

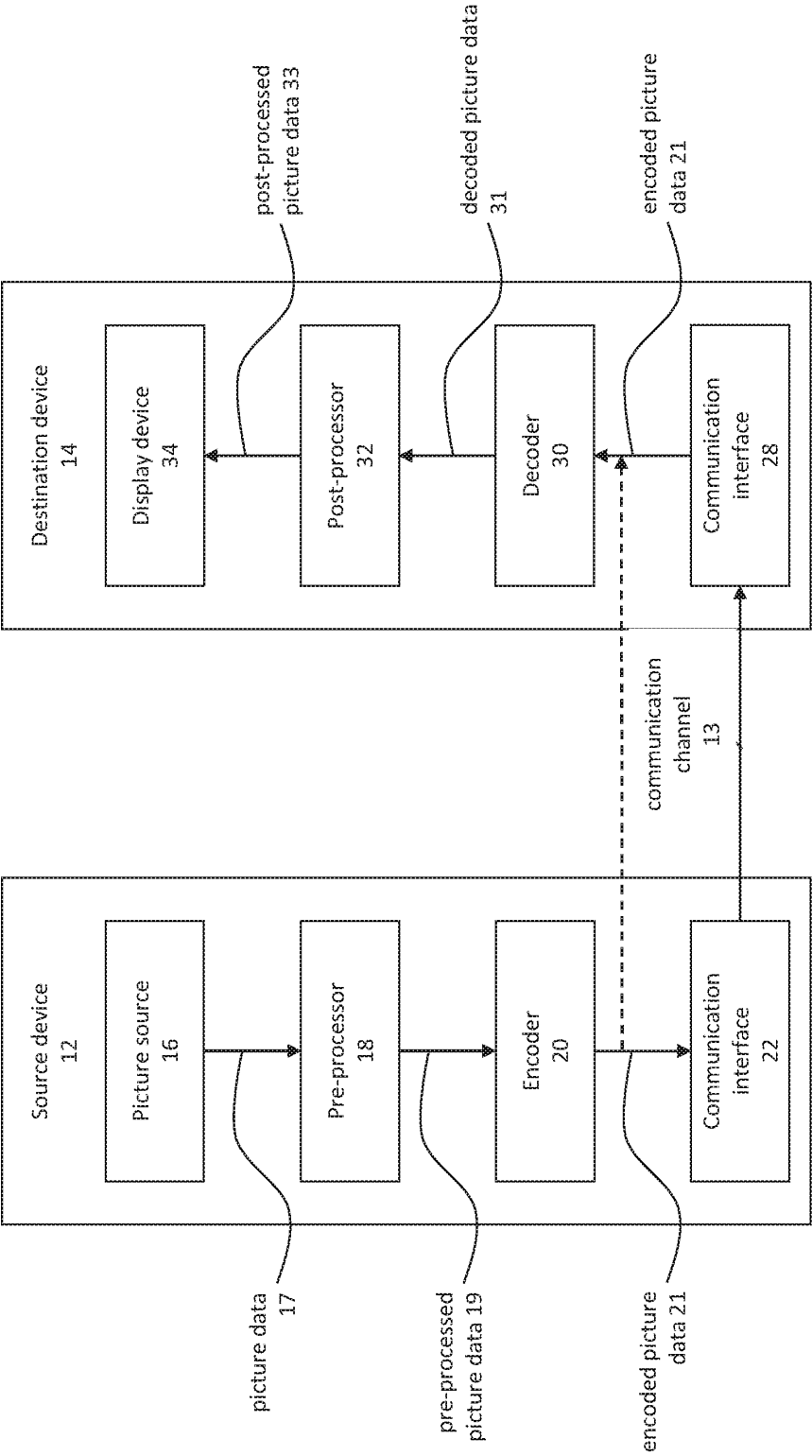


Fig. 1A

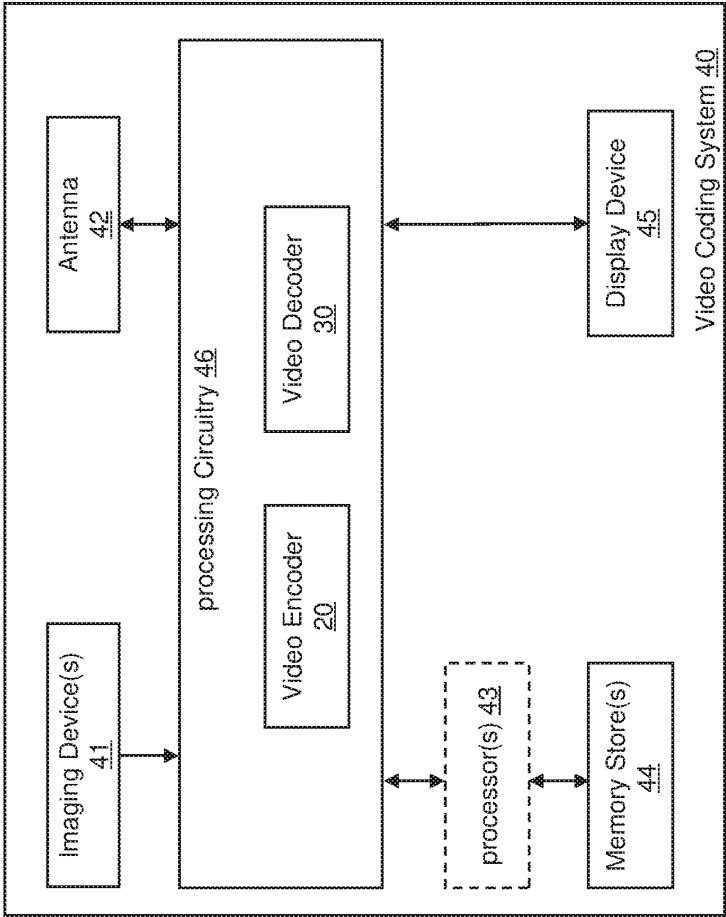


Fig. 1B

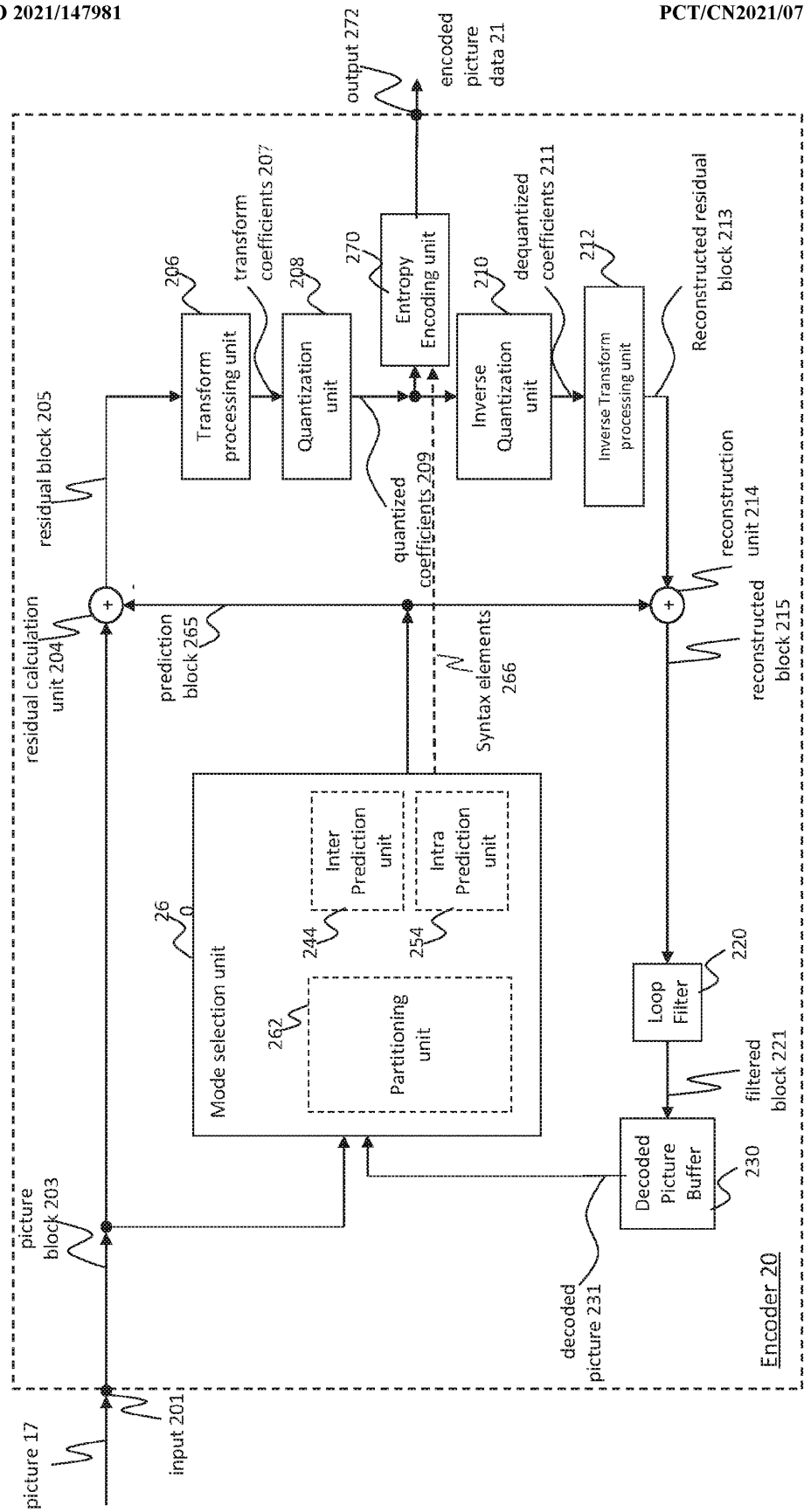


Fig. 2

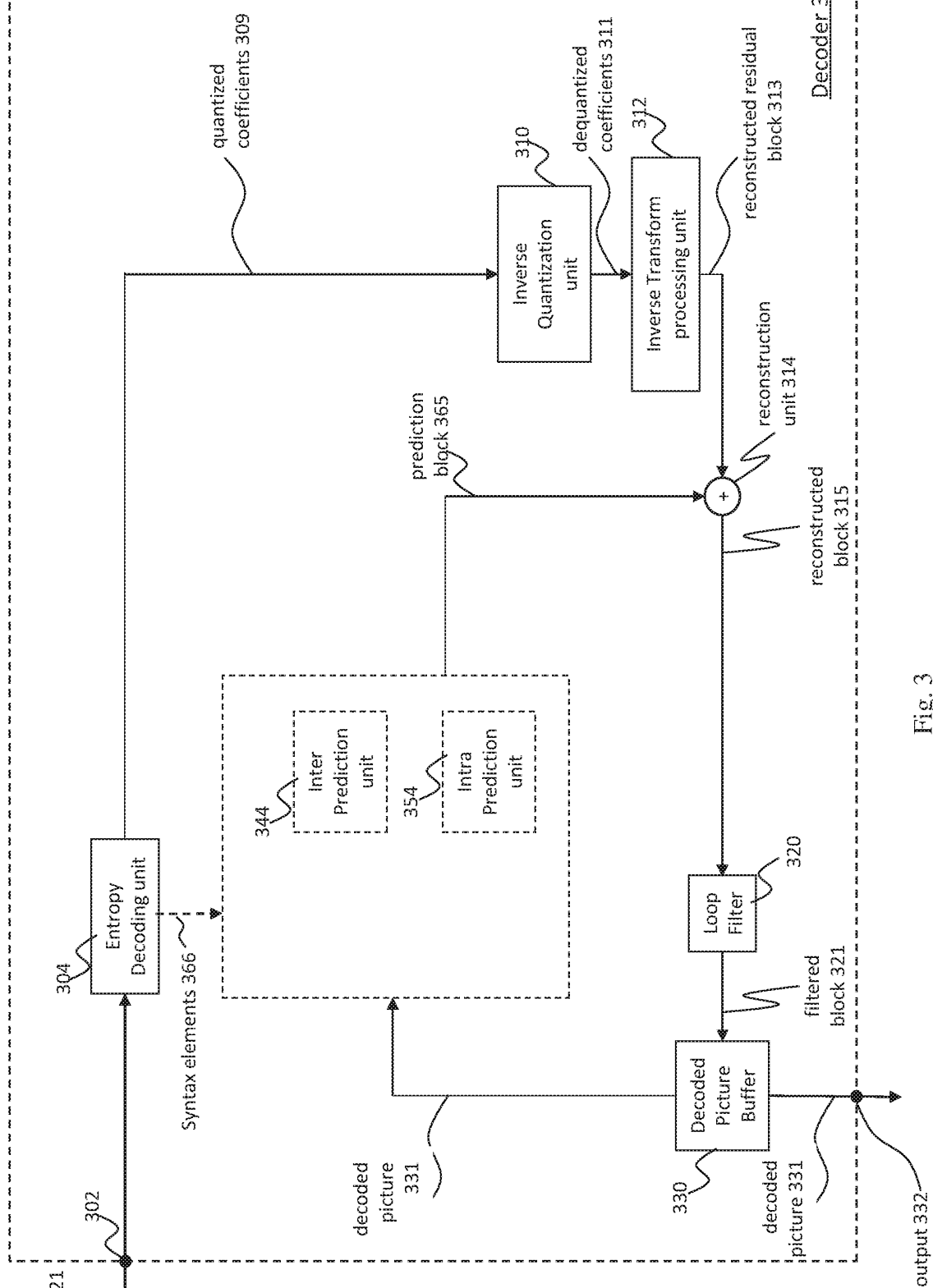


Fig. 3

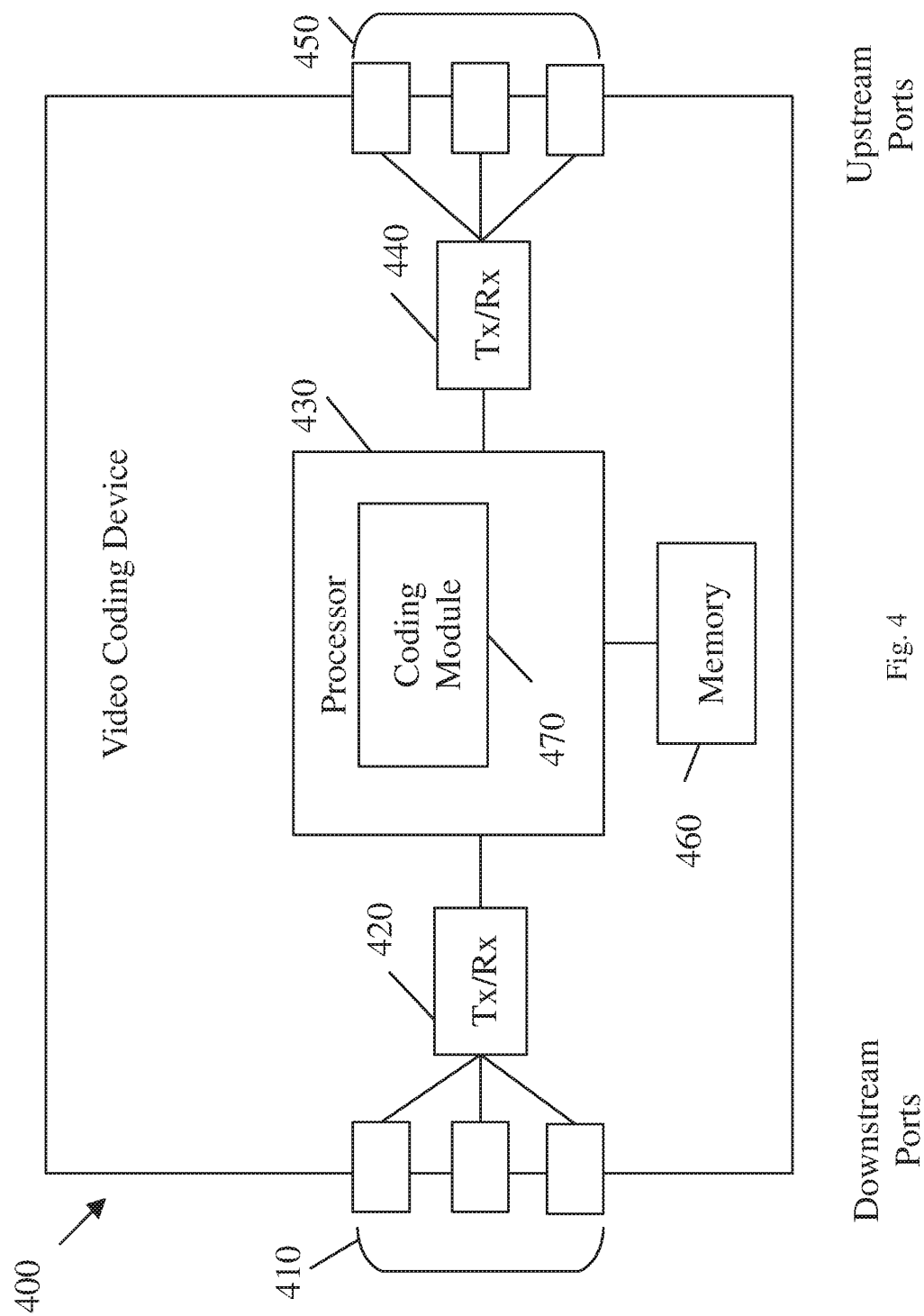


Fig. 4

