

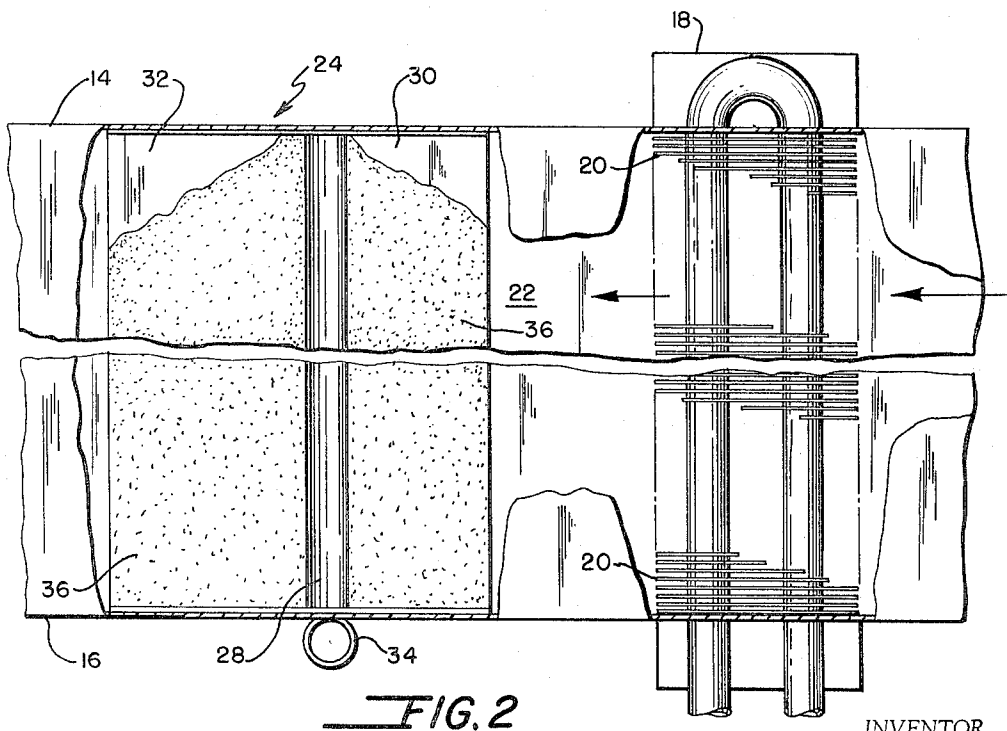
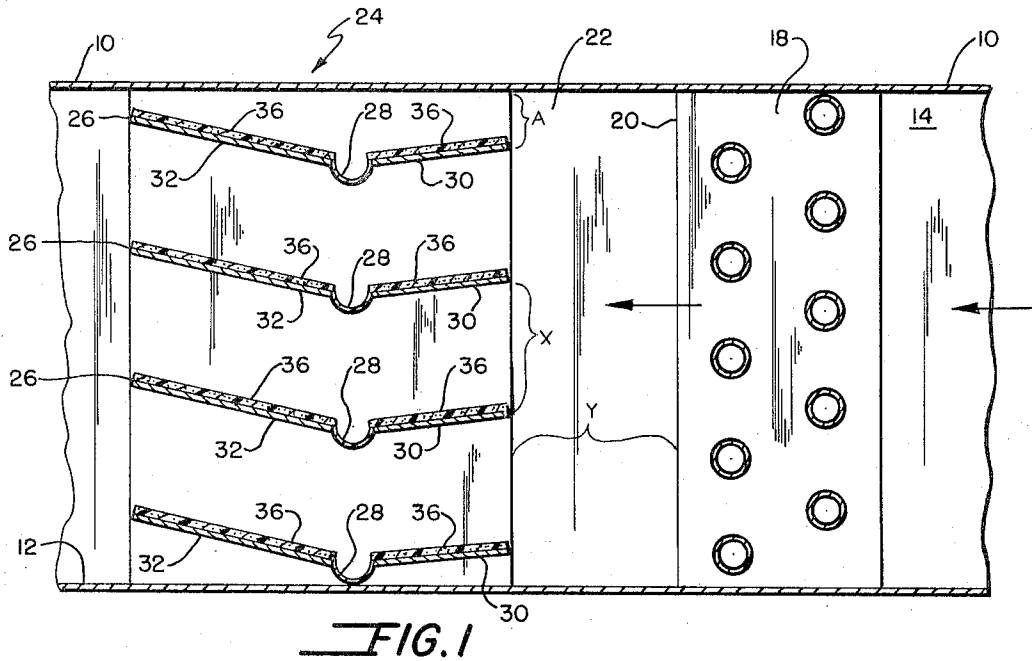
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WATER ELIMINATOR

