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EXHAUSHER FOR SPRINKLER FIRE EXTINGUISHING SYSTEMS

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My invention relates to improvements in an exhaust for sprinkler fire extinguishing systems and particularly to sprinkler systems employing dry pipe valves, and containing air under pressure for holding the dry pipe valves in the closed position for confining water under pressure within the system, and employing sprinkler heads for automatically releasing the air pressure upon the occurrence of a fire.

The object of my invention is to provide a novel exhaust for quickly exhausting the air from the sprinkler system for reducing the time required for the dry pipe valve to open automatically upon the reduction of the air pressure in the system, due to the opening of a sprinkler head, as it is desirable to have the sprinkler system operate and deliver water, instead of air, through the sprinkler heads at the earliest possible moment after a sprinkler head is opened; a further object is to provide an exhaust having two chambers, the first one thereof being an inlet or high pressure chamber, in direct communication with the air pressure in the sprinkler system, and the second one thereof being a retaining pressure chamber into which the air pressure may slowly equalize with the pressure in the inlet chamber, and to provide each chamber with an outlet valve through which the pressure from either chamber may be exhausted; a still further object is to provide a movable member in the casing actuated upon the sudden reduction of the pressure in the sprinkler system and in the inlet chamber for exhausting the air pressure first from the retaining chamber and then by a reverse movement of said member due to the relatively higher pressure remaining in the inlet chamber for exhausting all of the air pressure from the inlet chamber and from the sprinkler system; a still further object is to provide the outlet or auxiliary air exhaust valve located in the retaining chamber with latch mechanism for normally retaining said exhaust valve in the closed position and for opening the exhaust valve due to a sudden change between the relative pressures in the chambers; a still further object is to provide a spring actuated latch lever for holding the exhaust valve closed and also for imparting a quick opening movement to the air exhaust valve when the exhaust is brought into operation; a still further object is to provide a novel form of drain valve located in the inlet chamber, which valve is of relatively larger proportions for quickly exhausting the air pressure from the sprinkler system; a further object is to provide a novel form of mounting a shaft within the casing and securing the same upon said movable member and provide means associated with the shaft for operating the latch lever and the drain valve; a still further object is to provide a novel construction for slidably mounting the drain valve upon the shaft whereby the latter may be moved, in one direction, without moving the drain valve, when the latter is in the closed position and for opening the latter upon the final movement of the shaft; a still further object is to provide the shaft with a central passageway forming communication between the chambers formed at opposite sides of the diaphragm or movable member; a still further object is to provide the shaft with a novel form of regulating valve, whereby the passageway between the chambers may be restricted for allowing the air under pressure to equalize in said chambers and to slowly pass in one direction and quickly pass in the opposite direction; a still further object is to provide means for adjusting the regulating valve whereby the restricted passageway between the chambers may be varied; and a still further object is to provide latch mechanism for operating the auxiliary air exhaust valve which may either be mounted upon the auxiliary valve body or upon shaft carrying the drain valve.

Referring to the accompanying drawings, Fig. 1 is a vertical sectional view, illustrating my improved exhaust and showing the same diagrammatically connected with the dry pipe valve of a sprinkler system; Fig. 2 is a central vertical sectional view of the exhaust, drawn on a larger scale and showing the parts in a partial opened position; Fig. 3 is a horizontal sectional view, as on line 3—3, Fig. 2; Fig. 4 is a side elevation of the exhaust valve mechanism, shown in Fig. 100.
2; Fig. 5 is a view similar to Fig. 2, showing the parts in the fully opened position; Fig. 6 is a partial vertical sectional view of the exhaust valve showing a different form of locking mechanism; Fig. 7 is a horizontal sectional view as on line 7-7, Fig. 6; and Fig. 8 is a vertical sectional view, as on line 8-8, Fig. 7.

Referring to the accompanying drawings in which like reference characters refer to like parts 12 represents a casing comprising an upper section 13, a central section 14 and a lower section 15. A movable member in the form of a diaphragm 18 is located within the casing 12. The periphery of the diaphragm 18 is secured between flanges formed upon the sections 13 and 14 by fastening devices 19. A high pressure, or inlet chamber 20 and a retaining pressure chamber 22 are formed within the casing 12, and are separated by the diaphragm 18.

