SCOTT

A.S.T. Drying System

U.S. Patent #5,570,517

SCOTT
EQUIPMENT COMPANY

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Scott A.S.T. Dryer

AST Drying System

Scott's Air Swept Tubular (AST) Dryer is designed for rugged duty and versatility in the industrial minerals industry. The dryer's adjustable paddles and air dams permit optimum air to solids heat transfer. Materials ranging from filter cakes, thixotropes, and dilatent slurries to powders and granules can be effectively dried in the AST System. Even slurries with dry solids content as low as 5% can be dried efficiently to as high as 99% dry solids in a single pass.

The AST Dryer is fabricated in Scott Equipment's tradition of building for today to last for tomorrow.

FEATURES

- Patented agitator design incorporates intense mixing and grinding/ deagglomerating action.
- BTU's consumed per dry ton are 10-20% less than most existing dryers.
- Capable of handling feed materials the consistency of liquid slurry, filter cake or granules / powders.
- Single pass drying with feed material as high as 95% moisture reduced to less than 1% moisture.
- Custom designed to meet required specifications.
- Installation, in most cases, can be accomplished in significantly less time than spray dryers.
- Ruggedly designed for years of trouble-free operation.
- Low capital cost.
- Replaces very inefficient units such as apron/tunnel dryers, substantially decreasing energy and maintenance costs.
- Can produce material ranging from pulverized powders with less than 1% moisture to granules with moisture content as high as 15%.
- The ability to adjust product retention time for hard to dry material.

Brief List of Successfully Tested Materials

- Aluminum Monohydrate
- Aluminum Oxide
- Aluminum Trihydrate (ATH)
- Attapugite Clay slurry
- Barite
- Bentonite Clay (slurry & filter cake)
- Calcium Carbonate (slurry & filter cake)
- Calcium Chloride
- Calcium Hydroxide
- Calcium Silicate
- Calcium Sulfate (Gypsum Board & slurry)
- Ceramic Alumina Silicate
- Ceramic Fibers
- Ceramic Slurry
- Coal (filter cake & coal fines)
- Copper Sulfate
- Diatomaceous Earth
- Dry Peat
- Ferrite Powder
- Fly Ash
- Food Grade Dyes & Pigments
- Halloysite Mineral
- Iron Oxides (red & black)
- Kaolin Clay (slurry & filter cake)
- Magnesium Hydroxide
- Magnesium Oxide
- Mica
- Titanium Dioxide Pigment (slurry & filter cake)
- Raw Clay
- Silica 171
- Silica Sand
- Sodium Sulphate Decahydrate
- Zinc Borate
- Zinc Oxide
- Zirconium Carbonate (slurry)

