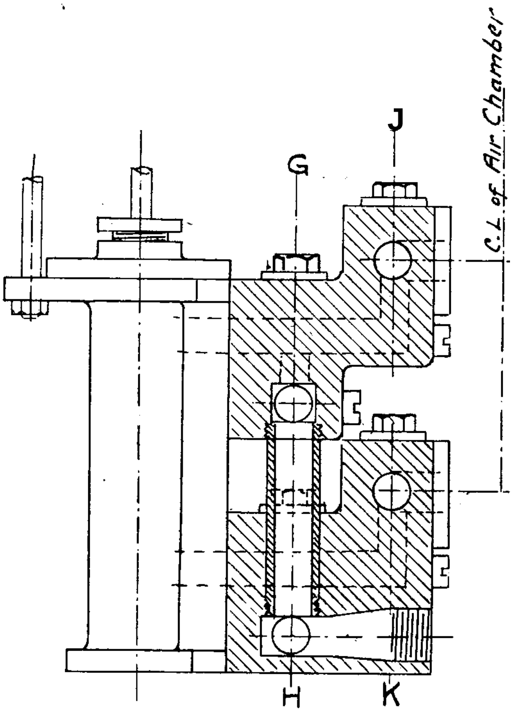
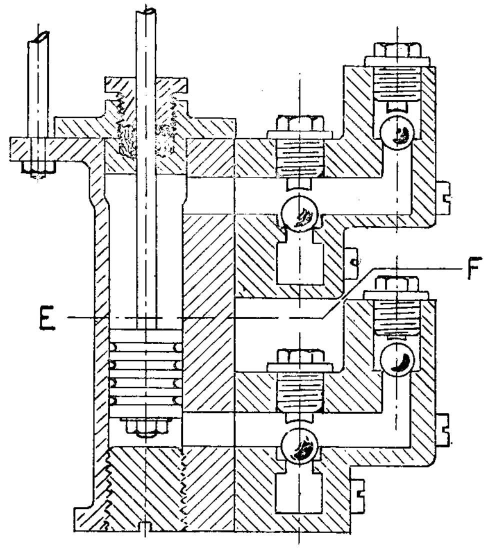


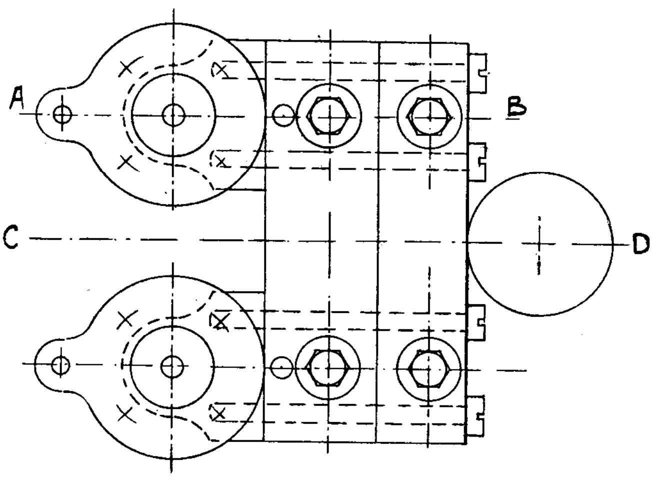

Fig. 47.--Air Vessel. *(Full size.)*



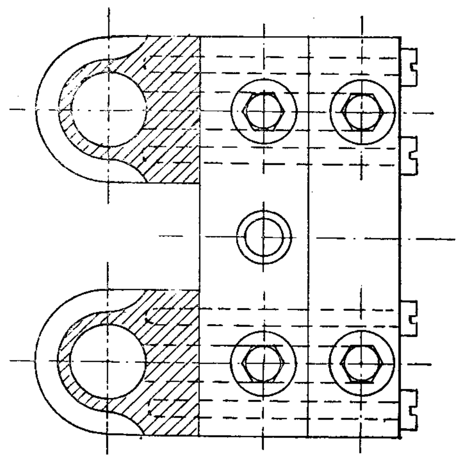

*Section C.D.*




*Sectional Elevation A.B.*




*Plan*



*Sectional Plan E.F:*

*FIG. 46.-DETAILS OF TWO-CYLINDER DOUBLE-ACTING PUMPS.(Three-quarter size.)*

the construction the various sections must be studied in conjunction with each other. On the front end elevation is shown the best method for carrying the pumps. It *is* by means of a hooked bracket, which is fastened to the sides of the upper valve chamber by two screws, and the brackets simply rest upon the main frame sides.

