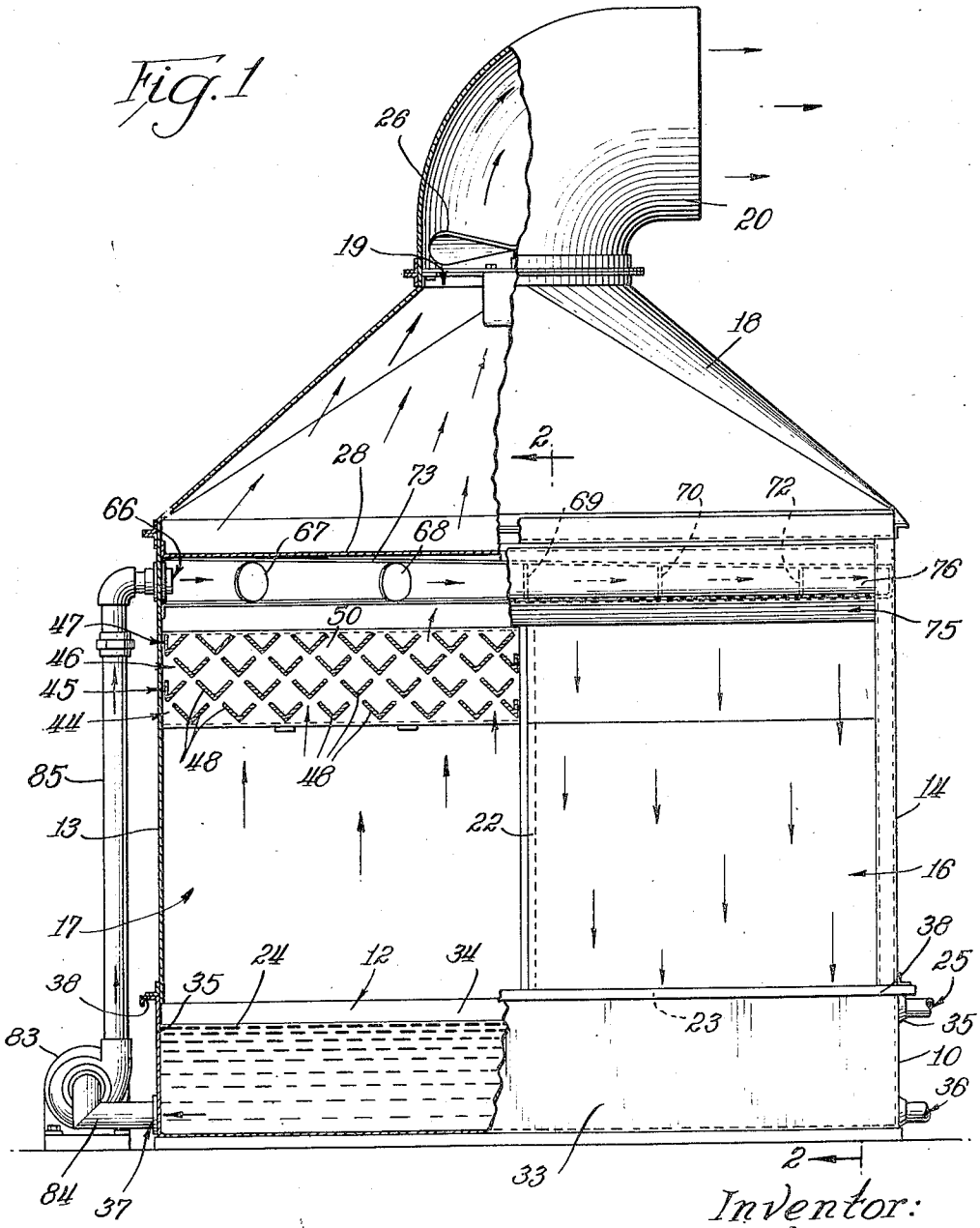
March 20, 1951 F. E. PEARSON 2,545,672

SPRAY BOOTH

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Fig. 1



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SPRAY BOOTH

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Fig. 2.

