

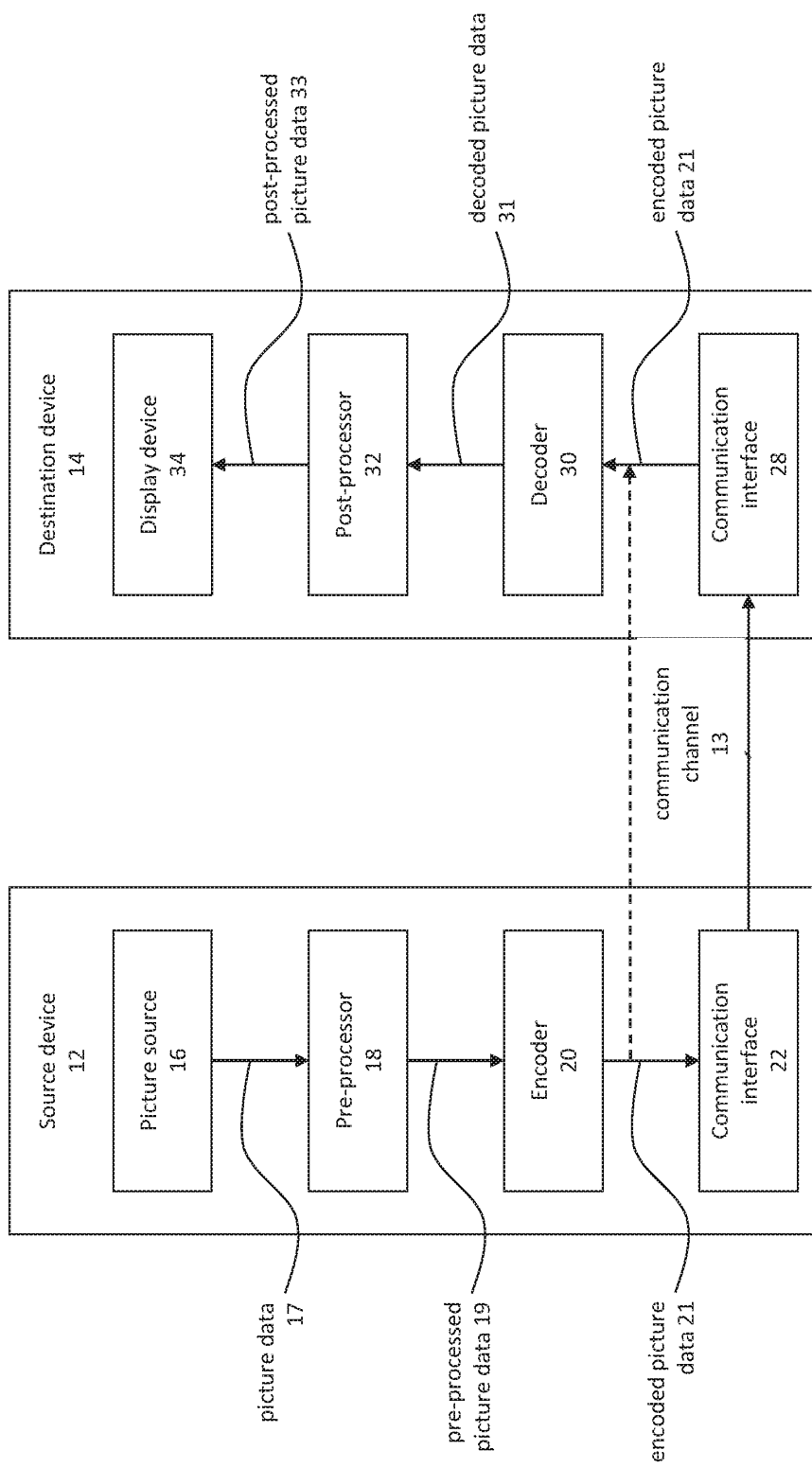


Fig. 1A

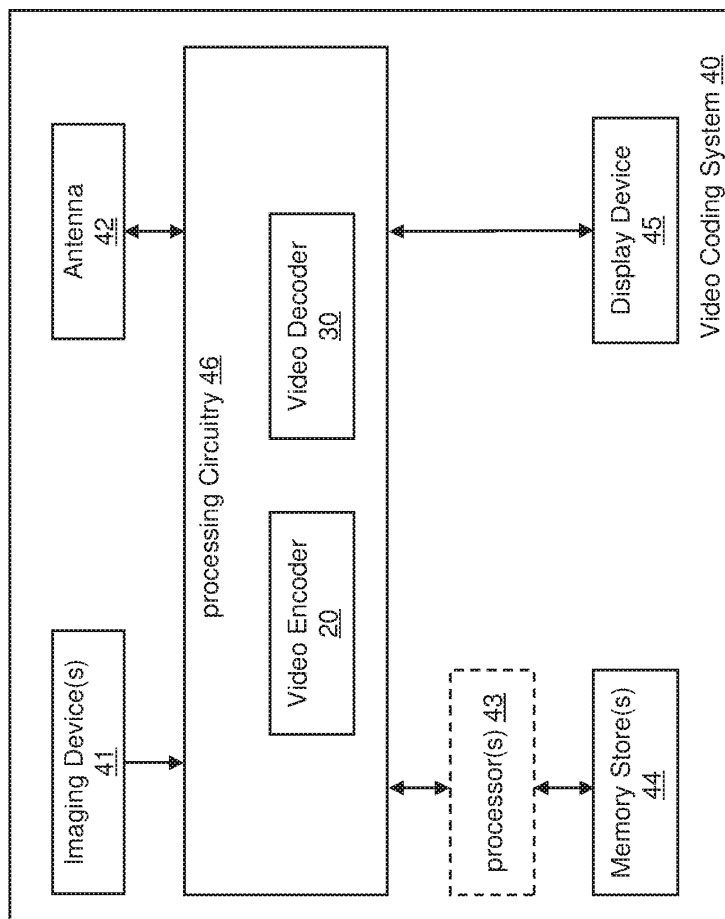


Fig. 1B

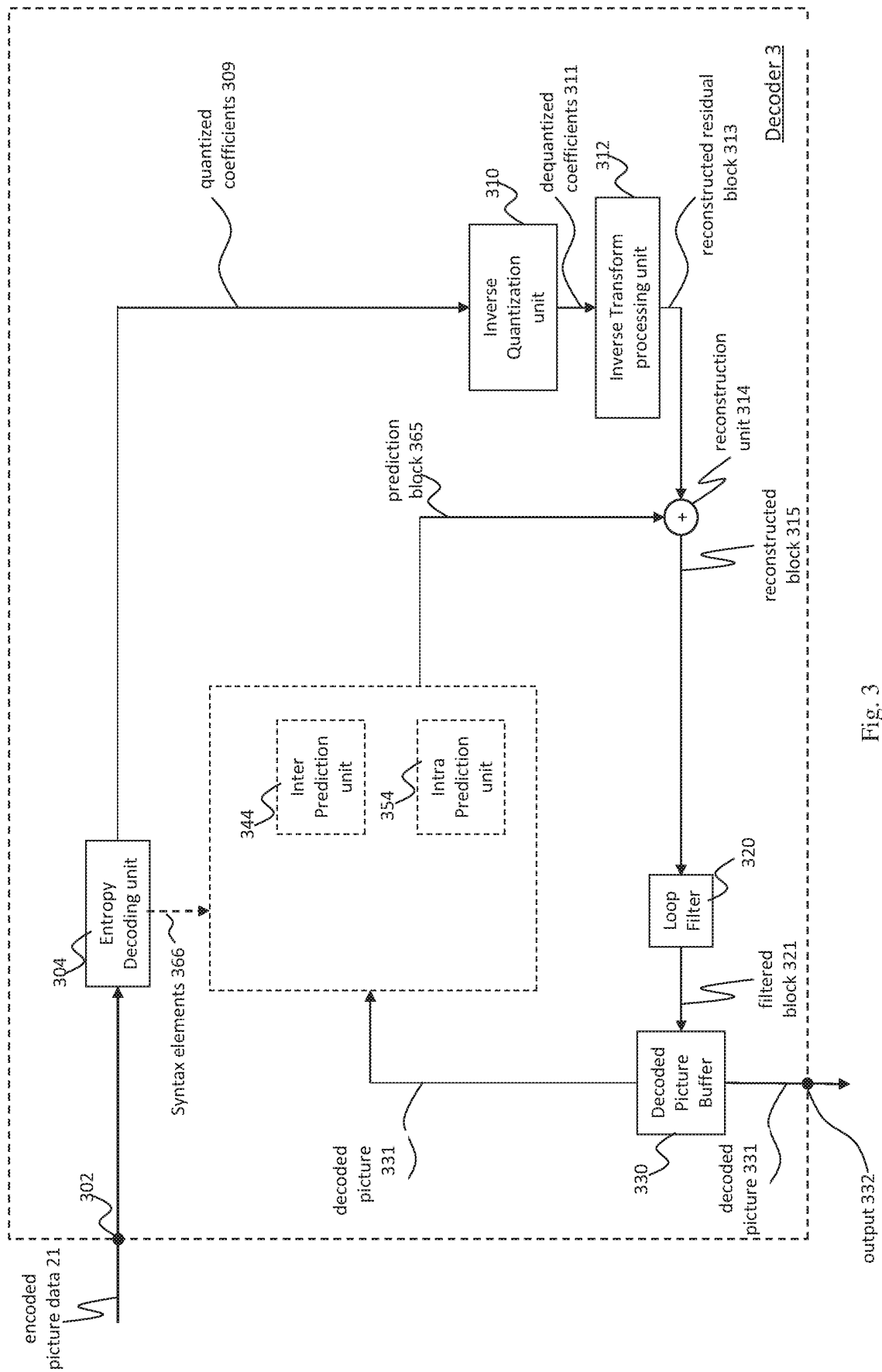


Fig. 3

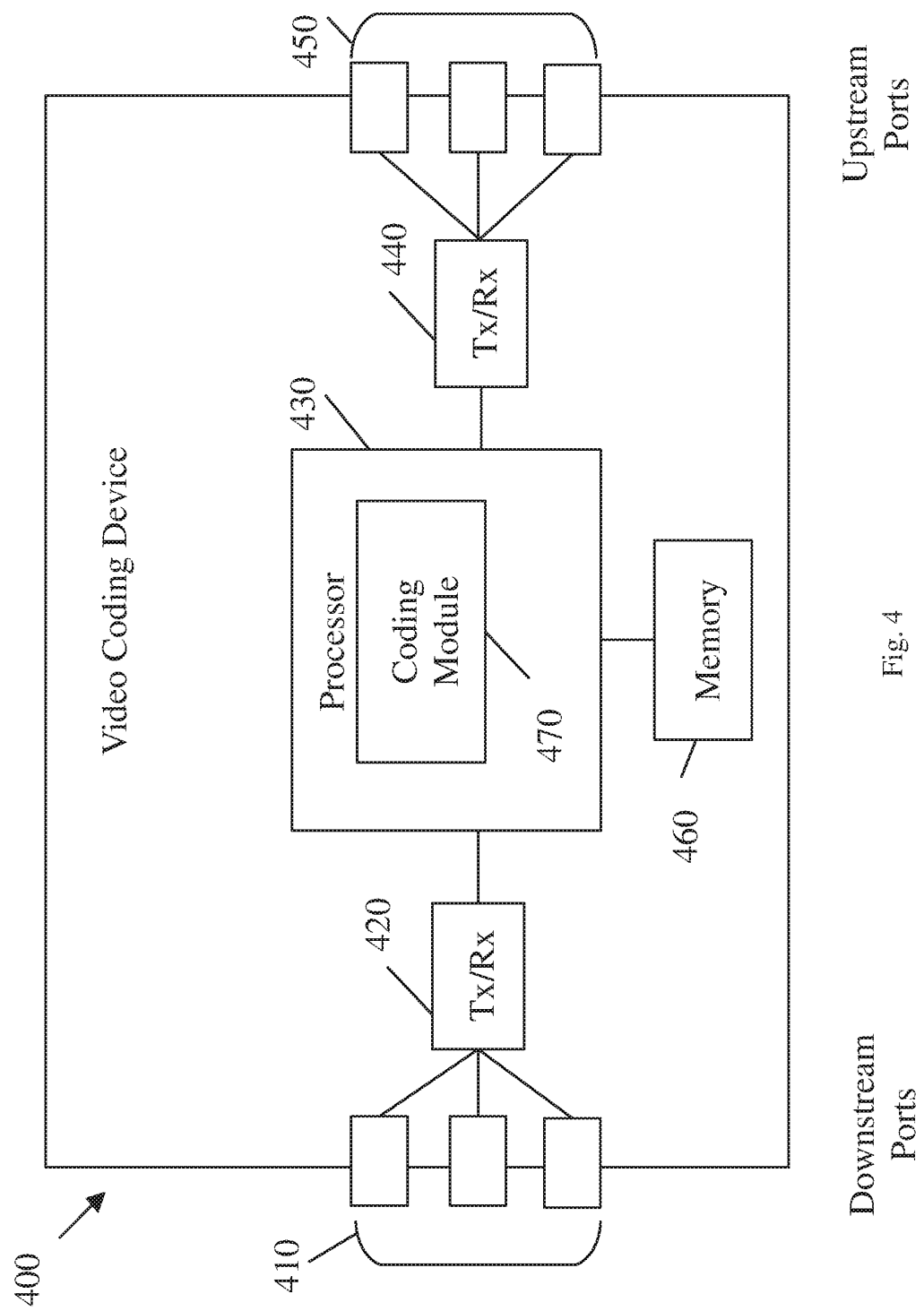


Fig. 4

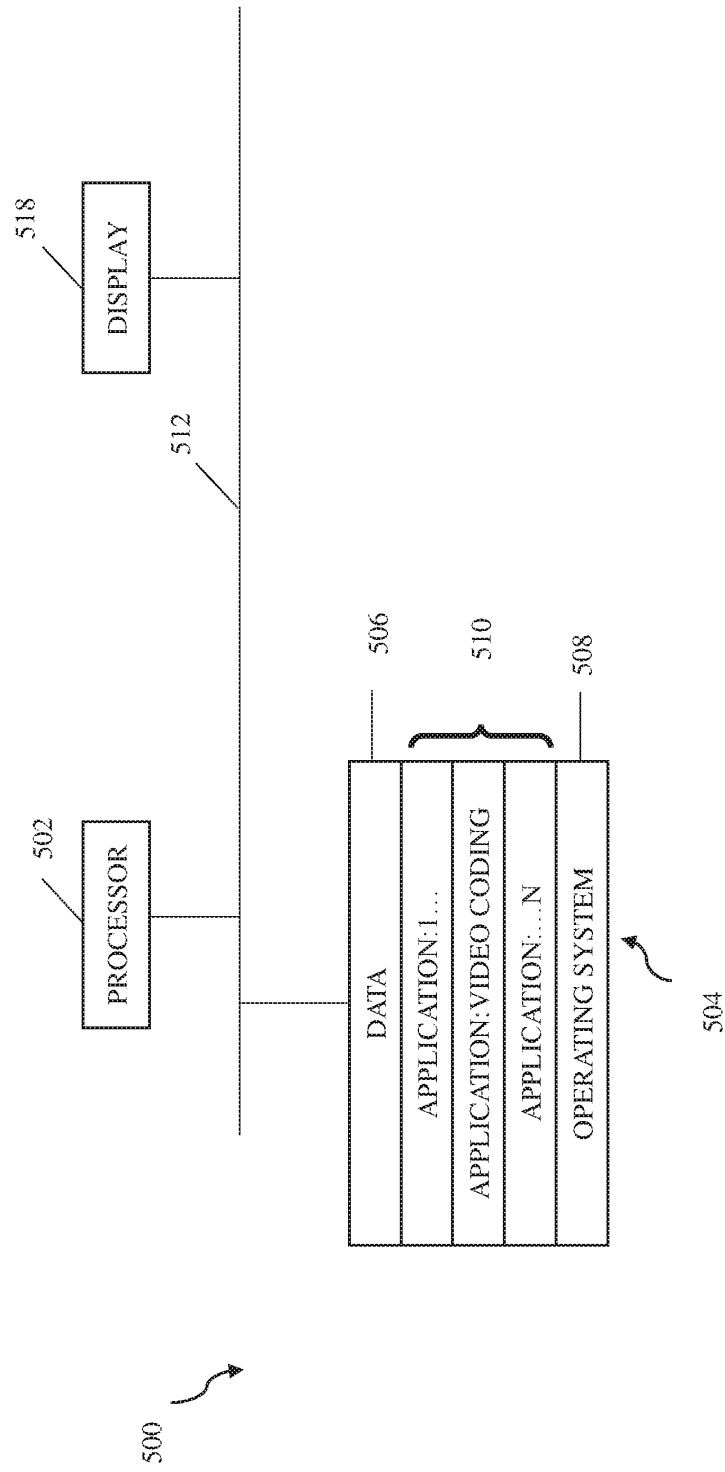


Fig. 5

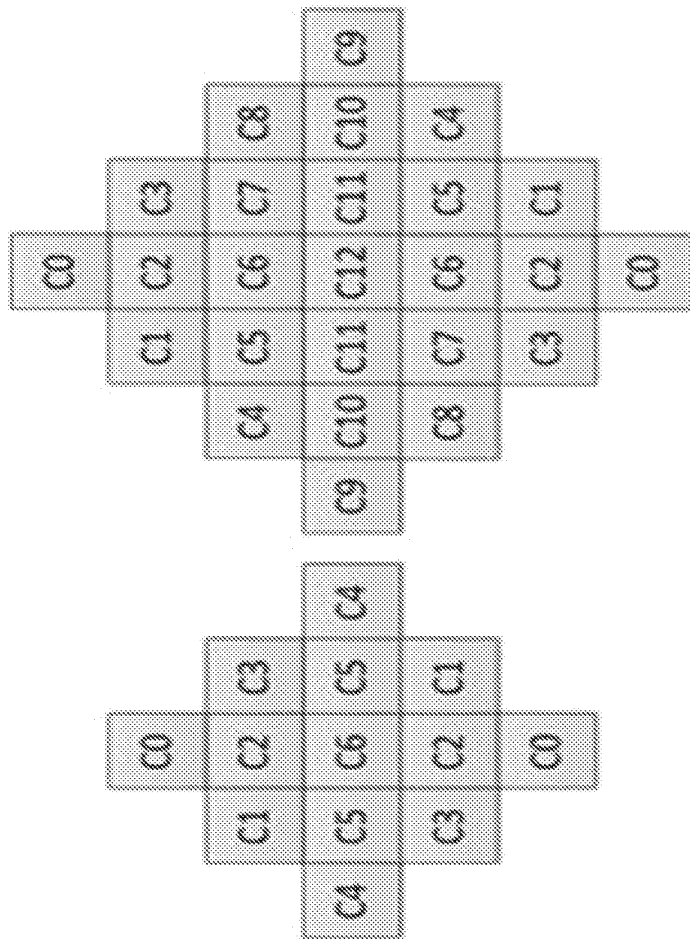


Fig.6

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	
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	
D1		D1		D1		D1		D1

(c) Subsampled positions for diagonal gradient

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	
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	
D2		D2		D2		D2		D2