The lower section 15 is provided with a connection in the form of a threaded aperture 25 which is connected, as shown in dotted lines, Fig. 1, by a pipe 26 with the riser pipe 27 of a sprinkler system having a dry pipe valve 28, which may be of any well known type. The section 15 is also provided with a drain aperture 30 for the connection of a drain pipe 32, as indicated in dotted lines, in Fig. 1. The section 13 is provided with an exhaust or outlet aperture 33 adapted to be connected by a pipe 34 with the neutral chamber of the dry pipe 28, as indicated in dotted lines, Fig. 1.

The section 15 of the casing is provided with a drain valve seat 35 surrounding the drain aperture 30. A drain valve disk 36 is provided for closing upon the drain valve seat.

The casing 12 is provided with bearings 38 and 39 in which is slidably mounted a shaft 40 which extends through the central portion of the diaphragm 18 and is secured therein by clamp plates 41 and 42 secured to the shaft 40 at opposite sides of the diaphragm by means of the nut 43. The shaft is made in two sections 44 and 45 rigidly secured together by means of a threaded stem 46 formed on the lower section 45, shown in Fig. 1. The section 46 of the shaft is provided with a central passageway 48 extending axially and also provided with a lateral opening 49 communicating with the inlet chamber 30.

The upper section 44 of the shaft is of tubular formation and communicates with the passageway 48 in the lower section 45. The section 44 is provided with a valve seat 50 surrounding a central aperture 51. Secured upon the upper end of the section 44 is a clamp bracket 53 forming a bearing for a pivot shaft 54, on which is pivoted a valve arm 55 carrying an adjusting screw 56. The end of the screw 56 is adapted to rest upon the valve seat 50 for partially closing the aperture 51, thus forming a restricted passageway through which the air under pressure in chambers 20 and 22 may slowly equalize. By turning the adjusting screw 56 the valve arm 55 will be tilted and also the inner end face of the screw 56 will be tilted relatively to the plane of the valve seat, thus providing means for varying the size of the aperture 51 by simply changing the position of the screw 56. Said arm may swing about the pivot 54 and fully open the aperture 51 when the air in the chamber 20 is under a relatively greater pressure than the air in the chamber 22. The adjusting screw 56 will restrict the flow of air under pressure from the chamber 22 toward the chamber 20, thus retaining the air under pressure within the retaining chamber 22 for a sufficient length of time to cause the movable member 18 to move toward the inlet chamber 20 when the pressure in the latter is suddenly reduced.

The drain valve disk 36, has secured thereon to a sleeve 60 which surrounds the lower end of the shaft 40. The sleeve 60 is provided with an inwardly projecting flange 62 and the shaft is provided with an enlarged collar 63, which engages the flange 62 of the sleeve and is arranged for lifting the sleeve and the disk 36 by an upward movement of the shaft 40, as shown in Fig. 5. The valve disk 36 is moved downwardly relatively to the valve seat 53 by a spring 65 positioned between the disk 36 and the bearing 39. The spring 65 tends to hold the valve disk 36 upon the seat 35 when the shaft 40 is in the positions shown in Figs. 1 and 2. A relatively lighter spring 66 is positioned between the collar 63 on the shaft and the upper surface of the disk 36 and tends to force the disk away from the end of the shaft. Its purpose is to permit the shaft 40 to move downwardly within the sleeve 60 when the disk is resting upon the seat 35, as shown in Fig. 2.

The upper section 13 of the casing 12 is provided with an auxiliary air exhaust valve 70 for controlling the aperture 43 through the casing. The exhaust valve 70 is provided with a valve seat 72 adapted to be closed by a clapper 73 which is pivotally mounted upon the valve body by means of a pivot shaft 75. The clapper 73 is provided with arms 74 extending horizontally and in a line parallel with the pivot shaft 75.