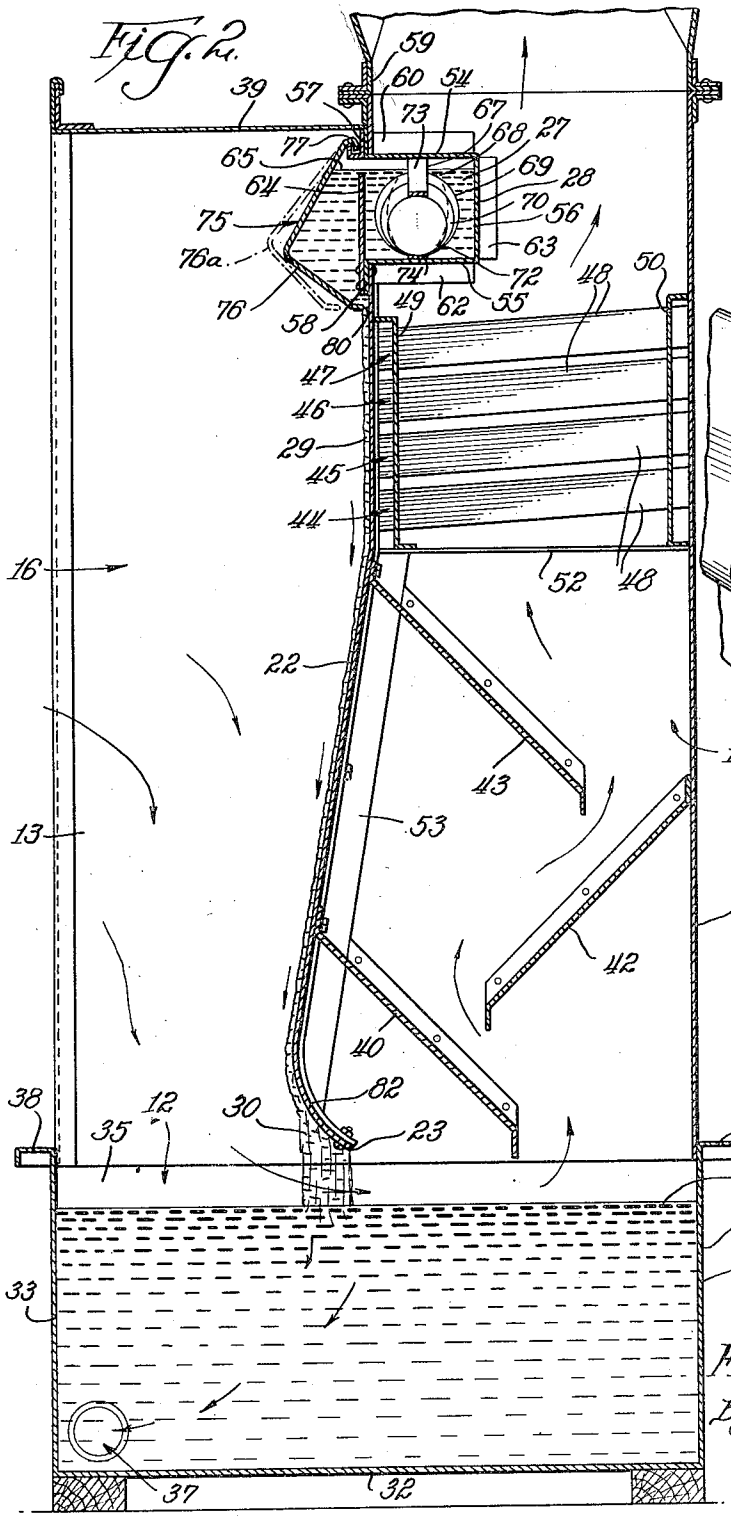
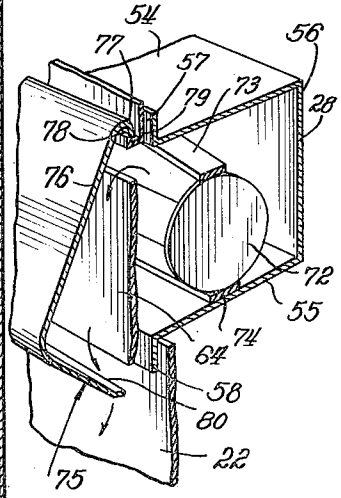


Fig. 3.



