Maidstone Model Engineering Society

NEWSLETTER

Autumn 1984

Saturday September 22nd - Visit by Sutton Club and Barbecue.

Friday October 5th - An Evening of Exotic Entertainment 7.30pm.

Sunday October 21st - Last Running Day..

Sunday October 28th - First Working Day.

Friday November 2nd - Video Evening 7.30pm.

Friday December 7th - Talk and Slide Show on the K. & E.S.R. 7.30pm.

Sutton Club are visiting us on Saturday September 22nd - this is re-scheduled from July 21st. We all had a good time when we went to them in June although the rain tried to dampen the evening proceedings and I know that they are looking forward to returning to us - everyone is welcome this day.

The first Friday in October is entitled An Evening of Exotic Entertainment - you have to admit that this sounds better than Bits and Pieces or Bring and Buy or General Natter Night. In fact it is a mixture of all three, however do not be lisappointed, you never know your luck there may be some surprises in store!.

The November club night will be packed with various videos ranging from some old big steam stuff to Maidstone Model Engineering Society Highlights of Summer 1984 and is definitely not to be missed.

For our December evening Mr Lindsay of the Kent and East Sussex Railway has kindly agreed to come and give us a talk and slide show on the said railway. Certainly worth attending.

Well, we have not had a bad summer as it has been fine most running days and for all the evening runs. It was glorious for the Open Day, the ladies laying on a superb spread as usual and all the visiting locomotives had a good run. Our thanks to one and all concerned who helped to make the day such a success.

The Clubhouse has now been equipped with a new cooker and fridge-freezer to help everyone dine in style.

Congratulations are in order to Martin and Julia Parham on the birth of their second son Thomas (dare I say a tank engine driver no doubt) and also congratulations to Mr and Mrs Wallis who have just celebrated their golden anniversary.

Welcome to the following new members who have joined in 1984:
Sam J. Ludford of East Farleigh who is an architectural modelmaker whose model making activites are construction of scale model ships and '0' gauge locomotives;
J.T. Brooks of Rainham who is a retired engineer interested in model locomotives;
Peter Jackson of Rochester who is a teacher whose hobbies are G 1 and 3½" G locomotives;
Peter Ashby of West Malling who is a horticultural fitter and has commenced a 5" gauge Speedy;
Frank Deeprose of Gillingham who is retired and building a 5" gauge Gert;
Charles H. Neil of Gillingham who is a receiver repairer rebuilding a 3½" gauge County;
George T. Ovenden of Canterbury who is retired and interested in all miniature steam locomotives;
Andrew J. Tate of Maidstone who is a quantity surveyor and constructing a 5" gauge Simplex.

MAIDSTONE MODEL ENGINEERING SOCIETY

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Secretary : M.N. Parham Esq. (Martin), Bramleys, Old Loose Hill, Loose, Maidstone, Kent. ME15 OBS. Maidstone 44175.
Treasurer : P.A. Roots Esq. (Pete), 97 Tonbridge Road, Maidstone, Kent. ME16 8JN. Maidstone 58599.

To provide a bumper Christmas issue I need articles and that means <u>YOU</u>. The sooner the better, but the closing date is Sunday December 2nd. It does not have to be specifically about model engineering either, so let's hear from you!

We are considering the possibility of dining out one Saturday evening next year on the Kent and East Sussex Railway. Their Wealden Pullman operates Saturday evenings whereby you enjoy a four course meal with wine while travelling through the Weald of Kent by steam locomotive. The pricehas not yet been agreed for 1985 but is anticipated to be approximately £16 and this includes the journey, food, wine service and VAT. As there is always a high demand for seats it is essential that we book early and therefore please complete and return the slip at the bottom of this newsletter by 7th October 1984 if you are interested in attending.

Well, I look forward to receiving all your items!
See you anon,

Sue

Please reserve me .... places on the Wealden Pullman on Saturday May 18th 1985.

....
signature

If unable to make this date but interested in going another time, please state.
You will be notified as soon as possible if your reservation is accepted.
Please return to any of the above officers, or Sue at the Clubhouse.

