SUMMARY AND CONCLUSIONS

The thesis is presented in three parts.

Part - I , deals with the swirling flow of a liquid through conical nozzles.

The scope of the subject relevant to the present studies has been discussed.

The experimental apparatus used in the studies is described.

A method for the measurement of rotational velocity inside the nozzle has been described. It consists in introducing a spherical ball inside the nozzle and measuring its rotational velocity, which can be related to the rotational velocity of water. The other experimental techniques are explained.

The main conclusions arrived at are :-

For constant pressure and rotational velocity at the inlet to nozzle, the air core diameter decreases with increasing entry/exit (D/d) diameter ratio and there exists a critical ratio beyond which no air core is observed.

This critical ratio increases with rotational velocity at inlet of the nozzle.

The entry pressure and nozzle cone angle are observed to have no effect on the critical ratio.

The value of the circulation constant decreases with increase in D/d ratio for constant conditions of operation at nozzle entry.

The measured pressure drop along the wall and in radial direction for any nozzle is found to decrease with increase in D/d ratio.

The relationship between tangential velocity and radius for free vortex motion has been found to be of the form $V_t r^n$ = constant. The value of 'n' is found to be a function of the nozzle geometry and decreases with increase in D/d ratio. Taylor's (5) analysis has been repeated for different values of 'n' and it is found that the boundary layer thickness decreases with decrease in the value of 'n'. The discharge through the boundary layer — decreases with decrease in the value of 'n'.

Part-II, deals with the performance characteristics of a two-fluid nozzle.

The scope of the subject relevant to jet break-up and break-up mechanism of a single drop under the action of another fluid stream has been discussed. The correlations evolved to perdict the average drop-size, from air atomizing nozzles, have been critically discussed.

The construction of the nozzle and the apparatus used in the studies have been described.

The experimental procedure has been explained.

The nozzle used in the studies was such that the continuous phase possessed a tangential velocity component also. The studies have been carried out with air liquid and liquid-liquid systems.

The following correlation has been arrived at from dimensional analysis :

$$\frac{X_{sm}}{d_o} = \left(\frac{\sigma d_o}{Mar}\right)^{0.7}\left[1 - 0.12\left(\frac{Mtr}{\sigma d_o}\right)^{0.12}\right]^{0.7}\left(\frac{Md}{Mc}\right)^{0.23}\left(\frac{\nu_d}{\nu_c}\right)^{0.46}$$

The above correlation can be used to perdict the sauter mean diameter for atomization of a liquid jet either by air or a stream of another immiscible liquid.

Part - III : deals with the flow pattern of a liquid on the vanes of a vaned disk atomizer.

The scope of the subject relevant to the present studies has been discussed.

The experimental apparatus and techniques have been described.

The results for the wetted area of the vanes of a radial vaned disk atomizer have been presented and explained.