Referring to Figs. 1 to 4, in which a form of latch lever 78 is shown consisting of two lever arms 79 and 80, pivotally mounted upon stud shafts 81 extending in opposite directions from a clamp bracket 82 which embraces the shaft 40 and is secured thereon by a clamp screw 83. Each lever arm 79 and 80 is provided with a projection 85 which extends over the arms 76 of the clapper 73 for holding the latter tightly upon its seat, as shown.
in Fig. 1. The lever arms 79 and 80 are also provided with lifting projections 86 for engaging the arms 76 of the clapper 73, for lifting the latter from its seat. The upper ends of the lever arms 79 and 80 are connected with springs 88 having their lower ends connected with a clamp bracket 89 secured upon the shaft 40 by means of a clamp screw 90. Said bracket 89 is provided with arms 91 extending in opposite directions from the bracket 89 and in parallel alignment with the stud shafts 81 upon which the lever arms 79 and 80 are pivoted. The arms 79 and 80 are constructed so that when the projections 85 are resting upon the arms 76 of the clapper, the upper ends of the arms, where the springs 88 are attached, will be out of vertical alignment between the arms 91 of the lower bracket 89 and the stud shafts 81 so that the line of force of the springs 88 will be off the dead center and the action of the springs will tend to move the arms so that the projections 85 will press upon the arms 76, thus holding the clapper 73 upon its seat, as shown in Fig. 1.

When the shaft 40 is moved downwardly from the position shown in Fig. 1 to the position shown in Fig. 2, the lever arms 79 and 80 will be moved about the stud shafts 81 by the projections 85 being prevented from moving due to the fact that they are resting upon the arms 76 of the clapper, thus the levers will be tilted about the stud shafts 81 until the line of action of the springs 88 passes the dead center when the springs will move the lever arms 79 and 80 into the position shown in Figs. 2 and 3, causing the lifting projections 86 to engage the under side of the arms 76 of the clapper and lift the clapper from its seat, as shown in Fig. 2, thus allowing the air under pressure to exhaust from the retaining chamber 22. Fig. 2 shows the shaft 40 in its lowest position with the springs 88 acting upon the arms 79 and 80 for opening the exhaust valve clapper 73, and Fig. 5 shows the shaft 40 in its upper position for opening the drain valve 86, during which movement the lever arms 79 and 80 have been carried upwardly with the shaft 40, with the lifting projections 86 still holding the clapper 73 in the open position.

Figs. 6, 7, and 8 illustrate a slightly different form of latch lever for opening the exhaust valve clapper. The valve body 92 is provided with a pivot shaft 93 on which the clapper 94 is pivoted at a point between the clapper and the shaft 40a. The latch lever 95 is pivotally mounted upon the same pivot shaft 93 on which the clapper 94 is pivoted. Both the clapper 94 and the latch lever 95 are loosely mounted upon the pivot shaft 93. The latch lever 95 consists of two side arms connected by cross bars 96 and 97 rigidly connecting said arms. The cross bar 96 is provided with a centrally located projection 98 forming a finger which is adapted to press upon the clapper 94 and hold it upon the valve seat. Said clapper 94 is provided with oppositely extending arms 100 arranged in parallel relation with the pivot shaft 93, and the levers 95 are provided with lifting projections 102, adapted to engage the arms 100 of the clapper for lifting the clapper from its seat. The latch levers 95 are provided with springs 104 connected at the upper ends of the levers and also connected with arms 106 forming part of the body of the valve 92. Said arms 106 are located immediately below the pivot shaft 93 on which the arms of the lever 95 are mounted. The springs 104 tend to force the levers 95 into a position where the projecting fingers 96 will hold the clapper 94 in the closed position, as shown in Fig. 6. The lower cross bar 97 of the lever 95 forms a dog positioned in alignment with a collar 108 secured upon the shaft 40a. When said shaft moves downwardly the collar 108 engages the dog 97 and moves the lever 95 about the pivot shaft 93 until the upper ends of the springs 104 pass the dead center at which time the springs will act upon the levers for turning them in the direction to cause the lower lifting projections 102 to lift the valve clapper 94 from its seat, as shown in Fig. 5.