(d) Subsampled positions for diagonal gradient

Fig. 7

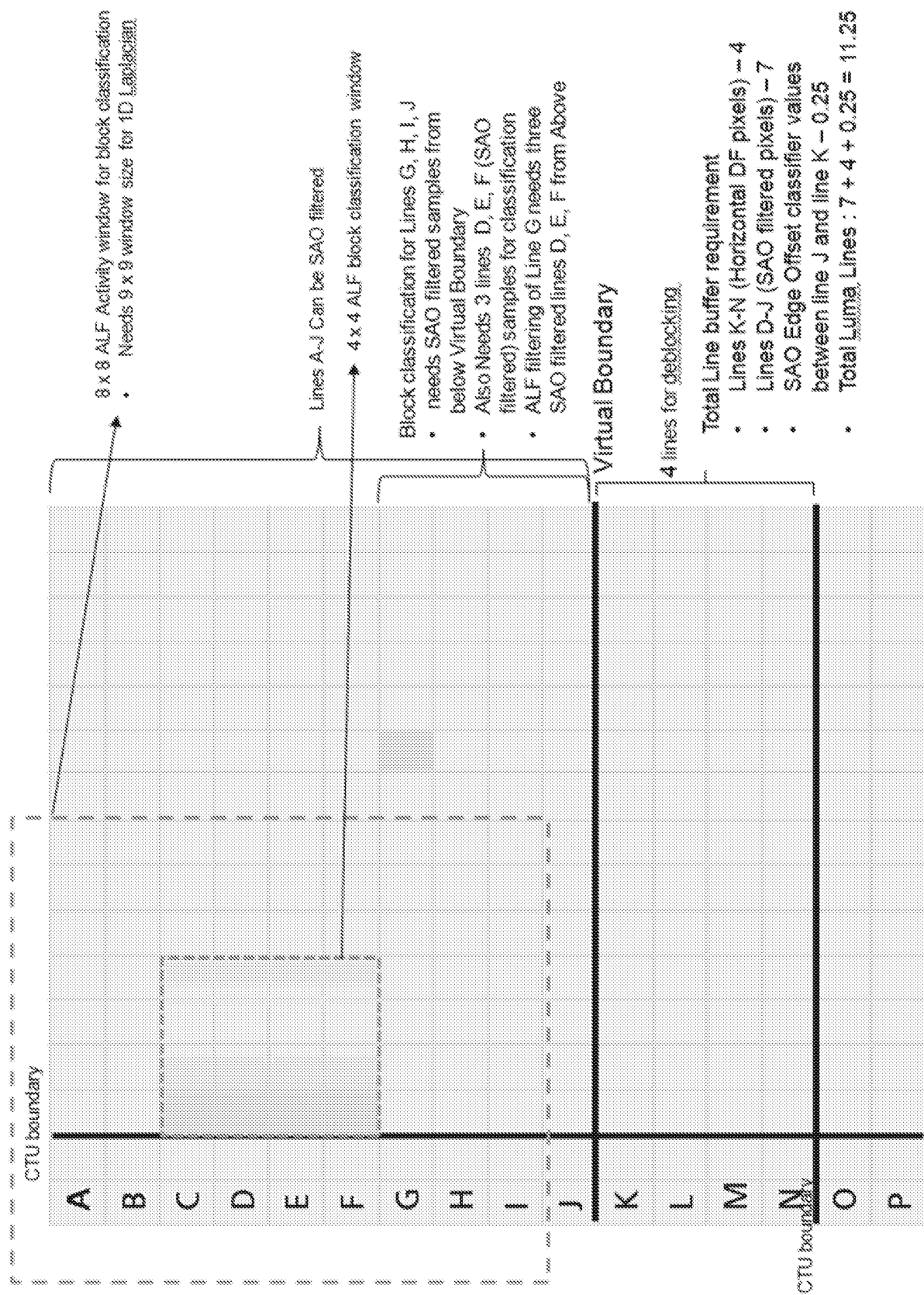


Fig. 8

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

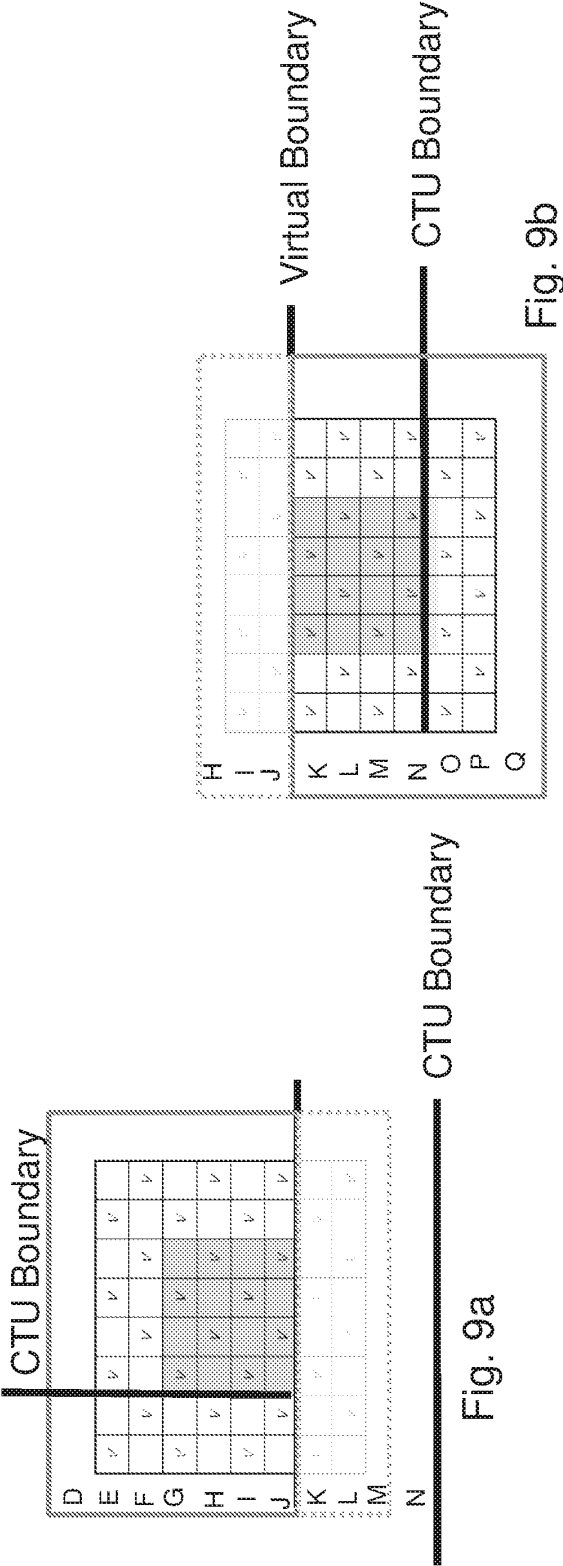


Fig.9

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

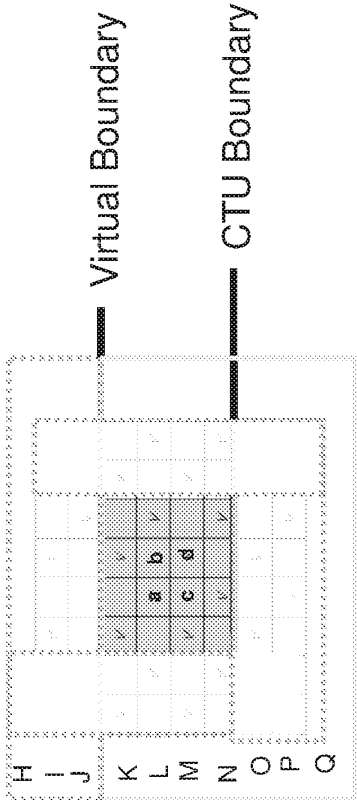
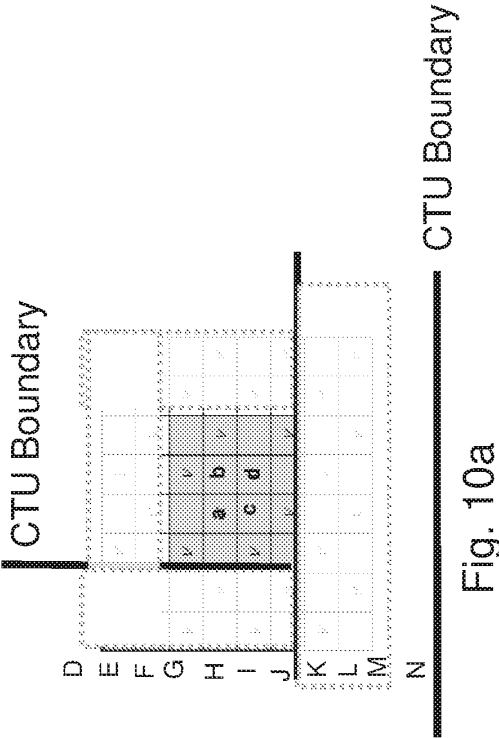