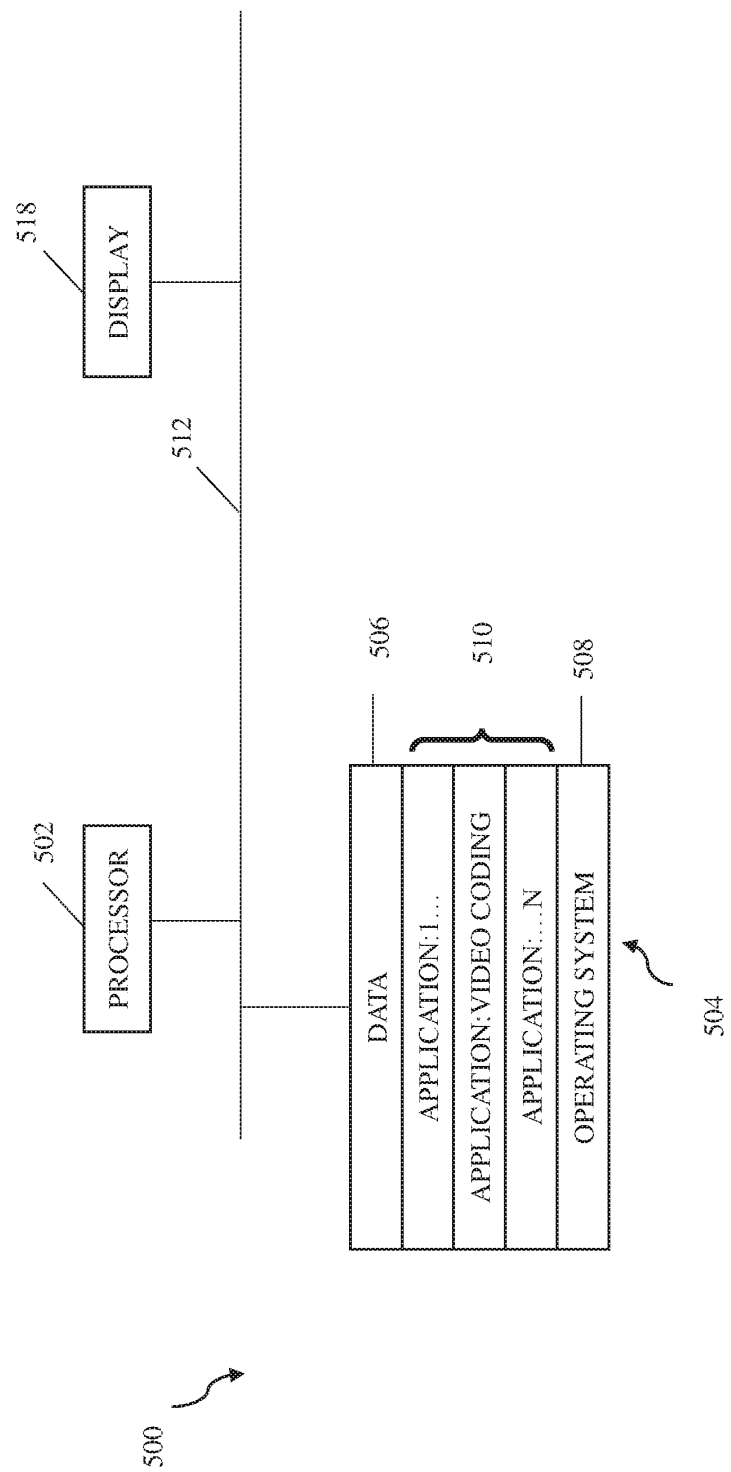


Fig. 5

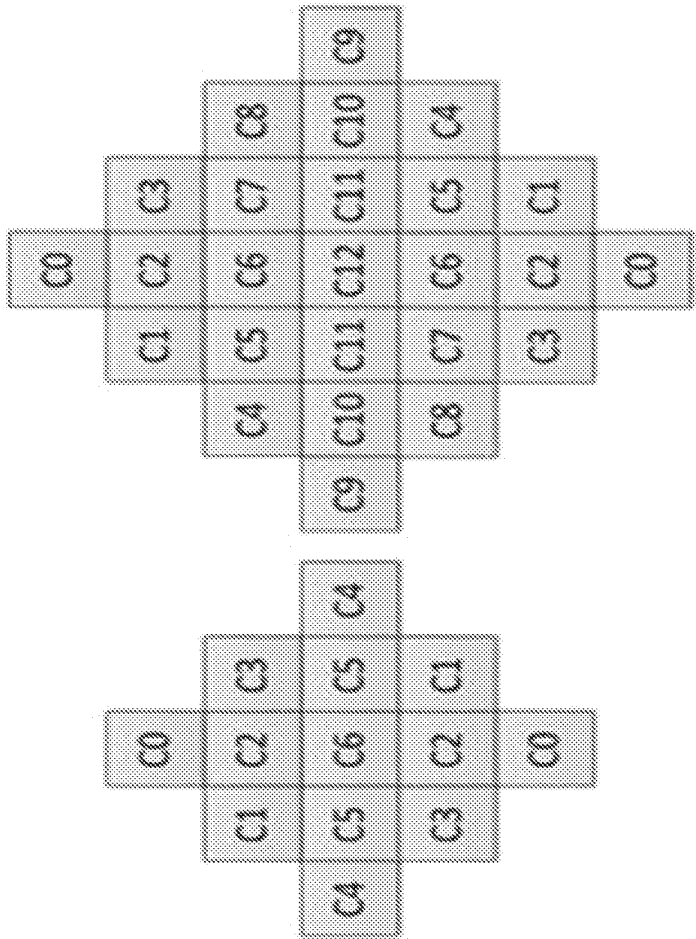


Fig.6

H		H		H		H		H		H
		H				H				H
H				H				H		
		H				H				H
H				H				H		
		H				H				H
H				H				H		
		H				H				H
H				H				H		
		H				H				H
H				H				H		