The operation of my invention is as follows: The parts of the exhausters are positioned as shown in Fig. 1. Air under pressure is admitted to the inlet chamber 20 through the pipe 26 from the riser 27 of the sprinkler system. The air may pass rapidly from the chamber 20 through the axial passegway 48 formed through the shaft 40, and through the regulating valve at the top of the shaft 40 into the retaining chamber 22 of the casing, thus equalizing the pressure upon the opposite sides of the diaphragm 18, without imparting any movement to the latter. Any slight variation in the pressure in the chambers 20 and 22 will be equalized through the restricted aperture 51 of the regulating valve. It will be noted that in the position shown in Fig. 1, the drain valve 36 is closed by the disk 36, which is held upon its seat by the spring 63. The auxiliary exhaust valve outlet 33 from the chamber 22 is held closed by the springs 88, and the lever arms 79 and 80. When there is a sudden reduction of the air under pressure in the sprinkler system, due to the opening of a sprinkler head, the pressure in the chamber 20 of the exhaust will also be reduced. The air under pressure in the retaining chamber 22 will be retained due to the restricted aperture 51, for a sufficient period of time for the preponderance of pressure in the chamber 22, relatively to the reduced pressure in the chamber 20 to move the diaphragm 18 and the shaft 40 downwardly from the position shown in Fig. 1 to the position shown in
The downward movement of the shaft 40 is possible by means of the telescopic connection between the drain valve disk sleeve 60 and the lower end of the shaft 40. The lighter spring 65 will be compressed, permitting the shaft 40 to move downwardly relative to the disk 30. The downward movement of the diaphragm and shaft 40 will carry the latch lever 78 downwardly, which downward movement will impart a rotary movement to the lever arms about the pivot shafts 81, due to the projections 85 resting upon the arms 76 of the clapper. When the lever arms 79 and 80 have rotated until the upper ends of the arms have passed the line extending through the points of attachment of the lower end of the springs 86 and the stud shafts 81, the springs will contract and further rotate the arms causing the lifting of the elements 86 to engage the arms 87 of the clapper and lift the latter from its seat, thus allowing the air under pressure to exhaust from the chamber 82. The preponderance of air pressure will then be shifted to the chamber 20 below the diaphragm causing the diaphragm to move upwardly carrying with it the shaft 40, which in turn lifts the disk 36 from the drain valve seat thereby allowing the air under pressure to pass from the sprinkler system through the chamber 20 of the exhaust chamber and through the drain outlet opening 30. The dry pipe valve of the sprinkler system will then open and allow the water to pass through the dry pipe valve and fill the system and also the chambers 20 and 22 of the exhaust chamber, thus again equalizing the pressure through the passageway 48, upon opposite sides of the diaphragm 18, thereby allowing the spring 65 to close the disk 36 upon the drain outlet.

My improved exhauster provides means for quickly exhausting the air from the sprinkler system allowing the latter to be in full operation at a very short interval of time after a sprinkler head has been opened.

I claim:
1. An exhauster for sprinkler systems comprising, a casing having two air pressure chambers connected by a restricted passageway, a normally closed drain outlet valve located in each chamber, said casing having an inlet connection located in one of said chambers for admitting air under pressure from the system, a member movably mounted upon the casing having its opposite surfaces subjected to the pressure in said chambers, and means operatively associated with said member and said valves for opening the valve located in the chamber opposite to said inlet connection when said member is moved by a preponderance of pressure in said chamber opposite to said inlet connection produced by a sudden reduction of the pressure in the system and in the chamber in which the inlet connection is located for opening the other one of said valves when said member is moved in the opposite direction by a preponderance of pressure remaining in the chamber in which the inlet connection is located after the valve in the chamber opposite to the chamber in which the inlet connection is located has been opened.