The air-vessel on the prototypes is not usually seen, being covered up by the wood box which we call the driver's seat ; but a touch of polished copper lends a better effect to the model, and for this reason it has been kept in a prominent position. The detail is shown in Fig. 47. The main body is a piece of tube 1-3/4 ins. by I in. diameter, turned down and screwed for 1/8 in. at each end. The top can be beaten to the required shape and the rim turned and screwed to fit one end of tube, likewise the bottom end with flange. It may be mentioned, in concluding these articles, that there are numerous accessories which, whilst insignificant, are essential to the finished model. For instance, the hose pipe-small +-in. flexible metallic tubing-is a good representation. The bell which hangs in front can be obtained from a toy dealers. Lamps are easily made to good effect from wood or lead. When all is ready for painting, which, after all, is an important item when it refers to anything with the fire brigade, I cannot do better than refer my readers to the excellent articles that have appeared in THE MODEL ENGINEER on painting and finishing models. The brilliant red familiar to all must be carefully matched, and when the model is ready for the paint, it is advisable to compare the colour at the nearest fire station before applying it to the model. It is hardly necessary to mention that the boiler is left bright, also steam pipes, cylinders, and pumps. The parts to be coloured red include the wheels, main frame, water tank, front plate, spirit tank, and driver's seat. A little lining, it properly done, will improve the decoration, and the words-" THE MODEL ENGINEER Fire Engine "-might be added to the sides of the water tank.

# The Colouring of Various Metals by Lacquering, Bronzing, etc.

By C. A. G. SIANDAGE.

*(Continued from page 401.)*

CHEMICAL FLUIDS FOR COLOURING METALS.

THESE liquids are used simply by dipping the metal article in them for a sufficiently long time.

*For Colouring Brass Seimply by* Immersion.

No. I.-Brown tones to black :
 I pt. water.
 5 drachms nitrate of iron.

No. a.-Brown and all shades to black :
 I pt. of water.
 5 drachms of protochloride of iron.

No. 3.-Brown and all tones to red :
 I pt. of water.
 16 drachms nitrate of iron.
 16 hyposulphite of soda.

No. 4.--Brown and every shade to red :
 I pt. of water.
 16 drachms of hyposulphite of soda.
 I drachm of nitric acid.

No. S.-Brownish red :
 I pt. of water.
 I oz. nitrate of copper.
 I oz. oxalic acid.

No. 6.-Orange red :
 I pt. of water.
 I drachm of a solution of sulphide of potash.

No. 7.-Olive :
 2 pts. of water.
 2 drachms of perchloride of iron.

No. S.-Blue :
 I pt. of water.
 2 drachms of hyposulphite of soda.

Bronze powders are usually dusted on a surface that has been coated with some suitable agglutinant to cause the powder to adhere ; in some cases a bronze paint is used, while in the case of leather articles a liquid bronzing fluid is employed.

Such a fluid is one of the easiest methods of bronzing, because the fluid is similar to a quick-drying varnish, that, when dry, exhibits a " bronzed " effect, which is generally due to the presence of a superabundance of an aniline dye.

Success in the art of bronzing greatly depends on circumstances, such as the temperature of the alloy (metallic bronzing powder) or of the solution, the proportions of the metal used in forming the powder, and the quality of the materials.

The moment at which to withdraw the goods, the drying of them, and many other little items require a care and attention in manipulation which experience alone can impart.

ANILINE BRONZING FLUID.

Take 10 parts of aniline red and 5 parts of aniline purple, dissolve them in 100 parts of methylated spirit at the heat of a water-bath.

As soon as the dyes are dissolved, add 5 parts of benzoic acid and raise the temperature of the mixture to boiling point, and keep it at that heat for five to ten minutes, until, in fact, the greenish colour of the mixture is transformed into a fine light-coloured bronze.

This fluid is laid on with a brush, and is applicable to metals, wood, leather, etc.

*Bronzing Fluid.*

*Ingredients* :
 50 grains of red aniline.
 50 grains of violet aniline.
 2 ozs. of alcohol.
 50 grains of benzoic acid.

Dissolve the aniline colours in a bottle by the aid of heat (over a water-bath), add the benzoic acid, and heat the mixture until its colour is of a light-brownish bronze.