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SPRAY BOOTH

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Application April 6, 1948, Serial No. 19,342

4 Claims. (Cl. 183—26)

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This invention relates to spray booths, and more particularly to those of the type used in spraying paint and the like, and which utilize a water curtain in addition to the controlled flow of air for confining and cleaning polluted air from the spray area.

One of the objects of my invention is to provide a spray booth which utilizes a water curtain to cover the rear wall of the spraying space and embodies structural parts and arrangements such that the flow of the curtain water is controlled and metered to produce a continuous and solid water curtain below that rear wall through which the flow of polluted air is directed from the spraying space for thorough washing by the water.

It is another object of the invention to provide a spray booth in which the air is sufficiently washed and dried that it may be recirculated into the room, rather than being exhausted outside of the building.

My invention further has within its purview the provision of a spray booth in which the air is washed by a cleaning liquid and wherein the construction and arrangement is such that the cleaning liquid may be recirculated for considerable periods without replacement.

Another object of this invention is to provide a spray booth in which a cleaning liquid is used for washing a directed flow of air which is circulated therethrough and wherein the structure and arrangement is such that a quantity of cleaning liquid may be used for a considerable period of time by recirculation without being changed and the pollution thus taken from the air will be collected in a reservoir for removal with the liquid and possible reclamation.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts through the several views.

Referring to the two sheets of drawings,

Fig. 1 is a front elevational view of a preferred embodiment of my spray booth with a portion at one side cut away to show the internal construction;

Fig. 2 is a side sectional view of the spray booth shown in Fig. 1, drawn to a somewhat larger scale and wherein the section is taken substantially on a line 2—2 of Fig. 1 and in a direction indicated by the arrows; and

Fig. 3 is a fragmentary perspective view depicting a detail of the preferred structure of my spray booth.

Referring generally to the exemplary embodiment of my invention which is disclosed in the accompanying drawings for illustrative purposes, the spray booth has a base portion 10 which by preference is in the form of a rectangular tank 12 from which side walls 13 and 14 and a back wall 15 extend upwardly to define the exterior of a spray housing 16 and an air flow duct 17. At the top, the side and back walls 13, 14 and 15 are adjoined by a hood-type top having an air flow opening 19 therein which communicates with the duct 17 and is adjoined by an air flow conduit 20. A partition wall 22 extends from side wall to side wall in spaced relationship to the back wall 15 to effect the division between the spray housing 16 and air flow duct 17. At its lower end, the partition wall 22 terminates in a substantially straight edge 23 spaced above a normal liquid level 24 in the tank 12 and determined by an overflow port 25.

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A fan 26 is, by preference, supported by the top 18 in the opening 19 to force air through the spray booth in the manner depicted by arrows in Figs. 1 and 2. Air is drawn into the booth through the spray housing and it passes under the partition wall 22 into and upwardly within the air flow duct 17. In order to prevent the adhesion of a sprayed substance, such as paint, to the surface of the partition wall 22, toward which the spray is generally directed, a flow of a liquid 27 from a reservoir 28 downwardly over the front surface of the partition wall provides a continuous and substantially complete liquid layer 29 over the front surface of the partition wall and produces a continuous substantially solid curtain 30 of the liquid which bridges the space between the lower end of the partition wall 22 and the liquid level in the tank 12. It may be noted that the flow of air from the spray housing partition of the booth is through the continuous and substantially solid layer of liquid which forms the curtain below the partition wall, so that the polluted air from the spray space is washed by the liquid and the air passes into the duct 17; the spray particles washed from the air being collected in the liquid which is held by the tank 12.