(b) Subsampled positions for horizontal gradient

D2		D2		D2		D2		D2		D2
		D2				D2				D2
D2				D2				D2		
		D2				D2				D2
D2				D2				D2		
		D2				D2				D2
D2				D2				D2		
		D2				D2				D2
D2				D2				D2		
		D2				D2				D2
D2				D2				D2		

(d) Subsampled positions for diagonal gradient

V		V		V		V		V		V
		V				V				V
V				V				V		
		V				V				V
V				V				V		
		V				V				V
V				V				V		
		V				V				V
V				V				V		
		V				V				V
V				V				V		

(a) Subsampled positions for vertical gradient

D1		D1		D1		D1		D1		D1
		D1				D1				D1
D1				D1				D1		
		D1				D1				D1
D1				D1				D1		
		D1				D1				D1
D1				D1				D1		
		D1				D1				D1
D1				D1				D1		
		D1				D1				D1
D1				D1				D1		

(c) Subsampled positions for diagonal gradient

Fig. 7

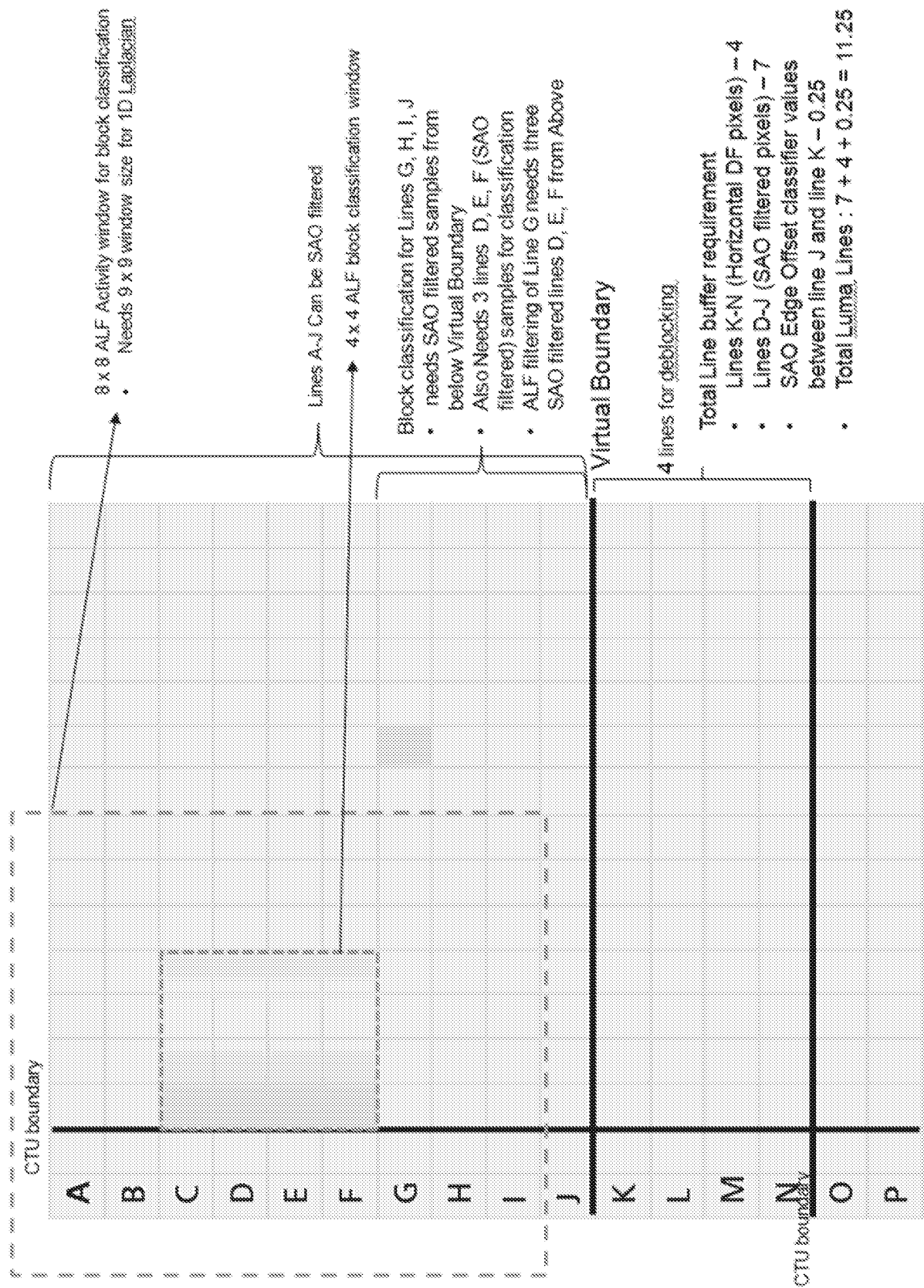


Fig. 8

modified ALF block classification for 4 x 4 blocks at virtual boundary

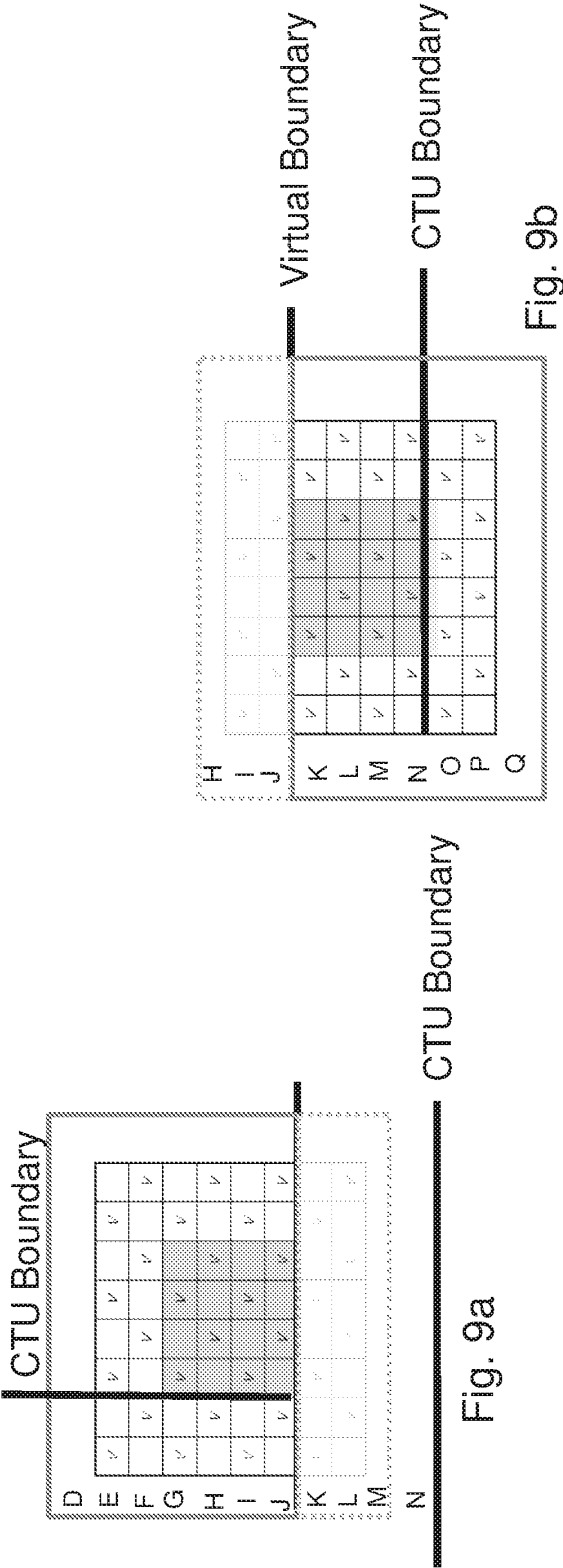


Fig.9

modified ALF block classification for 4 x 4 blocks at virtual boundary

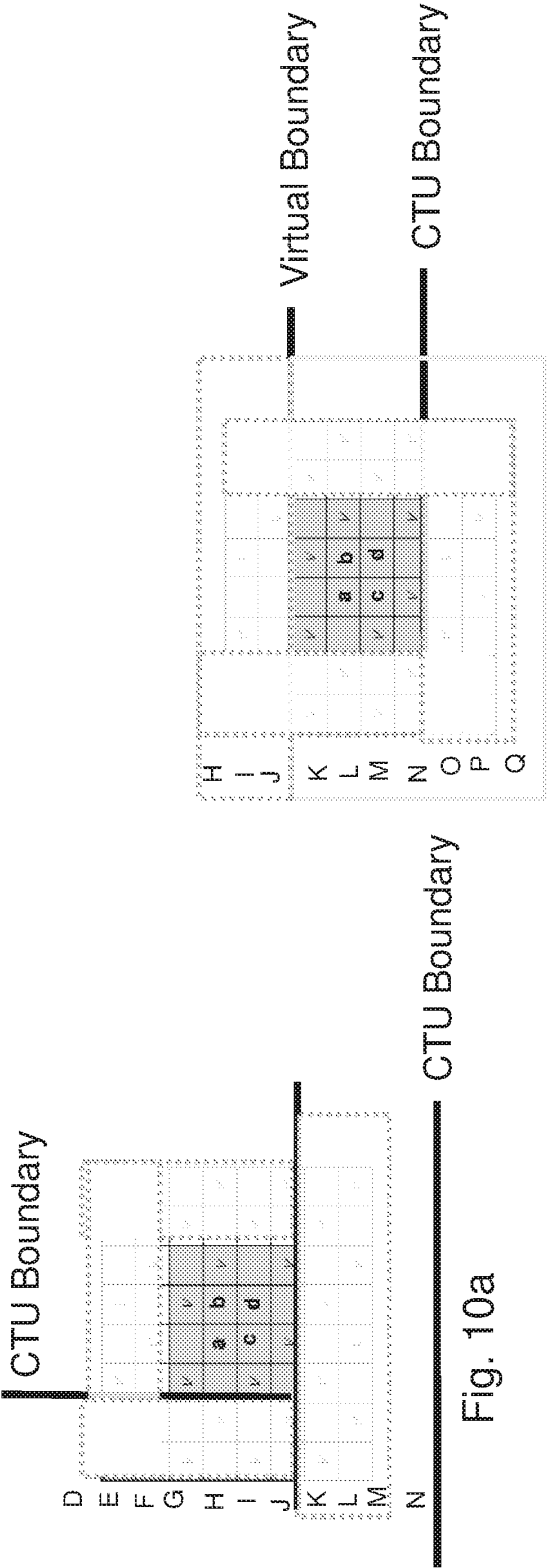


Fig. 10a

Fig. 10b