Fig. 10

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

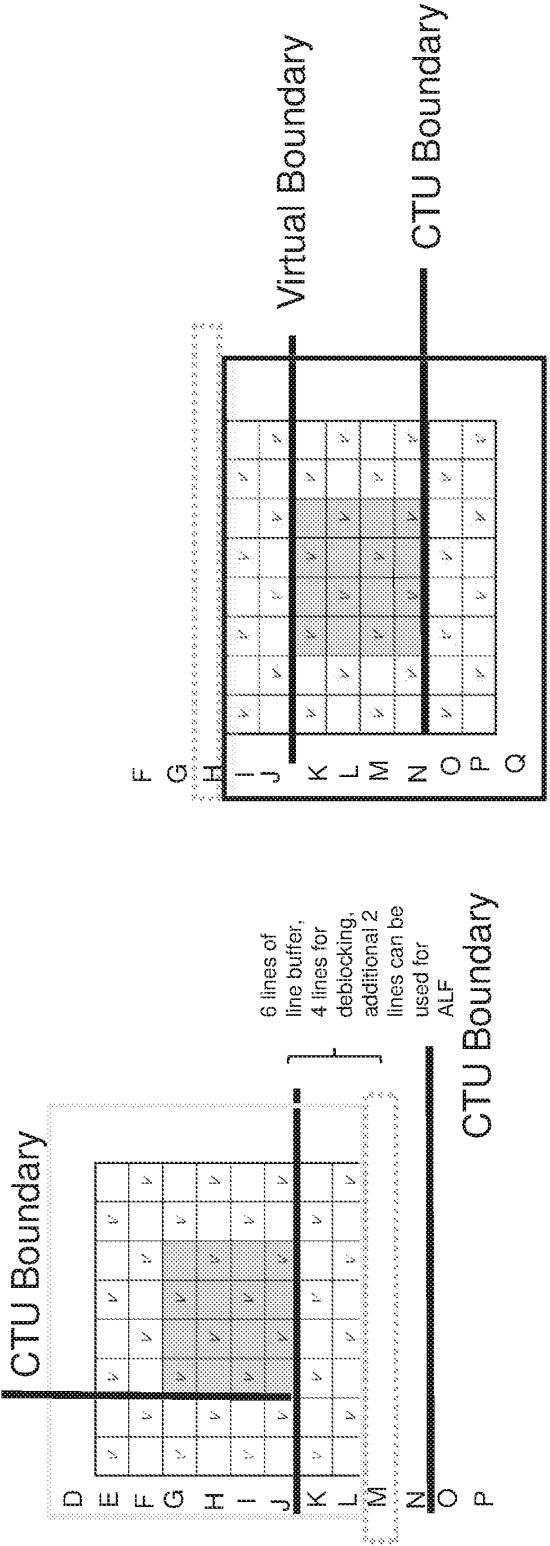


Fig.11

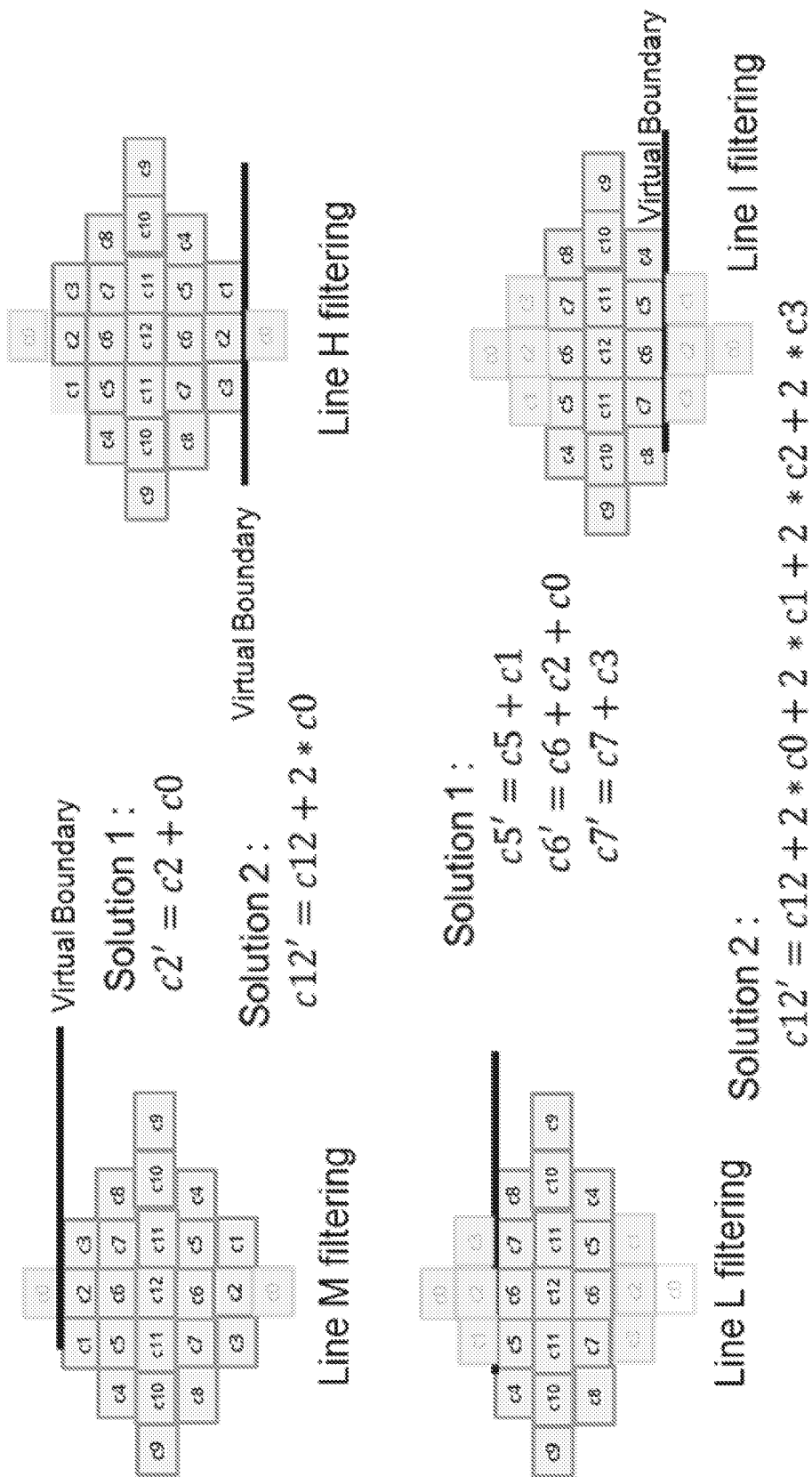


Fig. 12a



Line J filtering

Solution 1 :

$$c_{10}' = c_{10} + c_4 + c_8$$

$$c_{11}' = c_{11} + c_5 + c_7 + c_1 + c_3$$

$$c_{12}' = c_{12} + 2 * c_6 + 2 * c_2 + 2 * c_0$$

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

			c_0		
		c_1	c_2	c_3	
	c_4	c_5	c_6	c_7	c_8
c_9	c_{10}	c_{11}	c_{12}	c_{13}	c_{14}
	c_8	c_7	c_6	c_5	c_4
		c_3	c_2	c_1	
			c_0		

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):

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

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

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

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

			c_0		
		c_1	c_2	c_3	
	c_4	c_5	c_6	c_7	c_8
c_9	c_{10}	c_{11}	c_{12}	c_{13}	c_{14}
	c_8	c_7	c_6	c_5	c_4
		c_3	c_2	c_1	
			c_0		

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_0		
		c_1	c_2	c_3	
	c_4	c_5	c_6	c_7	c_8
c_9	c_{10}	c_{11}	c_{12}	c_{13}	c_{14}
	c_8	c_7	c_6	c_5	c_4
		c_3	c_2	c_1	
			c_0		

c) Vertical Gradient

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

Fig. 12c

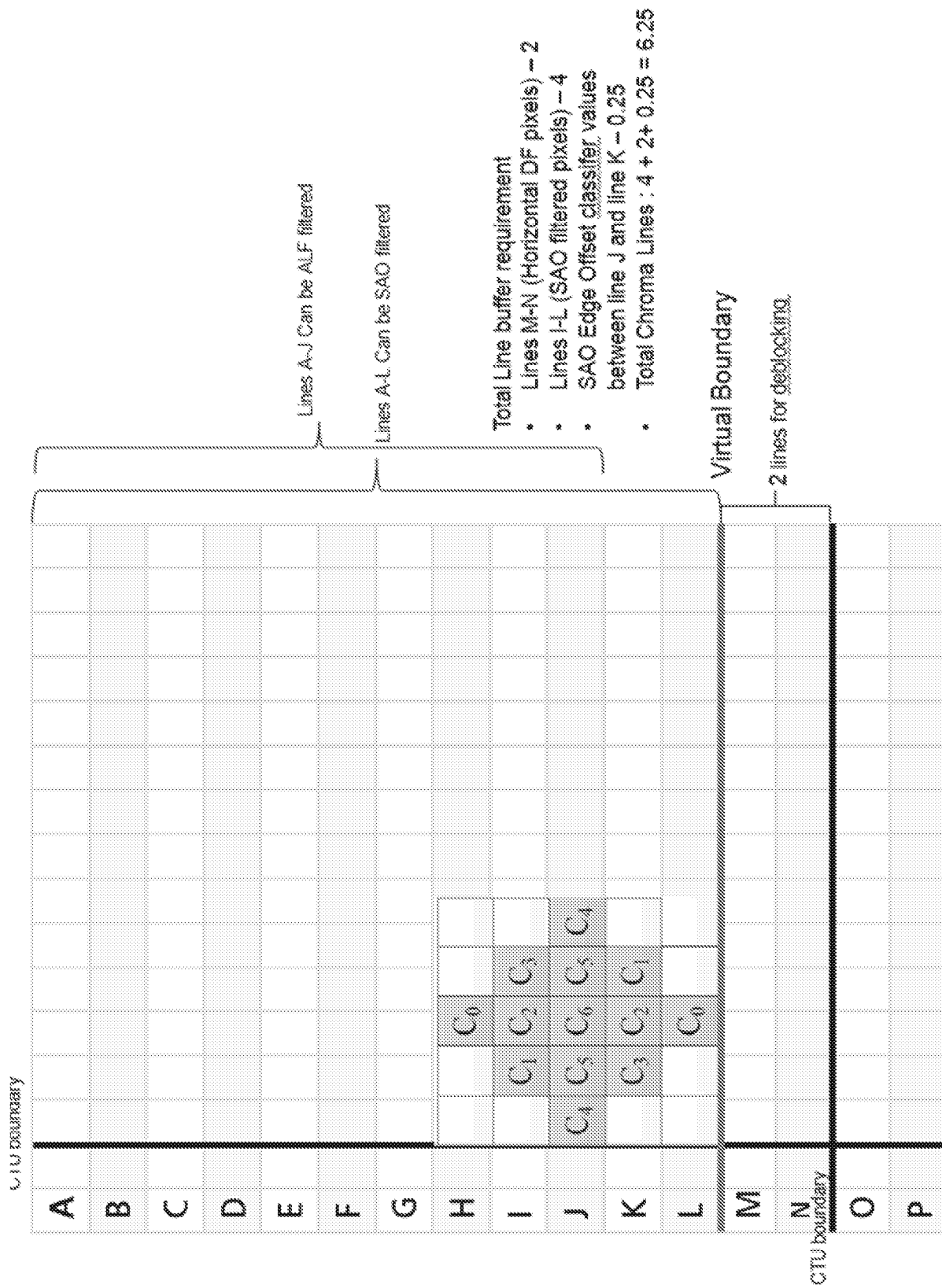
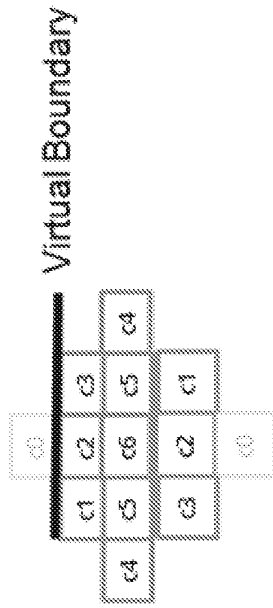


