

SPECIFICATION

CONTAMINATED AIR PURIFICATION SYSTEM FOR GAME FACILITY

TECHNICAL FIELD

[0001] The present invention relates to a contaminated air purification system configured to purify air contaminated by smoke of tobacco generated by smoking of a game player in a game facility equipped with a gaming machine such as a pachinko machine and/or a slot machine.

BACKGROUND TECHNOLOGY

[0002] Generally, in a gaming facility such as a pachinko hall, many playing islands each having a plurality of gaming machines such as pachinko machines and/or slot machines are formed in which each game player is playing a game in a manner to face a gaming machine. Under such conditions, since there are many game players who enjoy games while smoking, an environment of air in the gaming facility tends to become worse.

[0003] To improve the environment of air contaminated by smoke of tobacco in the gaming facility, various kinds of prior art have been proposed. For example, a tobacco smoke cut-off apparatus (see Patent Reference 1) has been disclosed in which, in order to prevent the flow-in of tobacco smoke, an air suck-in section internally having a fan is installed on an upper portion of a pachinko base and

an air blow-out section is also provided to partition pachinko machines in a direction of a width of a pachinko ball counter base and, by suction of the suck-in port, an air curtain is formed between the air suck-in section port and air blow-out port. Also, an air cleaning apparatus (Patent Reference 2) has been disclosed which has a blow-out section and suck-in section respectively in its upper and lower portions and in which an air cleaning machine internally equipped with an air blower is installed on an upper portion of a gaming machine and air sucked from the suck-in port on a lower side is purified and is then blown out from the blow-out port on an upper side.

[0004] Additionally, an air conditioning system (Patent Reference 3) has been disclosed in which, as shown in Fig. 8, air-conditioned air purified by the air purification device 1 and adjusted by an air conditioner 2 so as to have desired mixed humidity, after being blown out from under the floor through an blow-out port 6 formed on a base portion 5 of a chair 4 disposed on front of the pachinko base 3, is sucked into a suck-in port 7 formed on an upper portion of the chair 4 to form an updraft in surroundings of the chair 4.

Patent Reference 1: Japanese Patent Application
Laid-open No. Hei 10-165625

Patent Reference 2: Japanese Patent Application
Laid-open No. Hei 11-226359

Patent Reference 3: Japanese Patent Application
Laid-open No. Hei 8 - 261505

However, technologies disclosed in the Patent References 1 and 2, out of the above prior art technologies, have problems in that, due to suction of air on the suck-in port side which provides a guiding effect being only one-fifth the guiding effect on the blow-out port side, it is impossible to sufficiently prevent the diffusion of tobacco smoke and to remove satisfactory tobacco odor, thus resulting in giving a feeling of discomfort to a game player sitting on a chair adjacent to a game player who is smoking.

[0005] The technology disclosed in the Patent Reference 3 also has a problem. That is, a duct has to be installed under the floor, which causes a large scale of work and makes it difficult for the apparatus to be installed in existing game facilities and air is contaminated by further scattering of dust on the floor and/or foods and drinks dropped on the blow-out above the floor.

[0006] The present invention has been made in light of the problems described above and has an object to provide a contaminated air purification system which gives no feeling of discomfort to a game player sitting on a neighboring side and can remove tobacco odor reliably and provides excellent tobacco odor removing performance for a long period of time by simple installation work.

DISCLOSURE OF THE INVENTION

[0007] In order to achieve above object, the contaminated air purification system for a gaming facility

of the present invention is characterized by including a draft control device installed on each of left and right sides of a gaming machine so that air is able to be blown out in an upward slanted direction to prevent the diffusion of tobacco smoke from a smoking game player to a game player sitting adjacent to the smoking game player in a gaming facility having the gaming machine, wherein the draft control device runs at a wind flow rate of 22m³/h or higher and is installed at 800 mm to 1500 mm above floor level and facilitates the rising of tobacco smoke utilizing a guiding effect of a blown-out draft.