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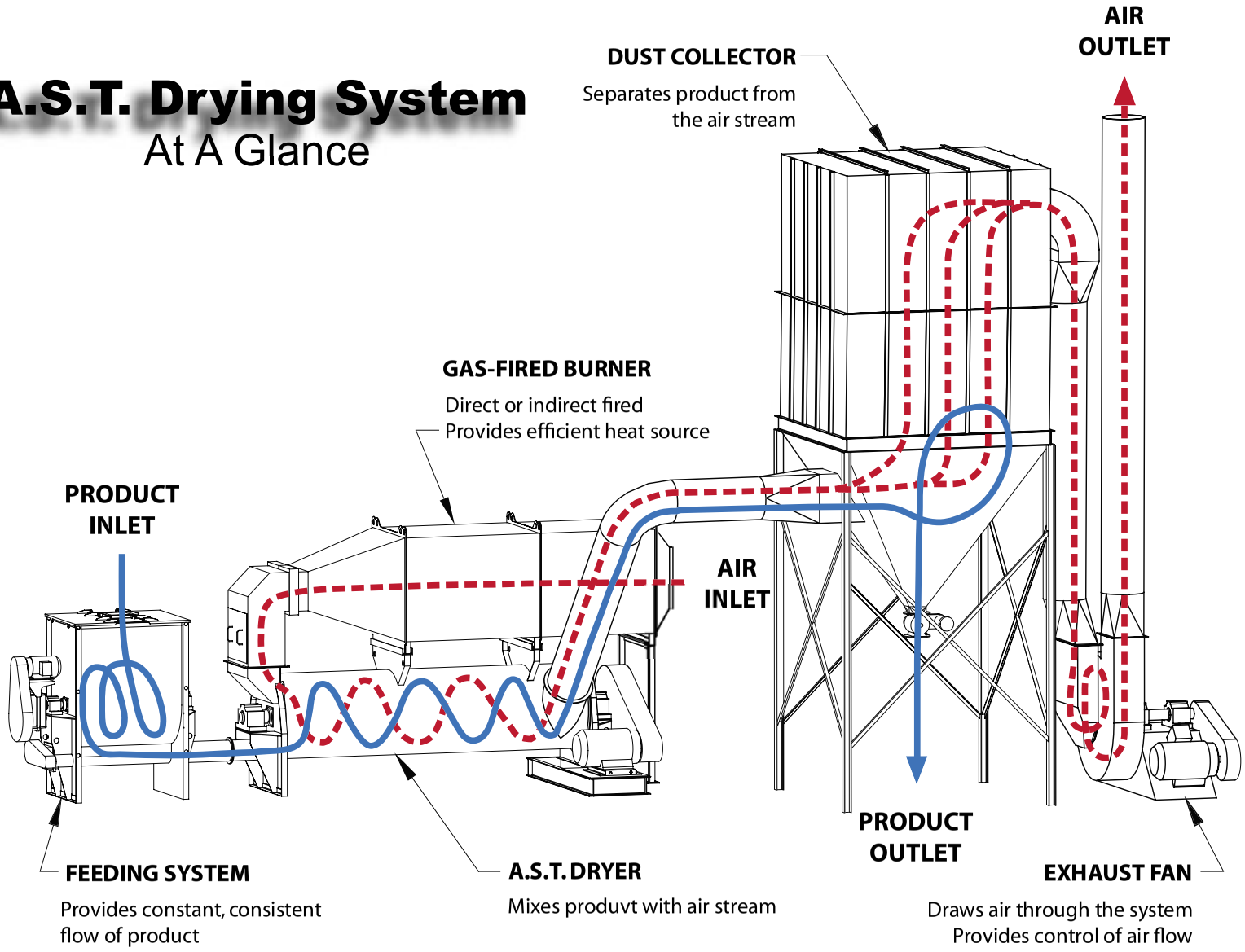
A.S.T. Drying System
At A Glance

How does our patented agitator design work?



- Adjustable paddles control the flow of material through the dryer.
- Agitator plates with multiple paddles produce a flash dry area in the entry zone.
- Flash dry zone allows drying without scorching or burning.
- The retention and discharge zones allow complete drying down to 1% when required.

Bottom Line

- Hot air drying at relatively low temperatur and minimum retnention time, less than one minute, produces a high quiality product which exits at approxiamately 140° - 180° F.

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Operational Theory

FEEDING SYSTEM

The purpose of the Feeding System is to accurately control the flow of product into the dryer. A constant and controlled feed to the dryer is important since a continuous system operates best at stable conditions. During steady-state operations, the feed rate is held constant as other parameters are monitored and controlled.

The Feeding System will be the Scott Cake Feeder, Scott Mixer Feeder or a pump (positive displacement or centrifugal), depending on the viscosity of the product to be processed. The feeder is equipped with a variable frequency drive to allow for a ramp up of product flow rate during equipment startup.

GAS-FIRED BURNER

The function of the gas-fired burner is to be the source of heat energy into the AST Dryer. The burner heats the process air to an elevated temperature (400°-1200° F), and is responsible for controlling the energy balance of the system. The energy control is achieved by monitoring the process control thermocouple located at the discharge of the dryer. The Drying System utilizes a PID loop (via the PLC) to maintain a set point by controlling the firing rate of the burner.

The burner is typically a direct fired gas burner complete with flame supervision system, fuel train, etc. Other fuel options include: propane vapor, fuel oil, or an indirectly heated system.

AST DRYER

The function of the AST Dryer is to effectively expose the product to the heated process air stream and retain the product until it has reached the specified moisture content. The AST Dryer has three distinct zones with differing operational functions.

INLET ZONE (ZONE 1)

The Inlet Zone achieves size reduction (when applicable) and the majority of moisture evaporation. This is accomplished by a highly turbulent agitator area and efficient mixing area utilizing adjustable paddles.

The agitator plates (with a high concentration of fixed blades) work to reduce the product into small pieces and provide a highly turbulent zone for efficient heat transfer. The smaller particle allows for more efficient heat penetration into the material and also allows the moisture to more readily escape to the surface as a vapor. High velocity achieved in this zone, 11,000-12,000 ft/min, further aids in the efficient transfer of heat to the material. This combination, velocity and agitation, working in concert with a high temperature differential results in efficient and rapid evaporation. This zone of the dryer is sometimes considered the "flash zone" of the unit.