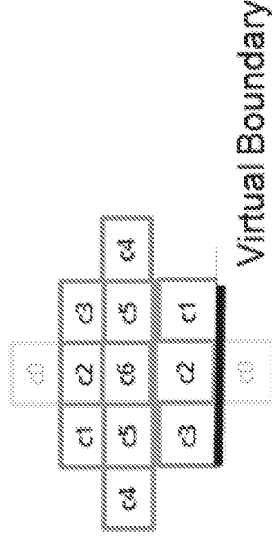
Fig. 13



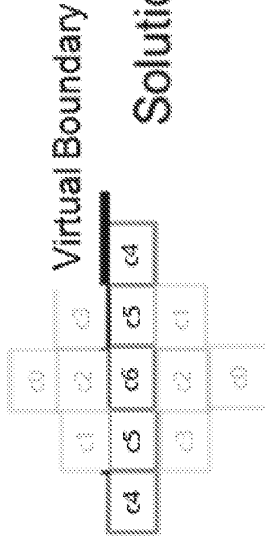
Solution 1 :
 $c2' = c2 + c0$

Solution 2 :
 $c6' = c6 + 2 * c0$

Line N filtering

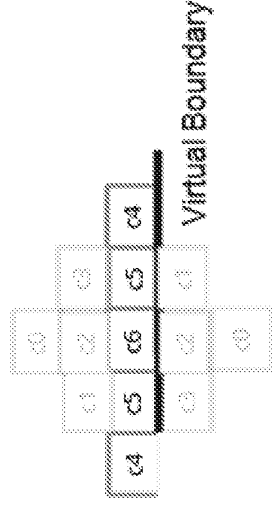


Line K filtering



Solution 1 :
 $c5' = c5 + c1 + c3$
 $c6' = c6 + 2 * c2 + 2 * c0$

Line M filtering



Line L filtering

Solution 2 :
 $c6' = c6 + 2 * c0 + 2 * c1 + 2 * c2 + 2 * c3$

Fig. 14

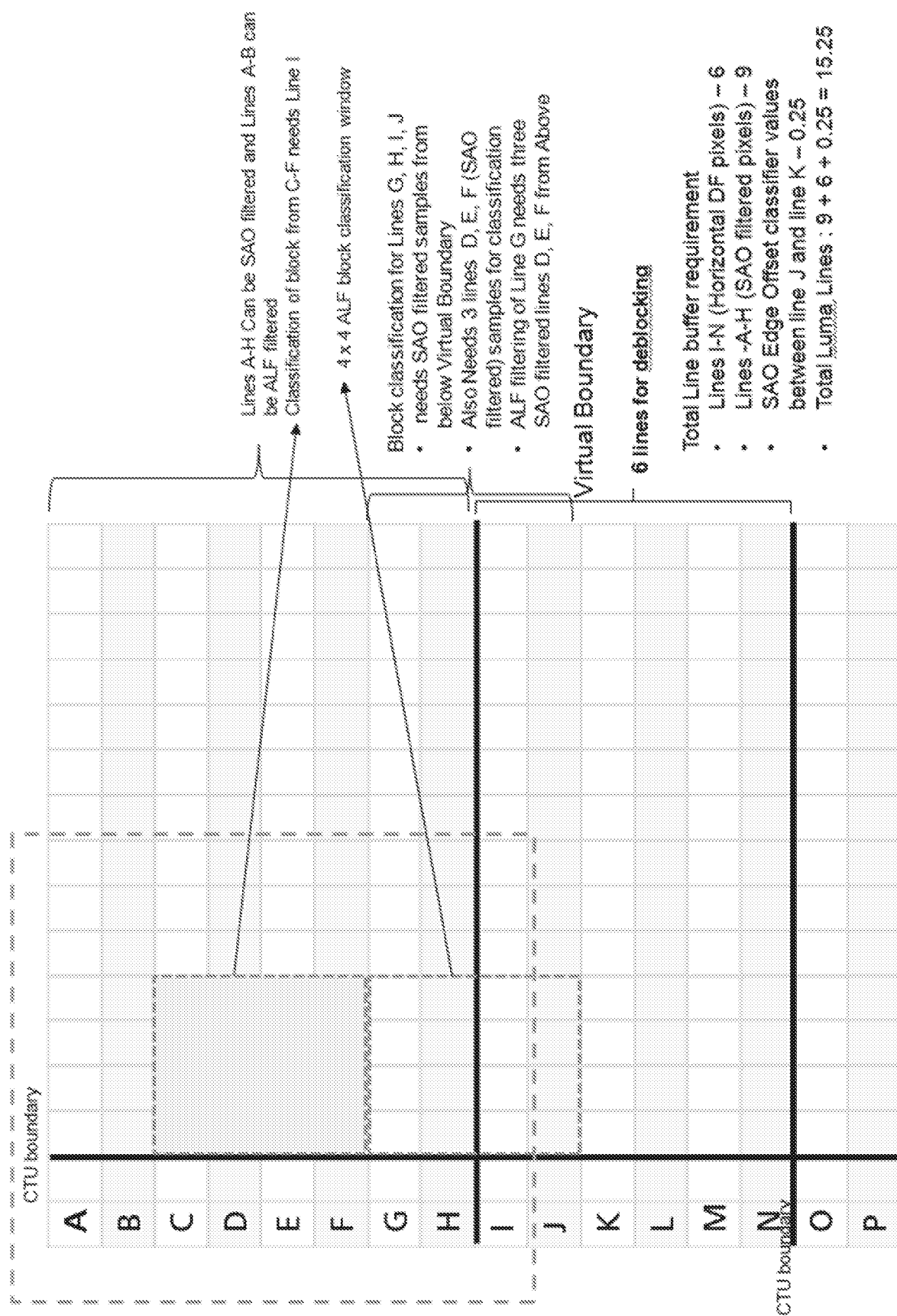


Fig. 15

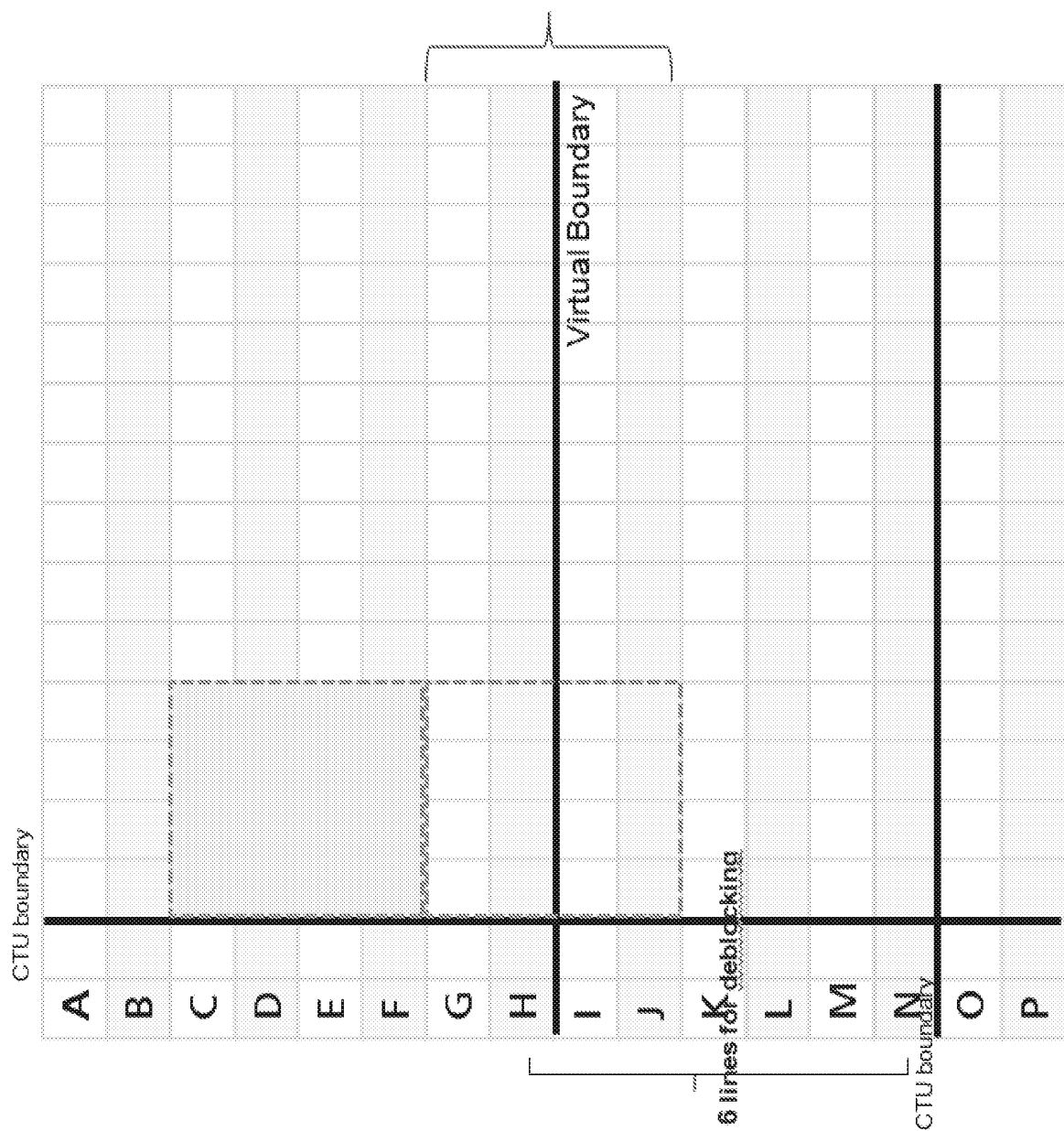


Fig. 16

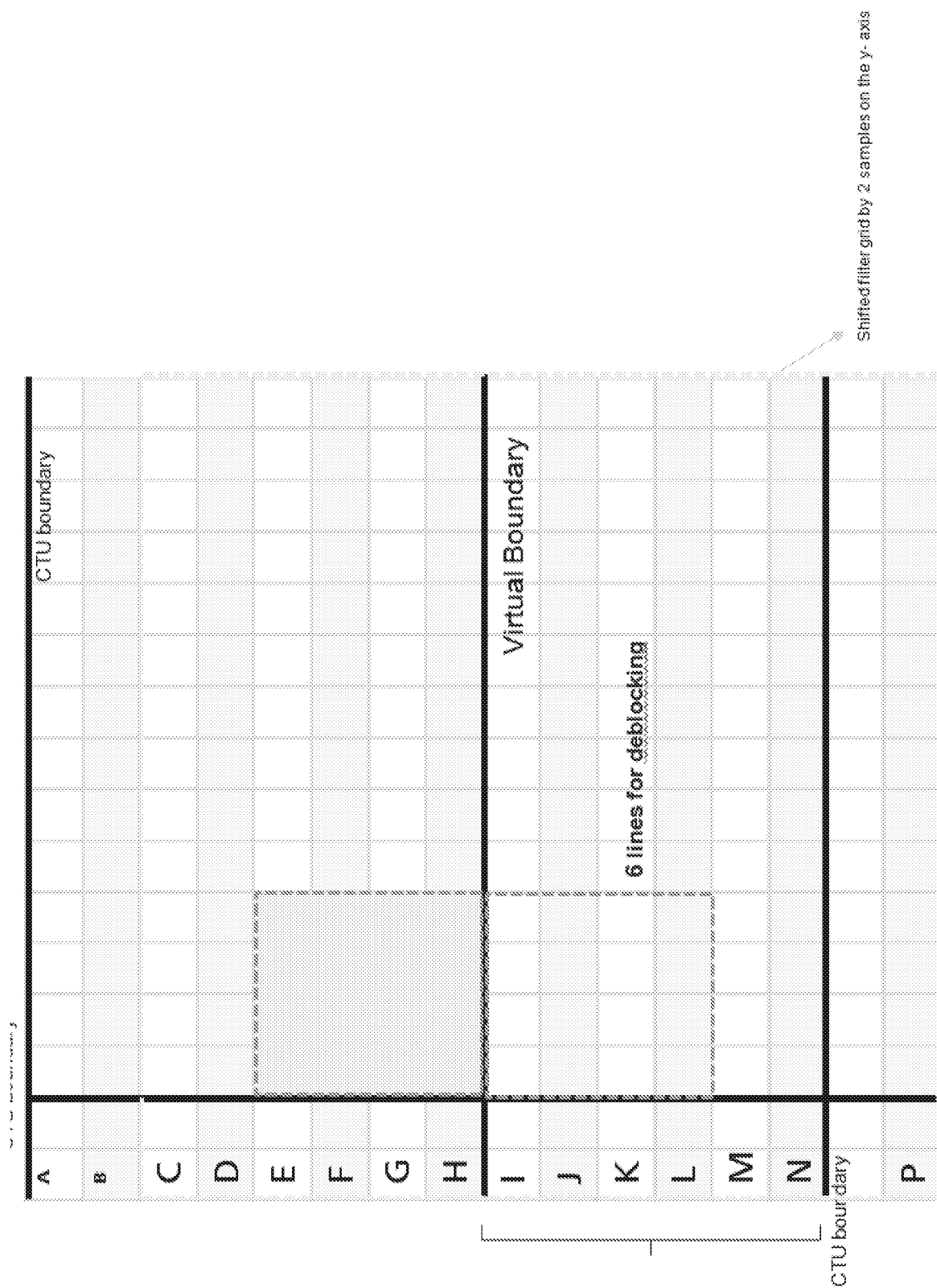


Fig. 17

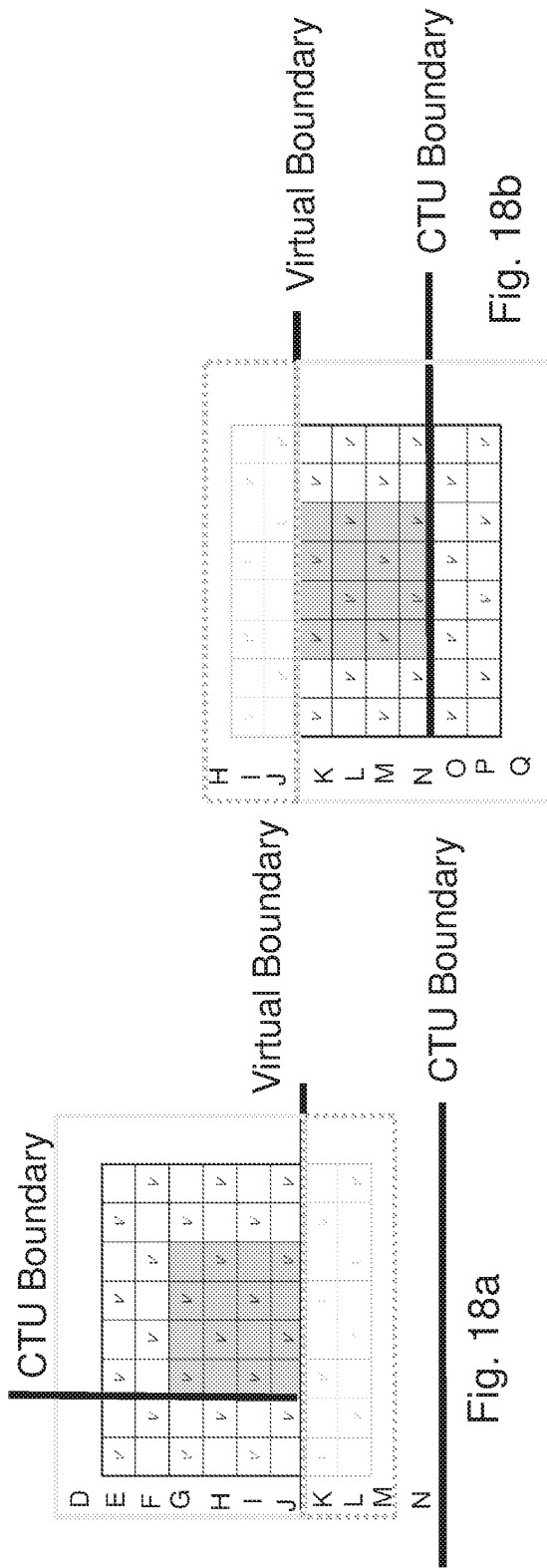


Fig.18