*Brown Bronze Dip.*

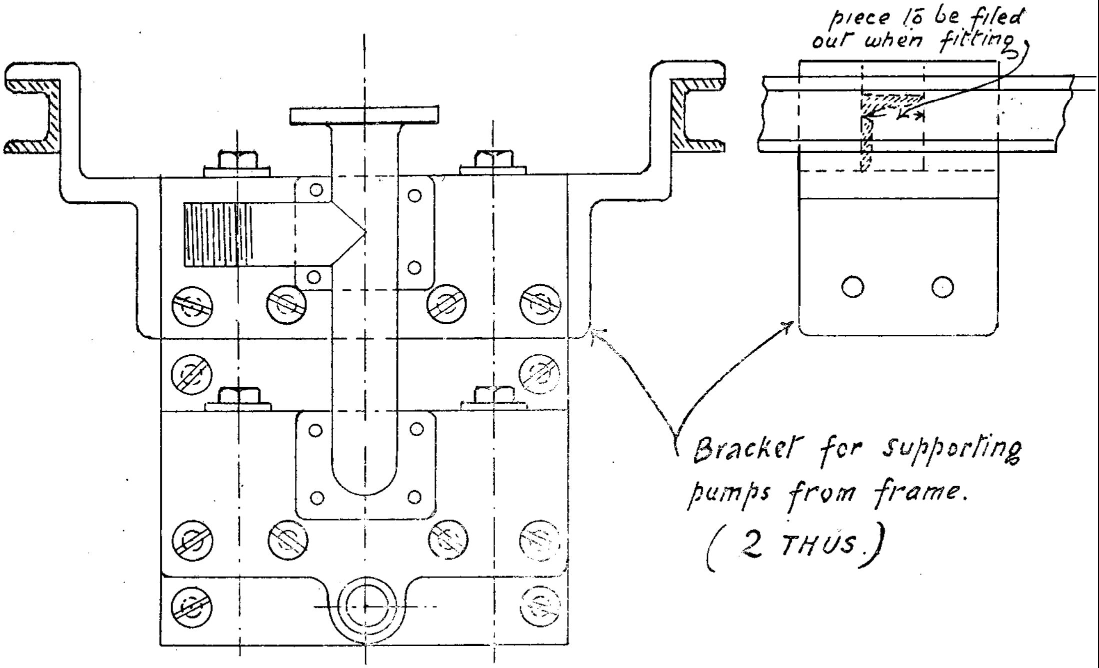
*Ingredients* :
 8 ozs. of iron scales.
 *8 ozs.* hydrochloric acid.
 1/2 oz. arsenic.
 1/2 oz. of zinc (solid).

Mix in a bottle and keep the zinc in the mixture only while the fluid is in use.

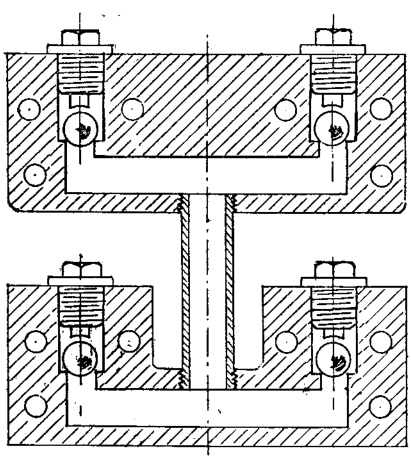
Green *Bronze Dip.*

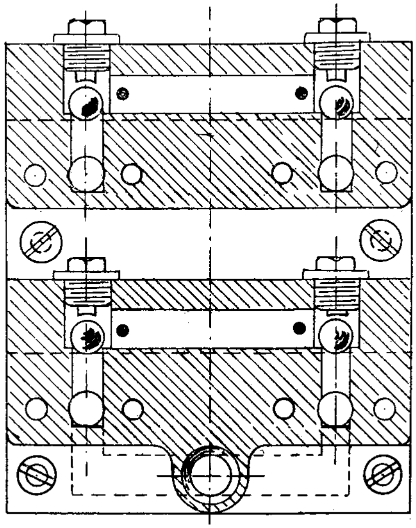
*Ingredients* :
 *4 ozs.* of verdite green.
 4 ozs. of common salt.
 2 ozs. of sal-ammoniac.
 I oz. of alum.
 16 ozs. of French berries.
 4 qrts. of vinegar.

Boil all these ingredients together.




***Front End Eevation***





***Section G.H.***

***Section J. K.***

*FIG. 46.-DETAILS OF TWO-CYLINDER DOUBLE-ACTING PUMPS. (Scale : three-quarter full size.)*