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WATER ELIMINATOR
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This invention relates to apparatus for collecting water
blown off a cooling coil by a high velocity horizontal air
stream.

Ordinary air stream velocities do not pose serious prob-
lems of water carryover from a cooling coil serving to
dehumidify the air stream. Condensate collected on the
coil fin surfaces simply drains down the fin surfaces to a
drain pan. However, when cooling coils are subjected
to air velocities exceeding about 600 feet per minute,
water removal problems of greater degree are encountered.
While conventional water eliminators can be used to re-
move the water from the air stream, they present a rela-
tively high resistance to air flow.

The object of the present invention is the provision of
apparatus which provides adequate water removal from
a high velocity horizontal air stream in a limited space
downstream of a coil, but does not impose an unduly
high resistance to air flow.

Apparatus according to the invention takes advantage
of the trajectory path of water droplets which are blown
off the downstream face of the high velocity coil by ar-
ranging a number of surfaces in locations to intersect the
paths of the various droplets.

To accomplish this a series of generally horizontally-
extending trays are arranged in generally tier formation a
specified distance downstream from the downstream verti-
cal face of the coil. The spaces in a vertical direction
between the trays are determined so that each tray en-
compasses a horizontal area through which droplets blown
off a specific portion of the coil will pass as a result of
their particular trajectory corresponding to the particular
air velocity. The trays are generally trough-shaped in
section so that gravity will urge the droplets captured
by the contact with the upper surface of the trays into
the drain trough provided in each tray rather than being
again carried off by the air stream. A further desirable
provision of the apparatus according to the invention is
the use of a material on the upper surface of the trays
which permits the drainage but prevents reentrainment
into the air stream.

The invention will be described in somewhat more
detail in connection with the accompanying drawing il-
lustrating apparatus embodying the invention by way of
example, and wherein:

FIGURE 1 is a vertical section through a fragment of
a duct containing a high velocity cooling coil and ap-
paratus according to the invention; and

FIGURE 2 is a plan view of a fragmentary portion of
the duct of FIGURE 1, with parts broken away.

In the drawing the horizontal air flow duct is defined
by top wall 10, bottom wall 12, and opposite side walls
14 and 16. The air flow is generally horizontal as indi-
cated by the arrows in each view, and is indicated in the
drawing as passing successively from right to left through
the cooling coil 18, the open space 22 immediately down-
stream of the downstream face 20 of the coil, and then
through the water eliminator section generally designated
24.

The eliminator section comprises a series of relatively
flat trays or trough-shaped elements 26 which extend
horizontally between the opposite vertical side walls 14
and 16 of the duct to provide a series of vertically-spaced,
generally horizontally-extending surfaces lying in the tra-

jectory paths of water droplets blown off the downstream
face 20 of the coil. One preferred cross-sectional shape
of the trays 26 is that shown in FIGURE 1 in which a
shallow V is formed with a drain trough 28 provided
at the point area of the V and extending for the length
of the trays. In that view the front portion 30 and the
rear portion 32 of the tray embrace an included angle
of about 150 degrees. The individual drain troughs 28
are each connected to a drain location 34 outside the
duct and which may be a vertical pipe into which the
individual drain troughs 28 are fed.

To reduce re-entrainment of the water collected on
the top surfaces of the trays 26, the front and rear por-
tions 30 and 32 have upper surfaces covered by a material
36 which essentially serves a wicking purpose. Water
droplets carried against the upper surfaces of the trays
by their trajectories strikes the material 36, with splashing
greatly reduced, and then pass down through the mate-
rial to the drain trough 28 without being again picked
up off the trays by the air stream. In one form the
wicking material 36 may be a relatively thin sheet (e.g.,
1/8 inch thick) of open cell polyurethane foam material
of, say, 20 cells per inch texture.