2. An exhauster for sprinkler systems comprising, a casing having inlet and retaining chambers connected by a restricted passageway, a normally closed drain valve located in the inlet chamber, a normally closed exhaust valve in the retaining chamber, said casing having an inlet connection located in said inlet chamber for admitting air under pressure from the system, a member movably mounted within the casing between said chambers having its opposite surfaces subjected to the pressure in the opposite chambers, means yieldingly associating the drain valve and said member by which the latter is movable toward the drain valve, and means operatively associated with said member and said valves for opening the valves successively when said member is moved in different directions by a preponderance of pressure in the retaining chamber produced by a sudden reduction of pressure in the system and in the inlet chamber, and then by a preponderance of pressure remaining in the inlet chamber after the pressure in the retaining chamber is reduced by the opening of the exhaust valve.

3. An exhauster comprising a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having inlet and drain outlet connections associated with said inlet chamber, a valve for closing the drain connection, an exhaust valve associated with the retaining chamber, a shaft operatively associated with said member, means associated with said shaft for opening the exhaust valve when said member is moved by a preponderance of pressure in the retaining chamber, and means associated with said member for opening the drain valve when said member is moved by a preponderance of pressure remaining in said inlet chamber after said exhaust valve has been opened.

4. An exhauster comprising a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having inlet and drain outlet connections associated with the inlet chamber, a drain valve for closing the drain connection, an exhaust valve associated with
the retaining chamber, a shaft operatively associated with said member, a lever positioned and arranged for opening and closing the exhaust valve, a spring tending to move the lever to open or close the exhaust valve, means upon the shaft for engaging the lever and for moving the latter into a position in which the spring will actuate the lever and open the exhaust valve when said member is moved by a preponderance of pressure in the retaining chamber, and means associated with the shaft for opening the drain valve when said member is moved by a preponderance of pressure remaining in said inlet chamber after said exhaust valve has been opened.

5. An exhaust for sprinkler systems comprising, a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having inlet and drain outlet connections associated with the inlet chamber, a drain valve for closing the drain connection, an exhaust valve associated with the retaining chamber, a shaft operatively associated with said member, a lever pivotally mounted adjacent to the exhaust valve, projections upon the lever for engaging the exhaust valve, a spring operatively associated with the lever for rotating the lever in one direction from a central position to close the exhaust valve and in the other direction to open the exhaust valve and in the other direction to open the latter when the shaft and lever are moved relatively to the exhaust valve by said member when the latter is moved by a preponderance of pressure in the retaining chamber, and means associated with said shaft for opening the drain valve when said member is moved by a preponderance of pressure remaining in said inlet chamber after said exhaust valve has been opened.

7. An exhaust for sprinkler systems comprising, a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having inlet and drain outlet connections associated with said inlet chamber, a drain valve for closing the drain connection, an exhaust valve body having an exhaust outlet associated with the retaining chamber, a clapper pivotally associated with said body arranged for opening and closing said exhaust outlet, a lever pivotally mounted upon said body, engaging means upon the lever arranged for moving the clapper relatively to said body, a spring operatively associated with the lever for rotating the lever in one direction from a central position to move the clapper into a position to close said exhaust outlet, engaging means operatively associated with said member for rotating the lever against the action of the spring into a position in which the spring will move the lever and the clapper for opening said exhaust outlet when said member is moved by a preponderance of pressure in the retaining chamber, upon a sudden reduction of pressure in the system and in the inlet chamber, and means operatively associated with said member and the drain valve for opening the latter when said member is moved by a preponderance of pressure remaining in said inlet chamber after the exhaust outlet has been opened.

8. In an exhaust for sprinkler systems, a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers through which the pressure in said chambers may equalize, said casing having inlet and drain outlet connections associated with said inlet chamber, a drain valve for closing the drain connection, an exhaust valve associated with the retaining chamber, a shaft operatively associated with said member, means upon the casing in which the shaft is slidably mounted, a lever pivotally mounted upon the shaft and movable therewith, means upon the lever arranged to engage the exhaust valve for opening and closing the latter, a spring operatively associated with the lever for rotating the lever in one direction from a central position to close the exhaust valve and in the other direction to open the latter when the shaft and lever are moved relatively to the exhaust valve by said member when the latter is moved by a preponderance of pressure in the retaining chamber, and means associated with said shaft for opening the drain valve when said member is moved by a preponderance of pressure remaining in said inlet chamber after said exhaust valve has been opened.