Kinematic Design

by

Jim Ewins

Don't be put off by the above title. The principles of kinematic design are not difficult to grasp in fact many people concerned with mechanical design follow them intuitively. Others I am afraid are quite oblivious of them and their designs suffer needlessly for, to observe them usually entails no extra work but just a little extra thought at the design stage.

I always say that the principles are a council of perfection by which I mean that to follow them explicitly is practically impossible, but this is no reason for the flagrant disregard of them.

The formal setting down of these principles involves an academic exercise which would no doubt bore most members and is best done verbally with the help of models such as were available to me when I lectured on the subject at University. I hope perhaps I can convey the gist of the idea here by reference to familiar situations which arise during the construction of model steam locomotives. One such situation is that which occurs in the functioning of a lathe. The saddle of a lathe slides along the bed in a linear direction parallel to the axis of the head-stock and tailstock. In kinematic terms it is thus said to have "one degree of translational freedom". If it moves in any other direction the lathe is faulty. What other directions might it move or tend to move in? Well, it might tend to move in a direction at right angles to the bed just as the cross-slide does. Similarly it might move up and down a vertical axis. Thus we see that there are three degrees of translational freedom possible only one of which is admissable in the present case. How else might it move or tend to move? It might tend to rotate about a vertical axis so that when looked down on in plan a clockwise or anticlockwise motion would be observed (most undesirable in a lathe but it sometimes does happen). Similarly it might tend to rotate about an axis parallel to that of the headstock and finally about an axis at right angles to the last two. In other words there are three rotational possibilities of motion all of which in the present case are objectionable. In total then there are six degrees of possible motion five of which for a lathe saddle must be prevented or 'constrained', leaving just one degree of translational freedom.

Kinematic constraints should theoretically be provided by points of contact and in the case of the lathe saddle should be five in number leaving the saddle unconstrained along the bed. Any constraints over and above the theoretical requirement are 'redundant constraints' which can only be brought into play by deforming one or other of the mating components. A homely example of this is to be seen in the case of an ordinary chair. Chairs need to move horizontally along two axies at right angles so that they can be placed anywhere in the room. They also need to rotate about a vertical axis so that when seated you are facing the desired direction. They must therefore have three degrees of freedom, two translational and one rotational. But they have four legs to act as constraints i.e one too many and therefore unless a deflection takes place (and it usually does) the chair rocks because it doesn't know which constraint is the redundant one. A similar situation occurs in a badly designed machine and [redacted] taking as we have done the lathe as an example where we need five constraints between the bed and saddle two common types are illustrated in Fig 1a and Fig 1b. Of course no lathe could ever be made with point constraints because points have no size so that any load upon them would be infinite. This what I mean by saying that the theory Kinematic Design is a council of perfection the points have to be replaced by areas of sufficient size to withstand the load upon them but these areas should be located around the positions as would be ideally occupied by the theorectical point constraints. In Fig 1a the arrows indicate the positions of the five constraints. Four of these are against the inverted vee (two at each side of the saddle the central areas being relieved) and one between the flat surfaces. Ideally the flat surfaces should not extend the whole width of the saddle but should be concentrated near to the chuck. Fig 1b shows the faulty two vee design in which there are eight constraints, three too many. The saddle dithers between one vee and the other because no matter how perfectly they are made to fit initially, wear and slight temperature change will cause this dither. Many old lathes suffered this fault and sadly some modern ones still do so look before you buy!

How does all this affect model locomotive design? It does to the extent that correct application of these principles can reduce the rate of wear very significantly along with a corresponding reduction in friction which arises when redundant constraints are fighting one another. In other instances the proper location of parts one with respect to another cannot be achieved in the presence of redundancy and although some designs look alright on the drawing board it is very different when the parts come to be fitted together. I will now give some examples of this.