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:

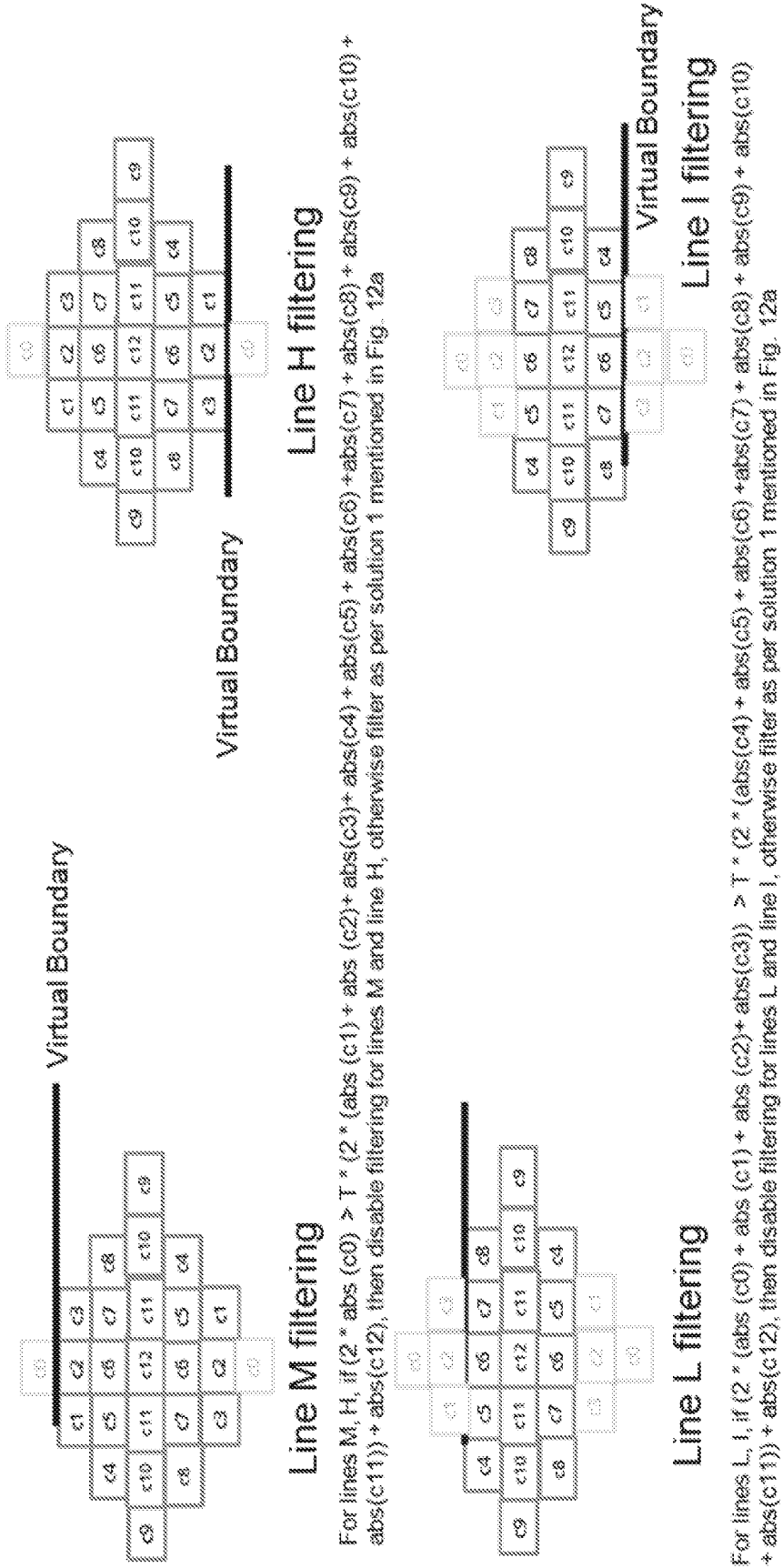
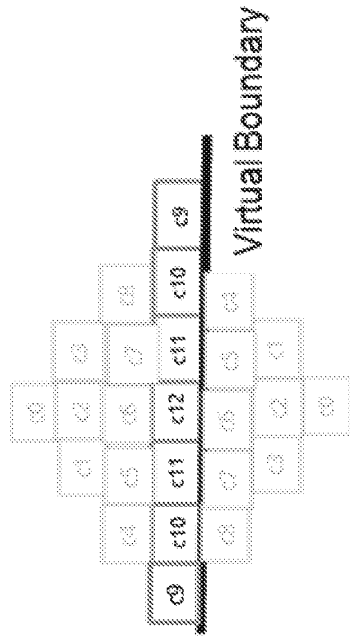


Fig.19a

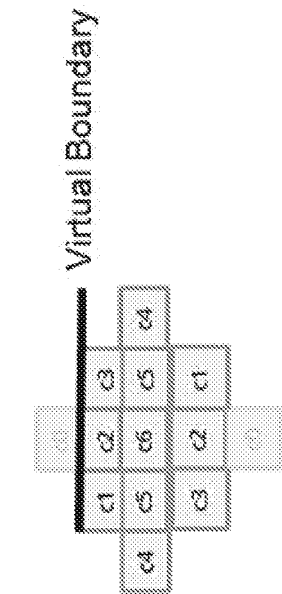


Line J filtering

Line K filtering

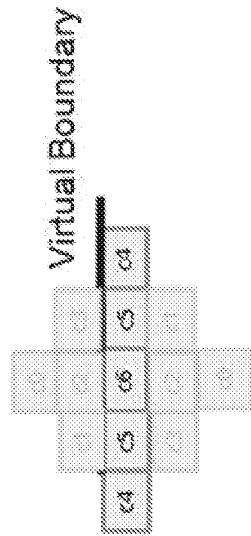
For lines J, K, if $2 * (\text{abs}(c0) + \text{abs}(c1) + \text{abs}(c2) + \text{abs}(c3) + \text{abs}(c4) + \text{abs}(c5) + \text{abs}(c6) + \text{abs}(c7) + \text{abs}(c8)) > T * (2 * (\text{abs}(c9) + \text{abs}(c10) + \text{abs}(c11)) + \text{abs}(c12))$, then disable filtering for lines J and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