9. In an exhaust for sprinkler systems, a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers, said casing having an inlet connection through which pressure is admitted from the system to the inlet chamber, an exhaust valve body having an exhaust outlet associated with the retaining chamber, a pivot shaft upon said body, a clapper pivoted upon the pivot shaft and movable relatively to the body for opening and closing said exhaust outlet, a lever pivoted upon the pivot shaft, engaging means upon the lever for moving the clapper, a spring operatively associated with the lever tending to rotate the lever in opposite directions from a central position, a shaft
mounted upon said movable member, and means upon the last mentioned shaft for engaging the lever and moving it into a position in which the spring will move the lever and the clapper for opening said exhaust outlet when the movable member is actuated by a preponderance of pressure in the retaining chamber produced by a sudden reduction of pressure in the system and in the inlet chamber.

10. An exhauster comprising a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having inlet and drain outlet connections associated with said inlet chamber, a drain valve located in the inlet chamber, a spring associated with the casing and with the drain valve tending to normally hold the drain valve in a position to close said drain connection, a shaft mounted upon said movable member, a sleeve upon the drain valve in which the shaft is slidably mounted and arranged to permit the free movement of the shaft toward the drain valve when the latter is in the closed position, engaging means upon the shaft and upon the sleeve arranged for moving the drain valve into the open position against the action of said spring when the shaft is moved by a preponderance of pressure in the inlet chamber, an exhaust valve located in the retaining chamber, and means operatively associated with the shaft and the exhaust valve for opening the latter when the movable member is actuated by a preponderance of pressure in the retaining chamber.

11. An exhauster for a sprinkler system comprising, a casing, a movable member mounted in the casing forming an inlet and a retaining chamber located on opposite sides of said member, a hollow shaft mounted upon the movable member forming a passageway between said chambers, a valve seat upon the end of the shaft located within the retaining chamber, said seat having a passageway formed through the same communicating with the passageway through the shaft, a bearing rigidly mounted upon the shaft adjacent to said seat, an arm pivotally mounted upon the bearing, and a part adjustably mounted upon the arm having one face thereof arranged to rest upon said seat and restrict said passageway through the latter.

12. An exhauster for a sprinkler system comprising, a casing, a member movably mounted in the casing forming an inlet and a retaining chamber located on opposite sides of said member, said casing having an inlet connection located in the inlet chamber for admitting air under pressure from the system, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having a drain outlet connection associated with said inlet chamber, a drain valve normally closing the drain connection, an exhaust valve associated with the retaining chamber, engaging means upon said member operatively associated with the exhaust valve for opening the latter when said member is moved by a preponderance of pressure in the retaining chamber produced by a sudden reduction of pressure in the system and in the inlet chamber, and engaging means upon said member operatively associated with the drain valve for closing the latter when said member is moved in the opposite direction by a preponderance of pressure remaining in the inlet chamber after the exhaust valve has been opened.

13. An exhauster for a sprinkler system comprising, a casing, a member movably mounted in the casing forming an inlet chamber and a retaining chamber located on opposite sides of said member, said casing having an inlet connection located in the inlet chamber for admitting air under pressure from the system, means forming a restricted passageway between said chambers through which the pressure in said chambers may slowly equalize, said casing having a drain outlet connection associated with said inlet chamber, a drain valve for closing the drain connection, an exhaust valve associated with the retaining chamber, engaging means upon said member operatively associated with the exhaust valve for opening the latter when said member is moved by a preponderance
of pressure in the retaining chamber produced by a sudden reduction of pressure in the system and in the inlet chamber, and means yieldingly associating said member with the drain valve permitting an initial movement of said member toward the drain valve when the latter is in the closed position and for opening the drain valve when said member is moved in the opposite direction by a preponderance of pressure remaining in the inlet chamber after the exhaust valve has been opened.

In testimony whereof I affix my signature.

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