The crosshead in a reciprocating engine like the saddle of a lathe needs to have five constraints. These are properly provided by the guide bars but in some designs owing to redundant constraints occuring at the gland and end cover the crosshead is left dangling. Fig 2a shows this condition and indicates how it can be further exacerbated when a crosshead pump is employed. Fig 2b shows how by removing the redundant constraints at the cylinder cover and pump connection the resultant force arising from the piston rod and the con-rod is properly taken by the slide bar. The amount of clearance given at these two points must be sufficient otherwise after the slightest wear at the crosshead the position will be as before. In one recent design I notice the cylinder cover clearance given as less than 1½ thou. This is a case of a good idea being taken up, and botched as frequently occurs when the designer does not understand the fundamental nature of a problem. The amount of clearance should be such that no lateral constraint can take place even when the crosshead is so severely worn as to be in dire need of overhaul. In order to accomodate such a clearance at the gland which would normally allow the packing to pass through, the solutions shown in Fig 3a and Fig 3b may be adopted. I originally used 3a on my 0-6-2T which has covered nearly 3000 miles without the packing being renewed. More recently I have adopted the scheme of Fig 3b where a floating P.T.F.E. seal takes care of the lateral motion. I devised this design of seal some years ago and have found it most effective having used it in place of packing and "O" rings in such places as wheel valve glands regulator glands and gauge glass seals.

Another situation in which good kinematic design is floated with unhappy results occurs in the design of pipe unions. The common solution is to use a coned nipple mating with a similar female cone. This is not so bad if the two cones are of different angle (which unwittingly they usually are) because provided lateral freedom is allowed and the pipes line up there will be a circular ring of contact effecting the seal. However to be sure of this condition it is only necessary to make the male nipple spherical as shown in Fig 4b with lateral clearance. The sphere-in-cone location ensures a truly circular line contact without the necessity of forcing one or other of the components to distort

A design which appears with monotonous regularity is the blow-down valve arrangement shown in Fig 5a. Here the poor ball doesn't know whether to locate in the proper seating or in the opposite cone provided by the screw-down part. Of course if the valve is sufficiently well made with accurate concentricity all will be well especially if the operating thread is a little slack. But why run the risk of a leaky fitting when all that is necessary is to observe the kinematic requirement that redundant constraints must be avoided as is the case in Fig 5b.

I hope the above notes will be helpful to members who wish to improve the mechanical design of their engines. They are not intended as a rigorous treatment of the subject which is hardly appropriate in the present context. Hopefully they indicate how to avoid the more blatent faults which impair the functioning and longevity of working models.