Considering the disclosed spray booth structure in greater detail, the tank 12 is desirably made of sheet metal and has a bottom 32, front and rear walls 33 and 34 respectively and end walls 35. As disclosed, the overflow port 25 is in one of the end walls 35. In addition to the overflow port, I also provide a drain port 36 and a flow outlet port 37. Formed marginal portions 38 provide a rim for the upper edge of the tank.

The side walls 13 and 14 of the spray housing

are secured and extend upwardly from the end walls 35 of the tank; the back wall 15 also being secured to and extending upwardly from the rear wall 34 of the tank. The top of the spray housing between the side walls 13 and 14 and back to the partition wall 22 is closed by a cover plate 39. The top 18 is constructed of formed sheet metal and shaped to provide a connection to the air flow conduit, as well as covering the air flow duct portion of the spray booth which acts as an air dryer.

In order to effect the drying of the air as it moves upwardly through the duct 17, which drying is particularly desirable in installations where the air is to be exhausted into the room from which it is taken, groups of baffles are preferably provided to effect the formation of a sinuous path for the flow of the air through the duct. In the preferred embodiment of my invention, baffles 40, 42 and 43 are secured within the lower portion of the duct 17. These baffles are secured to and extend between the side walls 13 and 14. Also, they are alternately mounted to extend inwardly to the partition wall 22 and back wall 15 so as to overlap one another in spaced relationship. To effect and assist the flow of moisture from the air to the tank 12, the baffles 40, 42 and 43 slope downwardly and inwardly. The baffle 42 has an outer edge adjoining the back wall 15, while the outer edges of the baffles 40 and 43 adjoin the partition wall 22. In the flow of air around the baffles 40, 42 and 43, the changes of direction of the air are from and toward the back wall 15 and partition wall 22.

Above the baffles 40, 42 and 43, it is my preference to provide vertically displaced rows 44, 45, 46 and 47 of substantially trough-like baffles 48, which baffles extend longitudinally between the back wall 15 and partition wall 22. Also, and by preference, the trough-like baffles 48 are laterally V-shaped in section with their concave surfaces disposed upwardly and the baffles of adjacent rows are in staggered and overlapping relationship to one another, as depicted in Fig. 1. At opposite ends, the baffles 48 are supported relative to the partition wall 22 and back wall 15 by formed bracket plates 49 and 50 respectively. At spaced positions along the bracket plates 49 and 50, bracing straps such as 52 extend between the bracket plates and are secured thereto. It may be observed with respect to the baffles 48 that the direction changes of the air flow effected by those baffles are lateral to the duct and transverse to those effected by the baffles 40, 42 and 43.

Along the opposite sides the partition wall 22 is secured to and supported by angle straps 53 on the side walls 13 and 14. For conservation of space and material, as well as to provide for effective and convenient construction, the reservoir 28 forms a part of the separating wall between the spray housing 16 and air flow duct 17 and is disposed to extend across the partition wall 22 at the top of the spray housing. As shown in Fig. 2, the reservoir 28 is made of formed sheet metal having top and bottom walls 54 and 55 respectively and a back wall 56 integrally connected and with flanged front margins 57 and 58 of the top and bottom walls secured to a partition wall extension plate 59 and the partition wall 22 respectively. Preferably end flanges 60, 62 and 63 on the top, bottom and rear walls 54, 55 and 56 respectively are secured to the side walls 13 and 14 of the air flow duct. At the front of the reservoir, a weir plate 64 is secured to the partition wall 22 and extends upwardly to a position spaced somewhat below the top reservoir wall 54 to establish a normal flow level 65 for the liquid 27 within the reservoir. At one end, the reservoir is provided with an inlet port 66.

For controlling and evening the flow of the liquid within the reservoir 28 from the inlet port 66 and over the top of the weir plate 64, a series of baffles 67, 68, 69, 70 and 72 is provided. These baffles, in my preferred structure, are each smaller in area than the lateral area of the reservoir 28 and, as satisfactory sectional contours which may be readily manufactured, as well as producing the desired results, I have selected substantially oval and circular shapes. In order to effect the desired flow control at different positions in the reservoir with respect to the inlet port, I also vary the size and angular disposition of the baffles relative to the normal direction of fluid flow at their location and the general plane of the weir over which fluid flows from the reservoir. I utilize two straps 73 and 74 on diametrically opposite sides of the baffles 67, 68, 69, 70 and 72, to which those baffles are secured, and which extend longitudinally of the reservoir 28, for supporting the baffles in spaced relationship and at their preferred angular positions within the reservoir.