The arrangement of trays in the generally vertical tier
formation shown provides for the efficient collection of
water from the horizontally directed air stream at the
relatively high velocities in the magnitude of 600 to 1000
f.p.m. at a relatively low air pressure drop. For example,
with a coil face velocity of about 750 f.p.m. and a vertical
spacing between five-inch wide trays of four inches, the
pressure drop encountered is less than the 0.1 inch water
gauge.

It will be apparent that a number of dimensional rela-
tionships exist in the described structure, and that varia-
tions in these dimensional relationships beyond a certain
limit will usually result in a variation in both the collec-
tion efficiency and the pressure drop imposed by the
eliminator section. An example of satisfactory relation-
ships will be outlined in relation to FIGURE 1 in which
the dimension between the rear face 20 of the coil and
the upstream edge of the water eliminator section is indi-
cated by the letter Y, the vertical spacing between trays
is indicated by the letter X, and the vertical distance
between the top wall 10 of the duct and the upstream
edge of the upper tray is indicated by the letter A. With
each tray having a depth or distance in the direction of
air flow of about five inches, the following examples of
dimensions which yield satisfactory results for particular
air flow velocities are provided in the table.

Face Velocity in f.p.m.	X in Inches	Y in Inches	A in Inches
700	10 1/2	1 1/2 (max.)	11 1/2
800	8 1/2	1 1/2 (max.)	9 1/2
900	7	2 1/4 (max.)	10 1/4
	4	1 1/2 (min.)	9
1, 000	4 3/4	3 1/2 (max.)	8
	2 3/4	2 1/2 (min.)	7

The locational dimensions set forth above are provided
as a guide for a specific tray width of five inches and are
not intended to constitute limiting values as to the loca-
tion of the trays within the scope of this invention. Thus
it will be apparent to one skilled in the art that a change
in tray width from front to rear will require a correspond-
ing change in other dimensional relationships to achieve
the same collection efficiency, that the vertical spacing
between the trays will likewise have a corresponding
effect, and that a variation which will increase water
collection efficiency will likely increase the pressure drop
imposed by the section.

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An eliminator according to the invention is also very useful in a duct system where it is desirable to turn the air shortly after it exits from the downstream face of the coil. For example, even with the 1000 f.p.m. velocity, the Y distance plus five inch blade width totals only 8½ inches before the turn can begin.

I claim:

1. Apparatus for capturing condensate droplets blown off the downstream face of a cooling coil through which high velocity air moves generally horizontally, comprising:

a tier of vertically-spaced, relatively shallow horizontal trays extending for substantially the height of the downstream face of said coil, said trays being spaced apart a selected distance to provide substantially open spaces therebetween to form unobstructed generally horizontally directed linear air flow paths between successive trays, each of said trays extending substantially horizontally to present an upper face encompassing an area through which said droplets blown off a given height of the downstream face would be carried at the selected velocity of air passing through said coil, with successively higher and successively lower trays being spaced accordingly so as to encompass the areas through which droplets blown from successively higher portions and successively lower portions of the downstream face of said coil would be carried when following a normal gravity induced trajectory; trough means cooperatively disposed in the lower portion of said shallow horizontal trays to receive condensate from said shallow trays and to conduct such condensate from said shallow trays; and, moisture permeable materials covering the upper surfaces of said shallow trays to receive condensate droplets carried into contact with said upper surfaces and to conduct such condensate to said trough means for removal from said trays.

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2. The apparatus of claim 1 in which:

said trays of a shallow V shape in cross section are upwardly open and include trough means at the point area for carrying the collected condensate out of the air stream wherein said trough means is disposed generally transverse to the direction of flow of said air stream and wherein one side of said V-shaped tray extends downstream from said trough means, and the second side of said tray means extends upstream from said trough means so said trough means forms the low point of said V-shaped tray and the upper surface of said first side and the upper surface of said second side are covered with moisture permeable material to receive condensate droplets carried to said shallow trays to conduct such condensate to said trough means for removal from said tray.

3. The apparatus of claim 3 in which:

said moisture permeable material is open cell polyurethane foam.

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