[0008] The contaminated air purification system of the present invention is also characterized in that the air blown out by the draft control device in an upward slanted direction, after being treated by the air purification apparatus, is circulated as purified air through the gaming facility, or is totally exhausted outside the gaming facility and outer air having the same amount of the air exhausted, after being treated by an air conditioner, is supplied into the gaming facility, thus resulting in the improvement of an environment of air.

[0009] The contaminated air purification system of the present invention can reliably remove tobacco odor and can avoid a feeling of discomfort to a game player sitting on a neighboring side and can provide excellent tobacco odor removing performance for a long period of time by simple installation work.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Figure 1 is a perspective view showing a contaminated air purification system of a first embodiment of the present invention.

Figure 2 is a top view showing smoke generated points and tobacco odor concentration measuring points for performance test of the contaminated air purification system of the first embodiment of the present invention.

Figures 3 (a) to (c) are perspective views each showing installation height of a draft control device for performance test of the contaminated air purification system of the first embodiment of the present invention.

Figure 4 is a top view showing smoke generated points and tobacco odor concentration measuring points for performance test of the contaminated air purification system of the first embodiment of the present invention.

Figure 5 is a schematic view showing a contaminated air purification system for a gaming facility of the second embodiment of the present invention.

Figure 6 is a top view showing smoke generated points and tobacco odor concentration measuring points for performance test of the contaminated air purification system of the second embodiment of the present invention.

Figure 7 is a schematic diagram showing a modified example of the contaminated air purification system for the gaming facility of the second embodiment of the present invention.

Figure 8 is a schematic diagram showing a prior art

example.

BEST MODE CARRYING OUT THE INVENTION

[0011] Hereinafter, an embodiment of the present invention is described by referring to drawings.

[0012] First, with reference to Figs. 1 to 4, the contaminated air purification system for a game facility of the first embodiment of the present invention is described.

[0013] As shown in Fig. 1, the contaminated air purification system for the game facility of the first embodiment of the present invention includes a ceiling-mounted type air purification apparatus 13 disposed in a manner being suspended from an upper ceiling of a gaming island 12 having a plurality of gaming machines 11 (two machines in Fig. 1) placed in an arranged manner and/or a floor-mounted type air purification apparatus 14 placed on a floor along a wall surface, and a draft control device 15 disposed in a manner protruding forward in an upper direction on both left and right sides of the gaming machine 11.

[0014] Each of the ceiling-mounted type air purification apparatus 13 and floor-mounted type air purification apparatus 14 has a suck-in port (respectively 16 and 17) to suck air contaminated by smoke from a tobacco 18 into the game facility in which each of the gaming machines 11 is installed, an air purification portion (not shown) to purify the contaminated air, a blower (not shown) to send, with pressure, the air purified by the air purification portion,

and a blow-out port (not shown) to blow out the air sent, with pressure, by the blower into the game facility.

[0015] The draft control device 15 has a flat ended circular cylindrical shape, the inside of which a fan (not shown) is mounted and configured so as to blow out air sucked into its inner portion from surroundings toward an upward slanted direction to cause an updraft to occur in order to guide the air to the suck-in port 16.

[0016] Next, the action of the contaminated air purification system 10 for game facilities described above is described.

[0017] Air, which has been contaminated by smoke of the tobacco 18 that a game player sitting in front of the game machine 11 is smoking, rises owing to a guiding effect of air blown out from the draft control device 15 in an upward slanted direction and owing to a raising effect of heat generation of the tobacco 18 without being diffused and is then sucked, through the suck-in ports 16 and 17, into the inside of the ceiling-mounted type air purification apparatus 13 and floor-mounted type air purification apparatus 14. In this state, the air is blown out from the draft control device 15 in the upward slanted direction and, therefore, the game player does not feel the air draft.

[0018] The contaminated air sucked into the ceiling-mounted type air purification apparatus 13 and floor-mounted type air purification apparatus 14, after tobacco odor components such as dust, TVOC (Total Volatile Organic Compounds), nicotine, acetaldehyde, ammonia have been removed by the air purification

portion from the contaminated air, is sent out by the blower to be transferred into the gaming facility 19 through the blow-out port.