Further downstream in the first zone are a set of adjustable paddles that allow for back-mixing. Product that is still moist and potentially sticky will continue to be agitated and back-mixed via the adjustable paddles until it can be carried into the next zone by the airflow. The back-mix process is continuous with some product being carried over as new product is introduced.

At the division between Zone 1 and Zone 2 is a set of air dams. The purpose of these dams is to classify the product. Material that is dried enough to be free flowing and easily conveyed by the air stream can pass on to the next zone.

RETENTION ZONE (ZONE 2)

The Retention Zone achieves product retention, mixing and drying. This zone is comprised of a series of mixing paddles, adjustable from conveyance to retention. The air velocities in this zone are considerably lower than in the inlet zone, this in combination with the adjustable paddles allows the product to be retained for the necessary time to complete the drying process.

At the end of Zone 2 is another set of air dams which aid in product retention and provide a further means of classification.

DISCHARGE ZONE (ZONE 3)

The Discharge Zone achieves additional retention, air and product discharge. This zone is similar to the Retention Zone, except this zone contains the air and product discharge, and the mixing paddles are typically oriented to achieve discharge.

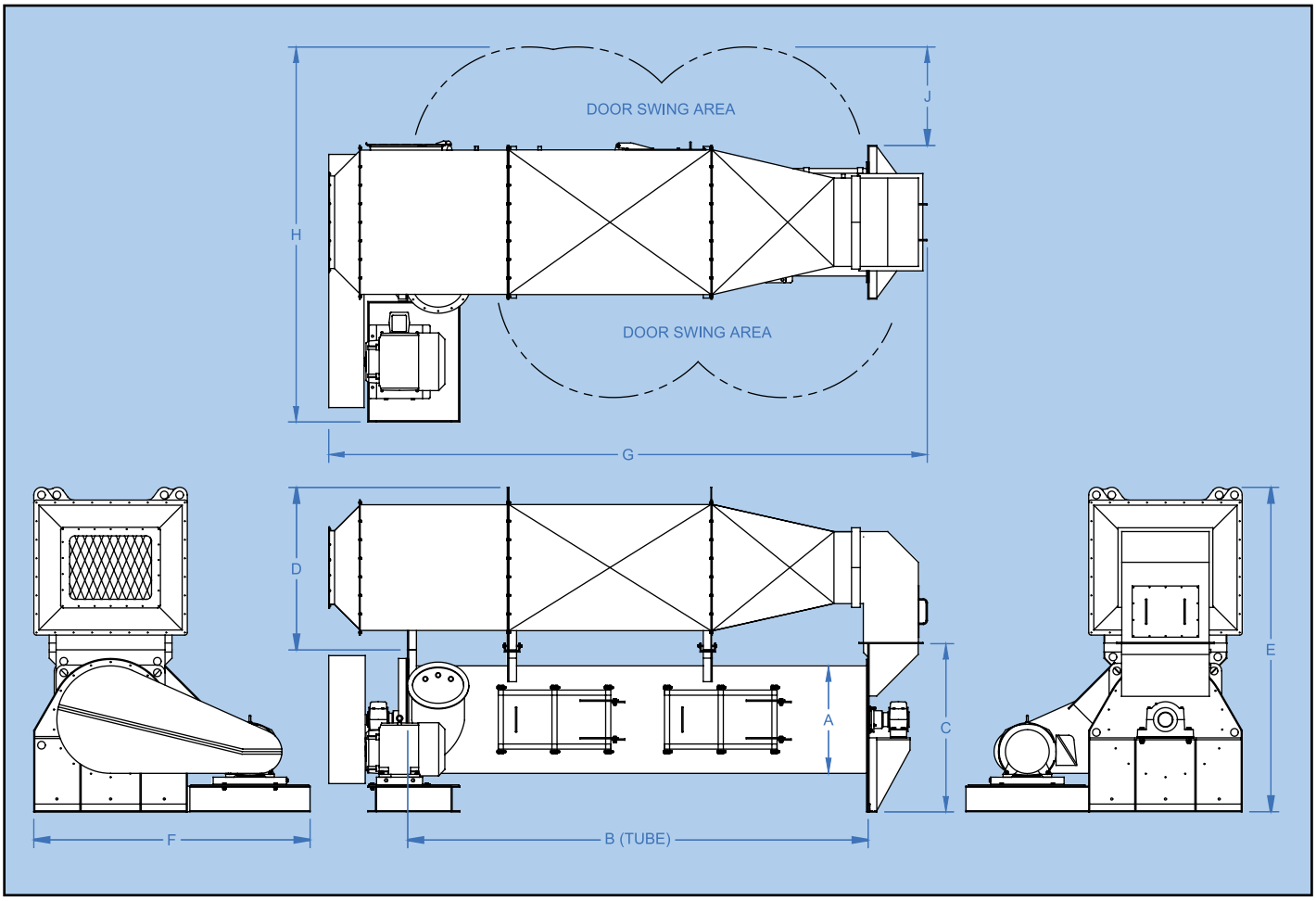
PRODUCT COLLECTOR AND EXHAUST FAN

Situated between the AST Dryer and the exhaust fan is the product collector, which separates the dried solids from the air stream. The industry standard is a baghouse.

The last component in the system is typically a centrifugal fan. The exhaust fan is located on the clean side of the collector and provides the process air required to do the work of drying the material, as well as product conveyance through the system. The entire system operates under negative pressure, which makes for a clean, dust-free operation.

On larger systems an inlet damper is provided to allow for airflow control, on smaller systems a variable frequency drive may be used for the same purpose.

Dimensions & Specifications



Model	BTU/hr (10^6)	ACFM	A	B	C	D	E	F	G	H	J
AST1610	1.0	1500	16(41)	120(305)	35(89)	41(104)	75(190)	69(175)	153(389)	91(231)	11(28)