Fig.19b



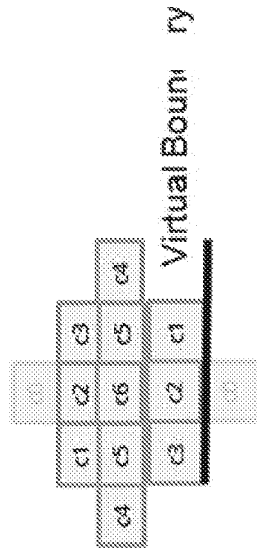
Line N filtering

For lines N, K, if $(2 * (\text{abs}(c_0)) > T * (2 * (\text{abs}(c_1) + \text{abs}(c_2) + \text{abs}(c_3) + \text{abs}(c_4) + \text{abs}(c_5)) + \text{abs}(c_6)) + \text{abs}(c_7))$, then disable filtering for lines N and line K, otherwise filter as per solution 1 mentioned in Fig. 14

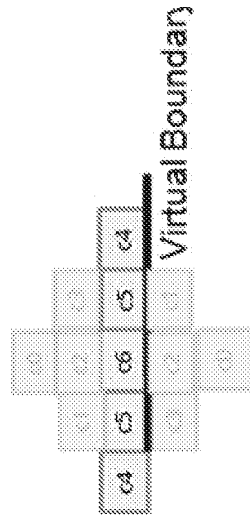


Line M filtering

For lines M, L, if $(2 * (\text{abs}(c_0) + \text{abs}(c_1) + \text{abs}(c_2) + \text{abs}(c_3)) > T * (2 * (\text{abs}(c_4) + \text{abs}(c_5)) + \text{abs}(c_6))$, then disable filtering for lines M and line L, otherwise filter as per solution 1 mentioned in Fig. 14