Fig. 10

modified ALF block classification for 4 x 4 blocks at virtual boundary

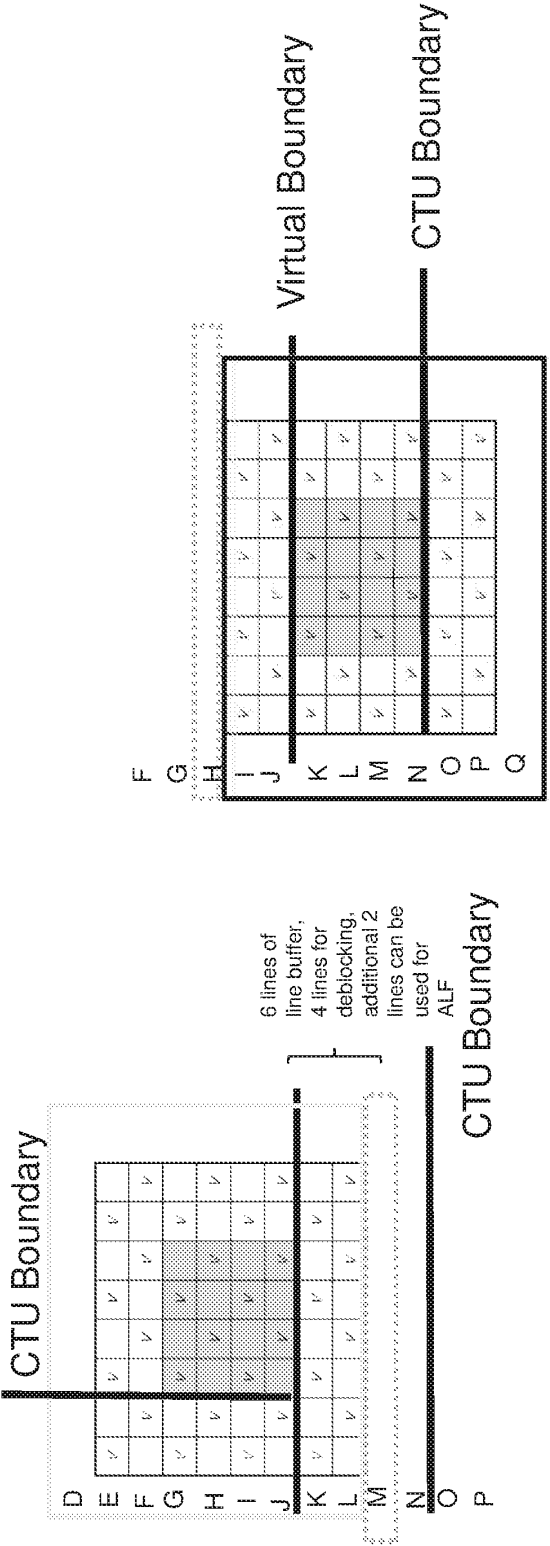
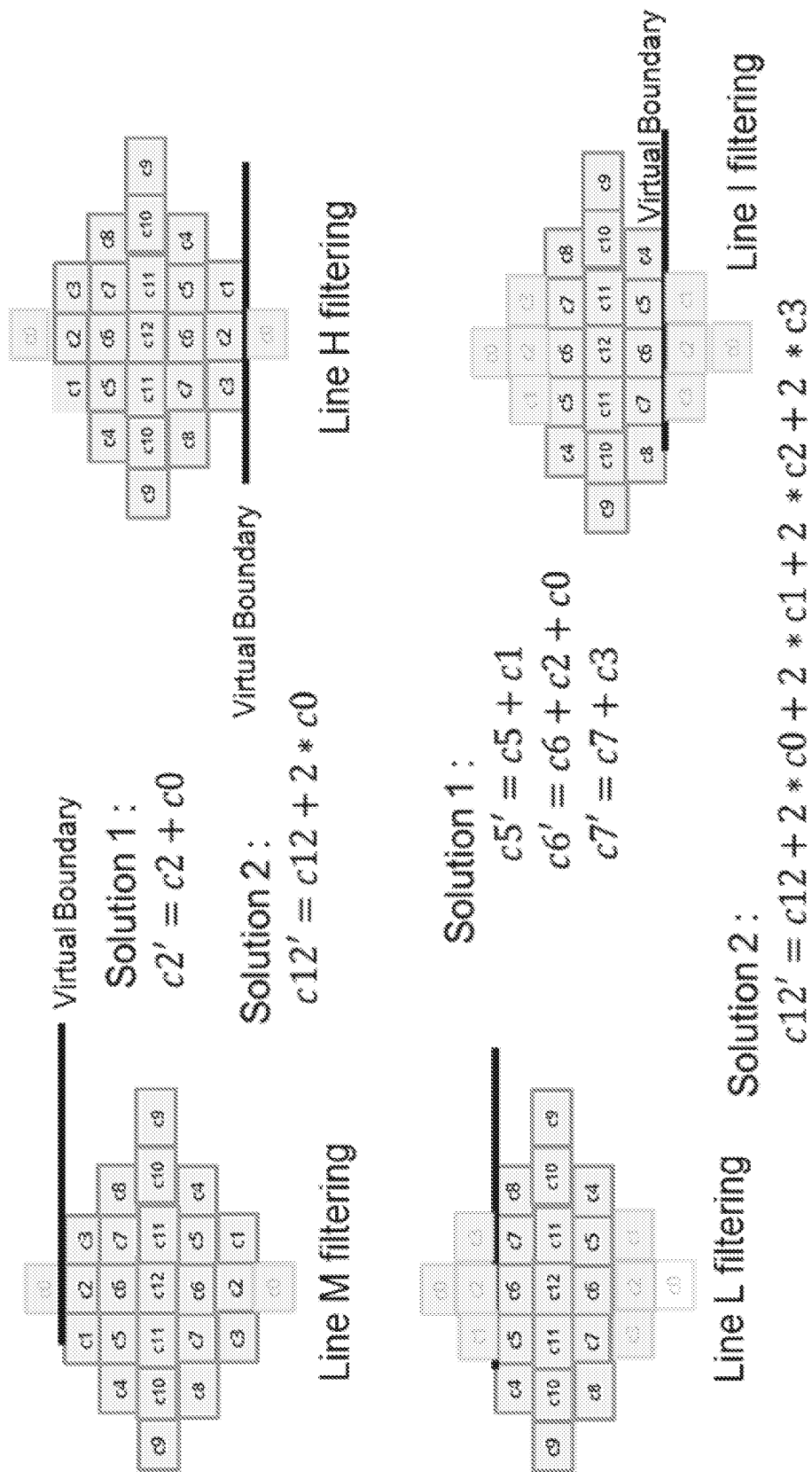


Fig.11





Line J filtering

Solution 1 :

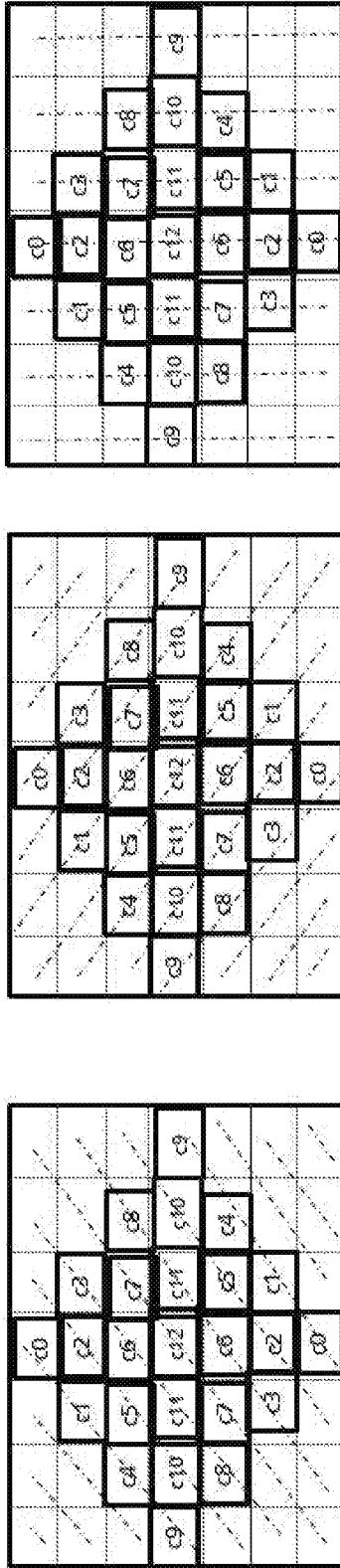
$$\begin{aligned} c_{10}' &= c_{10} + c_4 + c_8 \\ c_{11}' &= c_{11} + c_5 + c_7 + c_1 + c_3 \\ c_{12}' &= c_{12} + 2 * c_6 + 2 * c_2 + 2 * c_0 \end{aligned}$$

Line K filtering

Solution 2 :

$$c_{12}' = c_{12} + 2 * c_0 + 2 * c_1 + 2 * c_2 + 2 * c_3 + 2 * c_4 + 2 * c_5 + 2 * c_6 + 2 * c_7 + 2 * c_8$$

Fig. 12b



a) 45 Degree Gradient:

One line (Line M and H):

$$c1' = c1 + c0$$

Two lines (Line L and I):

$$c4' = c1 + c4 + c0$$

$$c5' = c5 + c2$$

$$c6' = c6 + c3$$

Three lines (Line J and K):

$$c9' = c9 + c4 + c1 + c0$$

$$c10' = c10 + c5 + c2$$

$$c11' = c8 + c7 + c6 + c3 + c11$$

$$c12' = c12 + 2 * c7$$

b) 135 Degree Gradient:

One line (Line M and H):

$$c3' = c3 + c0$$

Two lines (Line L and I):

$$c6' = c6 + c1$$

$$c7' = c7 + c2$$

$$c8' = c3 + c8 + c0$$

Three lines (Line J and K):