AST2010	1.0	2500	20(51)	120(305)	40(102)	41(104)	79(201)	70(178(	157(400)	96(244)	26(67)
AST2412	2.0	4000	24(61)	144(366)	44(112)	50(127)	94(239)	72(183)	184(467)	106(269)	34(86)
AST3012	2.5	6000	30(76)	144(366)	48(122)	56(142)	105(267)	86(218)	195(495)	119(302)	32(81)
AST3612	4.0	8500	36(91)	144(366)	56(142)	61(155)	117(297)	93(236)	194(493)	121(307)	37(94)
AST4215	4 - 8	12,500	42(107)	180(457)	66(168)	63(160)	127(323)	108(274)	234(594)	146(371)	38(97)
AST4815	6 - 9	15,500	48(122)	180(457)	68(173)	71(180)	136(345)	108(274)	238(605)	147(373)	39(99)
AST5418	8 - 14	20,000	54(137)	216(549)	92(234)	100(254)	189(480)	125(318)	288(732)	180(457)	55(140)
AST6018	9 - 15	25,000	60(152)	216(549)	97(246)	75(191)	169(429)	125(318)	288(732)	180(457)	55(140)
AST7220	12 - 18	35,000	72(183)	240(610)	100(254)	108(274)	205(521)	148(376)	340(864)	200(508)	52(132)
AST8424	16 - 24	50,000	84(213)	288(731)	120(305)	108(274)	228(579)	104(264)	480(1219)	213(541)	58(147)
AST9630	24 - 30	65,000	96(244)	360(914)	119(302)	108(274	227(577)	104(264)	560(1422)	236(599)	66(168)

Scott Feeding Systems

Designed for hard-to-feed products that are difficult to pump or screw-feed consistently

SCOTT MIXER FEEDER

Bridgeless, trouble-free feeder for materials with a non-flowing consistency and a steep angle of repose

- *Belt/filter pressed slurries*
- *Coal Fines*
- *Fly Ash (Wet Sand)*
- *Virtually any material with an angle of repose >60°*

- Superior to a live-bottom feeder due to lower maintenance required because of substantially fewer moving parts (two bearings and two drives are all that are required)
- Fitted with a screw conveyor discharge section

SCOTT CAKE FEEDER

Bridgeless, trouble-free feeder for materials with consistency of a cake or paste

- *Carbonates*
- *Clays*
- *Mica*
- *Oxides*
- *Pigments*

- May be fitted with a screw conveyor discharge section or a pump discharge section (or a combination of the two when required for material cross-over and versatility)
- Variable Frequency Drive for product feed
- Can be supplied with a pump for thixotropic slurries/filter cakes

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Services

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Equipment Rental Program
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