Line K filtering



Line L filtering

Fig. 20

Symmetric padding at the virtual boundary

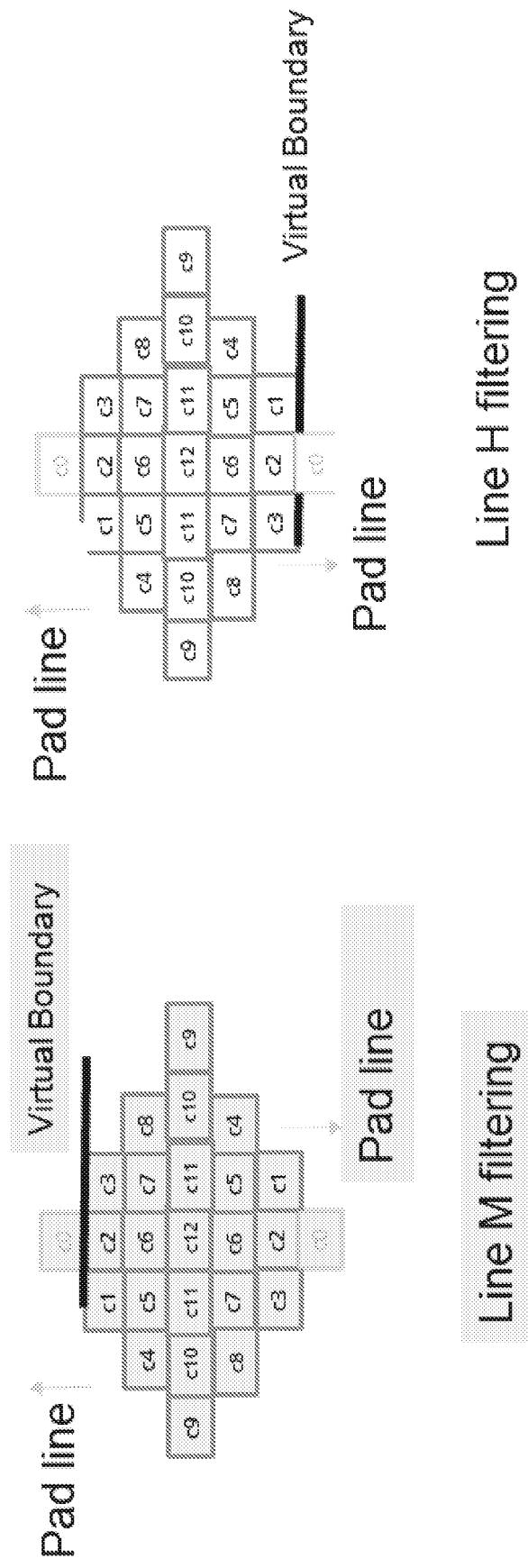


Fig. 21a

Symmetric padding at the virtual boundary

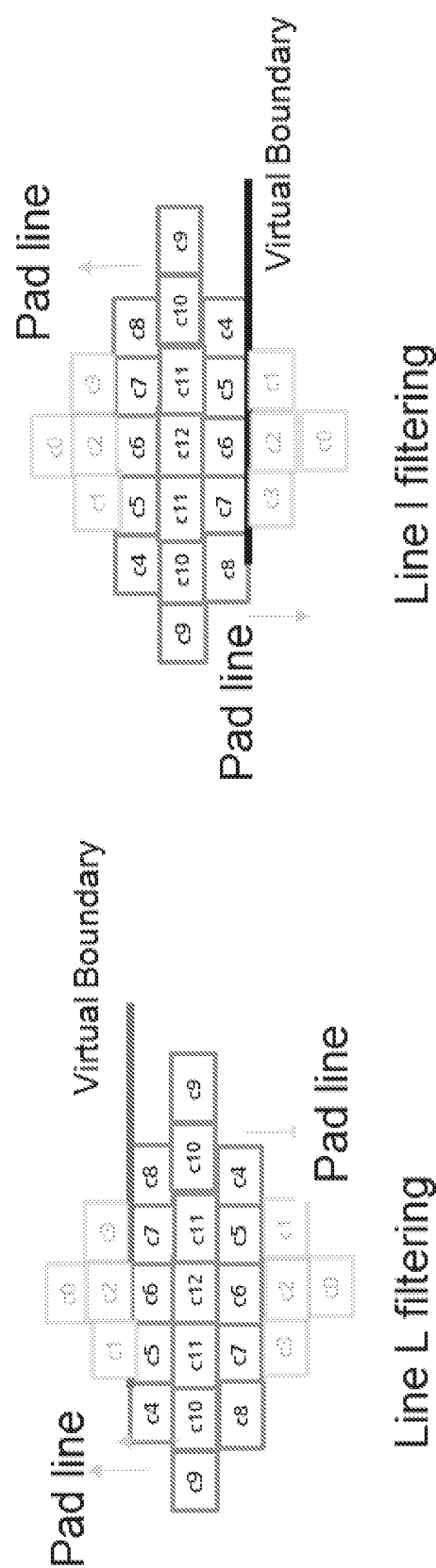


Fig. 21b

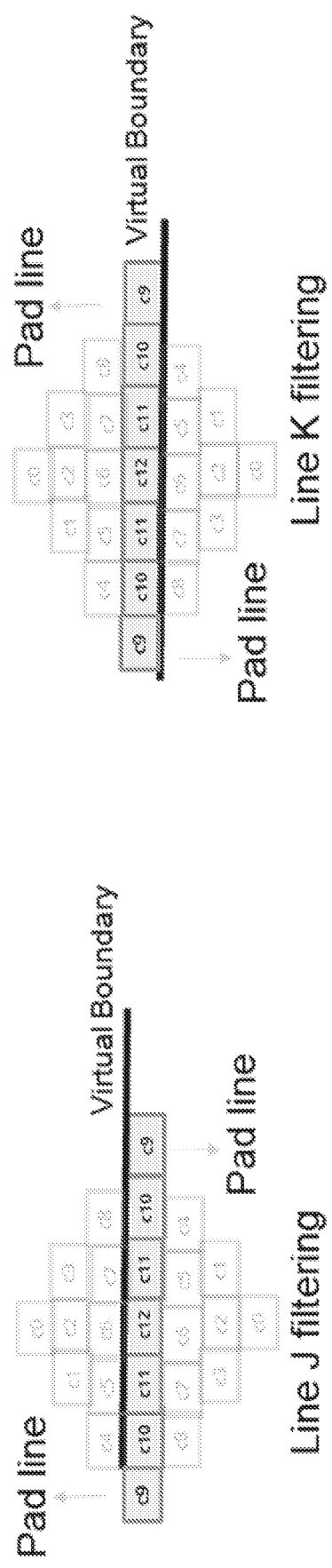


Fig. 21c