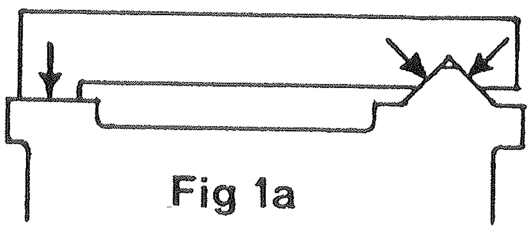


Fig 1a

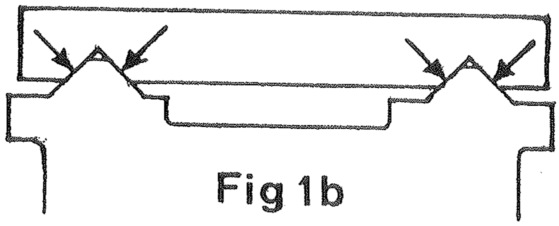
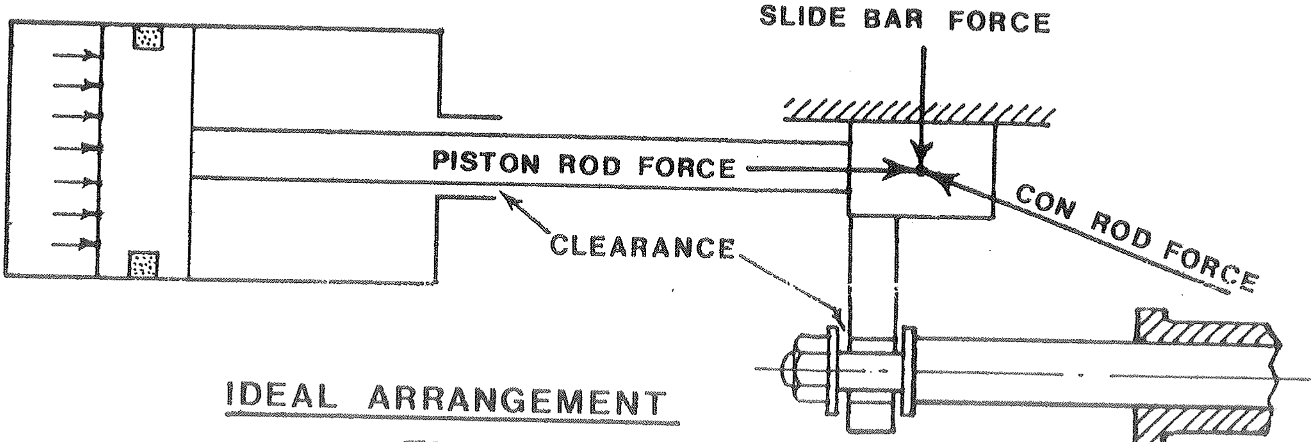
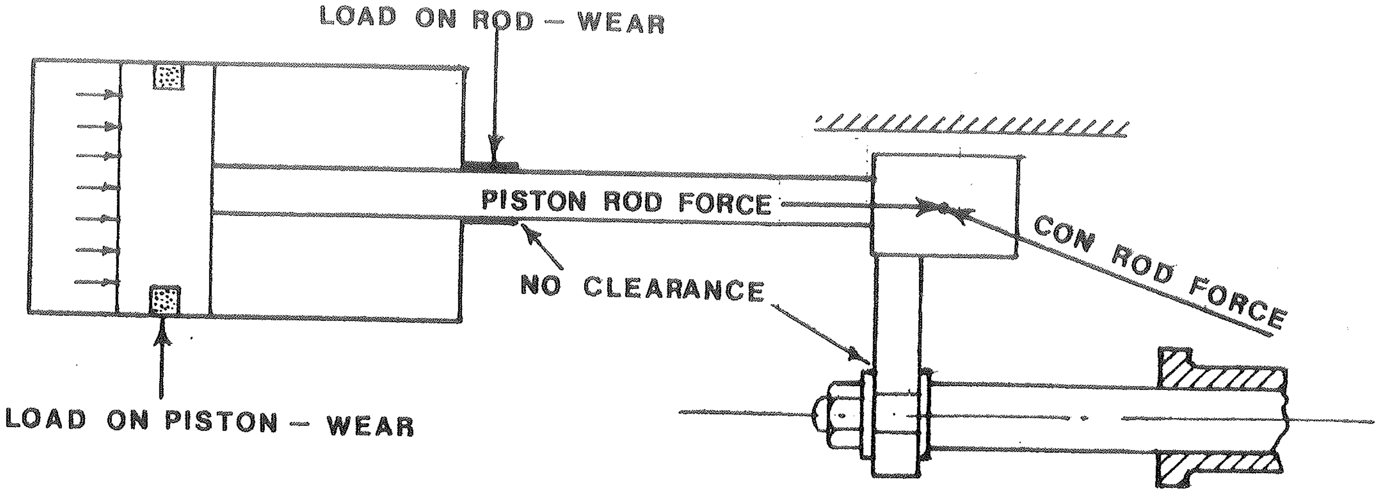