[0019] Hereinafter, tobacco odor removal capability of the contaminated air purification system 10 for game facilities is evaluated.

[0020] Figure 2 is a top view showing positions of an A point (at 1,100 mm above floor level) where the tobacco 18 was allowed to burn to generate smoke in the gaming facility 19, and two points B and C (both at 1,200 mm above floor level) being positions of seats on both sides of the A point where tobacco odor concentration was measured which have been set for the evaluation of the tobacco odor removal capability of the contaminated air purification system 10 for game facilities of the present embodiment. Figures (a) to (c) are a perspective view each showing installation height for the draft control device 15 and Fig. (a) shows the case of the installation height for the draft control device 15 being 800 mm above floor level, Fig. (b) shows the case of the installation height being 1,500 mm above floor level, and Fig. (c) shows the case of the installation height being 1,700 mm above floor level. Table 1 shows results from measurement of a flow rate of wind of the draft control device 15 and dust concentration ($\mu\text{ g/m}^3$) obtained by changing the installation height for the draft control device 15 under the conditions presented in Figs. 2 and 3.

[0021] [Table 1]

Draft control device	Tobacco	Flow rate of wind (m ³ /h)	Dust concentration (μg/m ³) of neighboring seats at 1,200 mm above floor level		
			Installation height		
			FL+800	FL+1,500	FL + 1,700
Absence	Absence	0	18	16	16
Absence	Presence	0	247	240	240
Presence	Presence	5	171	209	139
Presence	Presence	9	144	156	222
Presence	Presence	18	116	63	169
Presence	Presence	22	47	22	129
Presence	Presence	27	28	33	210

As shown in Table 1, it has turned out that the removal capability of the draft control device 15 becomes the highest when the device 15 runs at a wind flow rate of 22m³/h or higher and is installed at 800 to 1500 mm above floor level.

[0022] Figure 4 is a top view showing positions of 1 to 8 points (at 700 mm above floor level being a hand height position of a game player smoking the tobacco 18 and at 1,100 mm above floor level being the player's mouth height position where the tobacco 18 was allowed to burn to generate smoke in the gaming facility 19 and an atmosphere measuring point X where the tobacco 18 was burning (at 1,100 mm above floor level), which have been set for the evaluation of the tobacco odor removal capability of the contaminated air purification system 10 for the game facility of the present embodiment. Table 2 shows average values of measured dust concentrations (μg/m³) in neighboring seats (at 1,200 mm above floor level) on both sides of each of points 1 to 8 where smoke was generated.

[0023] [Table 2]

Draft control device Tobacco Smoke generated Points	Dust concentration ($\mu\text{g}/\text{m}^3$) of neighboring seats at 1,200 mm above floor level			
	FL + 700(hand height position)		FL + 1,100 (mouth height position)	
	ON	OFF	ON	OFF
1	56	58	76	449
2	62	87	65	889
3	106	82	62	125
4	129	197	58	122
5	82	367	41	161
6	126	144	39	138
7	63	166	42	99
8	65	406	50	127
<u>Measured value of Atmospheric concentration during burning of tobacco</u>	38			

Note: The measured value is an average on the left and right seats.

As shown in Table 2, it has also turned out that the dust concentration in the neighboring seats obtained when the draft control device 15 is turned ON is remarkably improved when compared with the case where the draft control device 15 is turned OFF and the concentration is lowered to the same level as for the atmospheric concentration. The results from the measurement shows that the diffusion of tobacco smoke can be reliably prevented by the draft control device 15.

[0024] Next, by referring to Figs. 5 and 6, the contaminated air purification system for game facilities of the second embodiment of the present invention is

described. Moreover, in Figs. 5 and 6, same reference numbers are assigned to components being the same as for those in Figs. 1 to 4 in the first embodiment for simplification of the description and their detailed explanations are omitted accordingly.