It is my preference, for effecting a relatively even flow of liquid over the weir plate 64, that the baffles 67 and 68 which are near the inlet port end of the reservoir shall be obliquely disposed within the reservoir and wtih respect to the general plane of the weir plate, with that oblique angular disposition selected to effect a reverse component of flow direction toward the weir plate and with respect to the normal direction of flow through the reservoir from the inlet port. The remaining baffles 69, 70 and 72 are disposed substantially in right angular relationship to the general plane of the weir plate. Also, since the required diversion of flow diminishes somewhat with the distance from the inlet port, the baffles of my disclosed structure are successfully smaller in area as their successive distances of disposition from the inlet port increase.

In addition to the use of the reservoir 28, together with its co-acting weir and baffle plates for effecting the flow of a continuous even and completely solid layer of liquid over the front surface of the partition plate and a substantially continuous and complete curtain of liquid below the partition plate, I also utilize a movable flow control valve element 75. In the present instance, the valve element 75 is in the nature of a formed cover plate 76 having a concave interior facing and covering the weir plate 64 and hingedly supported along its upper edge so as to have its normal position determined by gravity. The hinge support is inexpensively provided in the present instance by a returned bent marginal portion 77 along the upper edge of the cover plate which over-hangs and movably rides upon an upwardly disposed edge 78 of a channel 79 secured to the partition wall along the upper edge of the reservoir. Having a concave surface facing the weir plate 64, a substantially straight bottom edge 80 of the cover plate normally rests against the front surface of the partition wall 22 below the bottom edge of weir plate 64. In operation, the cover plate 76 tends to accumulate liquid within its concave interior which accumulated liquid forces the lower edge 80 of the cover plate away from the front surface of the partition wall 22 to a distance dependent upon

the rate of flow, and as illustrated in dot and dash lines at 76a in Fig. 2, so that the liquid flows downwardly over the surface of the partition wall. It may be understood that the action of the movable cover plate valve is to effect an even flow over the surface and to tend to eliminate any undesirable turbulance.

For additional improvement of the flow and liquid coverage over the front surface of the partition wall 22, I have also found it desirable that a considerable lower portion of that partition wall shall slope forwardly toward the bottom of the spray housing. Additionally, the bottom end portion of the partition wall 22, adjacent the lower edge 23 has a gentle, smooth and rearward curvature, as depicted at 82 in Fig. 2. The aforementioned forward slope and rearward curvature have a tendency to maintain the completeness of the liquid coverage over the surface of the partition wall and in the curtain below the partition wall, and thereby to prevent the forced air flow along that partition wall surface and through the curtain from effecting appreciable breaks in the liquid continuity.

The disclosed spray booth structure is adapted to the recirculation of a predetermined quantity of air cleaning liquid for a considerable period of time without the replacement of the liquid or the cleaning of the interior of the structure. For the purpose, and as shown in Fig. 1, a pump 83 is connected by a pipe 84 to the outlet port 37 of the tank 12. The output side of the pump 83 is connected through a pipe 85 to the inlet port 66 of the reservoir 28. The capacity of the pump 83 and its associated pipes 84 and 85 are such that a quantity of liquid is pumped from the tank 12 and into the reservoir 28 which is sufficient to maintain the desired continuous and complete liquid layer over the surface of the partition wall 22 and in the curtain below the partition wall. The liquid returns to the tank 12, carrying with it the spray particles collected along the surface of the partition wall and in the washing of the air by the liquid curtain during the passage of that air under the partition wall and along the surface of the liquid in the tank.

