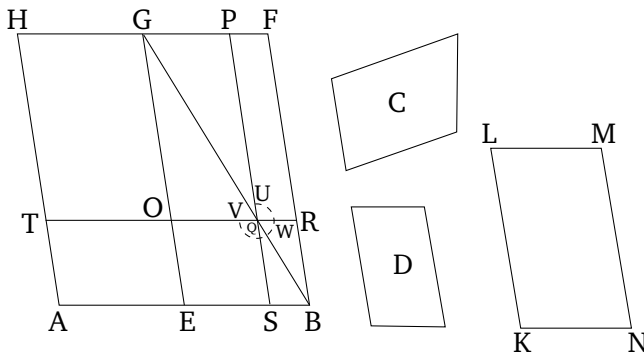# Book 6
Proposition 28

To apply a parallelogram, equal to a given rectilinear figure, to a given straight-line, (the applied parallelogram) falling short by a parallelogrammic figure similar to a given (parallelogram). It is necessary for the given rectilinear figure [to which it is required to apply an equal (parallelogram)] not to be greater than the (parallelogram) described on half (of the straight-line) and similar to the deficit.

Let AB be the given straight-line, and C the given rectilinear figure to which the (parallelogram) applied to AB is required (to be) equal, [being] not greater than the (parallelogram) described on half of AB and similar to the deficit, and D the (parallelogram) to which the deficit is required (to be) similar. So it is required to apply a parallelogram, equal to the given rectilinear figure C, to the straight-line AB, falling short by a parallelogrammic figure which is similar to D.

Let AB have been cut in half at point E , and let (parallelogram) $EBFG$, (which is) similar, and similarly laid out, to (parallelogram) D, have been de-

scribed on EB [Prop. 6.18]. And let parallelogram AG have been completed.

Therefore, if AG is equal to C then the thing prescribed has happened. For a parallelogram AG, equal to the given rectilinear figure C, has been applied to the given straight-line AB, falling short by a parallelogrammic figure GB which is similar to D. And if not, let HE be greater than C. And HE (is) equal to GB [Prop. 6.1]. Thus, GB (is) also greater than C. So, let (parallelogram) $KLMN$ have been constructed (so as to be) both similar, and similarly laid out, to D, and equal to the excess by which GB is greater than C [Prop. 6.25]. But, GB [is] similar to D. Thus, KM is also similar to GB [Prop. 6.21]. Therefore, let KL correspond to GE, and LM to GF. And since (parallelogram) GB is equal to (figure) C and (parallelogram) KM, GB is thus greater than KM. Thus, GE is also greater than KL, and GF than LM. Let GO be made equal to KL, and GP to LM [Prop. 1.3]. And let the parallelogram $OGPQ$ have been completed. Thus, $[GQ]$ is equal and similar to KM [but, KM is similar to GB]. Thus, GQ is also similar to GB [Prop. 6.21]. Thus, GQ and GB are about the same diagonal [Prop. 6.26]. Let GQB be their (common) diagonal, and let the (remainder of the) figure have been described.

Therefore, since BG is equal to C and KM, of which GQ is equal to KM, the remaining gnomon UWV is thus equal to the remainder C. And since (the complement) PR is equal to (the complement) OS [Prop. 1.43], let (parallelogram) QB have been added to both. Thus, the

whole (parallelogram) PB is equal to the whole (parallelogram) OB. But, OB is equal to TE, since side AE is equal to side EB [Prop. 6.1]. Thus, TE is also equal to PB. Let (parallelogram) OS have been added to both. Thus, the whole (parallelogram) TS is equal to the gnomon VWU. But, gnomon VWU was shown (to be) equal to C. Therefore, (parallelogram) TS is also equal to (figure) C.

Thus, the parallelogram ST, equal to the given rectilinear figure C, has been applied to the given straight-line AB, falling short by the parallelogrammic figure QB, which is similar to D [inasmuch as QB is similar to GQ [Prop. 6.24]]. (Which is) the very thing it was required to do.