$$c9' = c9 + c8 + c3 + c0$$

$$c10' = c10 + c7 + c2$$

$$c11' = c1 + c6 + c11 + c4$$

$$c12' = c12 + 2 * c5$$

c) Vertical Gradient

For vertical and horizontal gradient, solution 1 from Fig. 12 is used

Fig. 12c

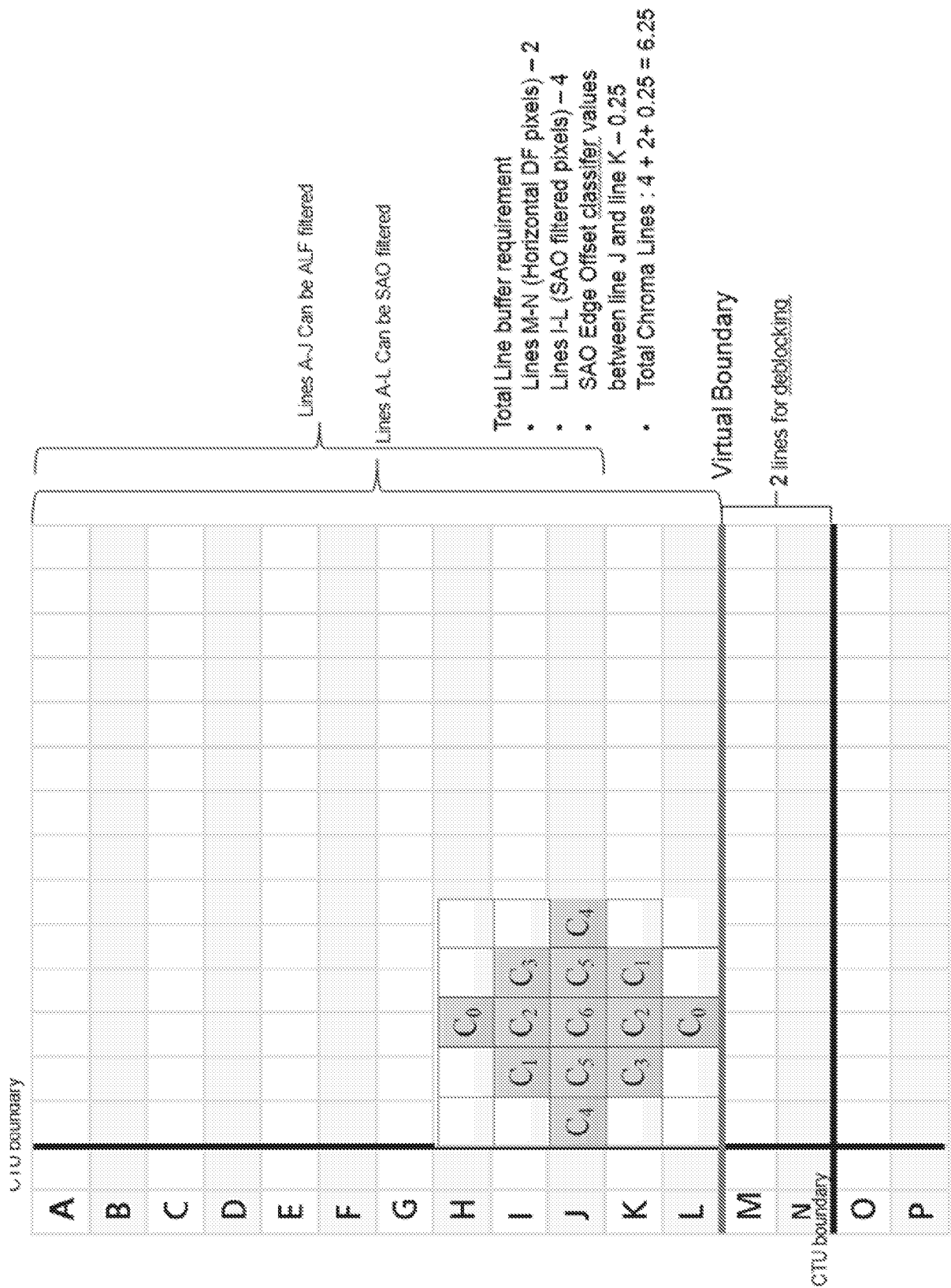


Fig. 13

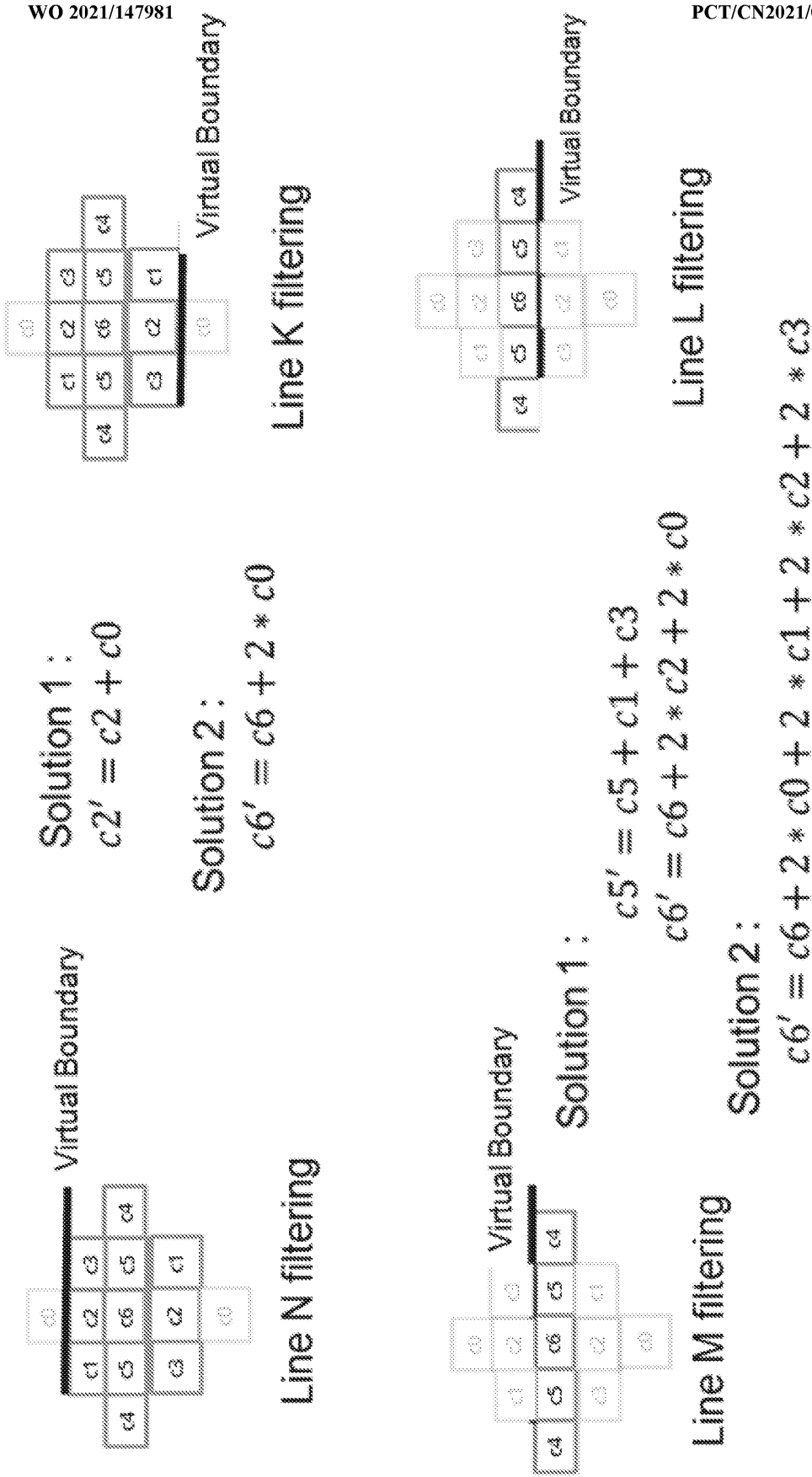


Fig. 14

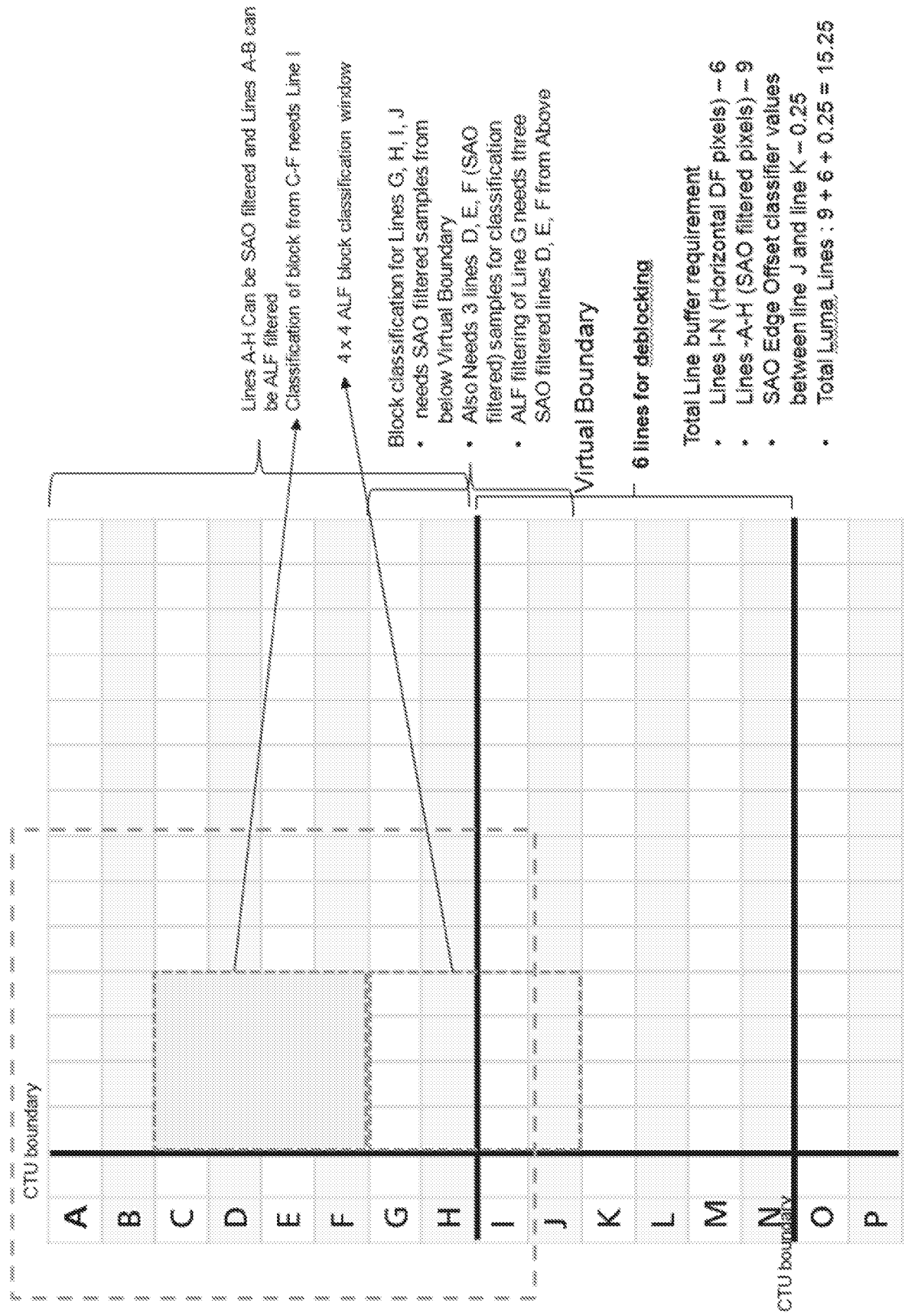


Fig. 15

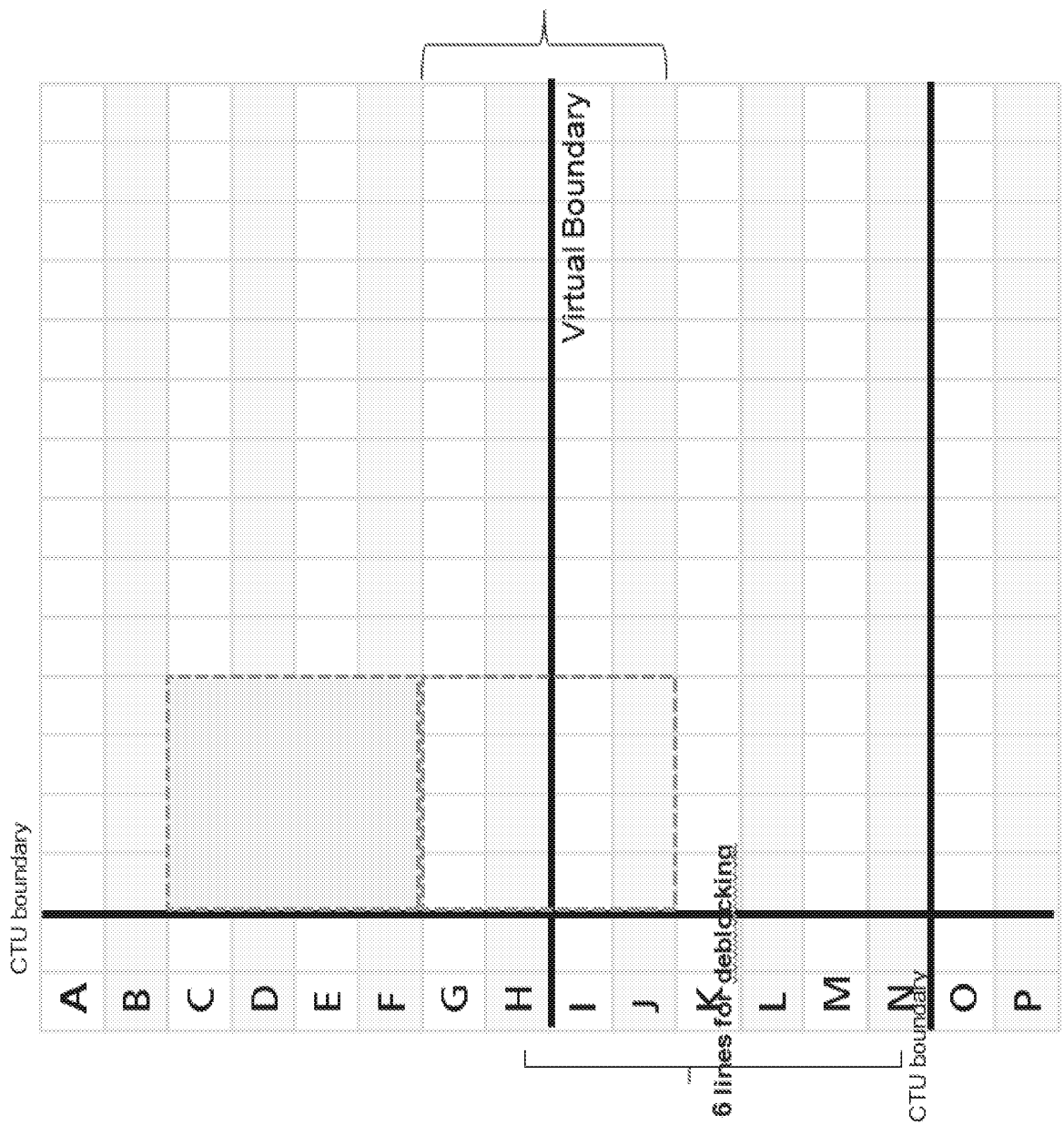


