



How is News Ink Manufactured?

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The manufacturing process of a news ink is a critical step in producing a quality product. We have previously discussed (What is Ink Vol. XII) the ingredients that are used in producing a news ink. The formulation, equipment and manufacturing steps are "recipes" for the production of the ink. In this article we will discuss two different types of ink manufacture, one from dry pigment, the other from flushed color pigments.

Dry pigment, carbon black, is predominantly used for black news ink manufacturing in the U.S. Different grades of carbon black are selected for different types of news ink: Letterpress, Web Offset, and Aqueous. The manufacturing goal is to disperse the pigment in a vehicle that can transport the pigment to the paper. For news inks, the primary carriers are petroleum oil, soybean oil, or water (for the flexographic printing process). Resins are also introduced to help disperse the pigment and to bind the pigment to the paper after printing.

As a pigment is dried and densified in its manufacturing phase, "aggregates" and "agglomerates" are formed. Dispersion is the process of breaking-up or reducing aggregates and agglomerates of pigment particles to a desired particle size. One of the main steps of the manufacturing process is "wetting" of the carbon black by the vehicle. This means displacement of occluded air and covering the surface of the agglomerates completely with vehicle. This is accomplished in the step called premixing. During premixing, the pigment is introduced into the oil phase. The viscosity of this mixture is high and large amounts of energy are used to wet and de-aerate the carbon black. For the early part of premixing, the mixture should be properly proportioned to obtain optimum dispersion. Otherwise, poor dispersion or damage to the mixer will occur. This part of premixing is sometimes called the "shear intensive part." The optimum mixture for the shear intensive part is different for each type of mixer configuration.

The most commonly used equipment for premixing and pre-dispersion work is a high speed disperser. Figure 1 and 2 illustrate typical high-speed dispersion equipment. These types of dispersers are most commonly found in ink manufacturing sites. They may have a variable, dual, or fixed speed drive.



Figure 1



Figure 2

The equipment illustrated in Figure 1 and 2 are mounted on a hydraulic lift, which can be raised or lowered. This is to either withdraw the mixing blade from a tank or to place the high speed mixing impeller at the most desirable level in order to achieve the best flow pattern. The equipment in Figure 2 also has a low speed blade to aid mixing.

There are many types of dispersion impellers that are commonly used in news ink manufacturing and some of them are shown in Figure 3.

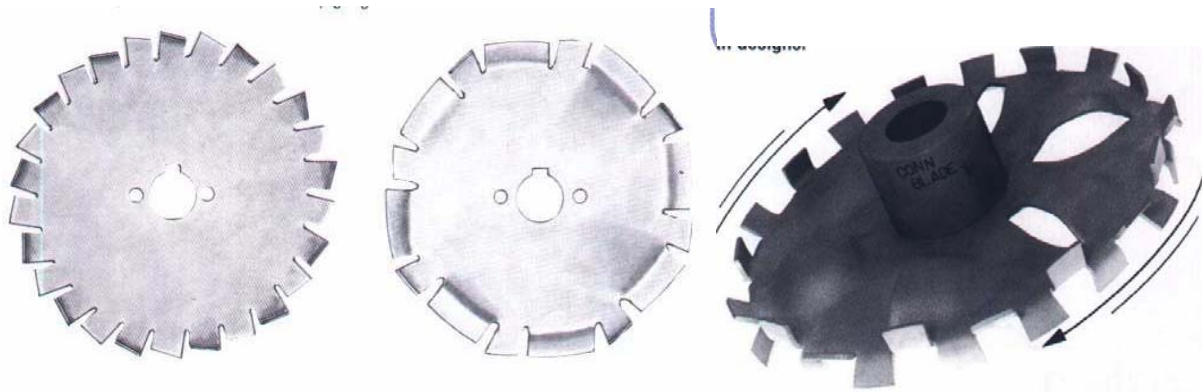


Figure 3

When the shear intensive part is completed, the premix is mixed further with more oil and resin to attain proper milling viscosity. This is called “mill base.” Milling follows premixing to achieve higher degree of dispersion with higher shear forces. For news ink black manufacturing a shot mill or media mill is used. The shot mill is made up of a chamber, rotating disks, and shot. The chamber is made of hardened steel and holds a shaft with rotating disks, the shot charge is placed inside the chamber. The shot can be made of several different types of material but typically for news inks, some type of steel alloy would be used. Inside the mill the shaft will rotate a high speed, thus spinning the shot inside the chamber. The ink is pumped through the chamber. As the ink passes through the chamber, the pigment is subjected to shear between the shot, thus producing smaller and smaller particle sizes of the pigment. The residence time in the shot mill will vary depending on how long it takes to achieve the desired degree of dispersion. Figure 4 shows the inside schematic of a media mill.

