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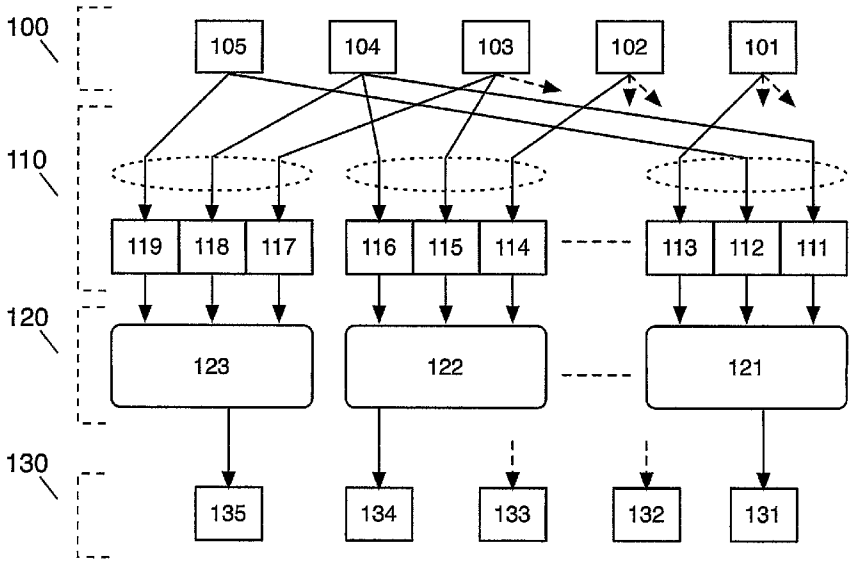
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(54) **Title:** SUBSTITUTION BOXES



(57) **Abstract:** A multiple-input multiple-output s-box receives a contiguously numbered input bits (101, 102, 103, 104, *105)*I_1, $I_2$to I_a, where *a* is at least 4, and outputs *b*contiguously numbered output bits (131, 132, 133, 134, 135) O_1, O_2, to O_b.The s-box comprises c primitive s-boxes (121, 122, 123) $sbl_i sb_2$ to sb_c,. Each primitive s-box (121, 122, 123) has a multiple-input single-output Boolean function f_1, f_2, to f_o defining the relationship between the multiple inputs and the single output. Each primitive s-box (121, 122, 123) receives a set of input bits s_1,s_2, to s_c, respectively, each such set is chosen from the *a* input bits (101, 102, 103, 104, 105) to the s-box and containing sl_1,sl_2, to sl_c bits respectively. Each of the numbers *s11, s12,* to sl_c is in the range of 3 to (a-1), and the sum of the numbers sl_1,sl_2, to sl_c is larger than *a.* The *b* output bits of the s-box (131, 132, 133, 134, 135) are the outputs of the c Boolean functions.

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