Fig. 16

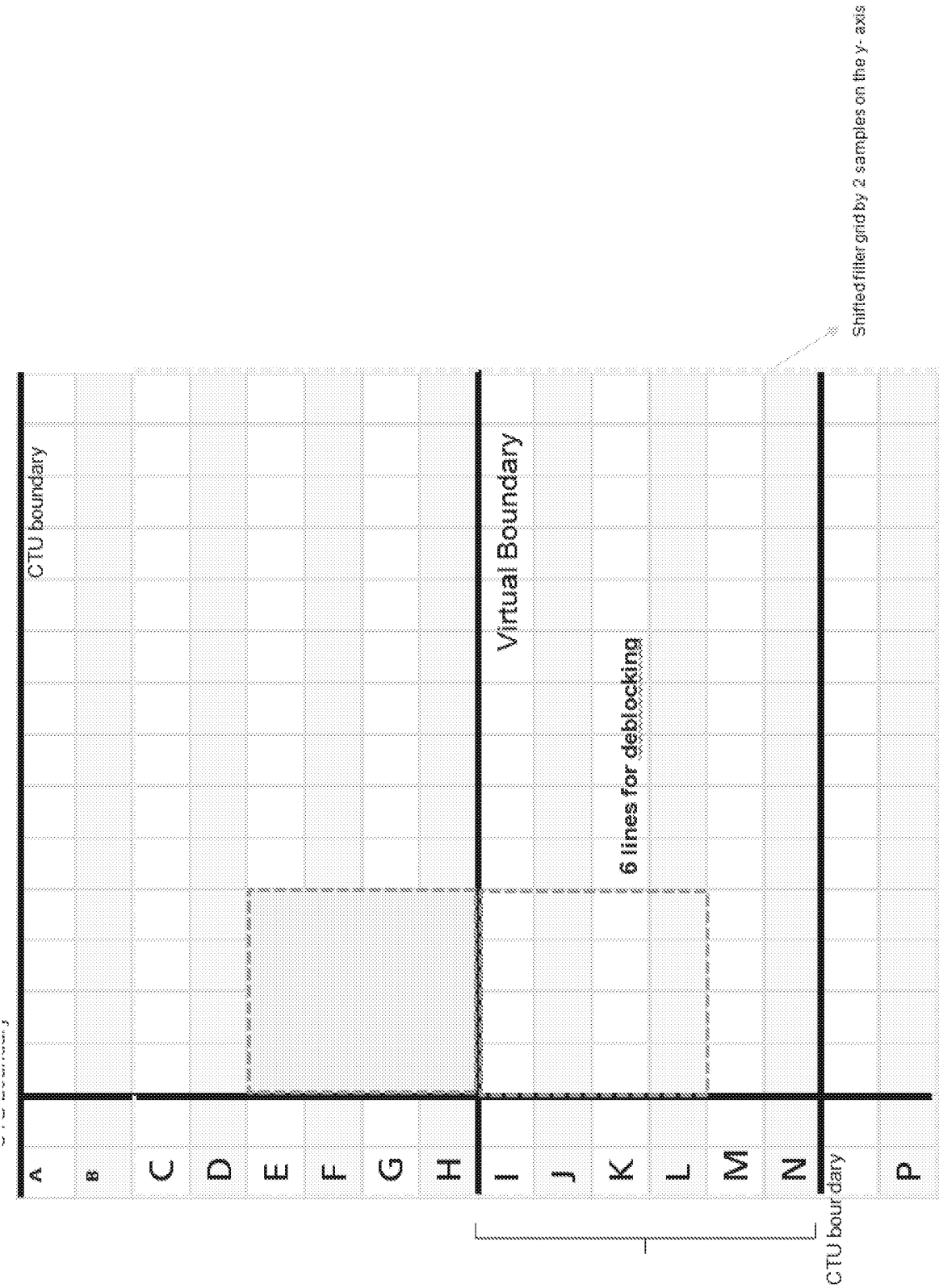
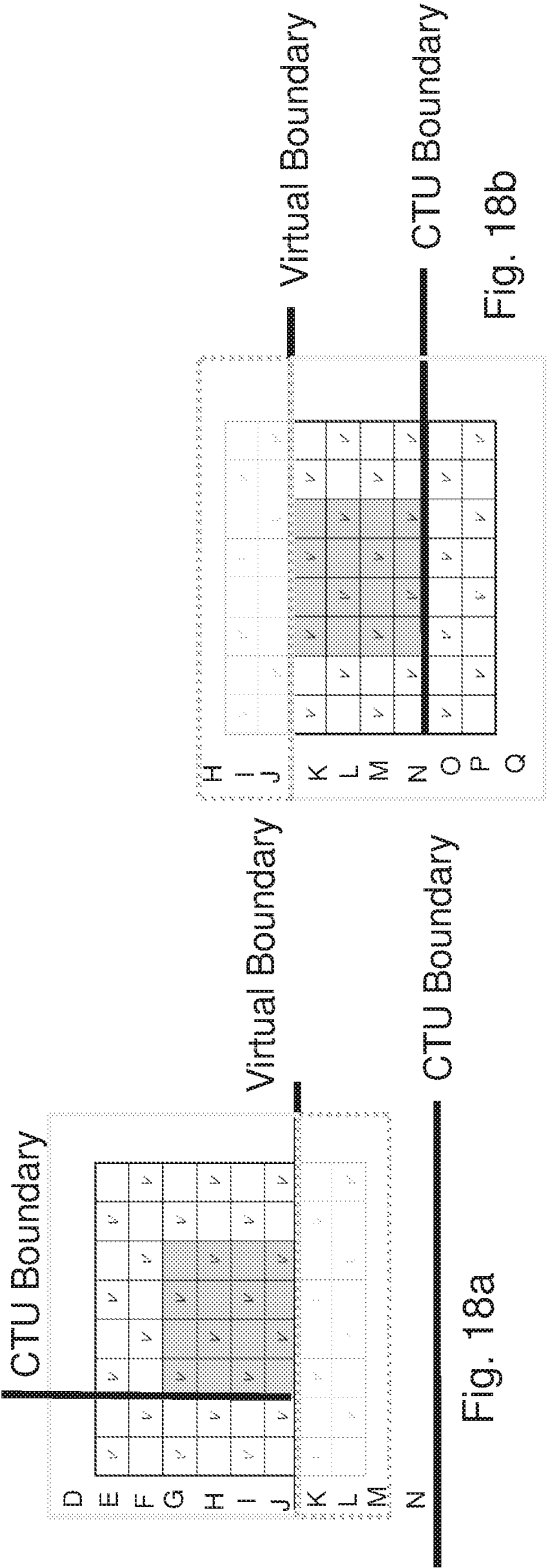


Fig. 17



For ALF filtering of lines H, I, J (above virtual boundary) and lines K, L, M (below virtual boundary) filtering is disabled in certain conditions:

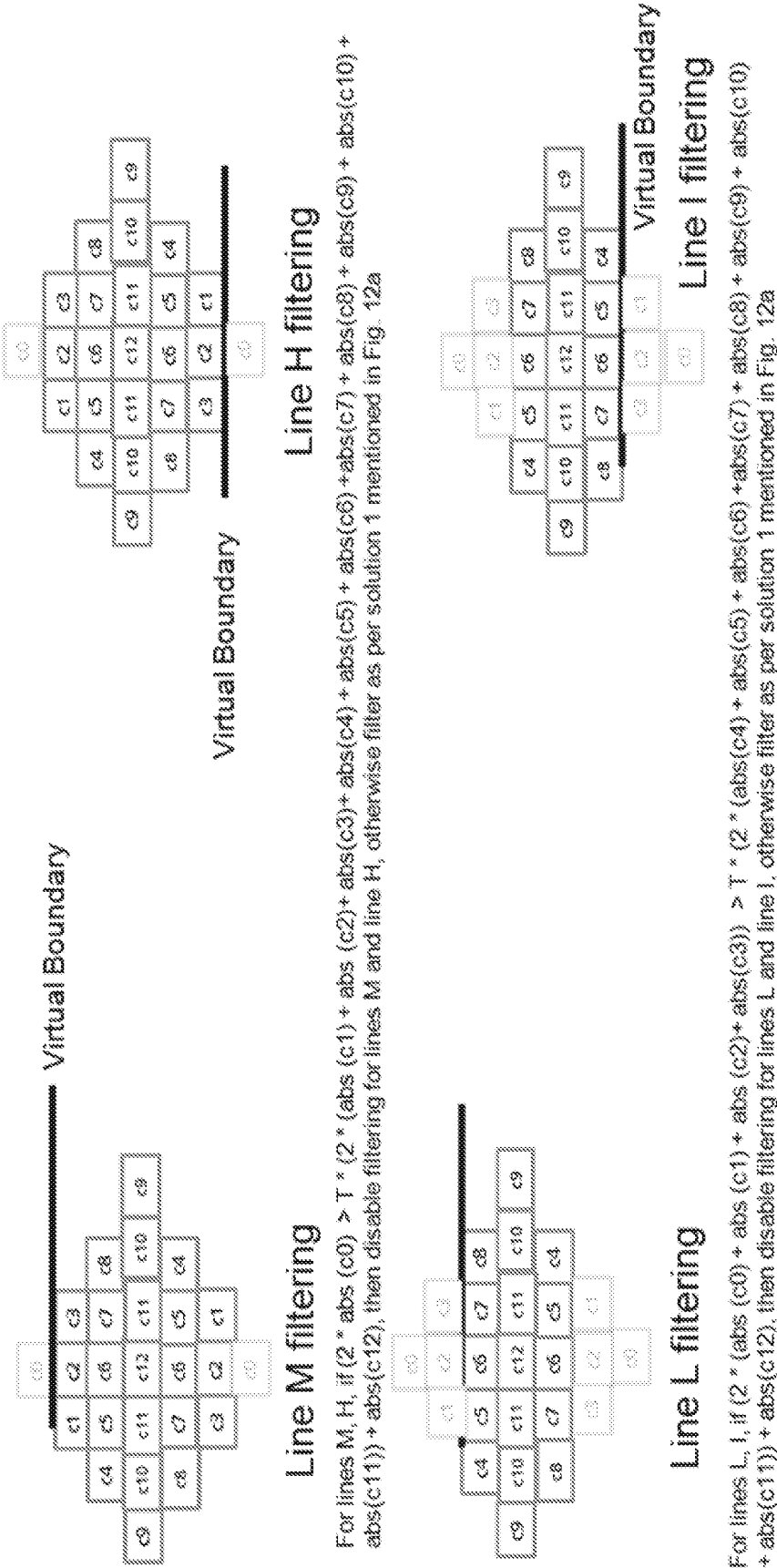
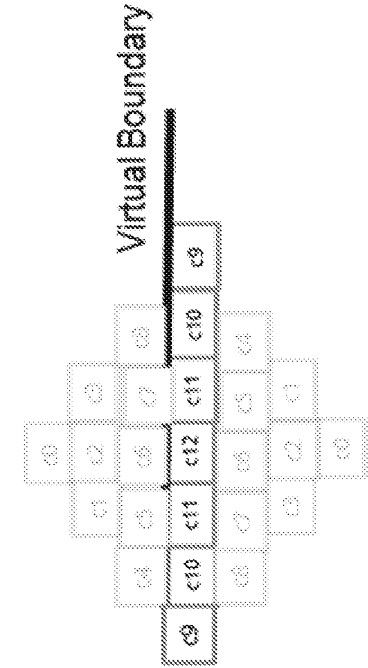
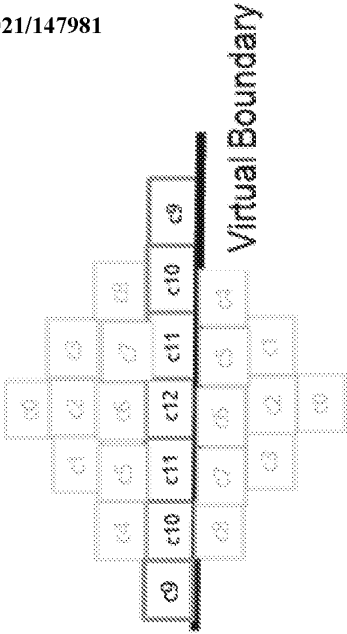


