the various components with respect to one another is preserved.

I claim:

1. X-ray lithography apparatus, comprising:

(a) a source of collimated, substantially monochromatic X-rays;

(b) a plurality of focusing zone plates onto which at least some of the X-rays may impinge, whereby at least some of the X-rays from said source are focused onto a focal plane by said focusing zone plates;

(c) means for placing in the focal plane a mask, a portion of which mask relatively permeable to X-rays, whereby X-rays are transmitted through the mask through the relatively X-ray permeable portion;

(d) a plurality of imaging zone plates located after the mask, whereby at least some of the X-rays transmitted through the relatively X-ray permeable portion of the mask impinge on said imaging zone plates, whereby at least some of the X-rays transmitted through that portion are focused onto an image plane by said imaging zone plates;

(e) means for placing a substrate with an X-ray sensitive resist in the image plane; and

(f) means for synchronously scanning said mask-placing means and said substrate-placing means to image at least part of the relatively X-ray permeable portion of the mask on the substrate.

2. Apparatus as recited in claim 1, additionally comprising:

(a) a first aperture plate between said focusing zone plates and said mask-placing means, said first aperture plate being relatively X-ray impermeable everywhere except at a plurality of apertures which are relatively X-ray permeable, one such aperture being near the focal point of each focusing zone plate; and

(b) a second aperture plate between said imaging zone plates and said substrate-placing means, said second aperture plate being relatively X-ray impermeable everywhere except at a plurality of apertures which are relatively X-ray permeable, one such aperture being near the image point of each imaging zone plate.

3. Apparatus as recited in claim 1, wherein:

(a) said imaging zone plates are 1:1 imaging zone plates; and

(b) said scanning means comprises means for synchronously scanning said mask placing means and said substrate placing means at the same velocity relative to said zone plates, and to said X-ray source, and at zero velocity relative to each other, whereby substantially all of the relatively X-ray permeable portion of the mask is imaged on the substrate at substantially the same size.

4. Apparatus as recited in claim 1, wherein:

(a) said imaging zone plates are n:1 reduction zone plates; and

(b) means for synchronously scanning said mask-placing means and said substrate-placing means in the same direction or in opposite directions relative to said zone plates and to said X-ray source, and at a ratio of speeds relative to said zone plates and to said X-ray source equal to the image reduction ratio n:1, whereby a portion of the relatively X-ray permeable portion of the mask is imaged on the substrate at an n:1 reduced image ratio; and

(c) means for repeating said scanning with a different portion of the mask, until the image on the substrate is completed at an n:1 reduced image ratio.

5. Apparatus as recited in claim 1, additionally comprising means for correcting for distortion, said correcting means comprising at least one of the following means:

(a) means for adjusting the scanning rate; or

(b) means for adjusting the alignment between the mask-placing means and the substrate-placing means during the scanning.

6. A process for imaging the relatively X-ray permeable portion of a mask onto a substrate with an X-ray sensitive resist, comprising the steps of:

(a) directing collimated, substantially monochromatic X-rays onto a plurality of focusing zone plates, whereby at least some of the X-rays are focused onto a focal plane by said focusing zone plates;

(b) placing the mask in the focal plane, whereby X-rays are transmitted through the mask through the relatively X-ray permeable portion;

(c) causing the transmitted X-rays to impinge on a plurality of imaging zone plates, whereby at least some of the X-rays are focused onto an image plane by said imaging zone plates;

(d) placing the substrate in the image plane; and

(e) synchronously scanning the mask and the substrate to image at least part of the relatively X-ray permeable portion of the mask on the substrate.

7. A process as recited in claim 6, additionally comprising the steps of:

(a) placing a first aperture plate between said focusing zone plates and the mask, and first aperture plate being relatively X-ray impermeable everywhere except at a plurality of apertures which are relatively X-ray permeable, one such aperture being near the focal point of each focusing zone plate; and

(b) placing a second aperture plate between said imaging zone plates and the substrate, said second aperture plate being relatively X-ray impermeable everywhere except at a plurality of apertures which are relatively X-ray permeable, one such aperture being near the image point of each imaging zone plate.

8. A process as recited in claim 6, wherein:

(a) Said imaging zone plates are 1:1 imaging zone plates; and

(b) said scanning comprises synchronously scanning the mask and the substrate at the same velocity relative to said zone plates, and to said X-ray source, and at zero velocity relative to each other, whereby substantially all of the relatively X-ray permeable portion of the mask is imaged on the substrate at substantially the same size.

9. A process as recited in claim 6, wherein:

(a) said imaging zone plates are n:1 reduction zone plates; and

(b) synchronously scanning the mask and the substrate in the same direction or in opposite directions relative to said zone plates and to said X-ray source, and at a ratio of speeds relative to said zone plates and to said X-ray source equal to the image reduction ratio n:1, whereby a portion of the relatively X-ray permeable portion of the mask is imaged on the substrate at an n:1 reduced image ratio; and