[0025] As shown in Fig. 5, the contaminated air purification system 20 for game facilities of the second embodiment of the present invention is made up of an air purification apparatus 21 disposed outside the gaming facility 19, an air conditioner 22 disposed also outside the gaming facility 19, a blow-out port 26 connected through a supply air duct 23 to the air conditioner 22 and disposed in a manner being suspended from an upper ceiling of a gaming island 12, a suck-in port 26 connected through a return air duct 25 to the air purification apparatus 21 and disposed in a manner being suspended from an upper ceiling of a gaming island 12, an outer air inlet duct 27 connected from an outside to a portion between the air purification apparatus 21 and air conditioner 22, an exhaust duct 28 branched from the return air duct 25 toward the outside, and a draft control device 15 disposed in a manner protruding forward in an upper direction on both left and right sides of the gaming machine 11.

[0026] Next, actions of the contaminated air purification system 20 of gaming facilities are described.

[0027] Air, which has been contaminated by smoke of the tobacco 18 that a game player sitting in front of the game machine 11 is smoking, rises owing to a guiding effect of air blown out from the draft control device 15 in an upward

slanted direction and owing to a raising effect of heat generation of the tobacco 18 without being diffused and is then sucked into the suck-in port 26. In this state, the air is blown out from the draft control device 15 in the upward slanted direction and, therefore, the game player does not feel the air draft.

[0028] Then, the contaminated air sucked into the suck-in port 26 flows through the return air duct 25 into the air purification apparatus 21 and part of the contaminated air is exhausted through the exhaust duct 28 to the outside. The contaminated air sucked into the air purification apparatus 21, after tobacco odor components such as dust, TVOC, nicotine, acetaldehyde, ammonia have been removed, is mixed with outside air guided by the outside air inlet duct and flows into the air conditioner 22 and is adjusted so as to have desired mixed humidity and is then blown from the supply air duct 23 through the blow-out port 24 into the gaming facility 19.

[0029] Hereinafter, tobacco odor removal capability of the contaminated air purification system 20 for game facilities is evaluated.

[0030] Figure 6 is a top view showing positions of a D point (at 1,100 mm above floor level) where two pieces of the tobacco 18 were allowed to simultaneously burn to generate smoke in the gaming facility 19, and two points E and F (at 1,200 mm above floor level) being positions of seats on both sides of the A point where tobacco odor concentration was measured, and a G point (at 1,500 mm above floor level) being a passage sufficiently apart from

the D point where tobacco odor concentration was also measured, which have been set for the evaluation of the tobacco odor removal capability of the contaminated air purification system 20 for game facilities of the present embodiment. Table 3 shows the result from measurement of the tobacco odor concentration ($\mu\text{ g/m}^3$) at the E point, Table 4 shows the result from the measurement of the tobacco odor concentration ($\mu\text{ g/m}^3$) at the F point, and Table 5 shows the result from the measurement of the tobacco odor concentration ($\mu\text{ g/m}^3$) at the G point.

[0031] [Table 3]

(Measurement point E)

$\mu\text{ g/m}^3$

Draft control device + Air purification apparatus	Absence	Presence
Dust	487	12
TVOC	313	180
Nicotine	112	N.D
Acetaldehyde	141	14
Ammonia	295	29

[0032] [Table 4]

(Measurement point F)

$\mu\text{ g/m}^3$

Draft control device + Air purification apparatus	Absence	Presence
Dust	280	16
TVOC	1134	220
Nicotine	384	N.D
Acetaldehyde	160	17
Ammonia	495	30

[0033] [Table 5]

(Measurement point G)

$\mu \text{ g/m}^3$

Draft control device + Air purification apparatus	Absence	Presence
Dust	207	6
TVOC	90	47
Nicotine	24	N.D
Acetaldehyde	119	16
Ammonia	81	29

As shown in Tables 3, 4, and 5, it has turned out that, by effects of the draft control device 15 and air purification device 21, the tobacco odor concentration in neighboring seats E and F at the point D where tobacco smoke is generated is lowered to the same level as for the tobacco odor concentration at the point G being a passage sufficiently apart from the D where tobacco smoke is generated.