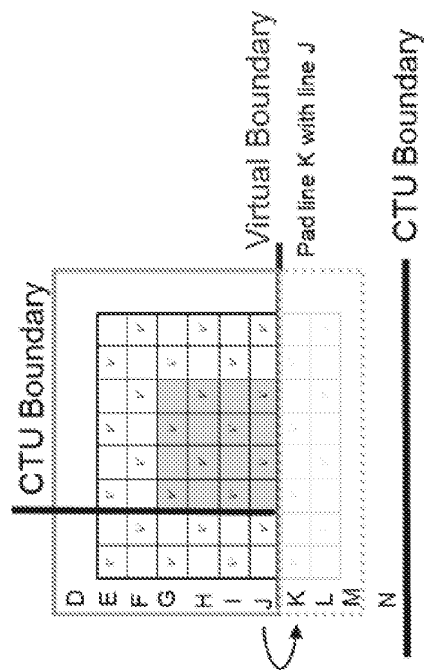


Fig 22a

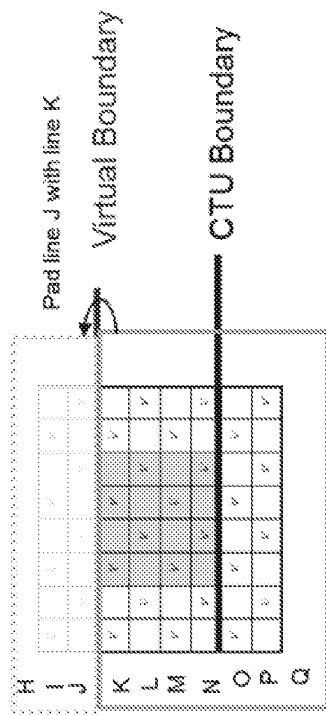


Fig 22b

Fig. 22

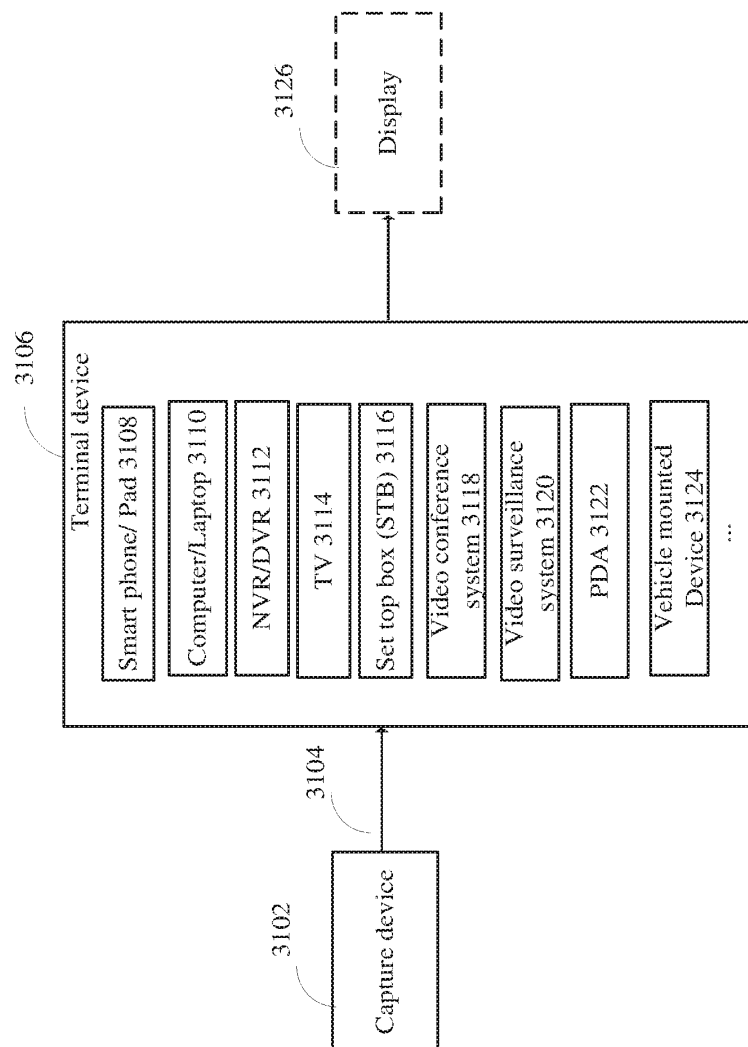


Fig. 23

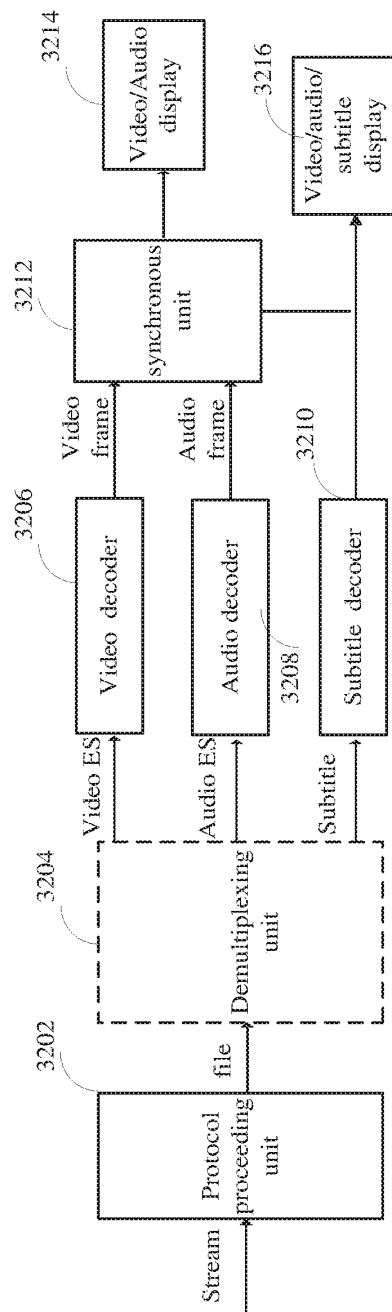


Fig. 24

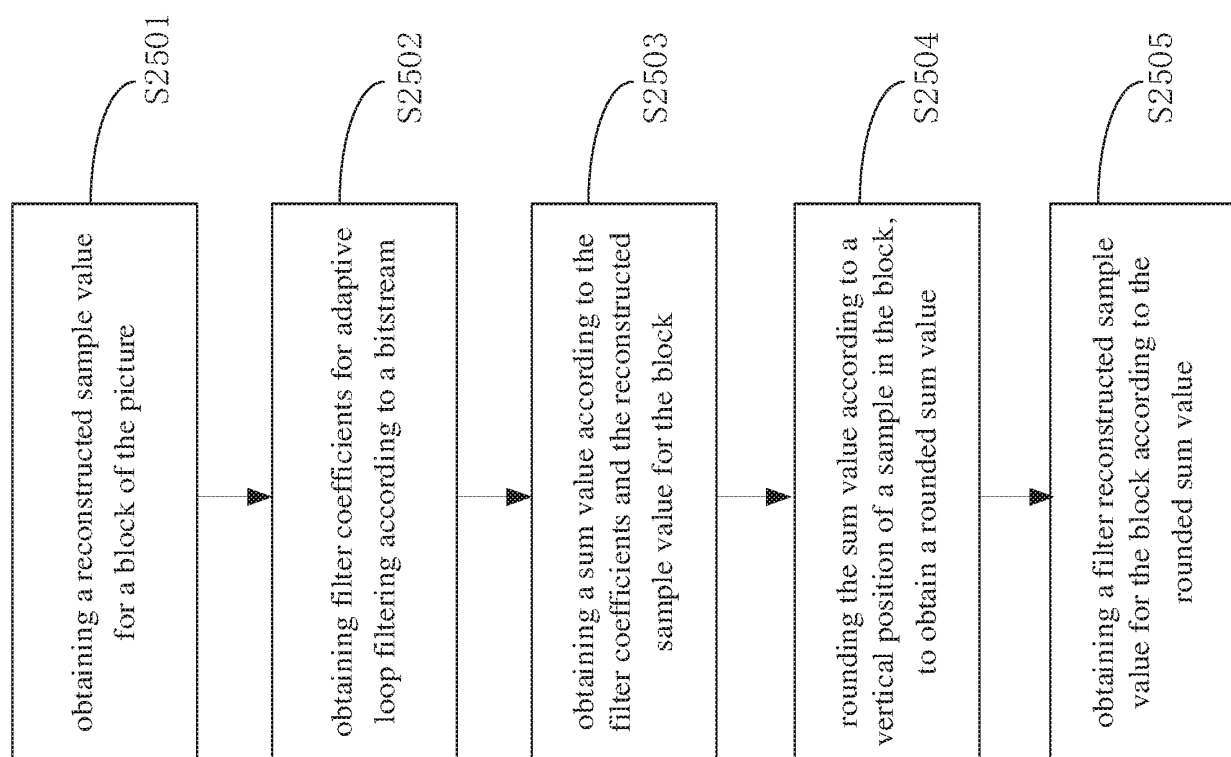


Fig. 25

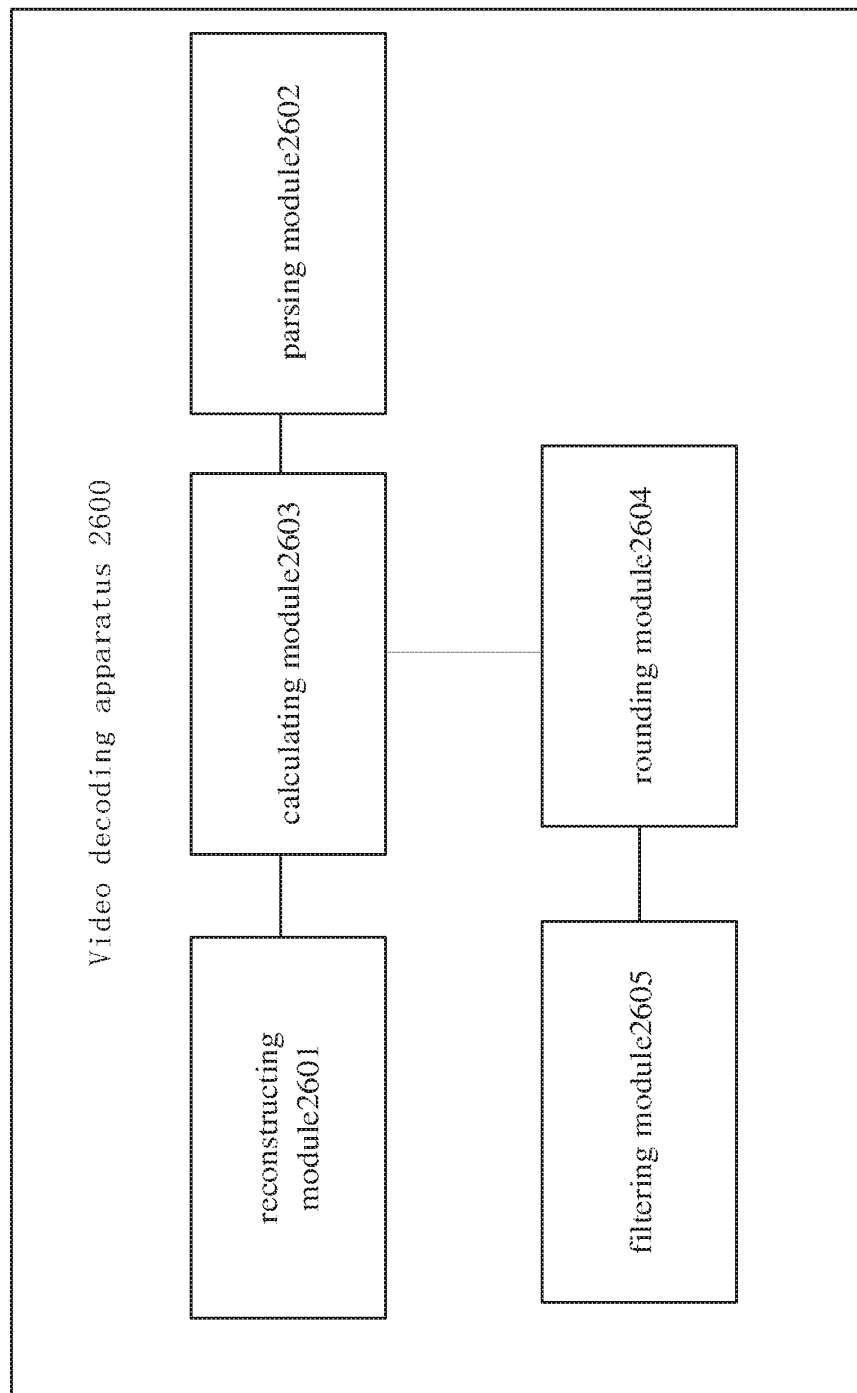


Fig. 26