Fig 1b



IDEAL ARRANGEMENT

Fig 2b



USUAL ARRANGEMENT

Fig 2a

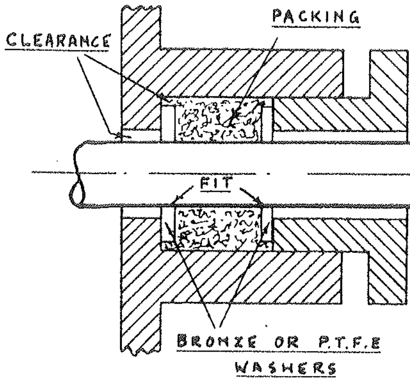


FIG 3a

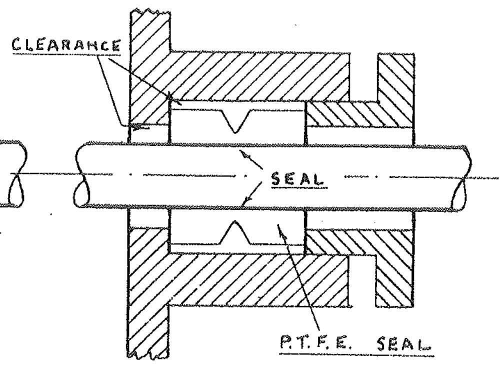


FIG 3b

IMPROVED SEALS

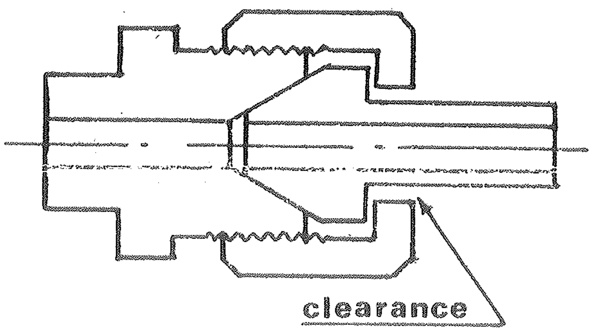


Fig 4a

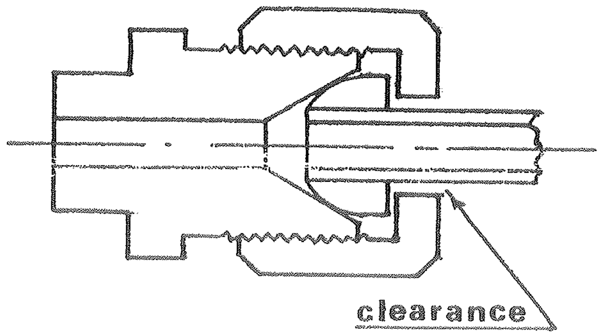


Fig 4b

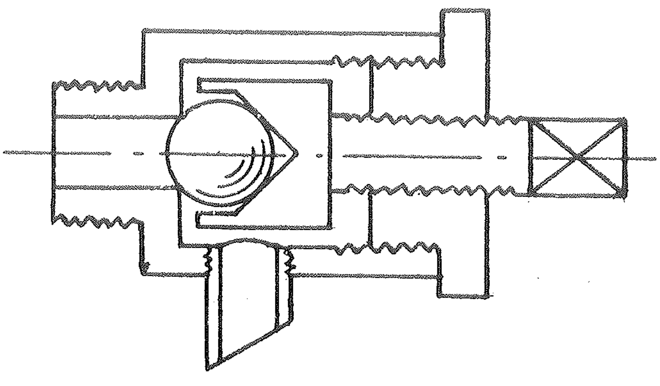


Fig 5a

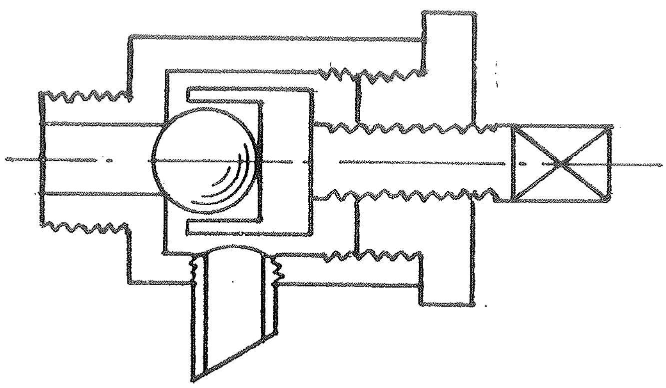


Fig 5b