[0034] As shown in Table 5, at the point G being 3.5 m apart from the tobacco burning point, a difference in concentrations of odor substances is clear between the absence and presence of the draft control device 15 and air purification apparatus 21, which it shows that the draft control device 15 and purification apparatus 21 are effective in removing the odor concentration. Moreover, N, D represents values less than the limit of detection.

[0035] [Table 6]

$\mu \text{ g/m}^3$

Draft control device + Air purification apparatus	Prior Art (left seat)	Present invention (left seat)
Dust	240	16
Acetaldehyde	128	17

Table 6 shows a result from comparison of concentrations of dust and acetaldehyde between the case where the draft control device 15 of the present embodiment is provided and the case where the draft control device 15 is not provided (prior art, air-conditioner system disclosed in the Patent Reference 3 [Japanese Patent Application Laid-open No. Hei 8 - 261505]) and, in the measurement, the number of pieces of tobacco used for the simultaneous burning of tobacco is two and an amount of air that can be treated by each of the air purification apparatuses 1 and 21 is 1,500 m³/h.

[0036] As is apparent from the results from the measurement shown in Table 6, the concentrations of dust and acetaldehyde are remarkably low in the case of the embodiment of the present invention and the effect of tobacco odor removal has been improved.

[0037] In the contaminated air purification system 20 of the second embodiment, the air purification device 21 and air conditioner 22 are installed outside the gaming facility 19, however, the embodiment is given by way of example only. For example, the present invention can be applied to, so-called "all outside air method" in which, as shown in Fig. 7, an outside air treating conditioner 30 is installed instead of the above air purification device 21 and air conditioner 22 and, outside air taken from the outside area, after being treated by the outside air treating conditioner 30, is flown out through the blow-out port 24 into the gaming facility and all the contaminated air sucked from the gaming facility through the suck-in port 26 is

exhausted to the outside.

[0038] According to the contaminated air purification systems 10 and 20 of the first and second embodiments of the present invention, the diffusion of smoke of the tobacco 18 can be reliably prevented and tobacco odor can be removed at a high removal rate and, therefore, no feeling of discomfort is given to a game player sitting on a chair adjacent to a game player who is smoking.

[0039] Furthermore, even if the contaminated purification systems 10 and 20 for gaming facilities are installed in an existing facility, it is not necessary to take down existing walls, ceilings, floors, or the like and large-scale construction is not required and, therefore, the contaminated purification systems 10 and 20 can be easily installed in the existing facility 19, thus enabling reduction in costs.

[0040] The contaminated air purification systems 10 and 20 cause no scattering of dust on the floor and/or foods and drinks, thus achieving effective air purification.

[0041] It is to be understood that the invention is not limited to the above embodiments but specified features may be changed and modified without departing from the scope and spirit of the invention.

CLAIMS

1. A contaminated air purification system for a gaming facility comprising:

a draft control device installed in an upward direction on each of left and right sides of a gaming machine to prevent diffusion of tobacco smoke from a smoking game player toward a game player sitting adjacent to the smoking game player in the gaming facility having the gaming machine and wherein the draft control device is equipped with a blower in its inner portion so as to blow out air sucked into its inner portion from surroundings toward an upward slanted direction and runs at a wind flow rate of $22\text{m}^3/\text{h}$ or higher and is installed at 800 mm to 1500 mm above floor level and facilitates rising of tobacco smoke utilizing a guiding effect of a blown-out draft.

2. The contaminated air purification system for a gaming facility according to Claim 1, wherein the air blown out by the draft control device in an upward slanted direction, after being treated by the air purification apparatus, is circulated, as purified air, through the gaming facility, or is totally exhausted outside the gaming facility and outer air having the same amount of the air exhausted, after being treated by an air conditioner, is supplied into the

gaming facility, resulting in improvement of an environment of air.