Fig.19a



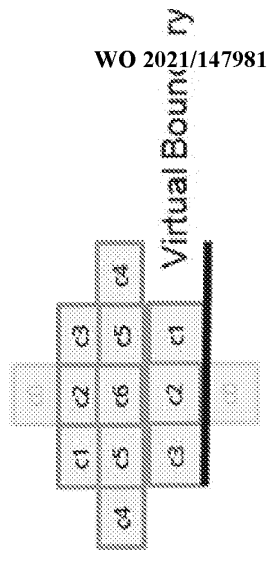
Line J filtering



Line K filtering

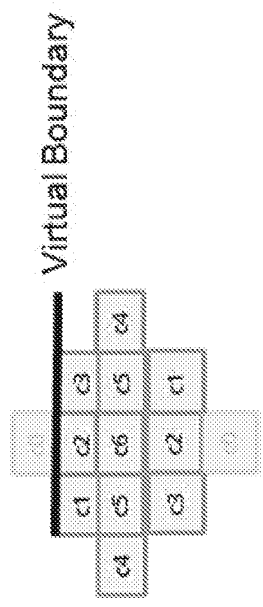
For lines J, K, if $2 * (abs(c0) + abs(c1) + abs(c2) + abs(c3) + abs(c4) + abs(c5) + abs(c6) + abs(c7) + abs(c8)) > T * (2 * (abs(c9) + abs(c10) + abs(c11)) + abs(c12))$, then disable filtering for lines J and line K, otherwise filter as per solution 1 mentioned in Fig. 12a

Fig.19b

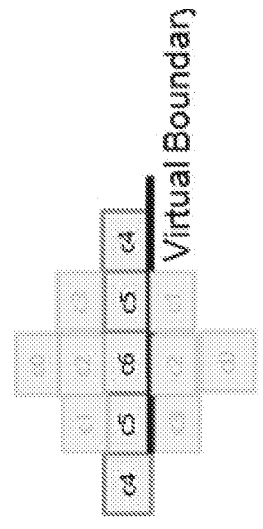


Line K filtering

For lines N, K, if $(2 * (abs(c0)) > T * (2 * (abs(c1) + abs(c2) + abs(c3) + abs(c4) + abs(c5)) + abs(c6)))$, then disable filtering for lines N and line K, otherwise filter as per solution 1 mentioned in Fig. 14

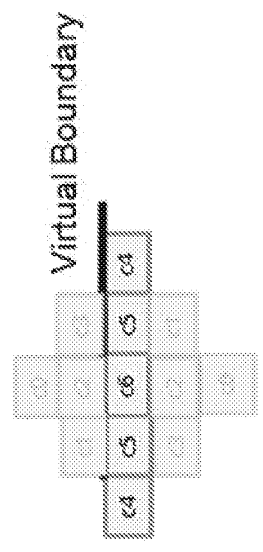


Line N filtering



Line L filtering

For lines M, L, if $(2 * (abs(c0) + abs(c1) + abs(c2) + abs(c3)) > T * (2 * (abs(c4) + abs(c5)) + abs(c6)))$, then disable filtering for lines M and line L, otherwise filter as per solution 1 mentioned in Fig. 14



