common point on each swing-arm line and so is the only pivot point to satisfy our initial requirement of 100% anti-squat at the extremes of suspension travel.

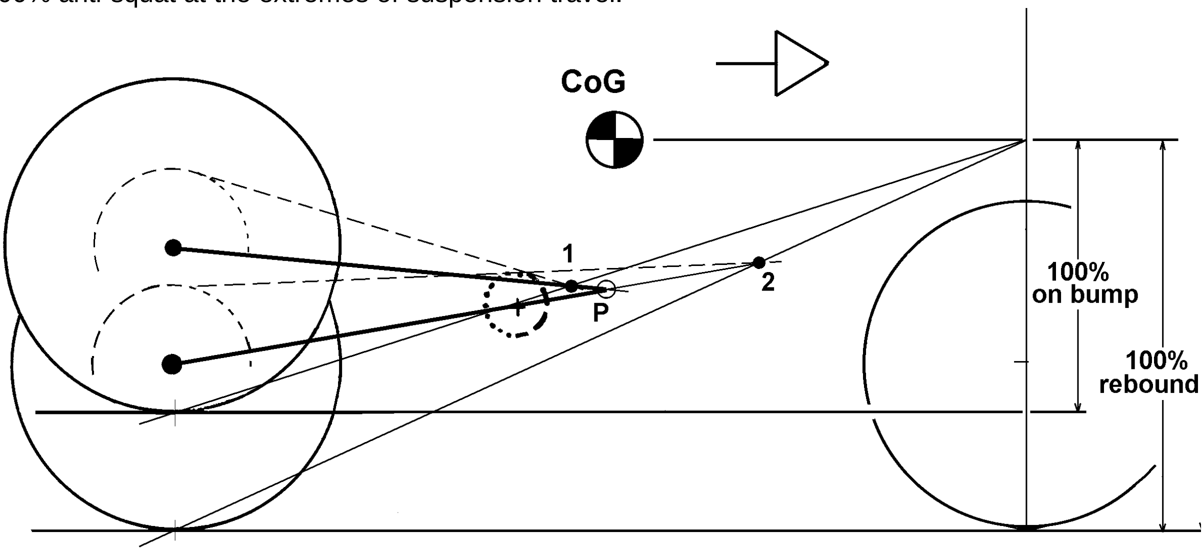

Fig. 9.16 **Determining the swing-arm pivot position to achieve 100% anti-squat at both extremes of the suspension range. The intersection of the respective chains lines and the force lines for 100% define the instantaneous force centres (1 & 2). The swing-arm lines must pass through these points and where the two swing-arms meet, P, is the only common point and hence is the required pivot position.**

We see that this pivot point is in front of the gearbox sprocket which is likely to be impractical to implement as a conventional single arm. So instead of a real single arm we need to create a virtual swing-arm, with the same properties, but from a double arm design. It turns out that there are two possible solutions. One puts the forward pivot points of both arms coaxial with the required virtual pivot point. This is really just a glorified form of a single arm and is most unlikely to be any more practical than using a normal single arm. The other solution is actually a parallelogram with the two forward pivots above and below the required virtual pivot position. From fig. 9.15 we saw that a parallelogram acts just like a single arm, and so the trick is simply to design the layout to simulate a single arm pivoted about point P in fig. 9.16. It is unlikely that this will be anymore practically feasible than a using a simple single arm. Even without the extra weight and mechanical complication of the two arms and all that goes with it, it seems that there are no worthwhile advantages to the use of the double arm to offset the disadvantages, even though it is theoretically possible to achieve the desired characteristics.

- **Tracklever system.** This recently patented design (designer: Josef Lluis Belil) is being promoted as a method to prevent high side accidents. Now, whilst suspension response, to the varying loads involved when the rear tyre exceeds it's maximum grip, can have important influences over the build up to a high-side, it is probably over ambitious to expect a complete solution to come from any form of anti-squat control. Fig. 9.17 shows the layout, the declared intention is to align the swing-arm and chain with the force line for 100% anti-squat in order to remove any residual squat or anti-squat moments. As we have seen, this is usually not possible over the full suspension range and this design does nothing to change that. If the swing-arm is aligned for 100% anti-squat at normal ride height (referred to as the neutral position) then the percentage will reduce on bump and increase on rebound, just like a conventional system. Using the same amount of wheel movement as in the previous examples, equally disposed about the neutral position, the anti-squat percentages change to 131% (133%) on rebound, 100% (100%) in mid stroke and 60% (30%) on full bump. The figures in brackets are from the conventional system shown in fig. 9.11. The range of variation with the Tracklever is therefore 2.2 to 1 which compares favourably with the 4.4 to 1 of the standard design.

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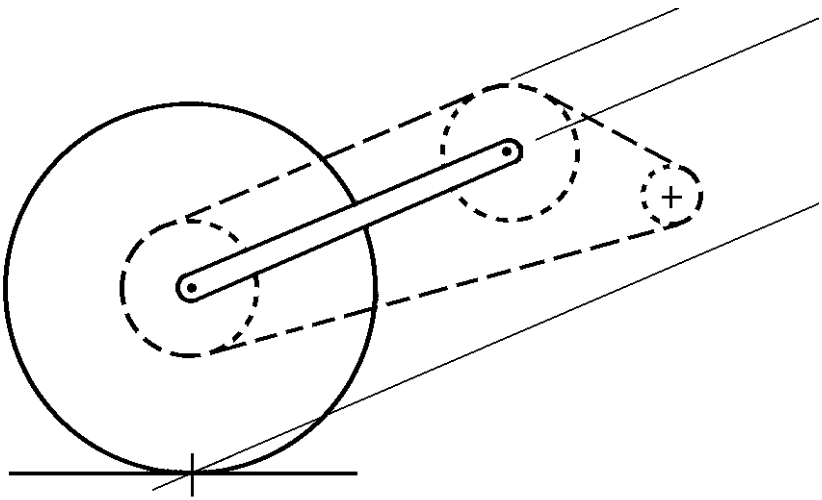

Fig. 9.17 **Tracklever system. An idler sprocket of the same size as the rear one is mounted to the frame, coaxial with the swing-arm pivot, to keep the chain line parallel to the swing-arm. In the normal ride position the swing-arm and chain are aligned with the force line appropriate for 100% anti-squat. The instantaneous force centres are always at infinity but the anti-squat percentage will still change with suspension movement.**

From these figures it can be seen that (in common with the A-Trak) most of the improvement occurs between normal ride height and full bump, this is likely to be the most important part of the suspension range, partly because the suspension becomes more compressed under hard cornering.
This design as illustrated appears to ignore the effects that occur on the overrun and in fact would have quite high pro-rise characteristics throughout the movement range. This is very likely to be detrimental to high-siding tendencies, because it is the rider's natural reaction to shut the throttle in times of trouble that often makes matters worse. This 'defect' would be quite easy to cure though. If the lower run of the chain was held against the bottom of the idler sprocket by a smaller idler mounted behind the gearbox sprocket, then the anti-rise properties would become similar to those of the anti-squat.
Unlike the A-Trak this design is not suitable for retro-fitting, it really needs to be designed into the bike from the beginning.

Aerodynamic squat

So far we've looked at the squat characteristics as if all the driving force went into producing acceleration, obviously as the speed rises more of the effort goes into overcoming aerodynamic drag. In fact at top speed virtually all of the traction force goes into parting the air. In this case the CoG position