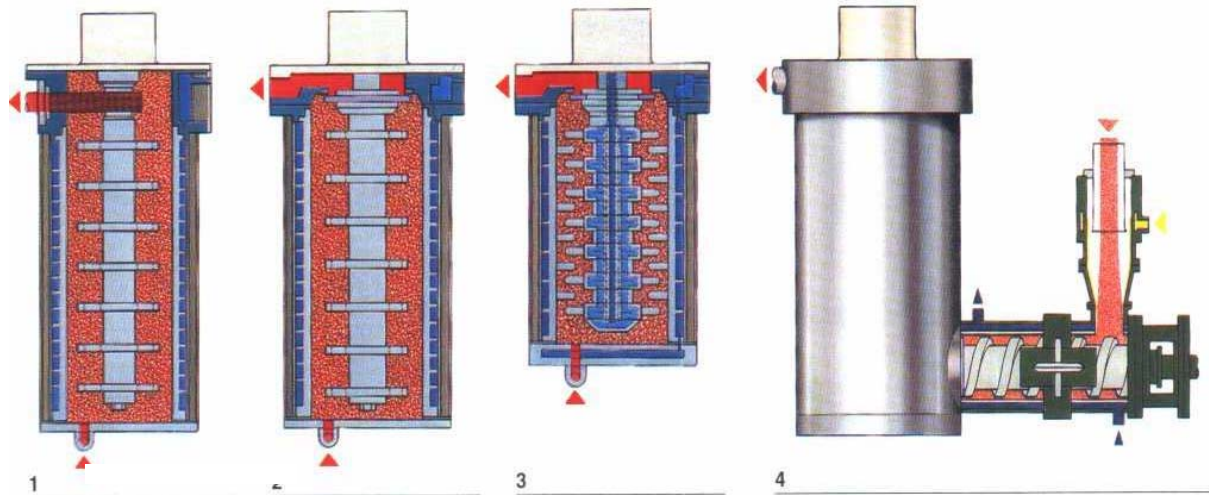


Figure 4

A mill base containing large particles will require extended residence time with a corresponding decrease in throughput rate. There are several different types of milling equipment. However, for the news ink industry, bead mills are typically used. The mill can be either vertical or horizontal mode as shown in Figure 5.

Figure 5



Vertical Mill

The grinding media must be contained and kept out of the mill discharge flow. This is done with screens and/or rotating controlled gap spaces. Many different sizes and types of media are available. Normally, chrome alloy steel shot with a 1-3 mm diameter are used for news inks. To achieve the optimum conditions for grinding/dispersion, it is necessary to achieve a maximum of energy input while obtaining “bead flotation.” This varies from product to product and also with temperature, surface area, behavior under shear, etc.

After the product exits the mill, it goes through a series of filtration steps to remove any oversized particulates. The filtration system consists of bag filters that have decreasing pore sizes (~150 microns to as small as 10 microns, one micron equals .000039 inches). Since milling involves



metal media, an electromagnetic filter is used as a part of the filtration system to eliminate any metal fragments from the product. The product is then pumped to a tank called the "letdown tank" for final adjustments to meet customer's requirements. If physical properties of the ink lie within the specifications, it is now ready to be shipped to the customer.

The manufacturing process of color inks is somewhat different from black inks. Instead of using dry pigment, flushes are used. Color pigments are formed in aqueous based reactions. In the final stage of the pigment manufacturing process, the water-based slurry is filtered and concentrated to approximately 15 to 30% pigment. The pigment/water mixture at this point would be called a presscake. The pigment can either be dried or it can be “flushed” into the base form. The presscake, instead of going through the drying process, is mixed with an oil-based varnish. The two components are kneaded together in a mixer. The pigments have a greater affinity for the oil-based material. The oil phase displaces the aqueous phase from the surface of the pigment. The water is thus “flushed” out of the system. Small remaining amounts of water are removed under vacuum at elevated temperatures.

One of the main reasons for flushing is to have pigment in a "fully dispersed" form and in a vehicle that can be used efficiently by the ink manufacturer. By using flush, the need for energy intensive milling equipment is eliminated. However, a thorough mixing of flush with raw materials such as oil, varnish, and extender is required. The mixers shown in Figure 1 and 2 are the most commonly used equipment for color ink manufacturing. Processing temperature needs to be monitored constantly so that deterioration of the pigment does not occur. Once the ink is properly mixed, the ink is checked using Quality Control tests. If the ink meets all the physical property requirements, it is processed through a series of filtration steps to remove any oversized particulates. An electromagnetic filter is not required, since no milling is involved. After checking the grind quality, it is now ready to be shipped to the customer.

In addition to what is mentioned above, several different technologies of manufacturing inks are available. The methods described above are the most common currently for the news ink industry. In our next issue we will discuss how the ink is Quality Controlled after it is manufactured.