Line M filtering

Fig. 20

Symmetric padding at the virtual boundary

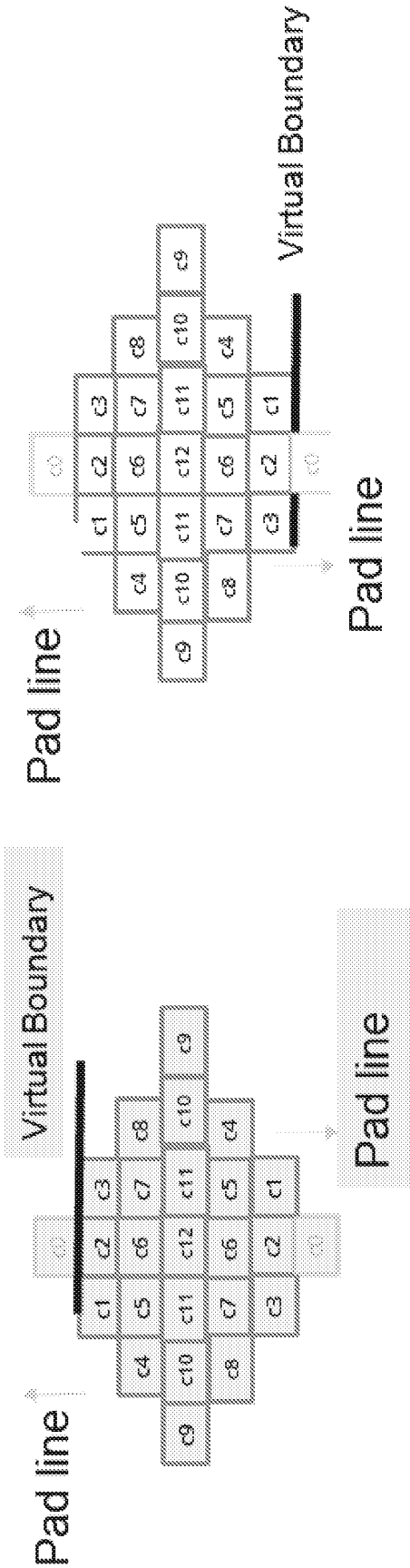


Fig. 21a

Symmetric padding at the virtual boundary

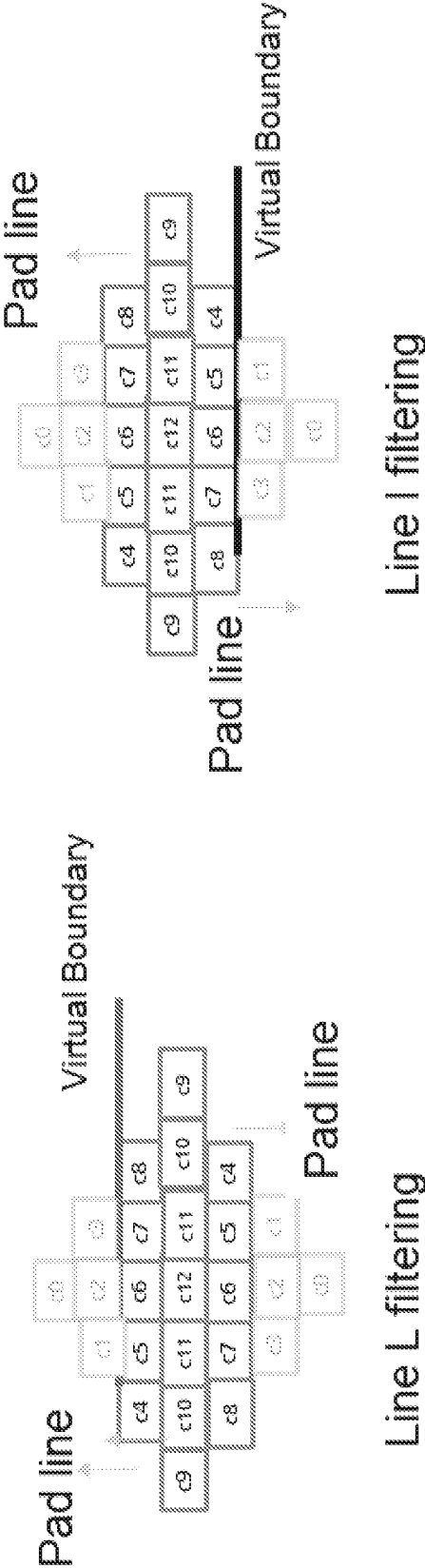


Fig. 21b

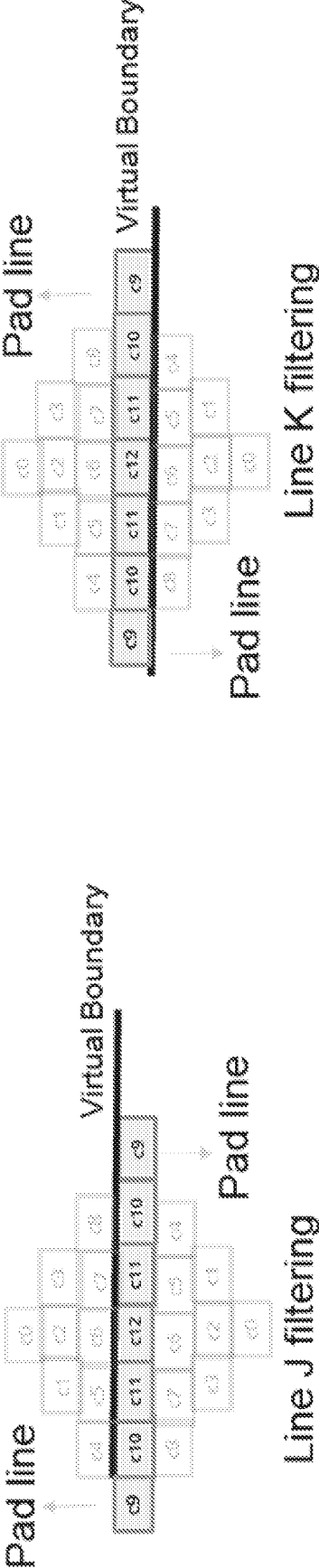


Fig. 21c

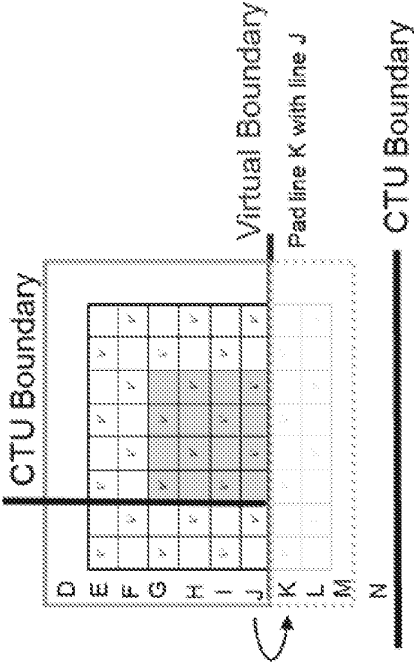


Fig 22a

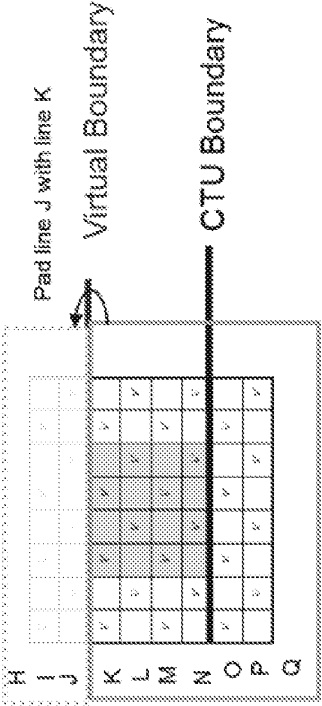


Fig 22b

Fig. 22

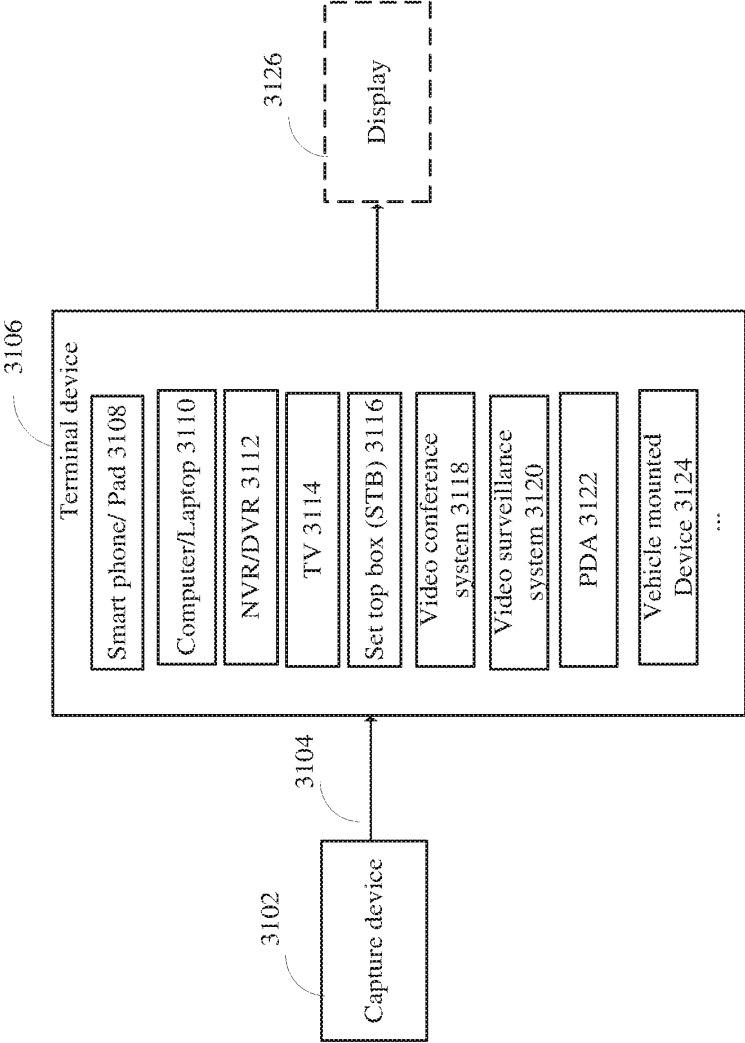


Fig. 23

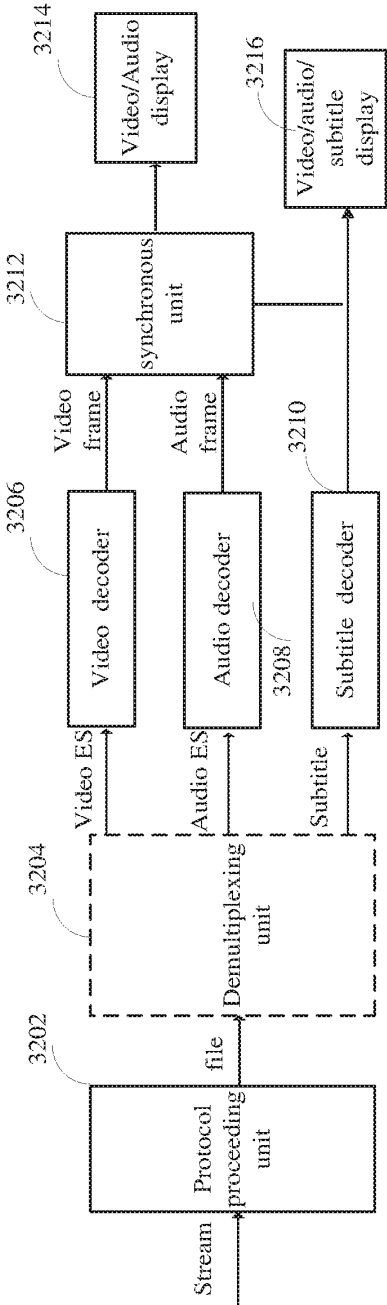


Fig. 24

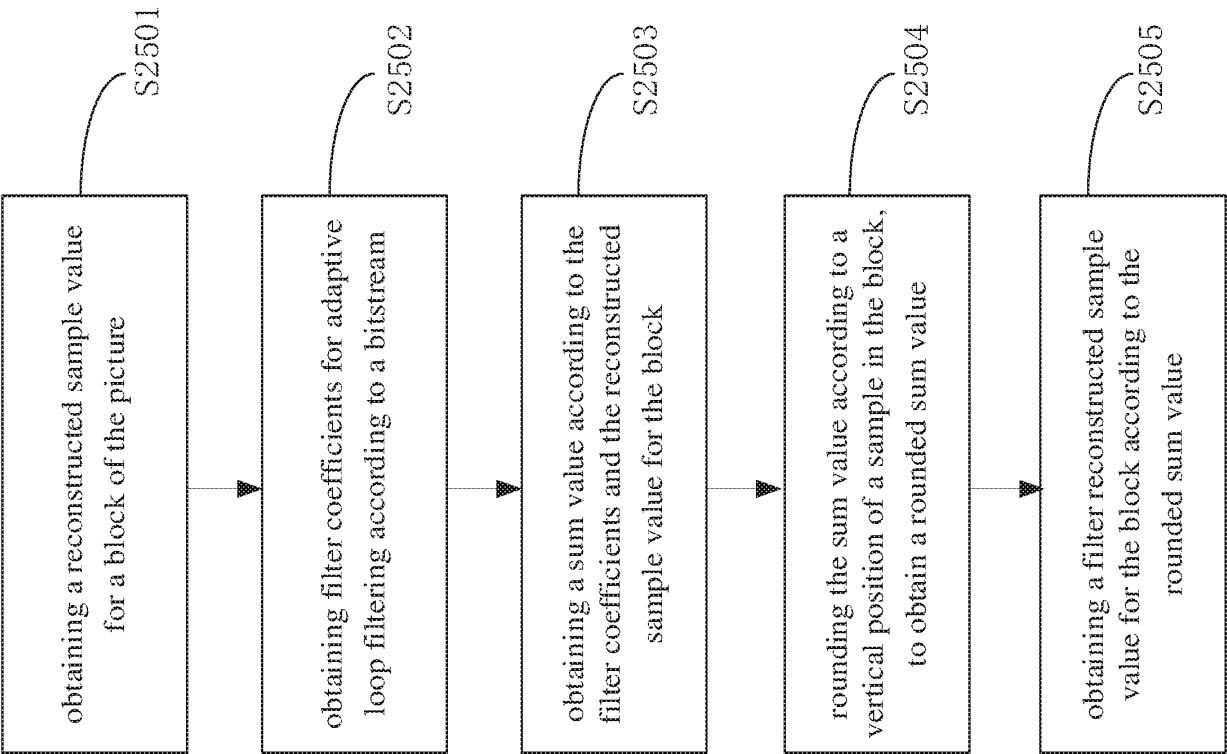


Fig. 25

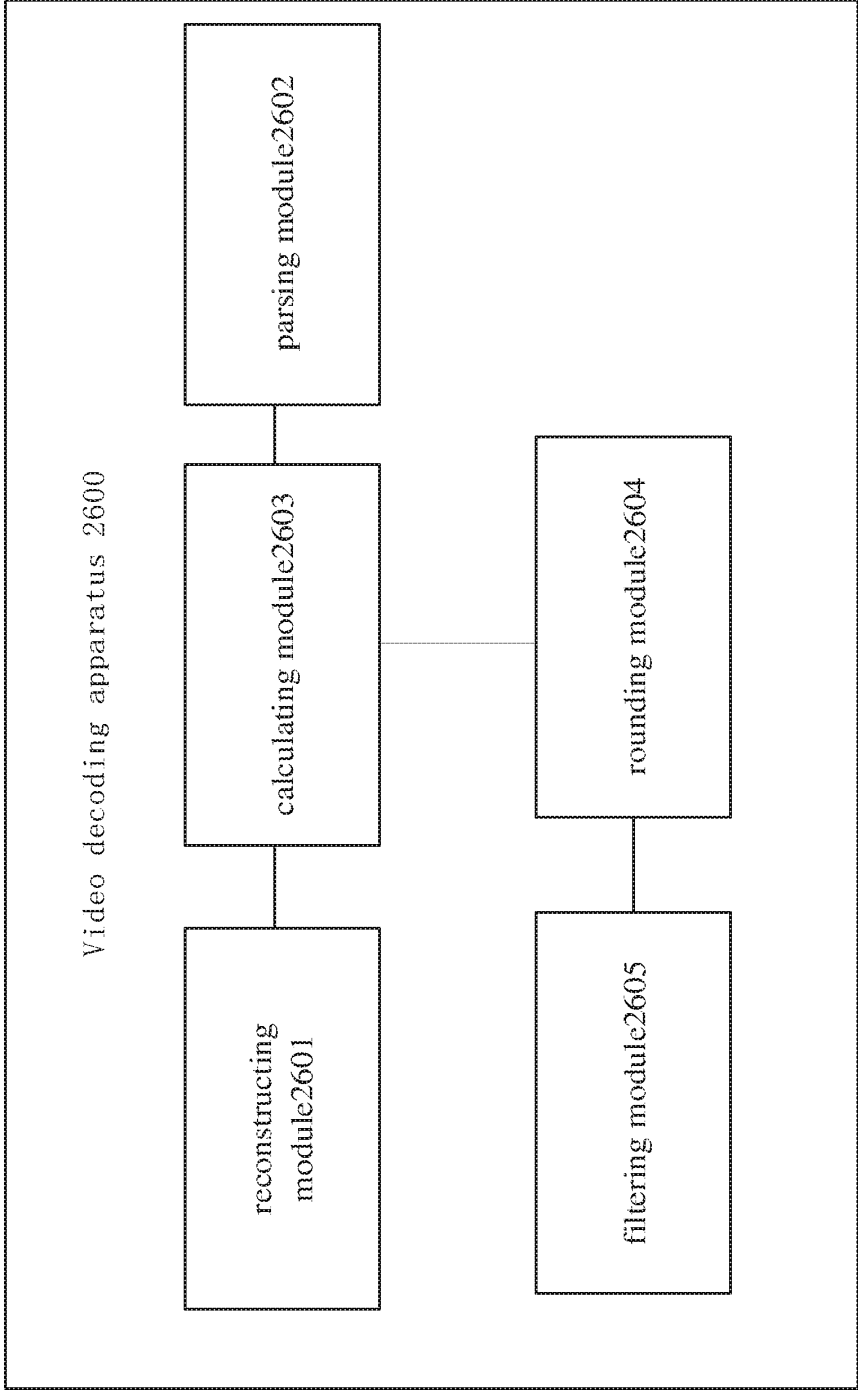


Fig. 26