From the foregoing description and structure of the operation of my spray booth, it may be readily understood that in addition to confining the spray particles to the interior of the booth, the air which flows through the spray housing is so completely washed by the liquid curtain and dried in the air flow duct that it can be recirculated, if desired, into the room in which the booth is located. In addition to adapting the booth for use in restricted and confined areas, the complete cleaning and drying of the air, so that the air is fit for recirculation, is important for the conservation of heat in the spray room. The maintenance of the continuous and substantially solid curtain for washing the air in a restricted area below the partition wall and immediately above the liquid in the tank at the bottom of the booth provides a thorough air cleaning action which is effective before the air enters the drying space within the flow duct at the rear of the booth. Additional washing of the air in that flow duct is entirely unnecessary. This eliminates the necessity for adding moisture in the drying space and also eliminates the necessity of frequent cleaning of the flow duct portion of the structure. Recirculation of the same washing liquid for considerable periods while the pollution from the spray is collected in the tank at the base of the booth effects an important saving in operating cost. It is also of importance that the parts such as the tank 12 which are subject to the necessity of periodic cleaning are readily accessible for the purpose.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A structure for removing foreign material from an air stream and comprising, in combination, a base in the form of a rectangular tank open at the top and having fluid outlet, drain and overflow ports therein, a housing including back and side walls extending upwardly from the base and having an open front, a hood-type top for said housing, an air flow opening in the top, a partition wall extending from side wall to side wall in the housing in spaced relationship to the back wall, said partition wall adjoining the top in front of said air flow opening and terminating at the bottom in an edge extending across said tank at a level above the level of said overflow port, the lower portion of said partition wall being sloped to extend somewhat away from the back wall toward the bottom, said partition wall, back wall and side walls together forming an air flow duct communicating with said opening, a series of baffles in staggered and overlapping relationship in said air flow duct between the back and partition walls, an elongated reservoir secured to the top portion of the partition wall between the latter and back walls and extending substantially from one side of said partion wall to the other, means defining a weir extending laterally of the partition wall at the front of said reservoir and over which weir fluid from the reservoir may flow downwardly over the surface of the partition wall, said reservoir having an inlet port at one end, a series of baffles in spaced relationship along the weir within the reservoir for evening the flow along the length of the weir, movable flow control means comprising a cover overlying said weir on the side thereof opposite the reservoir, said cover being hingedly supported at the top and having an interior space terminating in an edge extending across the partition wall below the base, said cover normally gravitating to a position such that said edge thereof rests against the partition wall, and a flow pipe including a pump connecting the outlet port of the tank to the inlet port of said reservoir, said flow pipe and pump having a fluid flow capacity for effecting the flow of a continuous and solid screen of fluid over the front surface of said partition wall and across the space below said edge of the partition wall.

2. A structure for removing foreign material from an air stream as defined in claim 1, and wherein said baffles in the air flow duct comprise a series of staggered plates sloping downwardly in spaced relationship from the partition and back walls and disposed below a plurality of rows of overlapping trough-like elements presenting laterally concaved upper surfaces and extending between the back and partition walls.

3. A structure for removing foreign material from an air stream as defined in claim 1, and

wherein said baffles in the reservoir comprise a series of substantially flat plate elements disposed in spaced relationship along the reservoir with their planes substantially perpendicular to the weir, said plate elements being smaller in size than the internal reservoir section and varying in size with their distance from the inlet part to the reservoir.

4. In a structure for removing foreign material from an air stream, the combination comprising a wall having substantially flat and contiguous front surface portions, one above the other, and the lower of which slopes forwardly toward the bottom, the lower end portion of the lower one of said surface portions being smoothly curved rearwardly and terminating in a substantially straight bottom edge, and means for effecting the flow of a continuous and substantially complete layer of liquid down the front surface of said wall which results in the formation of a substantially solid curtain of liquid flow from the bottom of the wall surface, said means comprising a reservoir at the top of said wall and

including a weir over which liquid flows from the reservoir to the front wall surface, said reservoir having a liquid inlet port at one end thereof for the flow of liquid thereto, and a series of baffles in the reservoir and disposed in angular relationship to the weir and to the direction of fluid flow from the inlet port for evening the flow over the weir.

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